




**ITU Regional Forum for ARAB Region:
IMT Systems Technology, Evolution and
Implementation, Tunisia, 7-9 May 2013.**

Session 3: IMT Business & Markets Forecasts

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- Facing The Mobile Data Explosion
- ITU & IMT
- ITU IMT-Related Works: Stats, Forecasts etc
- ITU & Arab Region Aspects
- Additional Slides & Some References

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• Facing The Mobile Data Explosion

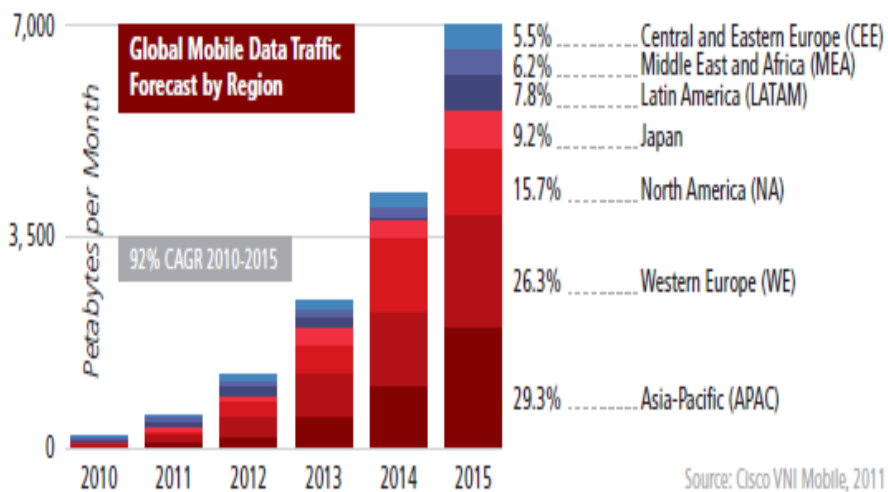
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Facing up to the Mobile Data Explosion: *Stats*

- As of today there are more than:
 - 1 billion 3G subscriptions
 - 400 3GPP-family networks of HSPA technology with data speeds in the 2-14 Mbps range.
 - 140 networks of HSPA+ technology with data speeds of up to 42 Mbps
 - 50 LTE already installed networks (started commercially late 2009) with 10 million LTE subscriptions and with many foreseen operators to deploy LTE gradually

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The Volume of Mobile Data is Growing by Approximately 92 %, year over year



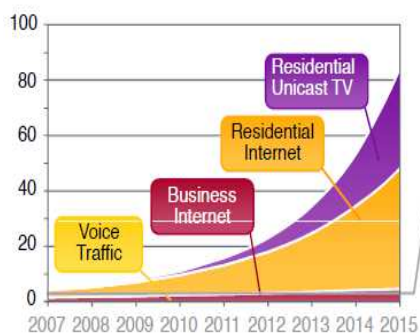
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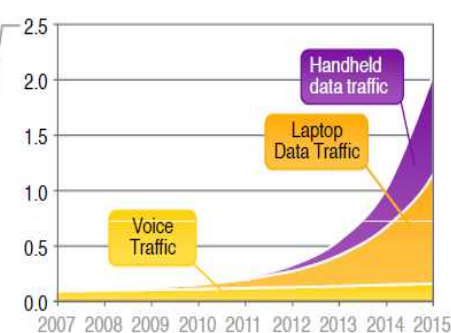
Internet Traffic Growth is Huge

Global FIXED traffic (ExaByte/month)



Fixed broadband traffic is 40x mobile in 2015

Global MOBILE traffic (ExaByte/month)



Mobile data traffic grows 300 fold

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Facing up to the Mobile Data Explosion: *What is Needed?*

- *So we need:*
 - More Spectrum to support the projected growth of mobile data.
 - Less Radio Latency
 - Higher Processing Speed
 - Access to all kind of networks & interfaces

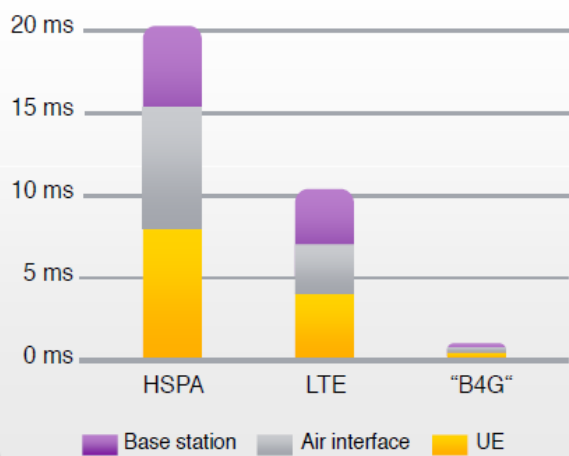
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Radio Can Reduce Latency 10X

Latency in radio networks



Radio latency can be pushed to 1 ms in 2020 by using a shorter frame length

The main benefit is realized when content is close. 1 ms limits fiber length to 100 km.

Enable low-latency M2M solutions

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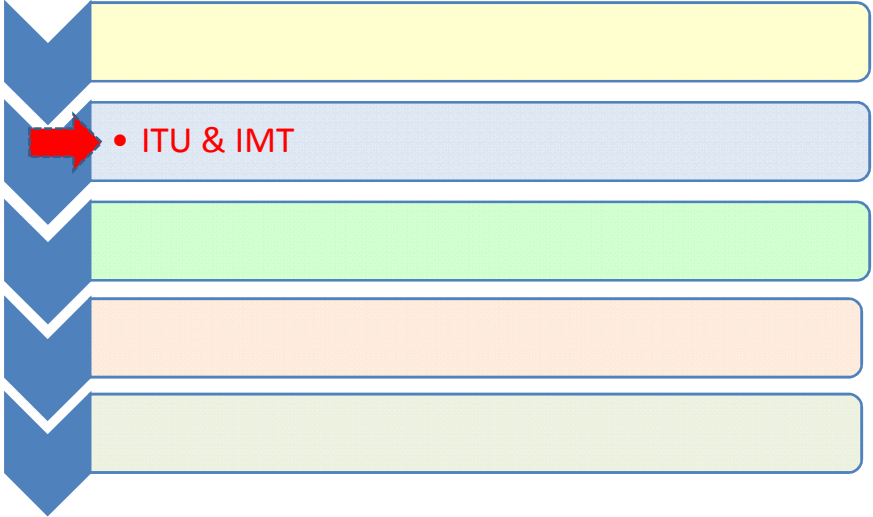
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WIRELESS ACCESS
FOR THE 21ST
CENTURY
Anywhere - Anytime

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• ITU & IMT

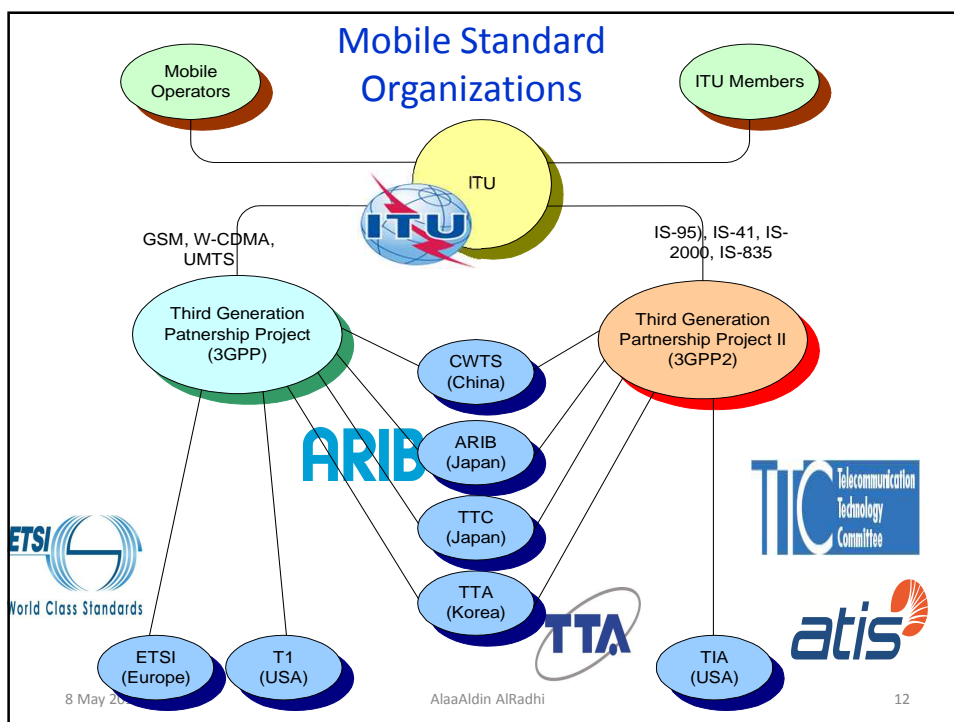
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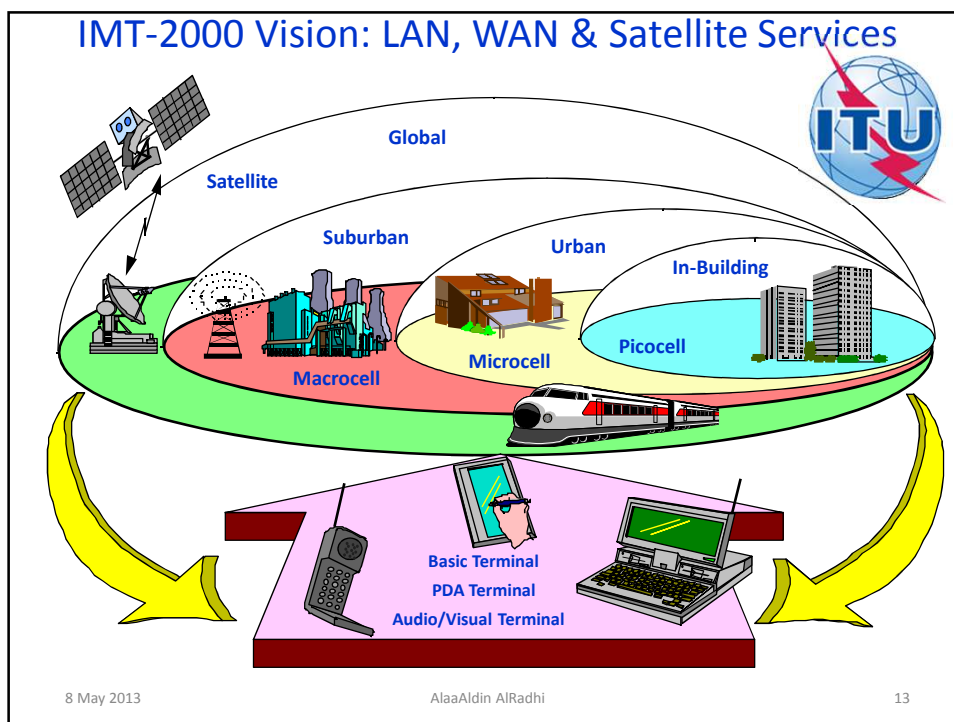
- **IMT = International Mobile Telecommunications**
- **ITU Global Broadband Multimedia International Mobile Telecommunication System**
- **A family of Standards:**
 - **IMT-2000:** ITU's umbrella name for 3G
 - **IMT-Advanced"**
- National & Regional standards bodies are collaborating in 3G partnership projects: **TIA (US), ETSI (EU), TTC (Japan), TTA (South Korea), etc**
- 3G Partnership Projects (**3GPP & 3GPP2**): Focused on evolution of access & core networks
- **Currently:** There Are More Than 2 Billion **IMT** Subscribers In The World

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IMT – Advanced: ITU Standard for 4G

- IMT- Advanced was standardized late 2011 & agreed @ [ITU Radiocommunication Assembly \(RA-12\)](#), in Geneva , January 2012, consensus was reached to expand the IMT Radio Interface Family by establishing the new IMT-Advanced standard. The Recommendation [ITU-R M.2012](#) dealing with IMT was approved by all Member States.
- During the ITU [World Radiocommunication Conference \(WRC-12\)](#) in Geneva, February 2012, it was agreed that additional spectrum for the mobile applications (which includes IMT) was made in [Resolution 232](#) in the band 694 - 790 MHz in Region 1 and additionally asked the ITU-R to perform sharing studies in this band and in additional bands to be identified for IMT in preparation for WRC-15 ([Resolution 233](#)). The additional spectrum will be assigned by the next WRC-15.
- IMT-Advanced to be commercialized by 2015
- Data Rates of 1 Gbps Range



IMT – Advanced: *Summary of Major Improvements Over IMT-2000*

- Increased spectrum efficiency — supporting more users at higher data rates per radio channel;
- Fully packet-based architecture — meaning reduced costs, and comprehensive support for broadband wireless data;
- Improved radio resource management and control — for enhanced quality of service;
- New capabilities for the physical layer of the radio interface — including wideband radio channels, MIMO [multiple input multiple output] smart antennas and flexible deployment options.

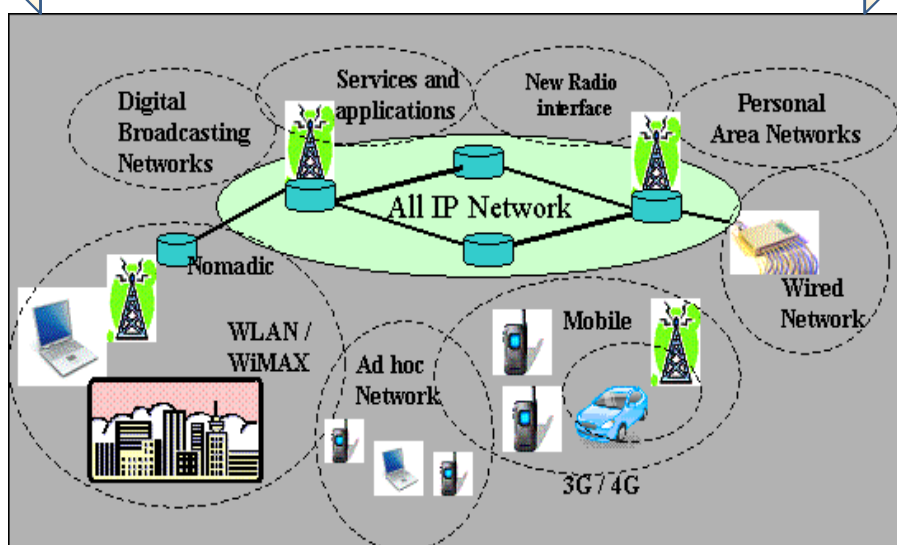
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IMT – Advanced: *Principle*

Convergence of Various Networks into 1 IP based Network



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IMT – Advanced: *Key Features*

- Compatibility of services within IMT & with fixed networks
- Capability of interworking with other radio access
- Worldwide roaming capability systems
- Enhanced peak data rates to support advanced services & applications (100 Mbit/s for high and 1 Gbit/s for low mobility)
- Use radio-frequency spectrum much more efficiently making higher data transfers possible on lesser bandwidth
- Less Latency
- A QoS that matches those of fixed networks

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IMT – Advanced: *Requirements*

- **1 IP based global core network.** Various networks (Wired PSTN, LAN, Cellular (3G), wireless (WIMAX), nomadic, ad hoc & sensor networks) will be able to communicate with this core network.
- The new Radio Channel Multiple access technologies will be backward compatible and must coexist with the IMT-2000 systems. Examples are:
 - OFDMA (Orthogonal Frequency Division Multiple Access)
 - SC-FDMA (Single Carrier- Frequency Division Multiple Access),
 - OFDM-TDMA (Orthogonal Frequency Division Multiplexing - Time Division Multiple Access)
- Radio Aspects:
 - Base station: 2 transmit & 2 receive antennas: (2 x 2)
 - Mobile Station: 1 transmit & 2 receive antennas (1 x 2)

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IMT – Advanced: *Bandwidth & Spectrum Requirements 1*

Spectrum	Current Use	Advantages	Disadvantages
410 - 430 MHz	Land mobile services-public protection and disaster relief	More coverage area, good propagation characteristics	Large antennas, limited band, capabilities of IMT-Advanced could downscale
450 - 470 MHz	Land mobile services-public protection and disaster relief	More coverage area, good propagation characteristics	Large antennas, limited band, capabilities of IMT-Advanced could downscale
470 - 806 MHz	Broadcasting services (TV & Radio)	More coverage area, good propagation , upper band closer to IMT-2000. So reduced complexity of Equipment	Large antennas, limited band, capabilities of IMT-Advanced could downscale
2300 - 2400 MHz	Fixed and mobile services	Band closer to IMT-2000. Simplifies development, planning & deployment of IMT systems	Insufficient bandwidth, Used in other applications

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IMT – Advanced: *Bandwidth & Spectrum Requirements 2*

Spectrum	Current Use	Advantages	Disadvantages
2700 - 2900 MHz	Radar systems, aeronautical radio navigation	Band closer to IMT-2000. Simplifies development, planning & deployment of IMT systems in this band	Not feasible for IMT-2000 systems. Lots of interference from radars
3400 - 4200 MHz	Fixed services & fixed satellite services; fixed & mobile BB wireless access systems	Large bandwidth, smaller antenna size, relatively better propagation characteristics	interference mitigation measures are required

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IMT – Advanced: *Bandwidth & Spectrum Requirements 3*

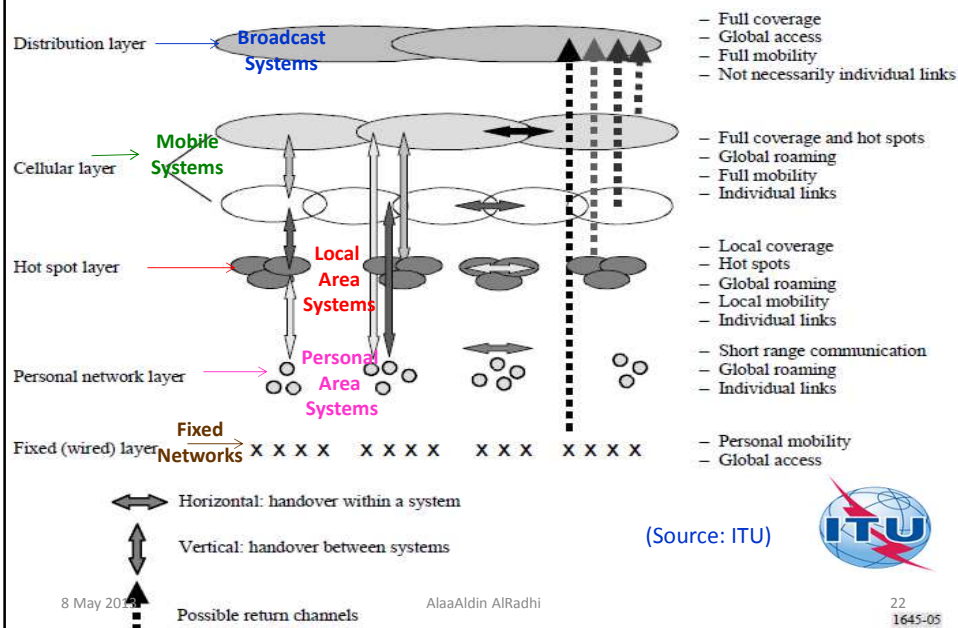
Spectrum	Current Use	Advantages	Disadvantages
4400 - 4990 MHz	Mobile service, FSS providing basic infrastructure telecommunication system, aeronautical mobile or for Fixed Services (FS) for long distance links, radio astronomy	Large bandwidth, smaller antenna size, multiple antenna techniques enabling high spectrum efficiency	largest frequency-dependent propagation loss adversely affecting high mobility

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IMT-Advanced Vision of Complementary Interconnected Access Systems

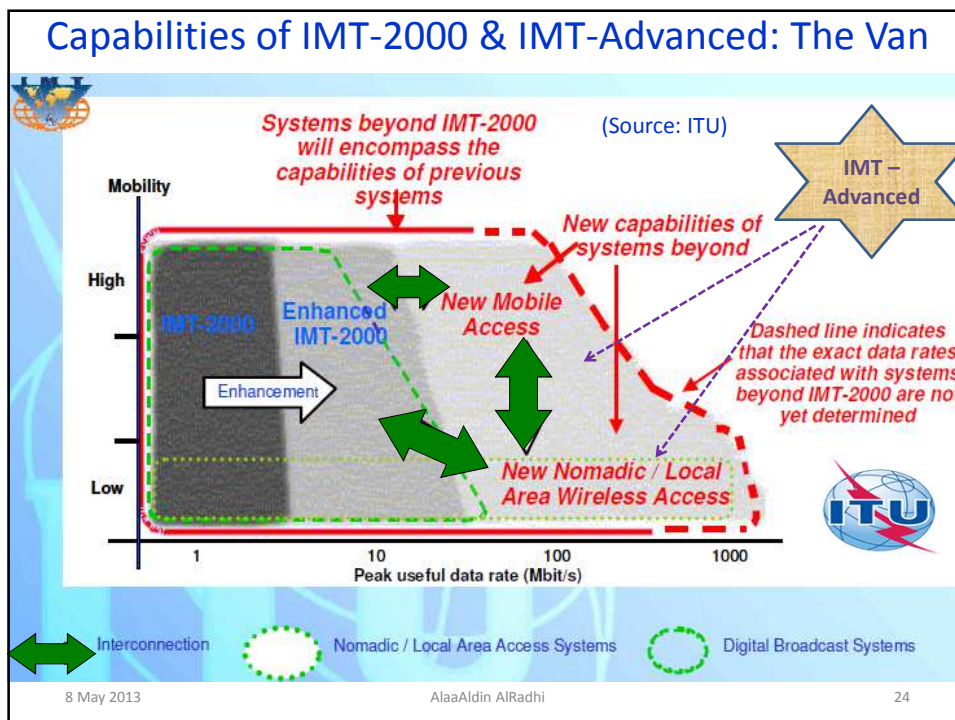
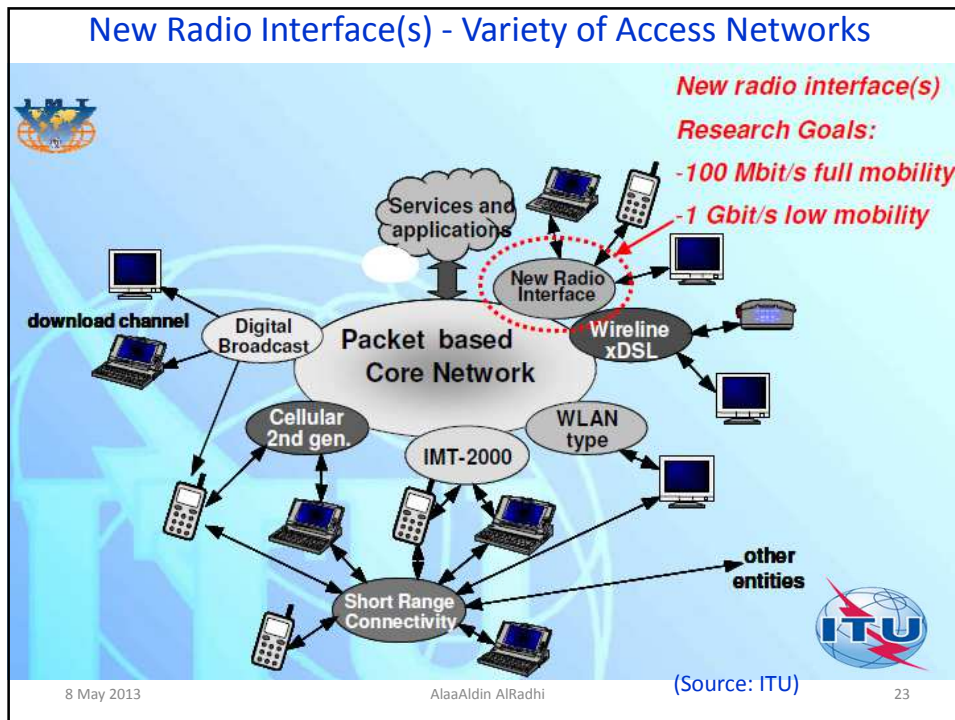


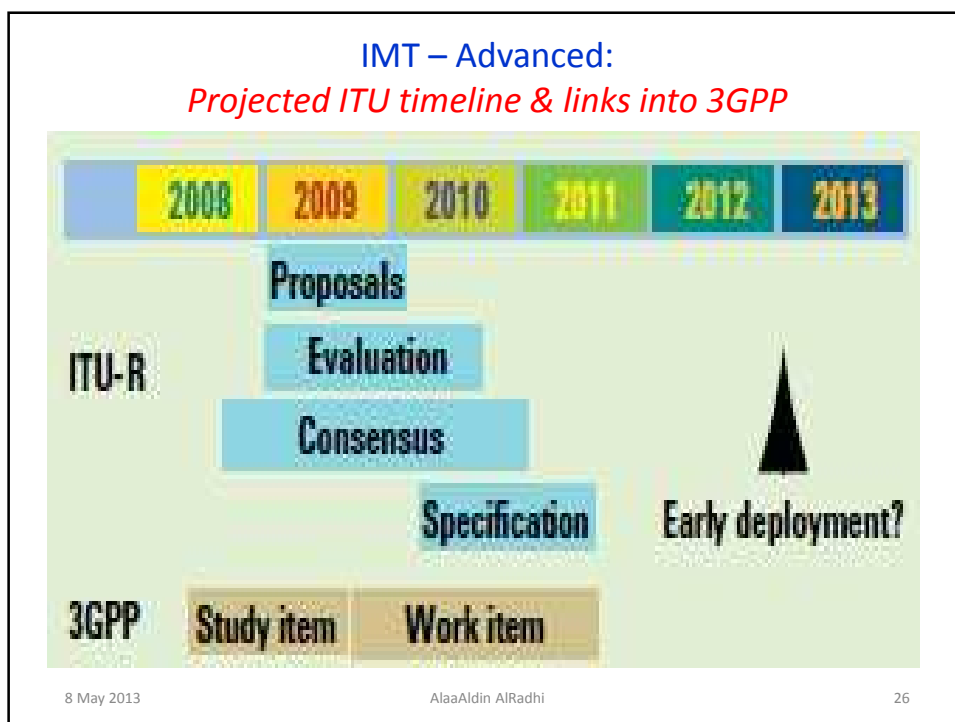
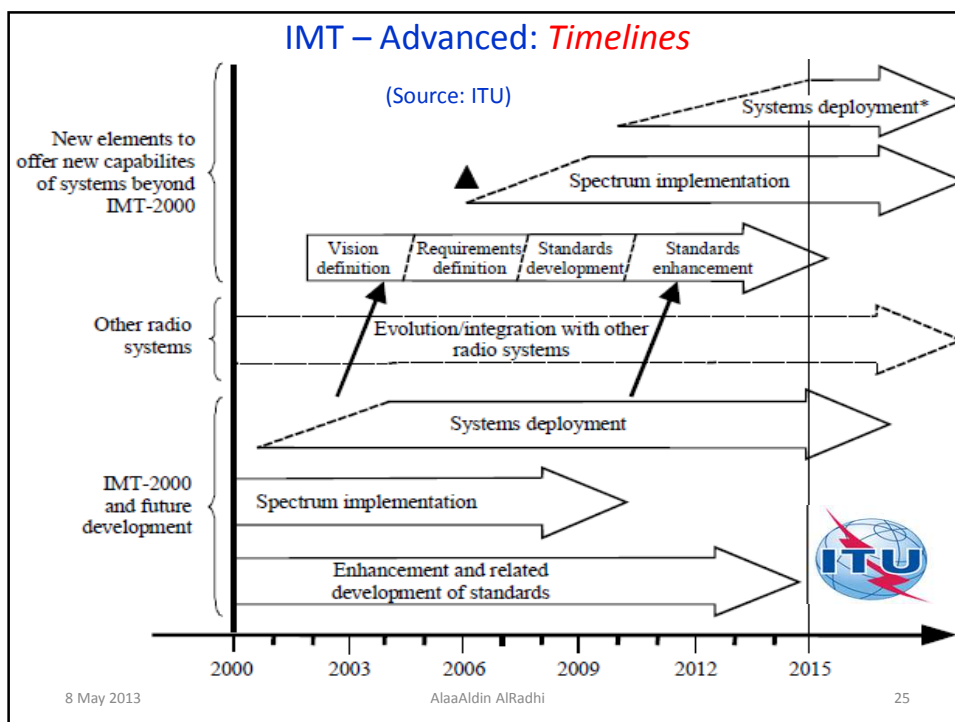
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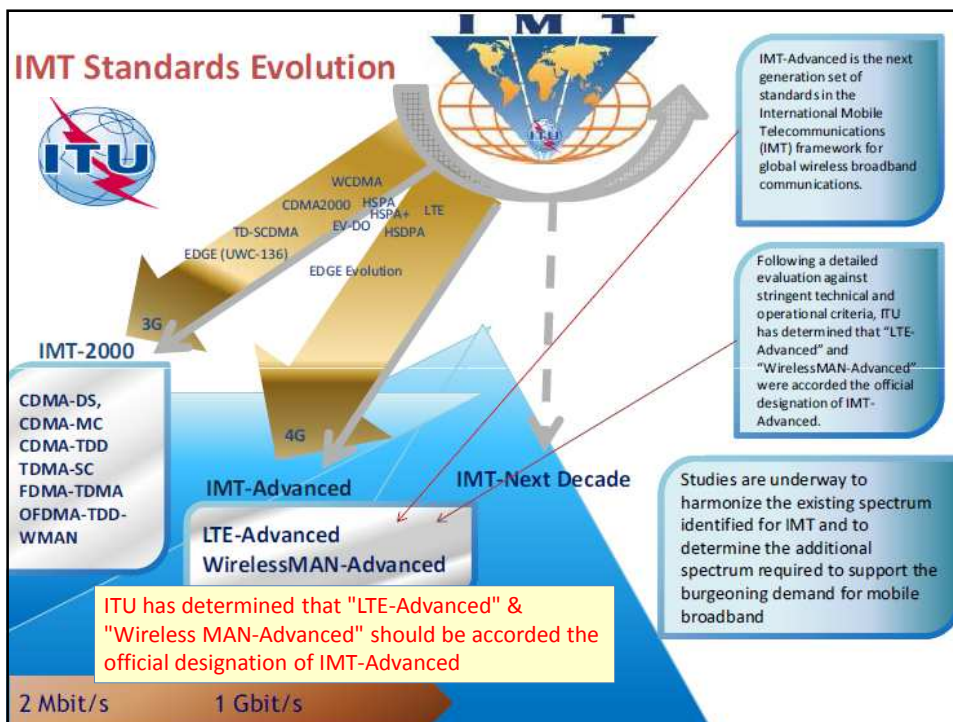




IMT – Advanced: *Summary*

Characteristics	Technology
Deployment	2012-2015
Core networks	IP based
Band	Below 6 GHz
Data rates	100 Mbps to 1 GHz
Access methods	OFDMA, SC- FDMA, OFDM-TDMA
Radio Interface	Cognitive radios, software defined radios.
Modulation	QPSK, 16QAM, 64QAM, DAPSK
Services provided	Rich multimedia, voice, high speed data.
Duplex methods	FDD(paired, unpaired), TDD
Error control	LDPC, turbo codes, HARQ
Handover	Seamless, vertical, horizontal, hard, soft

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Role of ITU

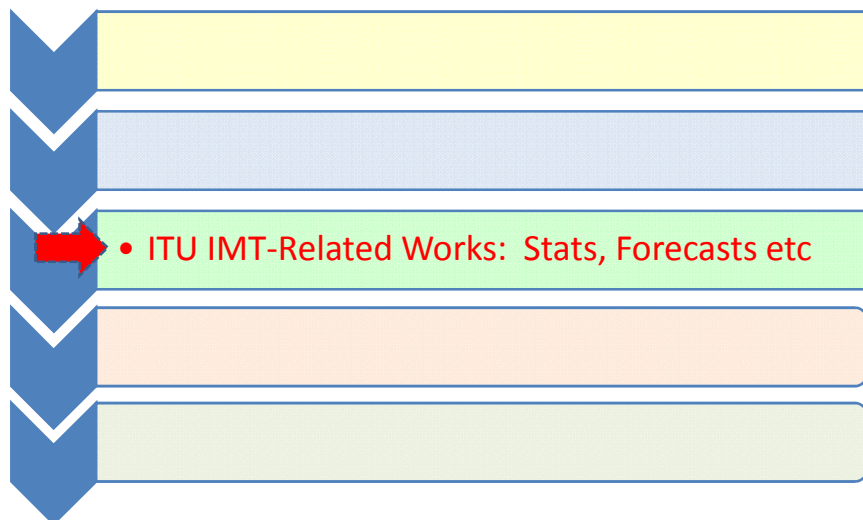


- World-Wide Spectrum Efficiency Coordination & Improvements
- Policy & Regulatory Harmonization
- International Standards for Key Access and Network Interfaces
- Provide Foundation, Framework & Catalyst For 3G Convergence Across Regions & Technologies
- Harmonize Regional Input Contributions & Consensus Building
- **World Radiocommunication Conference (WRCs)**: Reviews & revises the use of the Radio-Frequency spectrum
- **Radiocommunication Assembly (RA)**: Sets work priorities / time-frames and approves the Recommendations in support of WRCs
- **Radio Regulations Board (RRB)**: Approves Rules of Procedure for applying Radio Regulations and registering frequency assignments made by Member States

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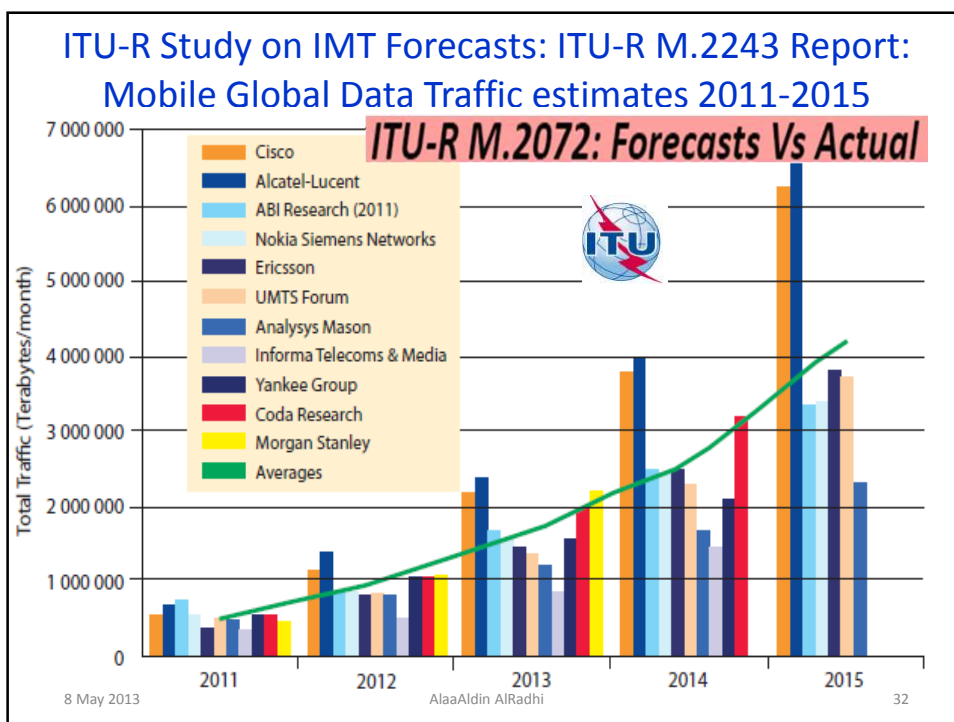
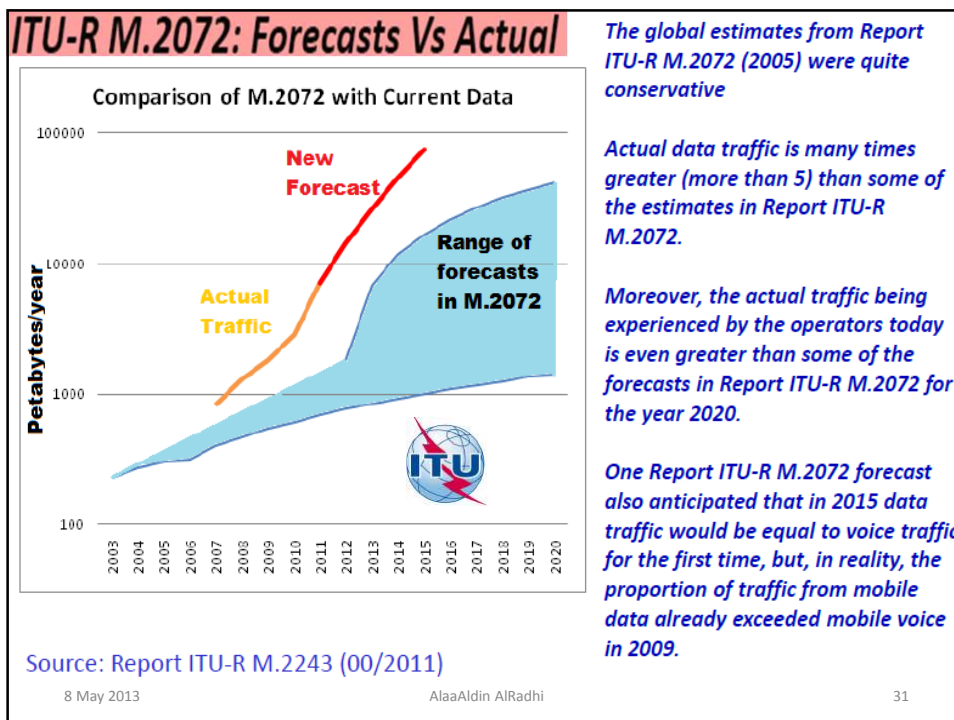
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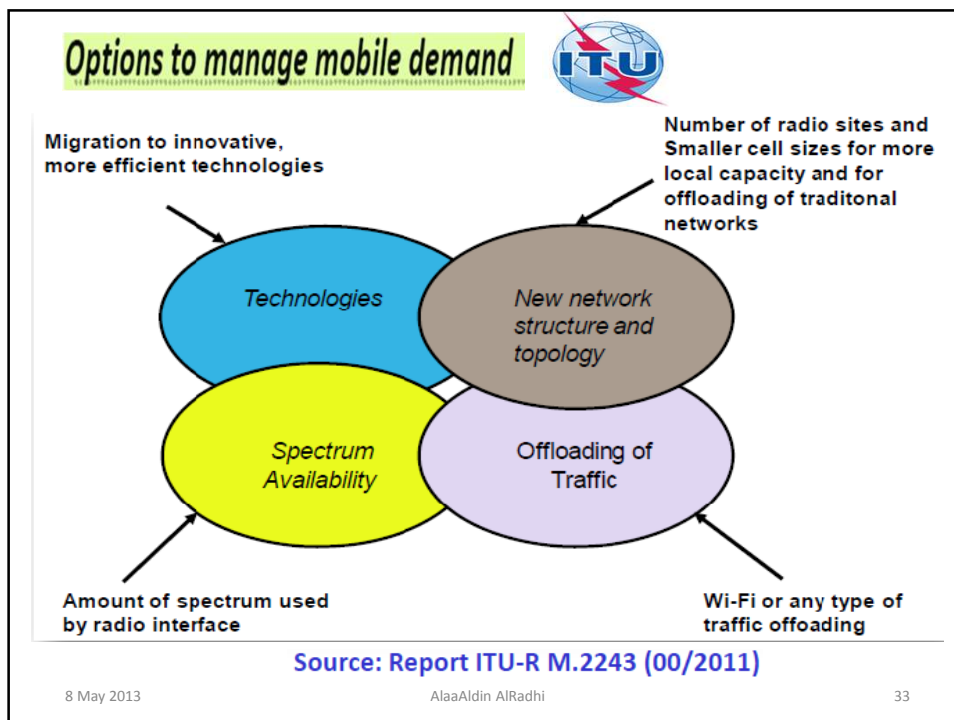


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Ensuring Full Availability of IMT Identified Spectrum

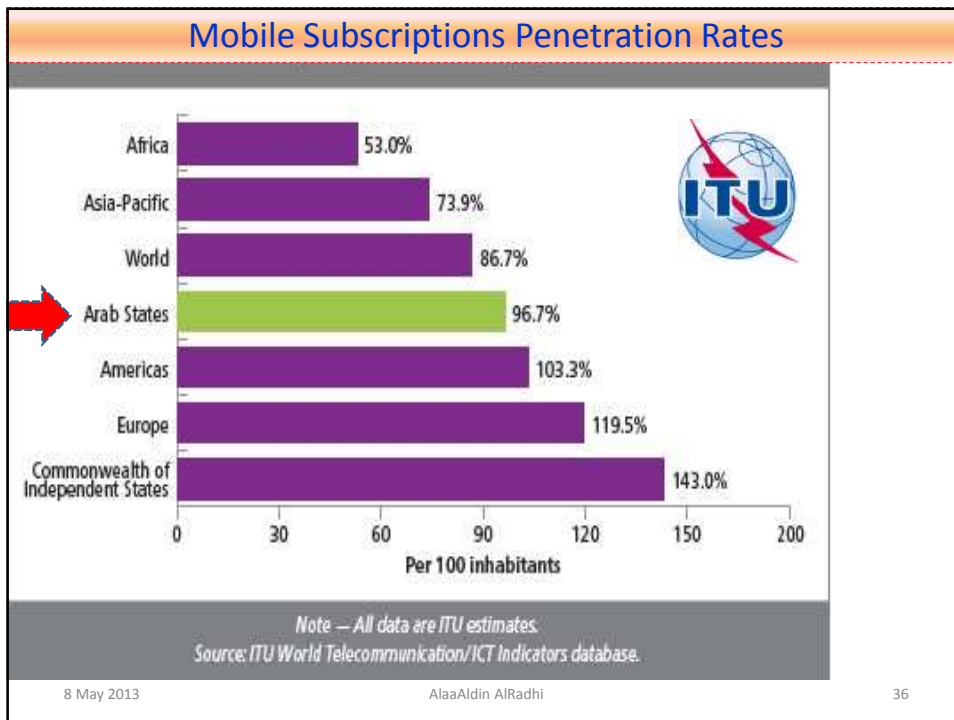
↔ The Amount of Typical Available Spectrum Per Region ↔

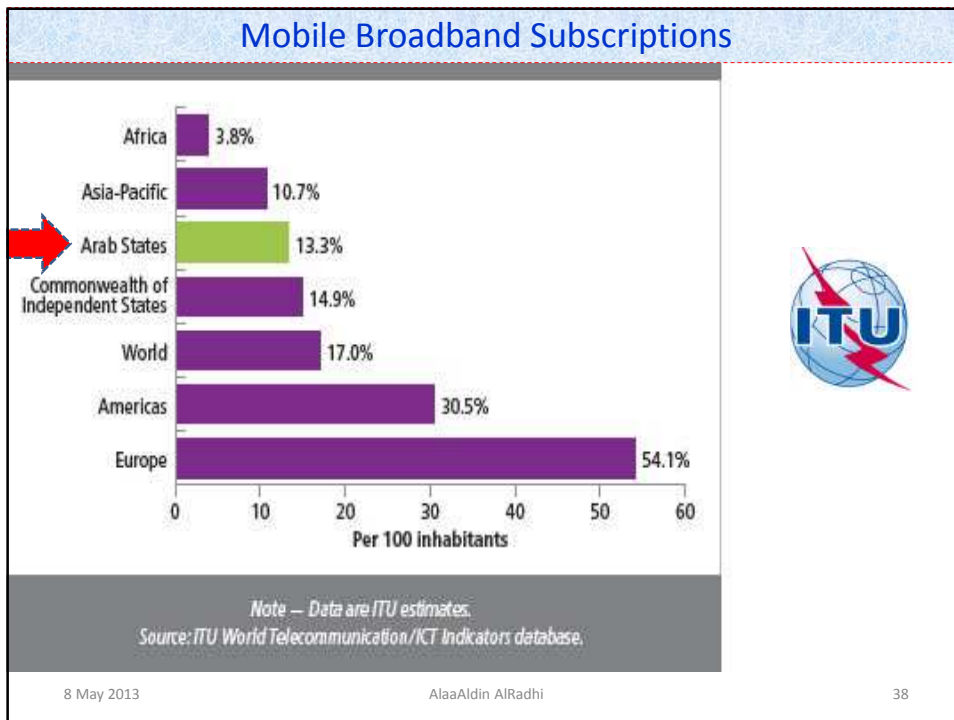
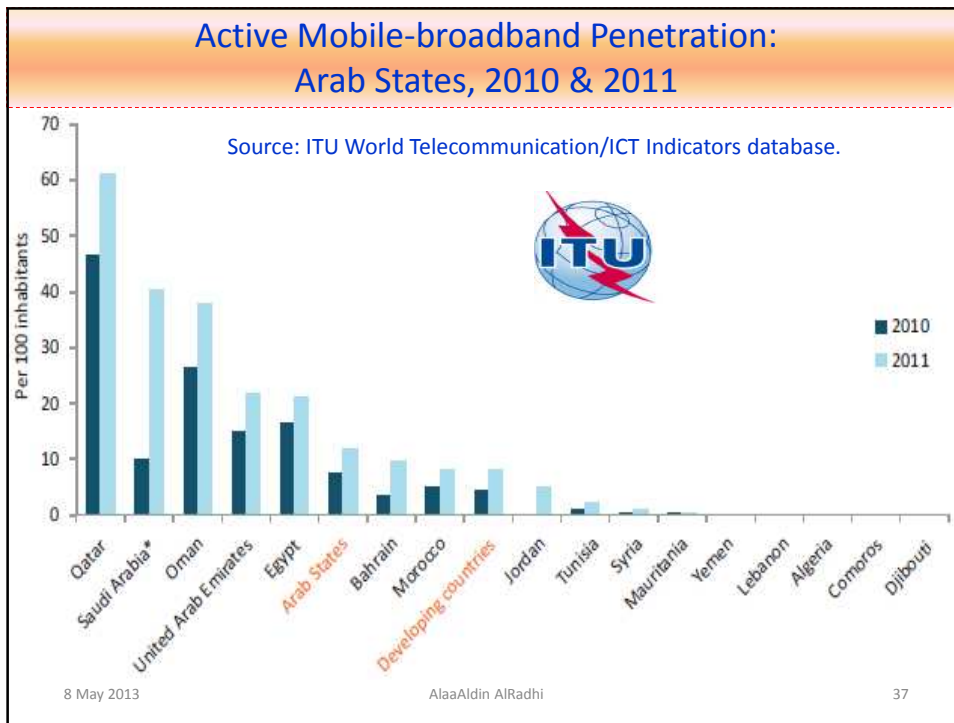
Region		Total spectrum available for IMT (Typical country)
APT	Asia-Pacific Telecommunity	Between 330 MHz and 510 MHz
ASMG	Arab Spectrum Management Group	Between 340 MHz and 630 MHz
ATU	African Telecomm Union	370 MHz
CEPT	EU Conference of Postal & Telecomm Administrations	590 MHz
North America (CITEL)		478 MHz
Latin America (CITEL)		Between 270 MHz and 360 MHz

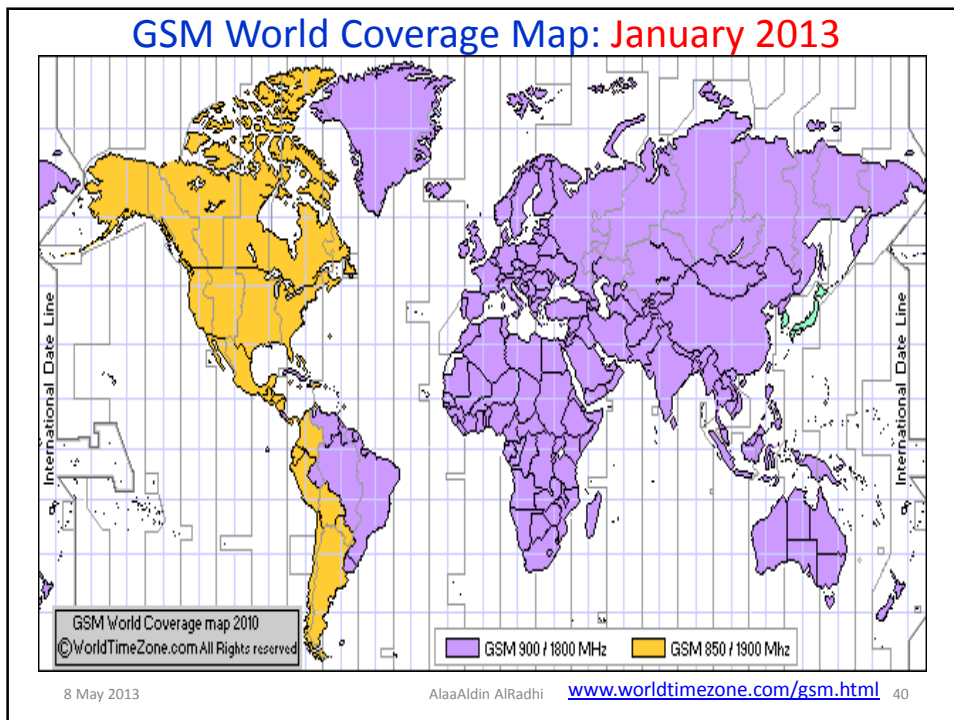
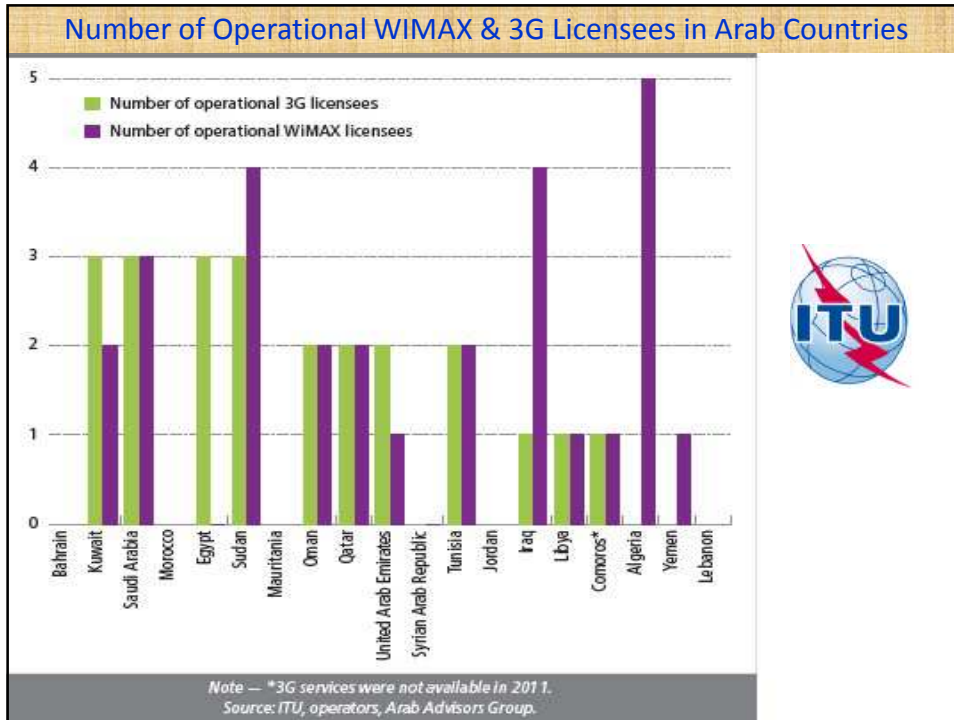
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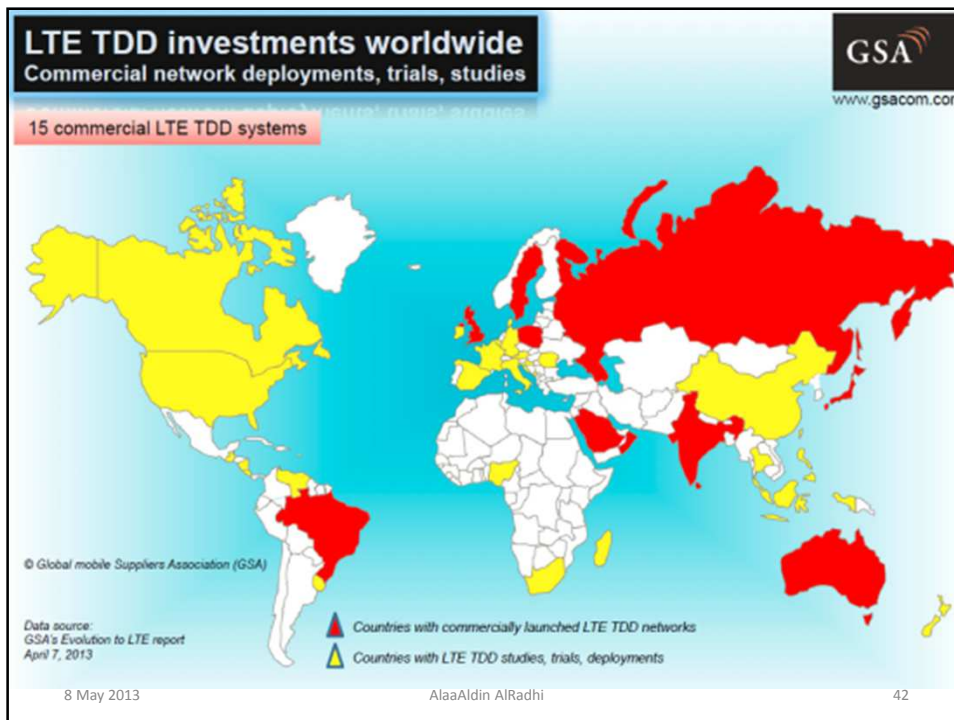
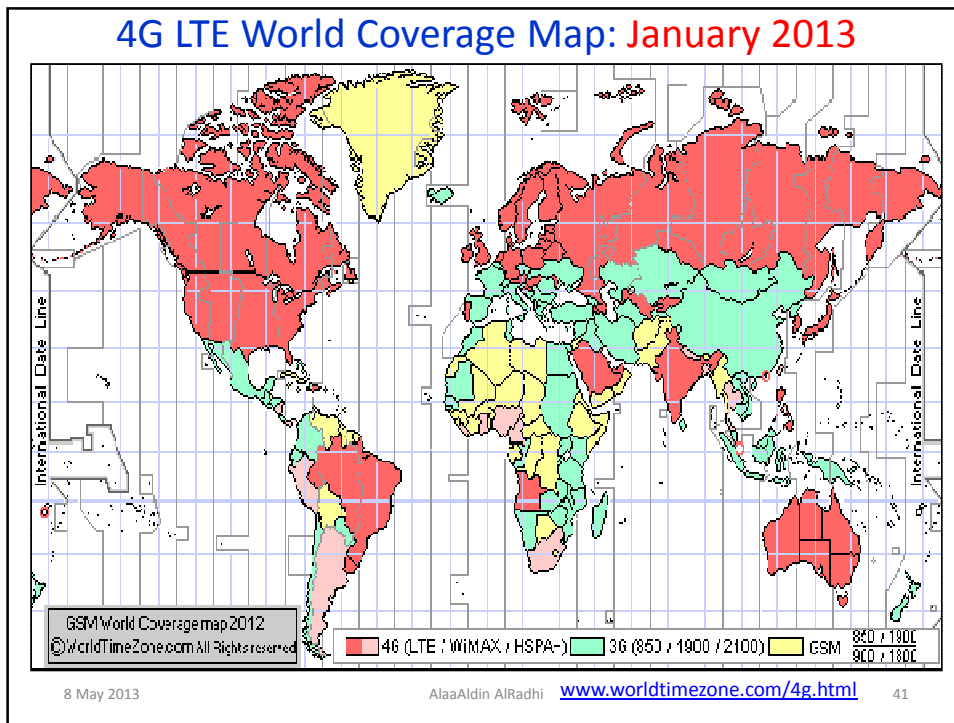
- ITU & Arab Region Aspects

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3G & 4G World Coverage Map: January 2013 Arab Countries 1 / 2

Country	900	1800	1900	850	3G	4G : Commercial LTE, WiMAX, HSPA+, Test, license
Algeria	√	√				
Bahrain	√	√			3G 2100, 3G 850	Menatelecom WiMAX; Testing 4G LTE Menatelecom – Huawei
Egypt	√	√			3G 2100	LTE by end 2014 / Beginning of 2015
Iraq	√				3G MobiTel	
Jordan	√	√			3G 1900/2100	4G WiMAX (UMAX)
Kuwait	√	√			3G 1900/2100	4G LTE: Zain Kuwait, Wataniya & Viva
Lebanon	√				3G 2100	4G LTE in April 2013: Alfa & Touch
Libya	√					

www.worldtimezone.com/4g.html

www.worldtimezone.com/gsm.html

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3G & 4G World Coverage Map: January 2013 Arab Countries 2 / 2

Country	900	1800	1900	850	3G	4G : Commercial LTE, WiMAX, HSPA+, Test, license
Morocco	√	√			3G 2100	
Oman	√				3G Nawras	Nawras WiMAX; 4G LTE Nawras in Feb. 2013
Qatar	√	√			3G 2100	4G LTE Qtel by Mid 2013
KSA	√	√			3G 2100	4G LTE: STC, Mobily & Zain Saudi
Sudan	√	√			3G 2100	
Syria	√	√			3G MTN & Syriatel	
Tunisia	√	√			3G 2100	
UAE	√	√			3G 2100	4G LTE Plans in Dec. 2012: Etisalat & Du

www.worldtimezone.com/4g.html

www.worldtimezone.com/gsm.html

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Connect Arab Summit Doha Qatar March 2012

- **Summit Goals**
 - Goal 1: Access and infrastructure
 - Goal 2: Digital content
 - Goal 3: Cybersecurity
 - Goal 4: Innovation
- **Projects:**
 - A total of USD 46.6 billion
 - Projects will continue to be accepted after the Summit
- **Follow-Up Mechanism:**
 - Will be implemented by ITU in collaboration with the League of Arab States & relevant stakeholders
 - Identify gaps & overlaps, if applicable

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Connect Arab Summit Doha Qatar March 2012

Projects / Concepts Papers:

Full List of Projects can be found @:
www.itu.int/ITU-D/connect/arabstates/projects.asp

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**Connect Arab Summit
Doha Qatar
March 2012**



Connecting the unconnected by 2015...

ARAB ICT HIGHWAY Theme

➔

Spectrum Management

www.itu.int/ITU-D/connect/arabstates/docs/Theme%201/Theme%201%20Doc%204.pdf

- **Goals & Objectives:**
 - Spectrum policies for frequency allocation (including new services) in accordance with agreed policy framework
 - Regional & National Frequency Allocation Table preparation
 - Frequency coordination procedures & cross-border interference (e.g. Harmonized Calculation Method, HCM, European borderline frequency coordination agreement)
 - Advanced Spectrum management regime; e.g. SMS4DC (ITU)
 - Spectrum pricing (methods & procedures)
- **Estimated Budget:** 2 Billion USD
- **Time Frame:** 4 years

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**Connect Arab Summit
Doha Qatar
March 2012**



Connecting the unconnected by 2015...

ARAB ICT HIGHWAY Theme


➔

Wireless Broadband Master Plan

<http://www.itu.int/ITU-D/connect/arabstates/docs/Theme%201/Theme%201%20Doc%205.pdf>

- **Goals & Objectives:**
 - General guidelines for wireless broadband access implementation and development or Arab Region;
 - Development of appropriate policies, regulations and capacity building, including licensing, and planning for building wireless broadband access networks
- **Estimated Budget:** 2 Billion USD
- **Time Frame:** 4 years

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- Additional Slides & Some References

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List of
ITU-R
Recommendations
on IMT:
M-Series



Radiocommunication Sector
(ITU-R)



RECOMMENDED

Freely Available & Updated @: <http://www.itu.int/ITU-R/index.asp?category=information&rlink=imt-advanced-rec&lang=en>

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- [M.687](#) - International Mobile Telecommunications-2000 (IMT-2000)
- [M.816](#) - Framework for services supported on International Mobile Telecommunications-2000 (IMT-2000)
- [M.817](#) - International Mobile Telecommunications-2000 (IMT-2000). Network architectures
- [M.818](#) - Satellite operation within International Mobile Telecommunications-2000 (IMT-2000)
- [M.819](#) - International Mobile Telecommunications-2000 (IMT-2000) for developing countries
- [M.1034](#) - Requirements for the radio interface(s) for International Mobile Telecommunications-2000 (IMT-2000)
- [M.1035](#) - Framework for the radio interface(s) and radio sub-system functionality for International Mobile Telecommunications-2000 (IMT-2000)
- [M.1036](#) - Frequency arrangements for implementation of the terrestrial component of International Mobile Telecommunications (IMT) in the bands identified for IMT in the Radio Regulations (RR)
- [M.1078](#) - Security principles for International Mobile Telecommunications-2000 (IMT-2000)

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- [M.1079](#) - Performance and quality of service requirements for International Mobile Telecommunications-2000 (IMT-2000) access networks
- [M.1167](#) - Framework for the satellite component of International Mobile Telecommunications-2000 (IMT-2000)
- [M.1168](#) - Framework of International Mobile Telecommunications-2000 (IMT-2000)
- [M.1182](#) - Integration of terrestrial and satellite mobile communication
- [M.1223](#) - Evaluation of security mechanisms for IMT-2000
- [M.1224](#) - Vocabulary of terms for International Mobile Telecommunications (IMT)
- [M.1225](#) - Guidelines for evaluation of radio transmission technologies for IMT-2000
- [M.1308](#) - Evolution of land mobile systems towards IMT-2000
- [M.1311](#) - Framework for modularity and radio commonality within IMT-2000
- [M.1390](#) - Methodology for the calculation of IMT-2000 terrestrial spectrum requirements
- [M.1391](#) - Methodology for the calculation of IMT-2000 satellite spectrum requirements

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- [M.1456](#) - Minimum performance characteristics & operational conditions for high altitude platform stations providing IMT-2000 in the bands 1 885-1 980 MHz, 2 010-2 025 MHz & 2 110-2 170 MHz in Regions 1 & 3 and 1 885-1 980 MHz & 2 110-2 160 MHz in Region 2
- [M.1457](#) - Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications-2000 (IMT-2000)
- [M.1545](#) - Measurement uncertainty as it applies to test limits for the terrestrial component of International Mobile Telecommunications-2000
- [M.1579](#) - Global circulation of IMT-2000 terrestrial terminals
- [M.1580](#) - Generic unwanted emission characteristics of base stations using the terrestrial radio interfaces of IMT 2000
- [M.1581](#) - Generic unwanted emission characteristics of mobile stations using the terrestrial radio interfaces of IMT 2000
- [M.1635](#) - General methodology for assessing the potential for interference between IMT-2000 or systems beyond IMT-2000 and other services
- [M.1641](#) - A methodology for co-channel interference evaluation to determine separation distance from a system using high-altitude platform stations to a cellular system to provide IMT-2000 service
- [M.1645](#) - Framework and overall objectives of the future development of IMT-2000 and systems beyond IMT-2000

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- [M.1646](#) - Parameters to be used in co-frequency sharing & pfd threshold studies between terrestrial IMT-2000 & BSS (sound) in the 2 630-2 655 MHz
- [M.1654](#) - A methodology to assess interference from broadcasting-satellite service (sound) into terrestrial IMT-2000 systems intending to use the band 2 630-2 655 MHz
- [M.1768](#) - Methodology for calculation of spectrum requirements for the future development of the terrestrial component of IMT-2000 and systems beyond IMT-2000
- [M.1822](#) - Framework for services supported by IMT
- [M.1850](#) - Detailed specifications of the radio interfaces for the satellite component of International Mobile Telecommunications-2000 (IMT-2000)
- [M.2012](#) - Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications Advanced (and 5.433A)
- [M.2014](#) - Global circulation of IMT-2000 satellite terminals
- [S.1856](#) - Methodologies for determining whether an IMT station at a given location operating in the band 3 400-3 600 MHz would transmit without exceeding the power flux-density limits in the Radio Regulations Nos. 5.430A, 5.432A, 5.432B and 5.433A

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List of
ITU-R Reports
on IMT:
M-Series



Radiocommunication Sector
(ITU-R)



RECOMMENDED

Freely Available & Updated @: <http://www.itu.int/ITU-R/index.asp?category=information&mlink=imt-advanced-rep&lang=en>

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- [BT.2247](#) - Field measurement and analysis of compatibility between DTTB and IMT
- [F.2060](#) - Fixed service use in the IMT-2000 transport network
- [M.1153](#) - Future public land mobile telecommunication systems
- [M.1155](#) - Adaptation of mobile Radiocommunication technology to the needs of developing countries
- [M.2023](#) - Spectrum requirements for International Mobile Telecommunications-2000 (IMT-2000)
- [M.2024](#) - Summary of spectrum usage survey results
- [M.2030](#) - Coexistence between IMT-2000 time division duplex and frequency division duplex terrestrial radio interface technologies around 2 600 MHz operating in adjacent bands and in the same geographical area
- [M.2031](#) - Compatibility between WCDMA 1800 downlink and GSM 1900 uplink
- [M.2038](#) - Technology trends
- [M.2039](#) - Characteristics of terrestrial IMT-2000 systems for frequency sharing/interference analyses
- [M.2041](#) - Sharing and adjacent band compatibility in the 2.5 GHz band between the terrestrial and satellite components of IMT-2000

- [M.2045](#) - Mitigating techniques to address coexistence between IMT-2000 time division duplex and frequency division duplex radio interface technologies within the frequency range 2 500-2 690 MHz operating in adjacent bands and in the same geographical area
- [M.2072](#) - World mobile telecommunication market forecast
- [M.2074](#) - Radio aspects for the terrestrial component of IMT-2000 and systems beyond IMT-2000
- [M.2077](#) - Traffic forecasts and estimated spectrum requirements for the satellite component of IMT 2000 and systems beyond IMT-2000 for the period 2010 to 2020
- [M.2078](#) - Estimated spectrum bandwidth requirements for the future development of IMT-2000 and IMT-Advanced
- [M.2079](#) - Technical and operational information for identifying Spectrum for the terrestrial component of future development of IMT-2000 and IMT-Advanced
- [M.2109](#) - Sharing studies between IMT Advanced systems and geostationary satellite networks in the fixed-satellite service in the 3 400-4 200 and 4 500-4 800 MHz frequency bands

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- [M.2110](#) - Sharing studies between Radiocommunication services and IMT systems operating in the 450-470 MHz band
- [M.2111](#) - Sharing studies between IMT-Advanced and the radiolocation service in the 3 400-3 700 MHz bands
- [M.2112](#) - Compatibility/sharing of airport surveillance radars and meteorological radar with IMT systems within the 2 700-2 900 MHz band
- [M.2113](#) - Sharing studies in the 2 500-2 690 MHz band between IMT-2000 and fixed broadband wireless access systems including nomadic applications in the same geographical area
- [M.2133](#) - Requirements, evaluation criteria and submission templates for the development of IMT-Advanced
- [M.2134](#) - Requirements related to technical performance for IMT-Advanced radio interface(s)
- [M.2135](#) - Guidelines for evaluation of radio interface technologies for IMT-Advanced
- [M.2146](#) - Coexistence between IMT-2000 CDMA-DS and IMT-2000 OFDMA TDD WMAN in the 2 500-2 690 MHz band operating in adjacent bands in the same area

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- [M.2176](#) - Vision and requirements for the satellite radio interface(s) of IMT-Advanced
- [M.2198](#) - The outcome of the evaluation, consensus building and decision of the IMT-Advanced process (steps 4-7), including characteristics of IMT-Advanced radio interfaces
- [M.2241](#) - Compatibility studies in relation to Resolution 224 in the bands 698-806 MHz and 790-862 MHz
- [M.2242](#) - Cognitive Radio Systems specific for IMT Systems
- [M.2243](#) - Assessment of the global mobile broadband deployments and forecasts for International Mobile Telecommunications
- [M.2244](#) - Isolation between antennas of IMT base stations in the land mobile service

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Partnership Project and Forums

- ITU IMT <http://www.itu.int/imt>
- Mobile Partnership Projects:
 - 3GPP: <http://www.3gpp.org>
 - 3GPP2: <http://www.3gpp2.org>
- Mobile Technical Forums:
 - 3G All IP Forum: <http://www.3gip.org>
 - IPv6 Forum: <http://www.ipv6forum.com>
- Mobile Marketing Forums
 - Mobile Wireless Internet Forum: <http://www.mwif.org>
 - UMTS Forum: <http://www.ums-forum.org>
 - GSM Forum: <http://www.gsmworld.org>
 - Universal Wireless Communication: <http://www.uwcc.org>
 - Global Mobile Supplier: <http://www.gsacom.com>

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Mobile Standards Organizations

- European Technical Standard Institute (Europe):
 - <http://www.etsi.org>
- Telecommunication Industry Association (USA):
 - <http://www.tiaonline.org>
- Standard Committee T1 (USA):
 - <http://www.t1.org>
- China Wireless Telecommunication Standard (China):
 - <http://www.cwts.org>
- The Association of Radio Industries and Businesses (Japan):
 - <http://www.arib.or.jp/arib/english/>
- The Telecommunication Technology Committee (Japan):
 - <http://www.ttc.or.jp/e/index.html>
- The Telecommunication Technology Association (Korea):
 - http://www.tta.or.kr/english/e_index.htm

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