



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 or 4G.
- 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.

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)

ITU-R WP8F (International Telecommunication union)



 Source: ITUR radio communication study group 8.

- Initial time plan approved, October 2002.
- Revised, February 2003.
- Voted, June 2003.

The sloped dotted lines indicate that the exact starting point of the particular subject can not yet be fixed.

: Expected spectrum identification at WRC07

Wireless World Research Forum (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 gowning global market, providing new opportunities for success for all sectors.





- 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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The Global Context





Working Groups

WG1

- Scenarios and analysis
- Reference model
- Ul technologies and techniques
- UCD process

WG2

- Terminology (basic terms for WG2)
- Business Model
- Personalization
- Ambient Awareness
- Adaptability
- Generic Service Elements
- Enabling Technologies

New document First draft Draft

Stable draft Stable version

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



Visions of WWRF

- 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 reorder as we might run out of milk over the weekend.





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







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

COSTIR.







FOURTH GENERATION MOBILE FORUM®



defining OPEN WIRELESS ARCHITECTURE®

A Program of "Mission 2020" R&D Plan

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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.



Mobile Office Project





Answers:

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



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







- 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 AII-IP will be terminated at the wireless end-terminal to enable End-to-End direct signaling and QoS guarantee.



- 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



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.





Establisheded in December 2002 and to be Done by December 2004.

🗈 Mobile Broadband Wireless Access - Home Page - Microsoft Internet Explorer						
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	IEEE 802.20 Mobile Broadband Wireless Access (MBWA)	^				
MEETINGS Next Meeting Future Meetings Conference Calls Members Only	IEEE 802.20 Mission and Project Scope On 11 December 2002, the IEEE Standards Board approved the establishment of IEEE 802.20, the Mobile Broadband Wireless Access (MBWA) Working Group. Mission					
DOCUMENTATION Contributions WG Documents Commentary E-MAIL Subscribe to Lists Archive Access Document Drop-	The mission of IEEE 802.20 is to develop the specification for an efficient packet based air interface that is optimized for the transport of IP based services. The goal is 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.					
Boxes MBWA 802.16 SG Document Archive	Specification of physical and medium access control layers of an air interface for interoperable mobile broadband wireless access systems, operating in licensed bands below 3.5 GHz, optimized for IP-data transport, with peak data rates per user in excess of 1 Mbps. It supports various vehicular mobility classes up to 250 Km/h in a MAN environment and 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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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 multivendor mobile broadband wireless access networks that meet the needs of business and residential end user markets.



- 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.



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 datarate low mobility services currently developed in IEEE 802 and the high mobility cellular networks.



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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		



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 (CPE) and PC Cards for mobile devices	End-user devices initially PC Card enabled data devices	End user devices initially data enabled handsets
	Support of low-latency data and real time voice services	Support of low-latency data services	Lack of support for low latency services
Service Provider	Evolving off Fixed Wireless service providers and WISPs adding mobility as enhance- ment 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



Relationship with Other Cellular Systems

Dimension	802.16e	802.20	3G
Technology	Extensions to 802.16a MAC & PHY	New PHY & MAC optimized for packet data and adaptive Antennas	W-CDMA, cdma2000
	Optimized for and backwards compatible with fixed stations	Optimized for full mobility	Evolving of GSM or IS-41
	Licensed bands 2-6 GHz	Licensed bands below 3.5 GHz	Licensed bands below 2.7
	Typical Channel BW >5 MHz	Typical Channel BW < 5 MHz	Typical Channel BW < 5 MHz
	Packet oriented architecture	Packet oriented architecture	Circuit oriented architecture – evolving to packet on the downlink
	Channelization and control for multimedia services with QoS	Channelization and control for mobile multimedia services. Mobile- IP Based	Channelization and control optimized for mobile voice services. MAP/SS7 based
	High efficiency data uplinks and downlinks	High efficiency data uplinks and downlinks	Medium efficiency data downlinks, low efficiency uplinks
	Low Latency architecture	Low latency data architecture	High latency data arch.



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.



FuTURE: Future Technology for Universal Radio Environment

- Part of China's 863 Program for 10th 5year 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,



Roadmap





Organization



3GPP LTE (Long Term Evolution) (From 3GPP TR 23.882)

WMN





Peak data rate

- Instantaneous downlink peak data rate of 100 Mb/s within a 20 MHz downlink spectrum allocation (5 bps/Hz)
- Instantaneous uplink peak data rate of 50 Mb/s (2.5 bps/Hz) within a 20MHz uplink spectrum allocation)



Coverage

 Throughput, spectrum efficiency and mobility targets above should be met for 5 km cells, and with a slight degradation for 30 km cells. Cells range up to 100 km should not be precluded.



Interfaces

- S1: It provides access to Evolved RAN radio resources for the transport of user plane and control plane traffic. The S1 reference point shall enable MME and UPE separation and also deployments of a combined MME and UPE solution.
- S2a: It provides the user plane with related control and mobility support between a trusted non 3GPP IP access and the SAÉ Anchor.
- S2b: It provides the user plane with related control and mobility support between ePDG and the SAE Anchor.
- **S3:** It enables user and bearer information exchange for inter 3GPP access system mobility in idle and/or active state. It is based on Gn reference point as defined between SGSNs.

User data forwarding for inter 3GPP access system mobility in active state (FFS). 48

3GPP LTE (Long Term Evolution) (From 3GPP TR 23.882)

WMN





- S4: It provides the user plane with related control and mobility support between GPRS Core and the 3GPP Anchor and is based on Gn reference point as defined between SGSN and GGSN.
- S5a: It provides the user plane with related control and mobility support between MME/UPE and 3GPP anchor. It is FFS whether a standardized S5a exists or whether MME/UPE and 3GPP anchor are combined into one entity.
- S5b: It provides the user plane with related control and mobility support between 3GPP anchor and SAE anchor. It is FFS whether a standardized S5b exists or whether 3GPP anchor and SAE anchor are combined into one entity.
- S6: It enables transfer of subscription and authentication data for authenticating/authorizing user access to the evolved system (AAA interface).



S7: It provides transfer of (QoS) policy and charging rules from PCRF to Policy and Charging Enforcement Point (PCEP).

The allocation of the PCEP is FFS.

SGi: It is the reference point between the Inter AS Anchor and the packet data network. Packet data network may be an operator external public or private packet data network or an intra operator packet data network, e.g. for provision of IMS services. This reference point corresponds to Gi and Wi functionalities and supports any 3GPP and non-3GPP access systems.