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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ITU Affiliated & Internet, Telecoms & Emerging Technologies Infrastructures Landscape:

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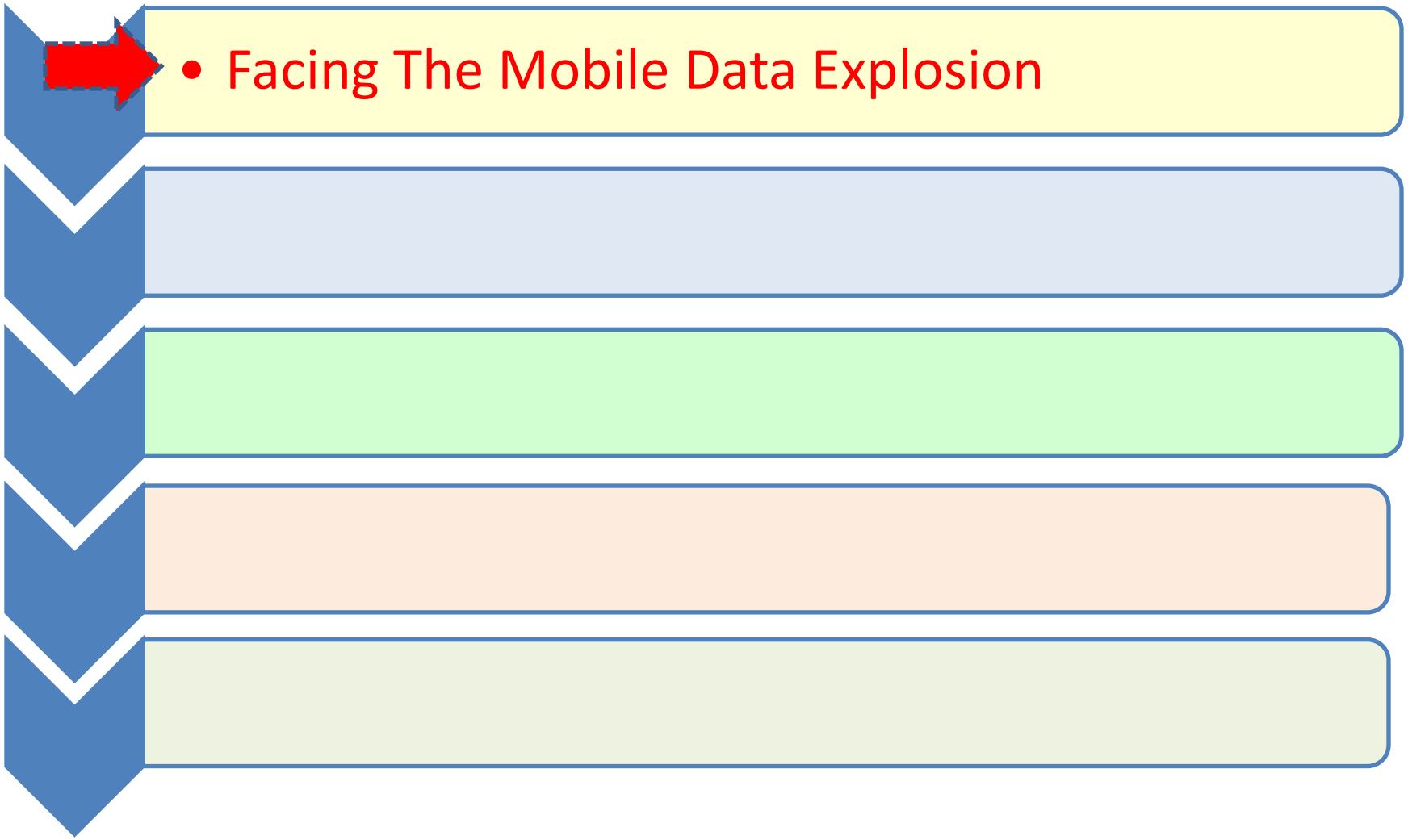
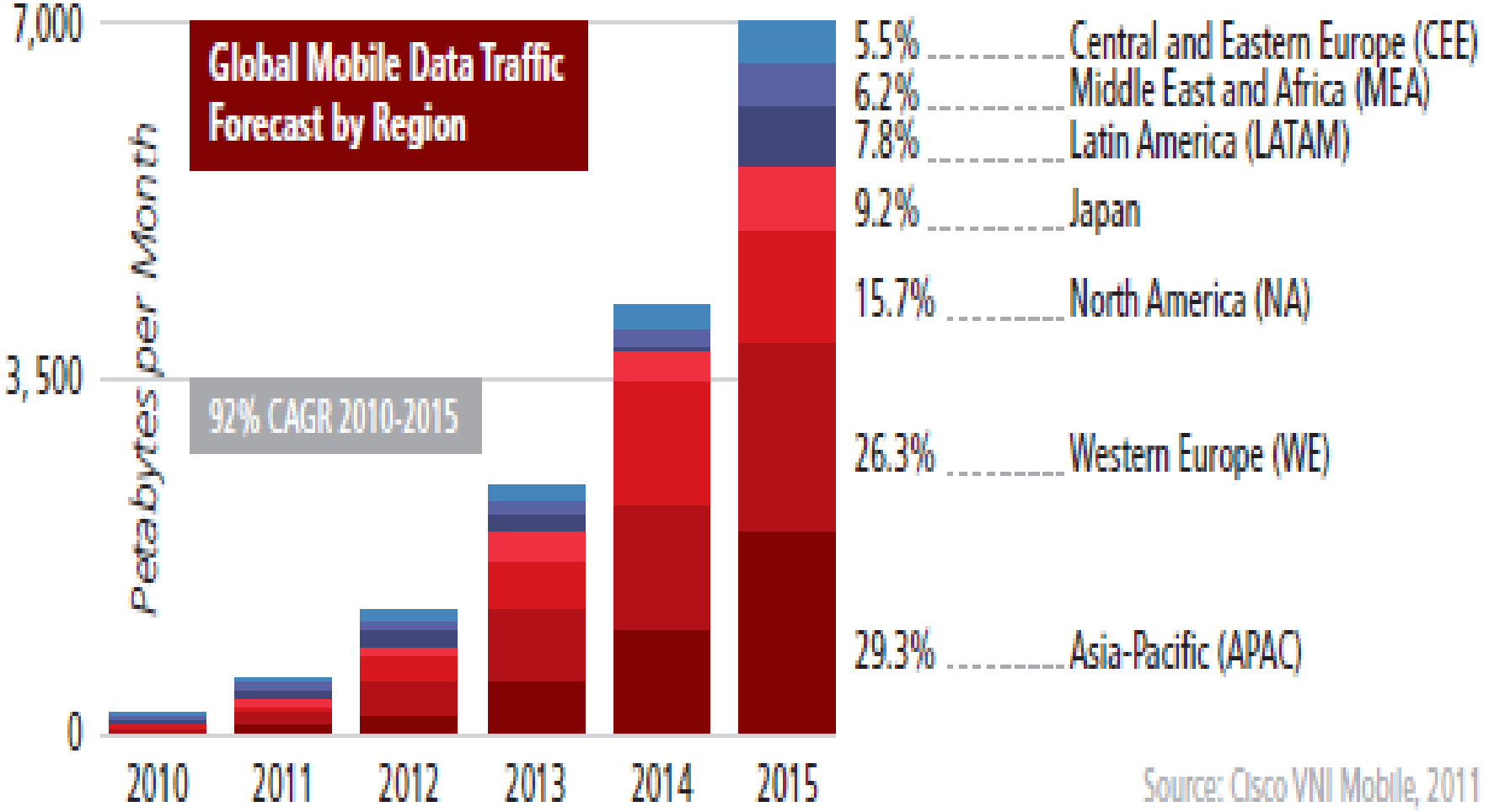
- Facing The Mobile Data Explosion
- ITU & IMT
- ITU IMT-Related Works: Stats, Forecasts etc
- ITU & Arab Region Aspects
- Additional Slides & Some References


• Facing The Mobile Data Explosion

Facing up to the Mobile Data Explosion: *Stats*

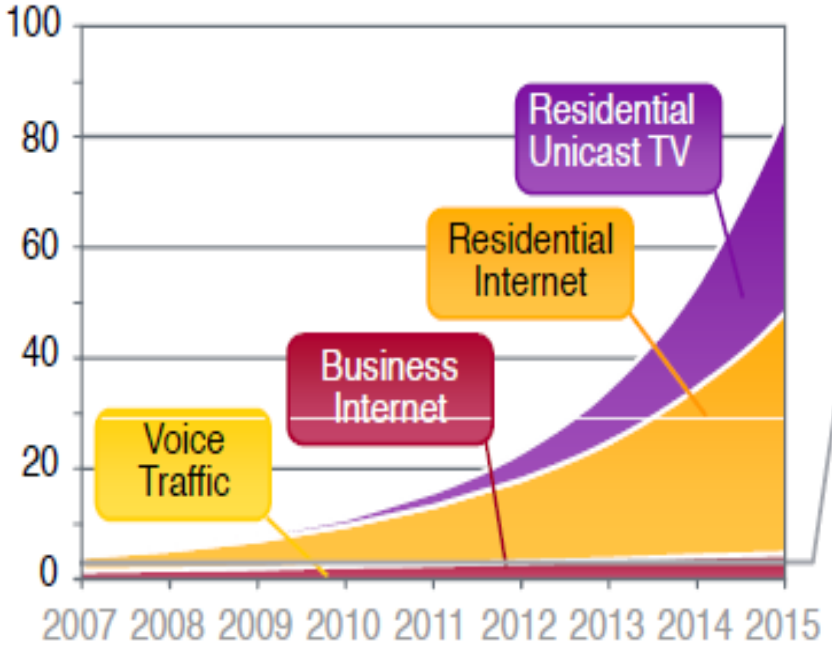
- As of today there are more than:
  - 1 billion 3G subscriptions
  - 400 3GPP-family networks of HSPA technology with data speeds in the 2-14 Mbps range.
  - 140 networks of HSPA+ technology with data speeds of up to 42 Mbps
  - 50 LTE already installed networks (started commercially late 2009) with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

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

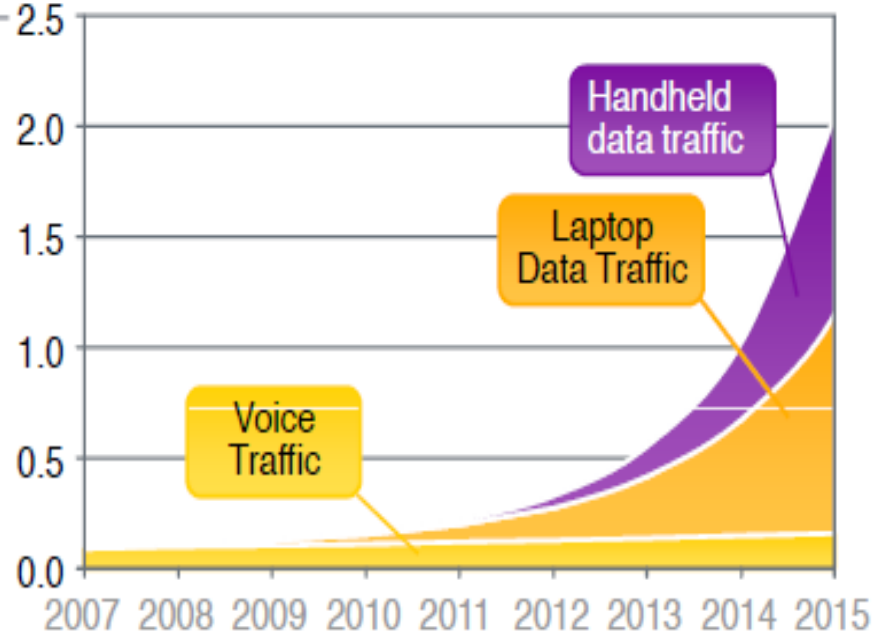


Internet Traffic Growth is Huge

Global FIXED traffic (ExaByte/month)



Global MOBILE traffic (ExaByte/month)



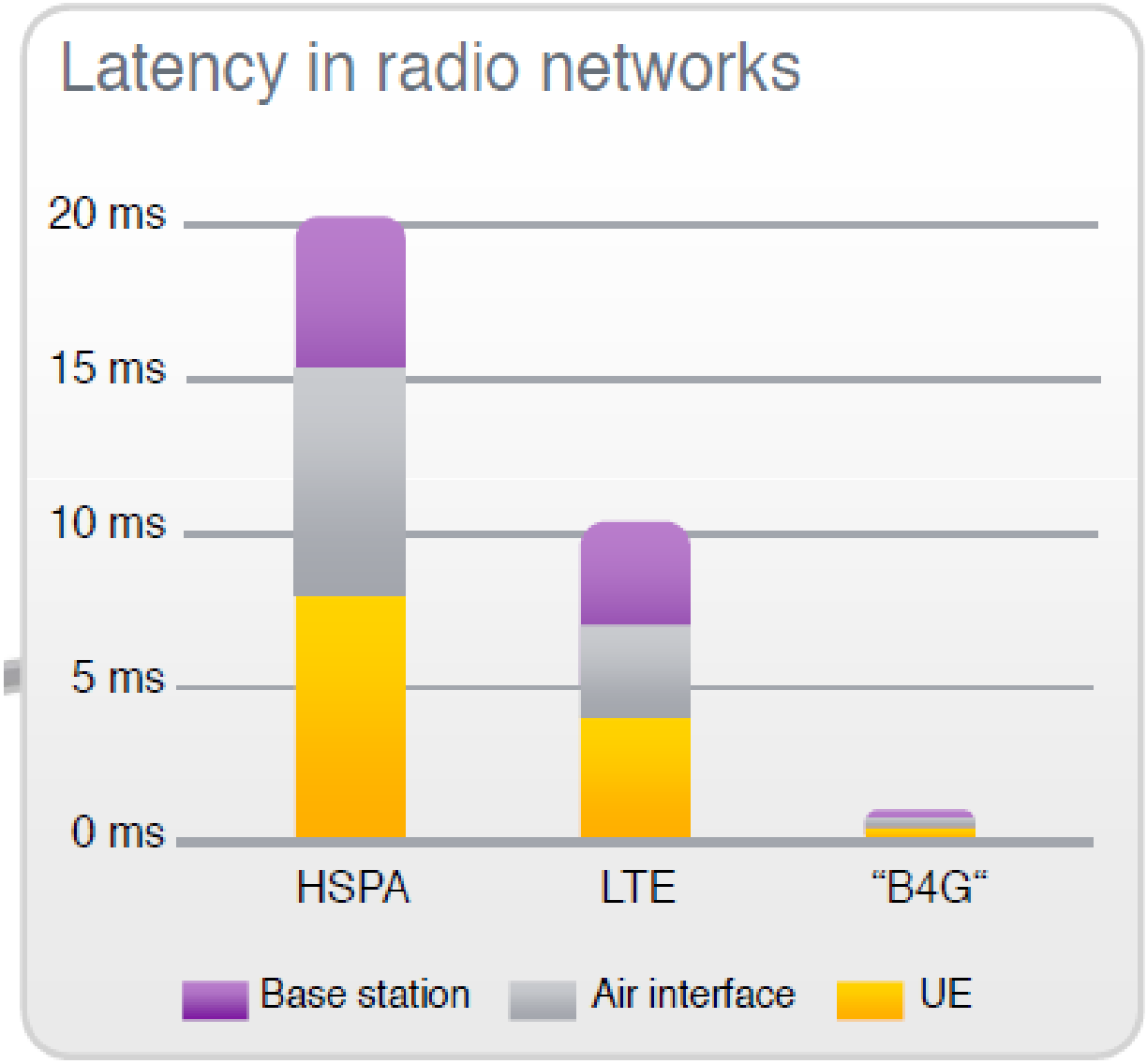
Fixed broadband traffic is 40x mobile in 2015

Mobile data traffic grows 300 fold

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

Radio Can Reduce Latency 10X

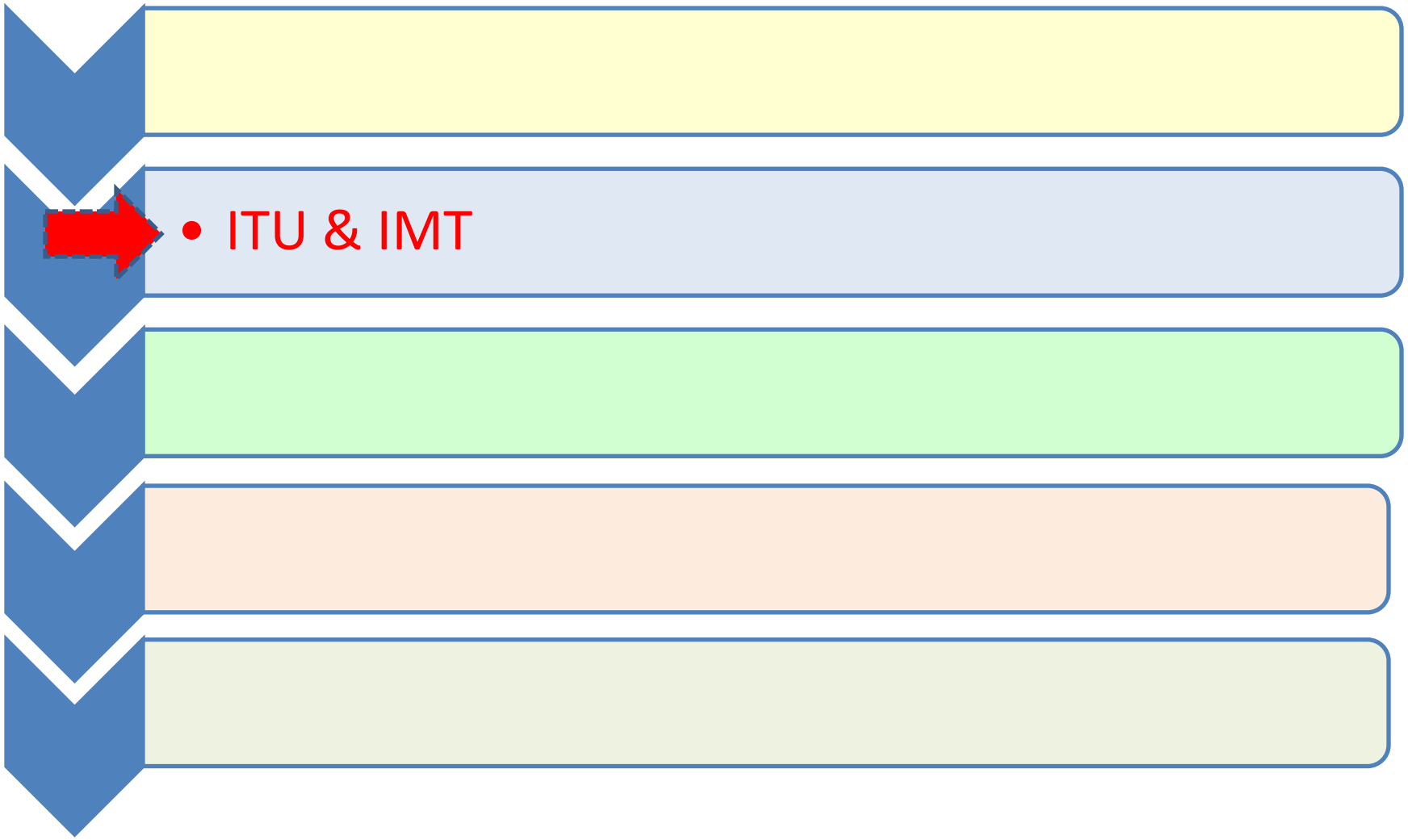


Radio latency can be pushed to 1 ms in 2020 by using a shorter frame length

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

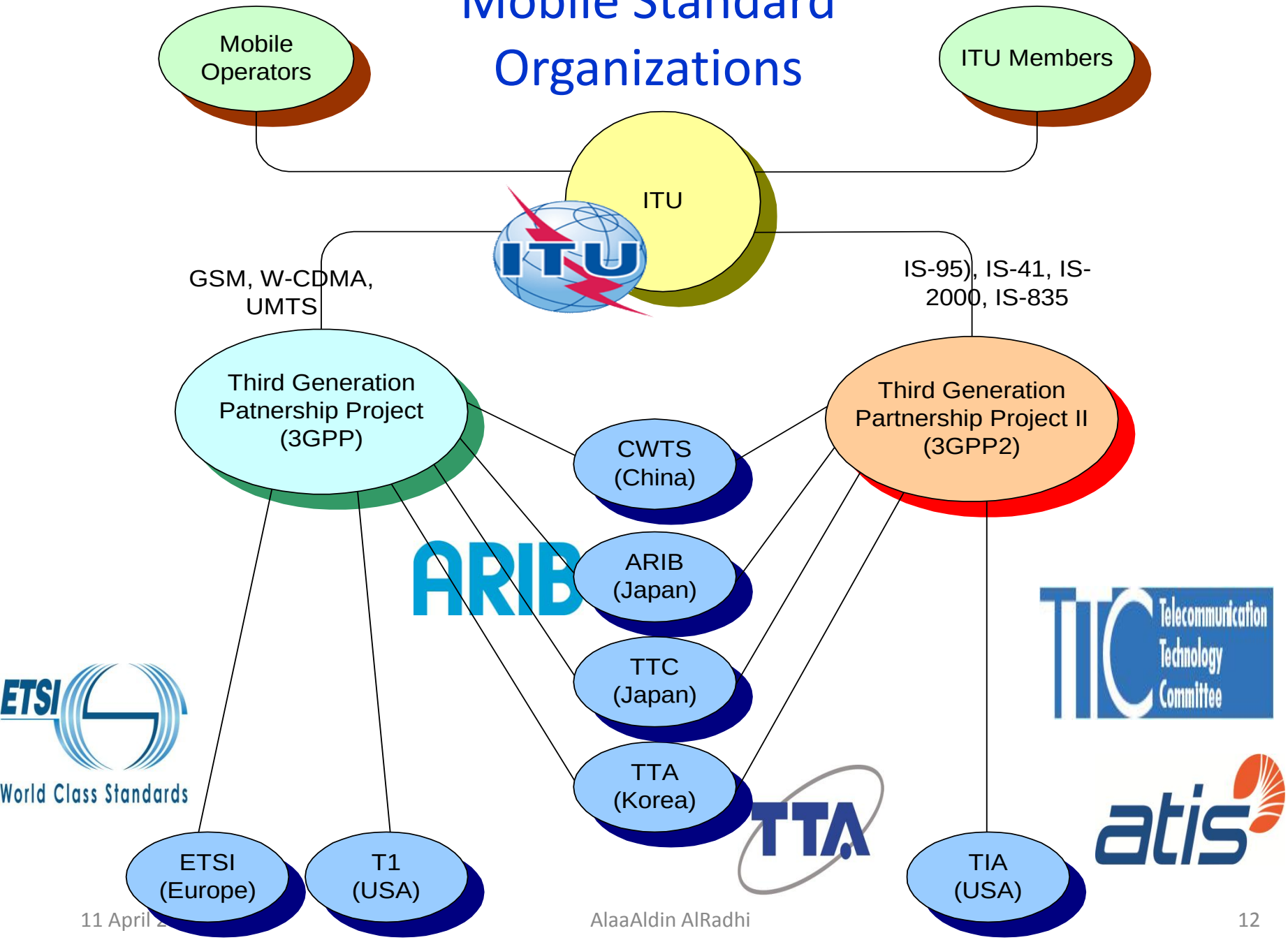
Enable low-latency M2M solutions

WIRELESS ACCESS
FOR THE 21ST
CENTURY
Anywhere - Anytime

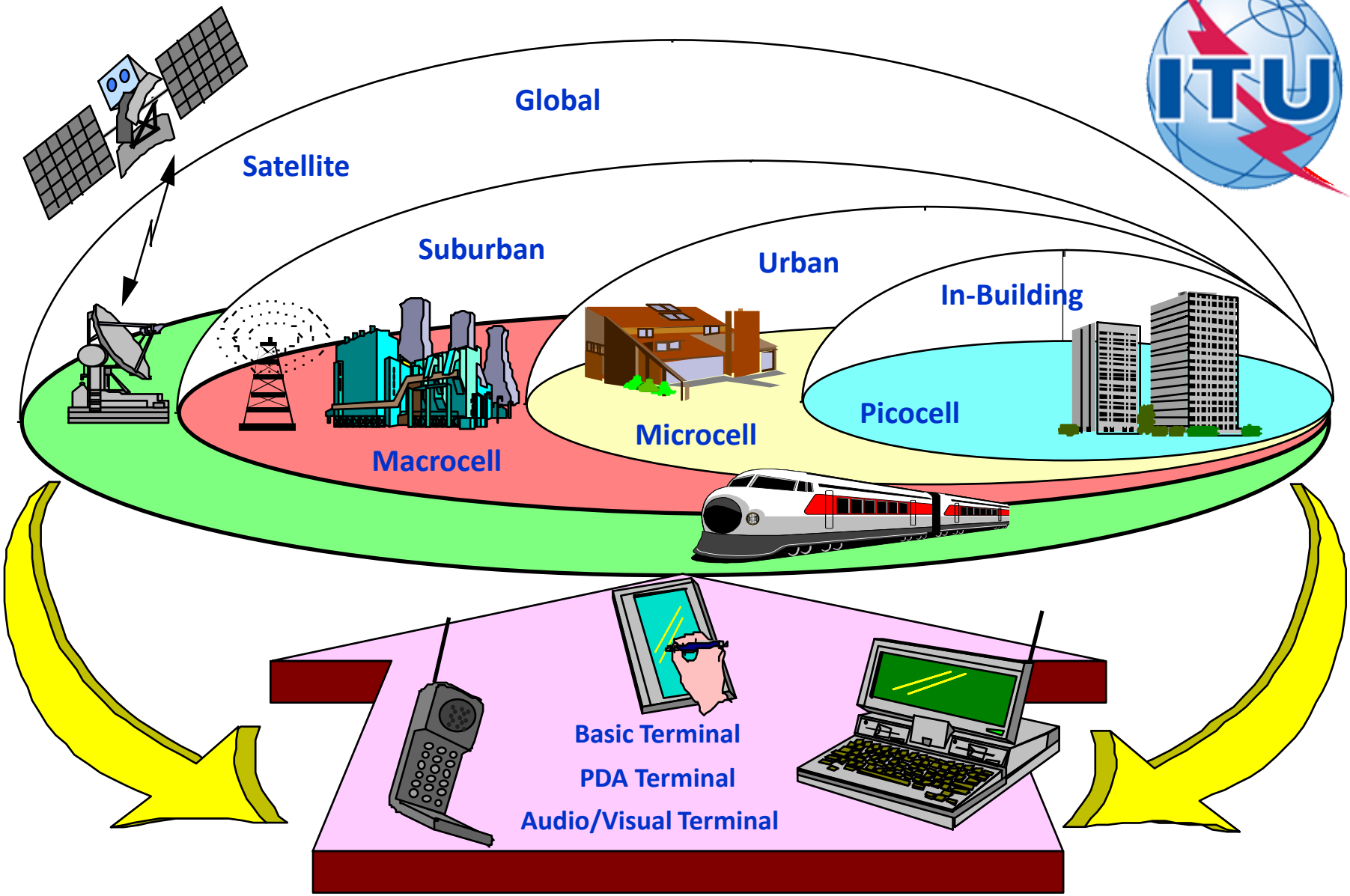

• ITU & IMT

- 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

Mobile Standard Organizations



IMT-2000 Vision: LAN, WAN & Satellite Services



IMT – Advanced: ITU Standard for 4G

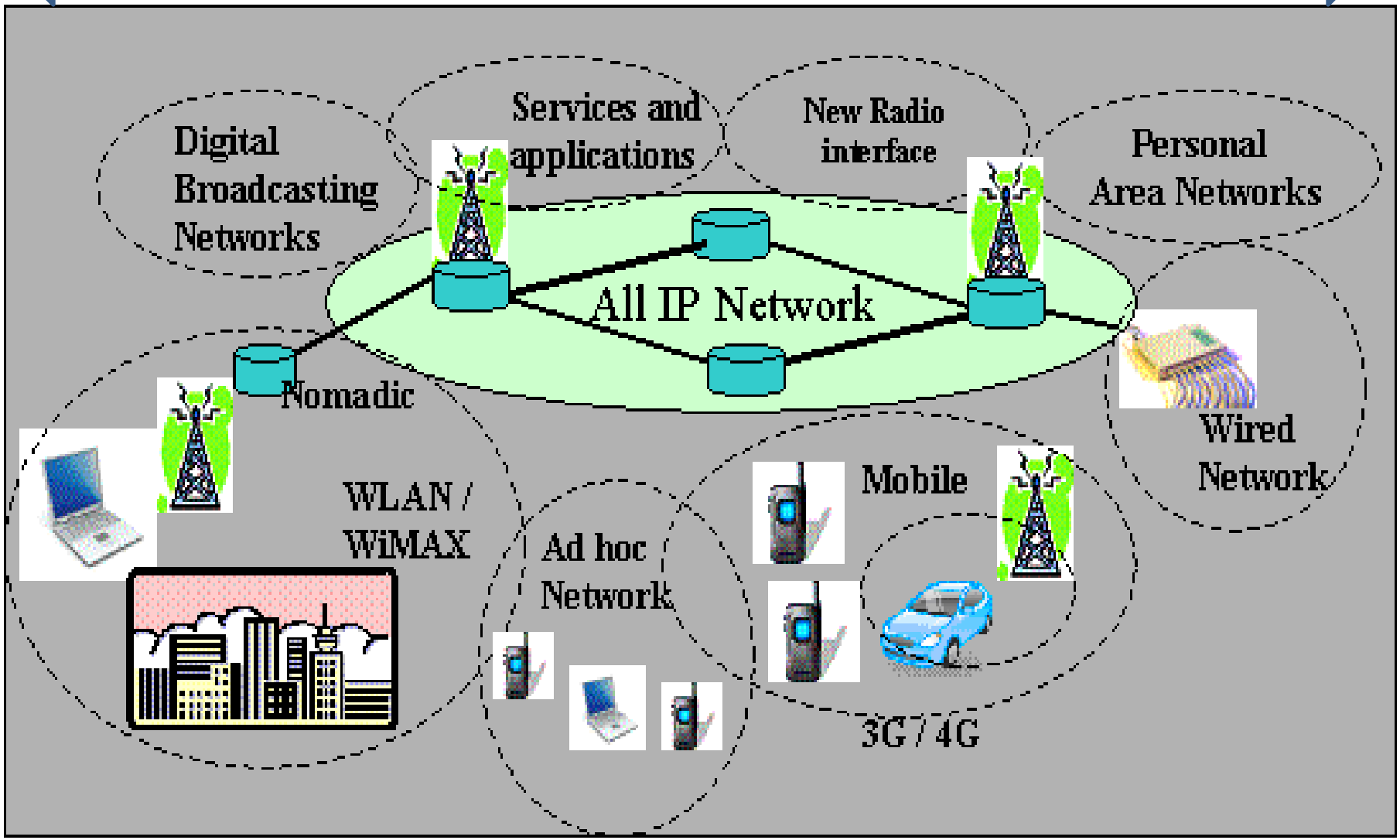
- IMT- Advanced was standardized late 2011 & agreed @ ITU Radiocommunication Assembly (RA-12), in Geneva , January 2012, consensus was reached to expand the IMT Radio Interface Family by establishing the new IMT-Advanced standard. The Recommendation ITU-R M.2012 dealing with IMT was approved by all Member 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.

IMT – Advanced: *Principle*

Convergence of Various Networks into 1 IP based Network



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

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)

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

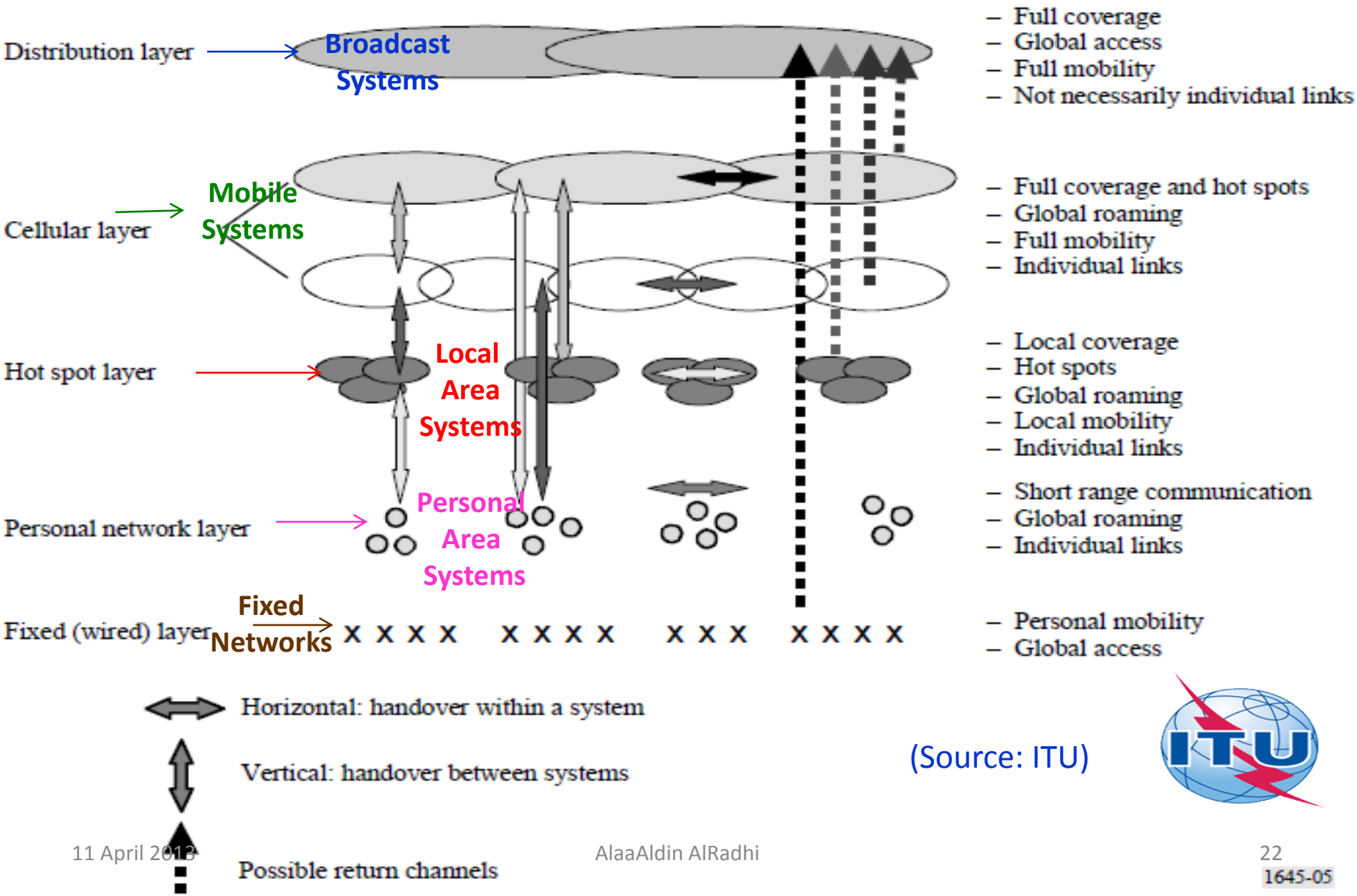
IMT – Advanced: *Bandwidth & Spectrum Requirements 2*

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

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

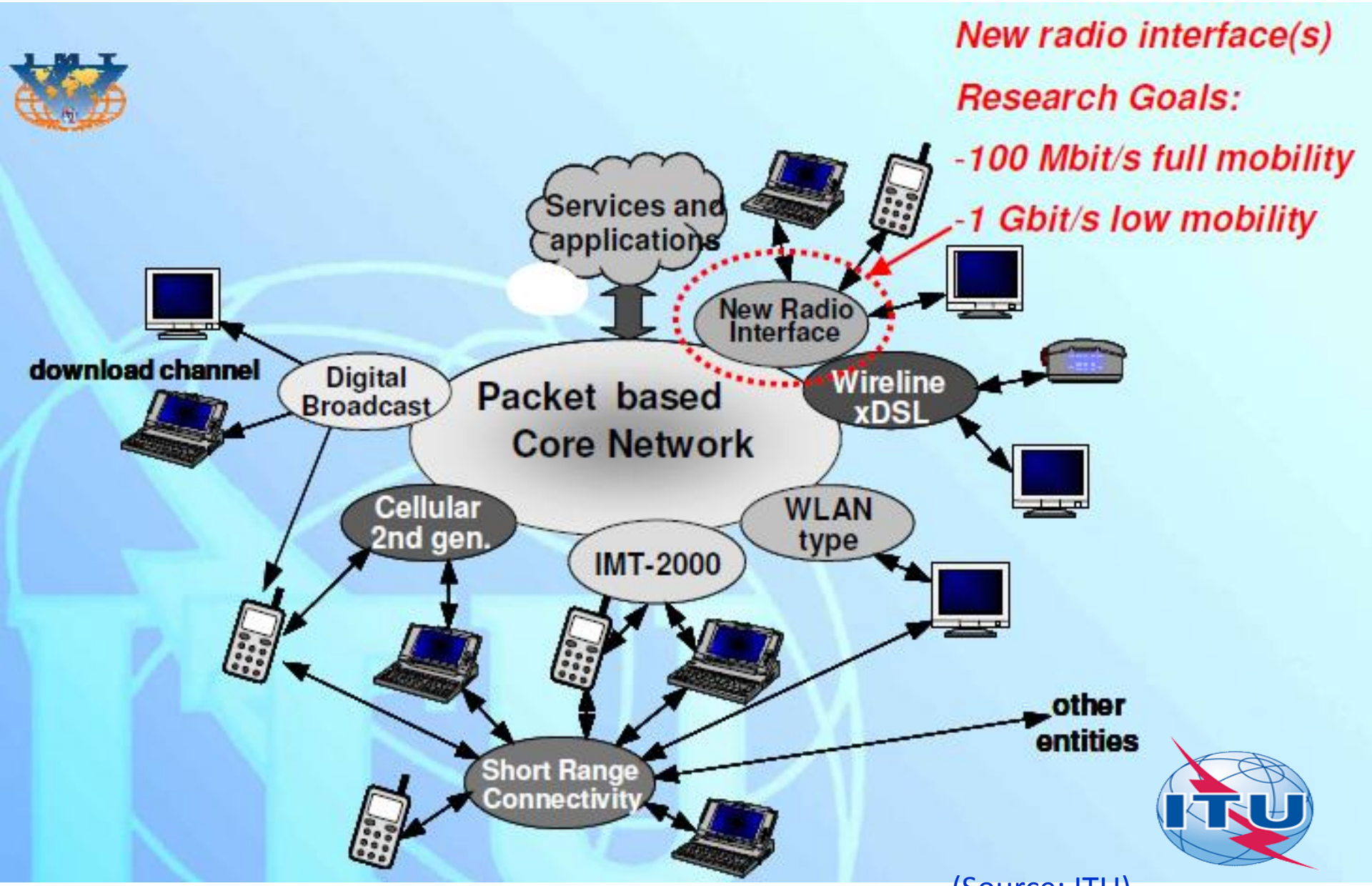
IMT-Advanced Vision of Complementary Interconnected Access Systems



(Source: ITU)

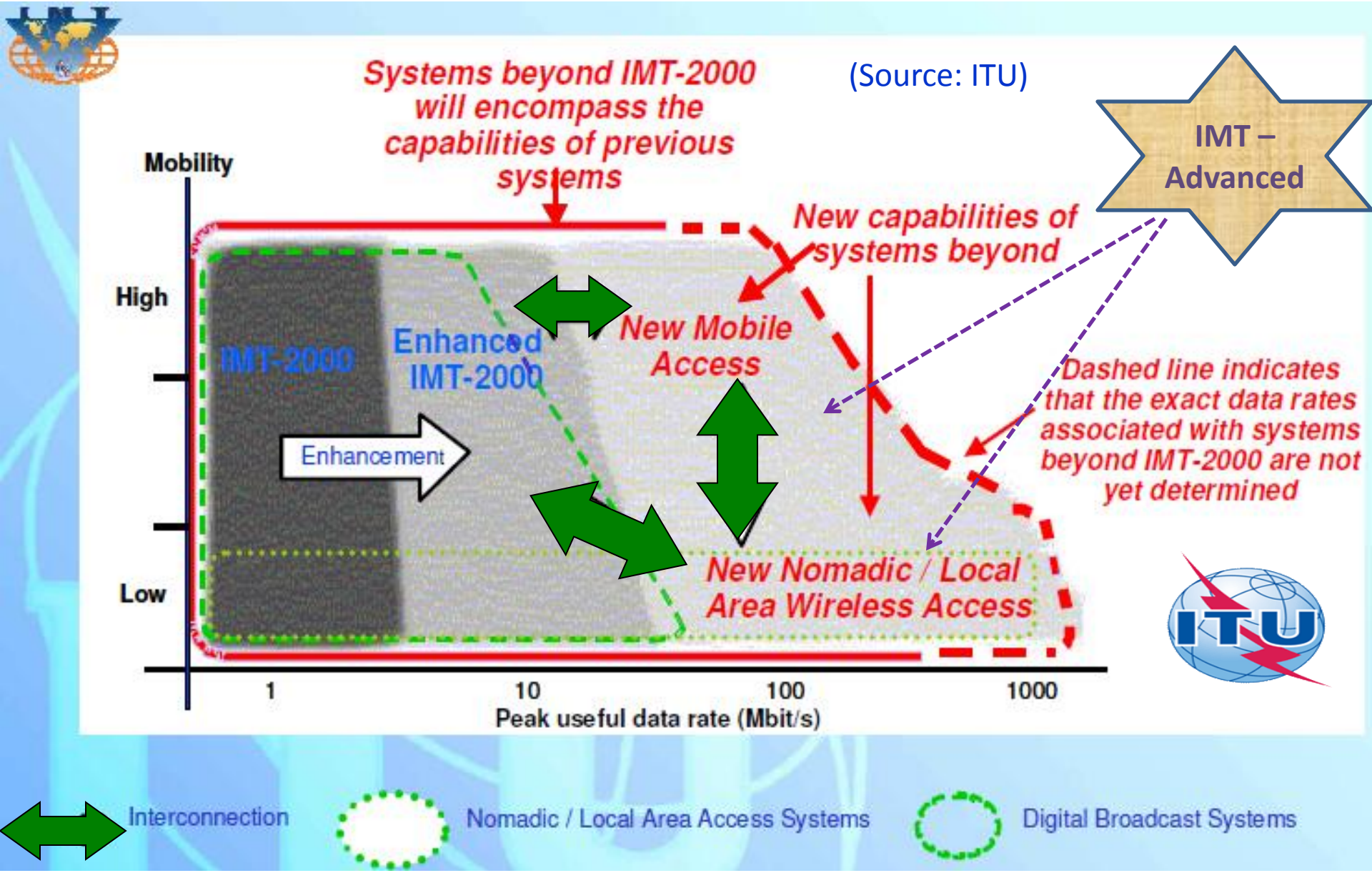
1645-05

New Radio Interface(s) - Variety of Access Networks



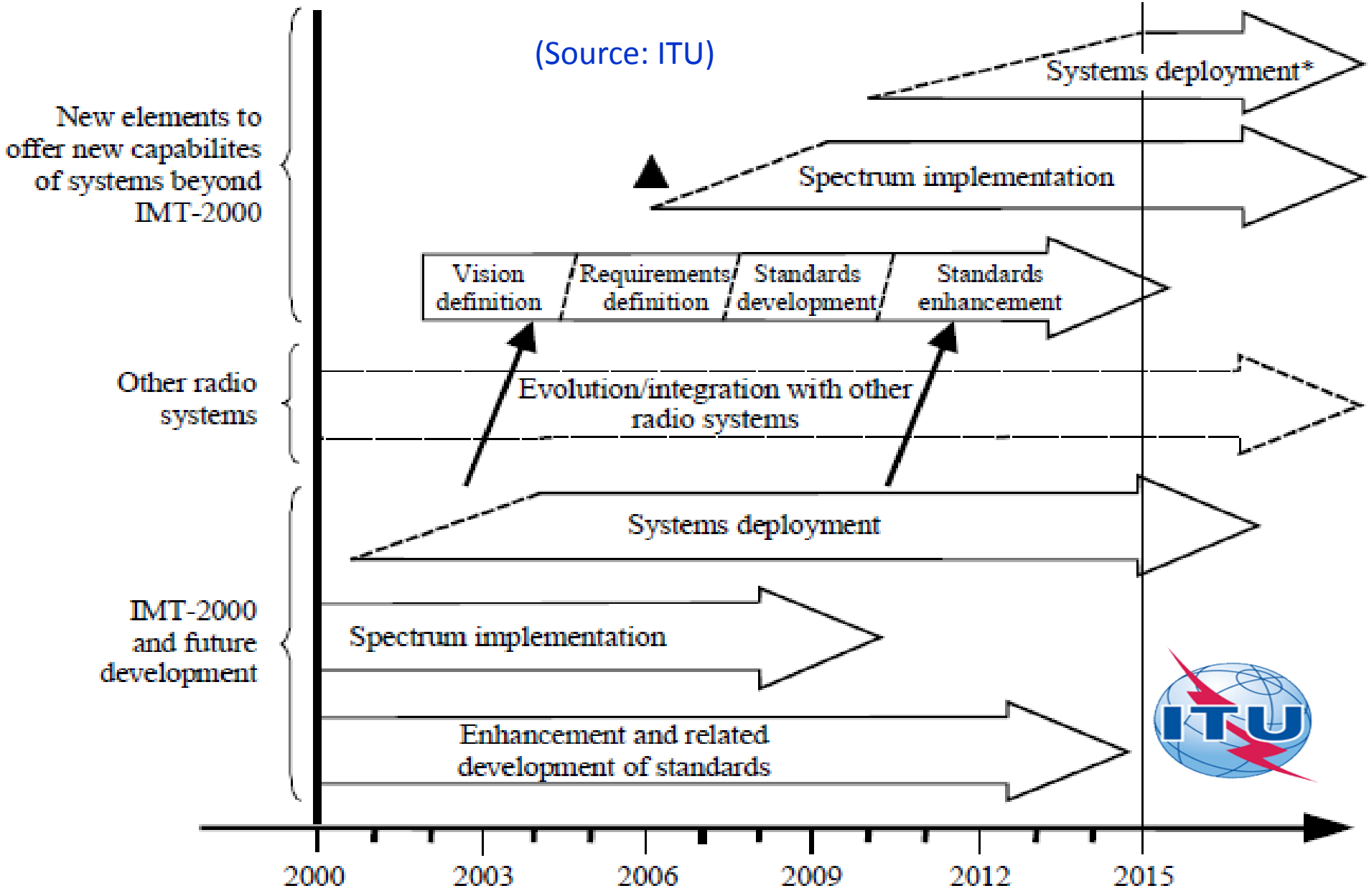
(Source: ITU)

Capabilities of IMT-2000 & IMT-Advanced: The Van



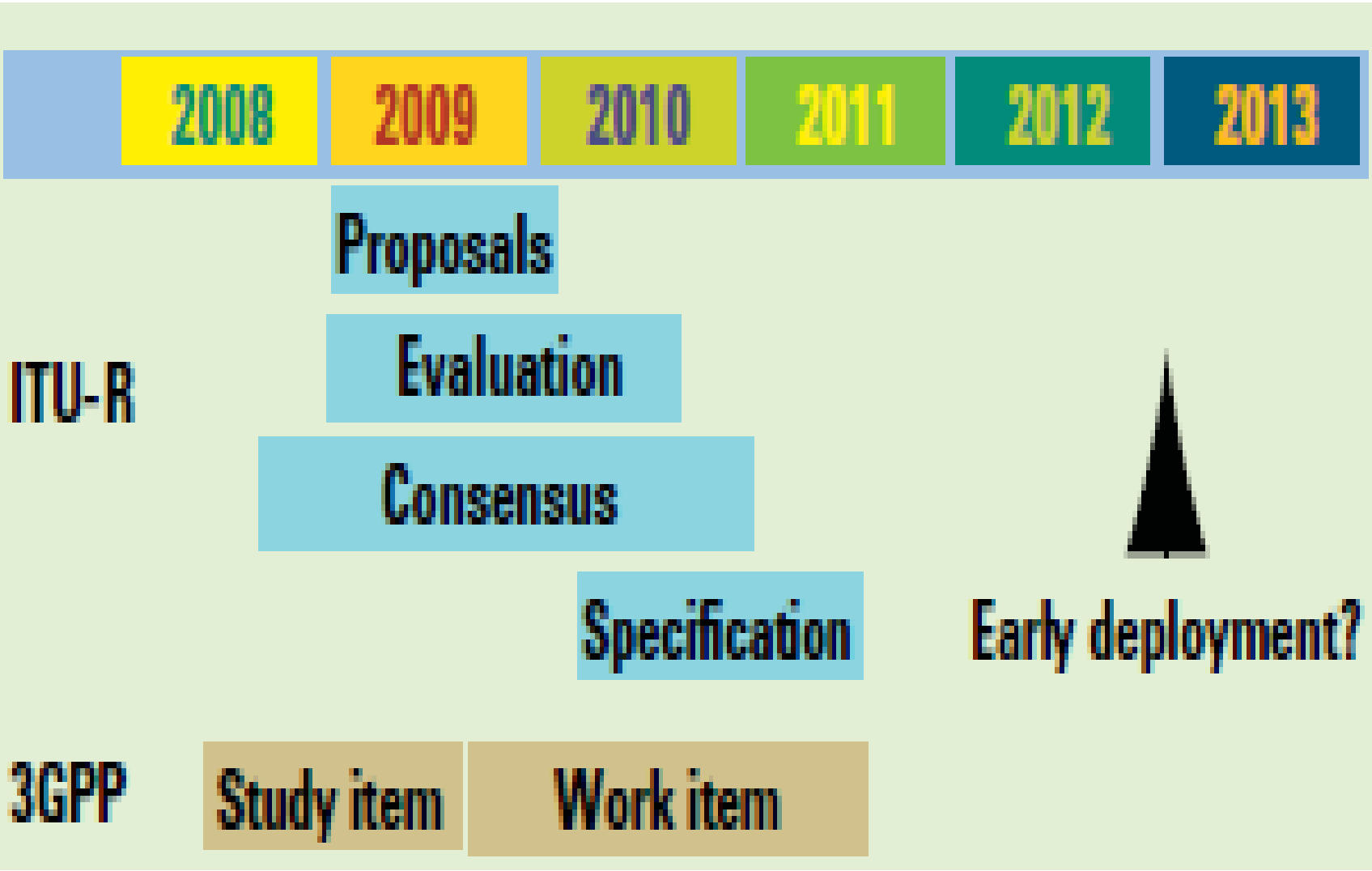
IMT – Advanced: *Timelines*

(Source: ITU)



IMT – Advanced:

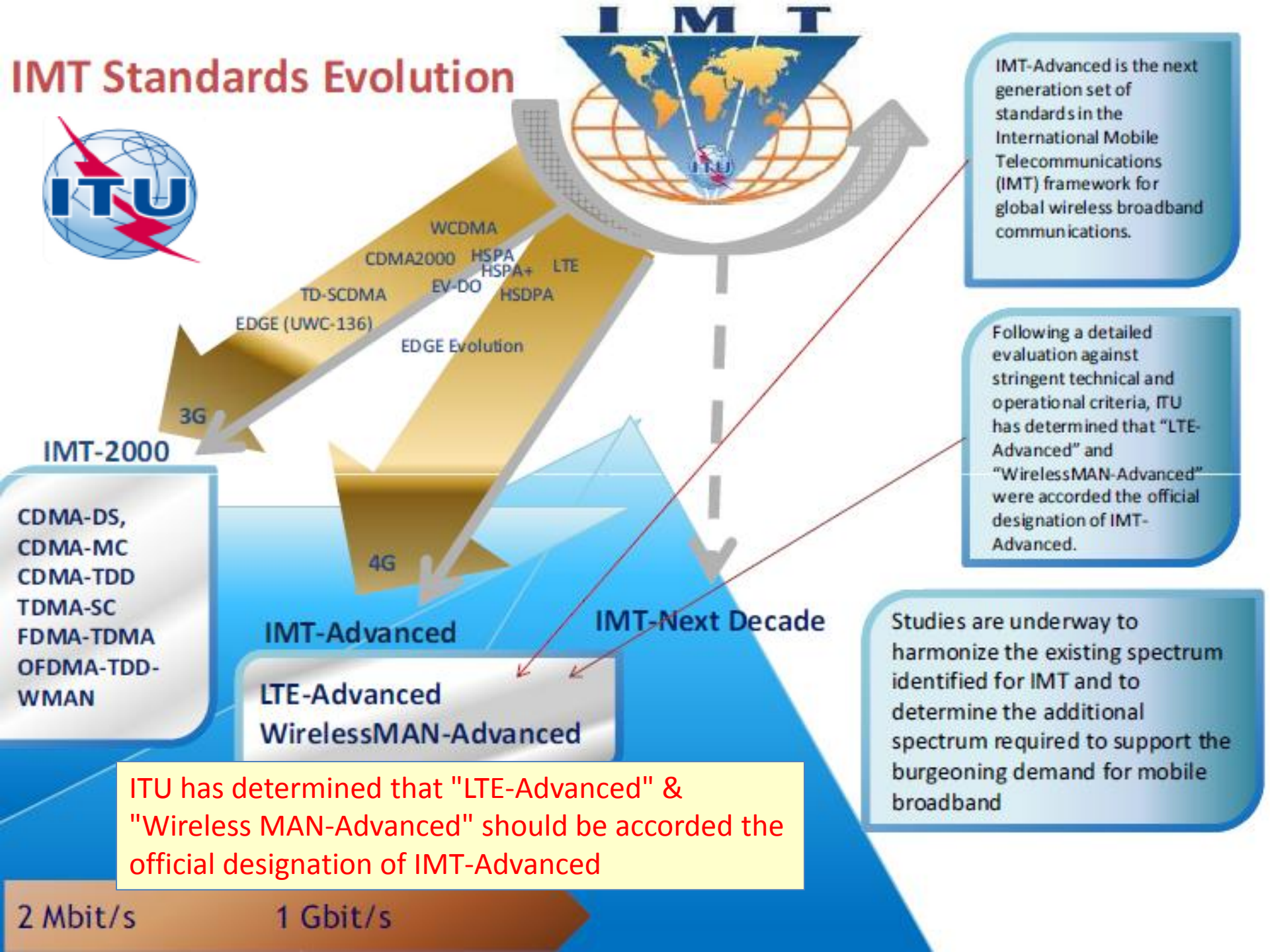
Projected ITU timeline & links into 3GPP



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

IMT Standards Evolution



IMT-Advanced is the next generation set of standards in the International Mobile Telecommunications (IMT) framework for global wireless broadband communications.

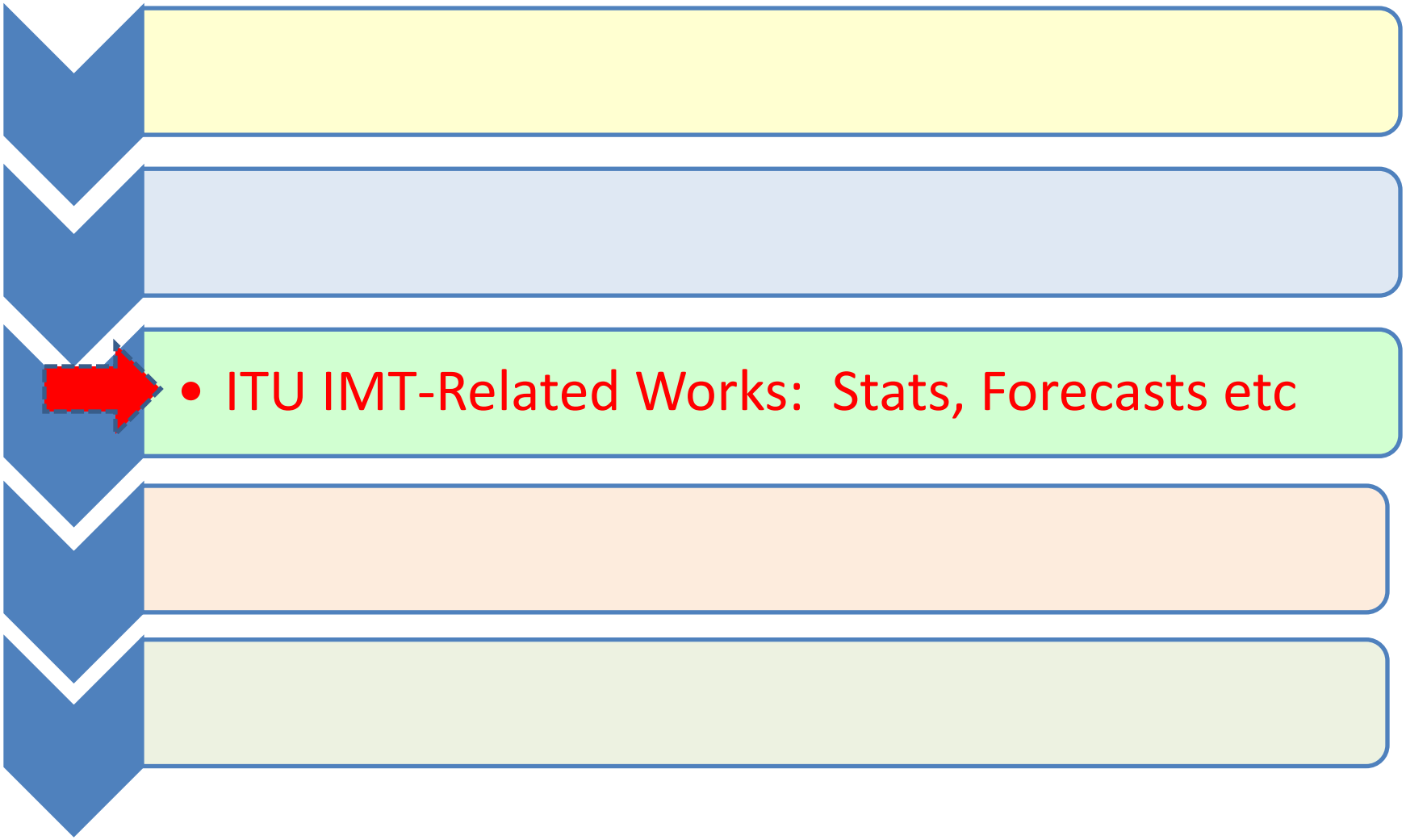
Following a detailed evaluation against stringent technical and operational criteria, ITU has determined that "LTE-Advanced" and "WirelessMAN-Advanced" were accorded the official designation of IMT-Advanced.

Studies are underway to harmonize the existing spectrum identified for IMT and to determine the additional spectrum required to support the burgeoning demand for mobile broadband

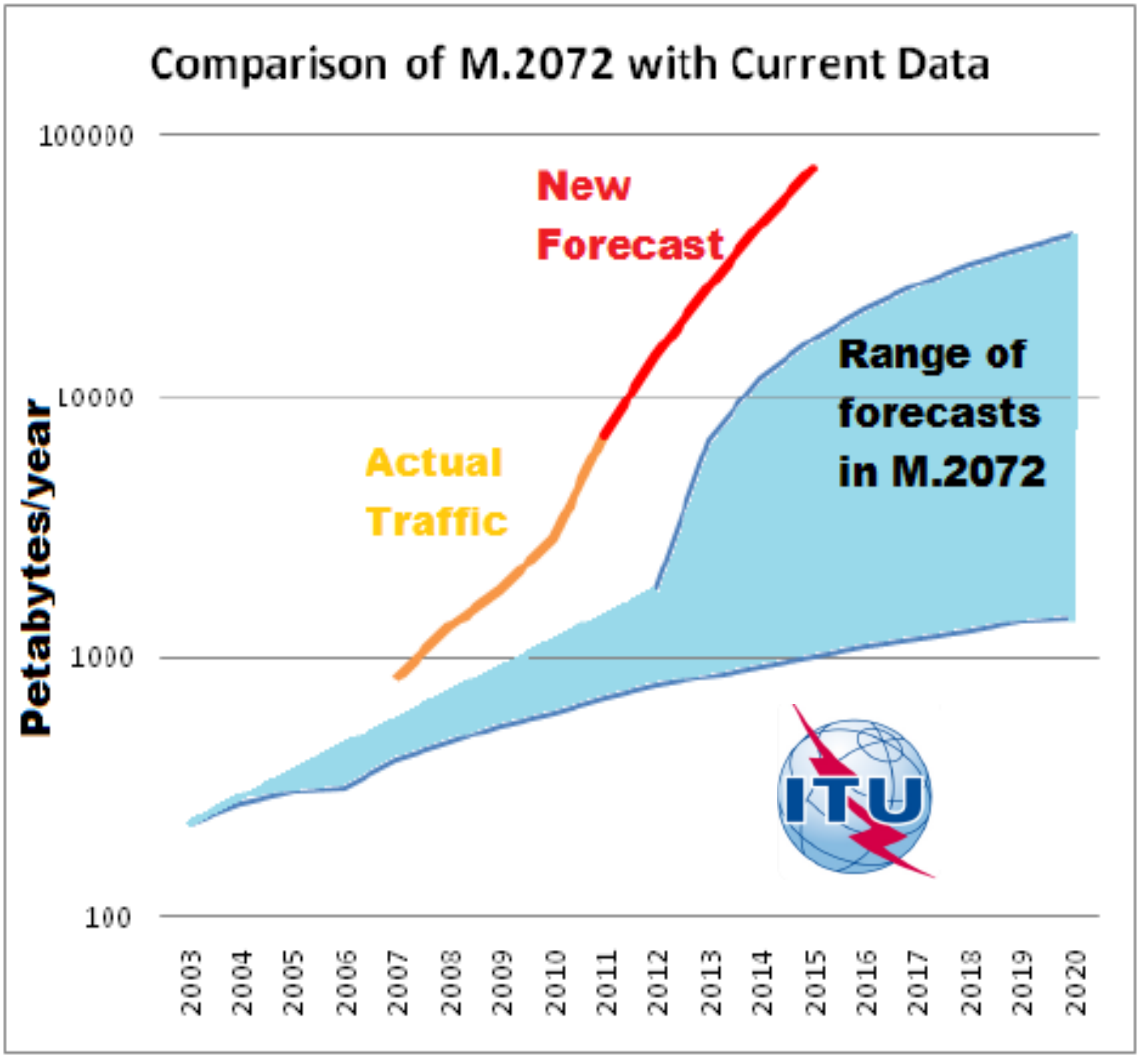
ITU has determined that "LTE-Advanced" & "Wireless MAN-Advanced" should be accorded the official designation of IMT-Advanced

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


• ITU IMT-Related Works: Stats, Forecasts etc

ITU-R M.2072: Forecasts Vs Actual



The global estimates from Report ITU-R M.2072 (2005) were quite conservative

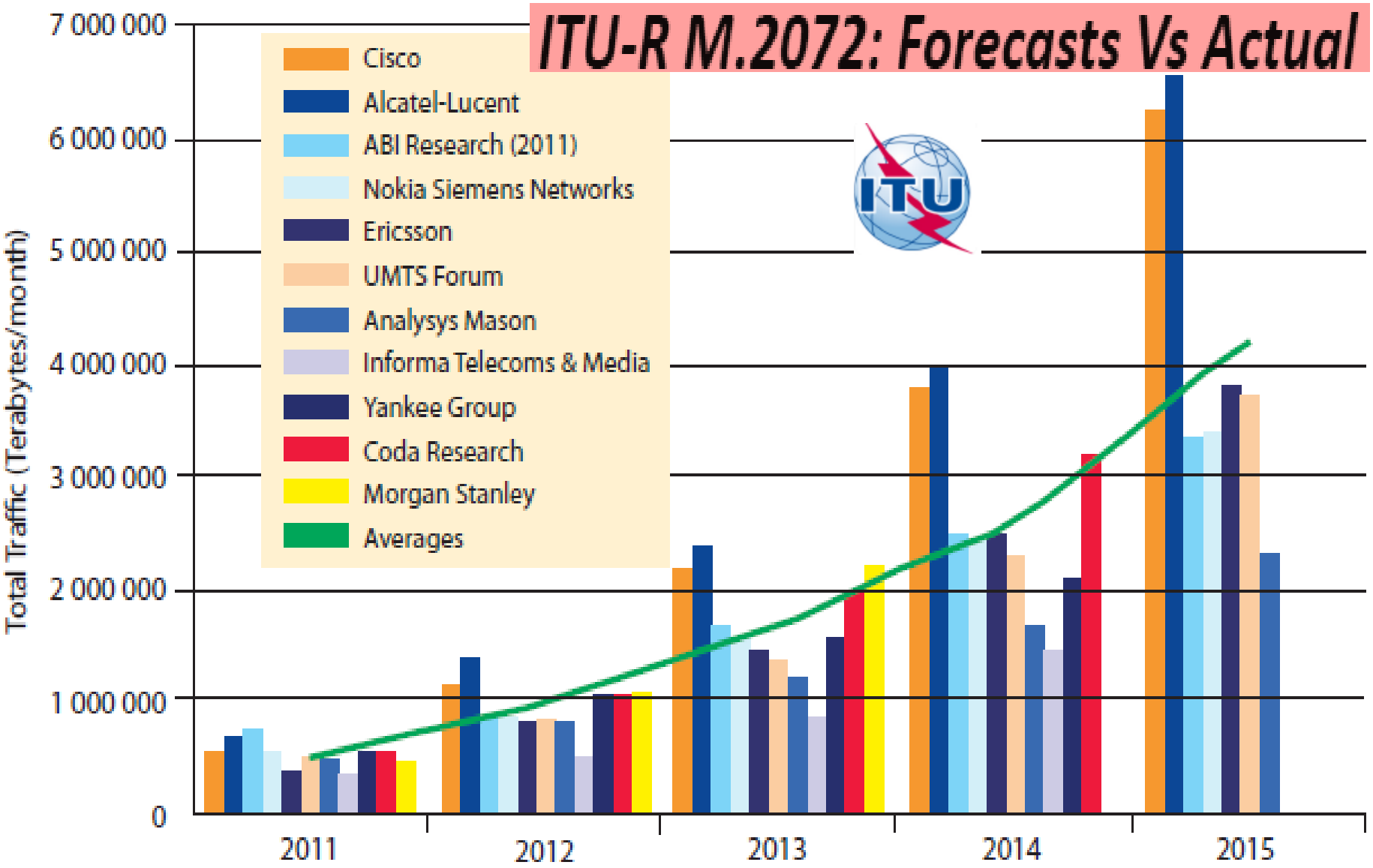
Actual data traffic is many times greater (more than 5) than some of the estimates in Report ITU-R M.2072.

Moreover, the actual traffic being experienced by the operators today is even greater than some of the forecasts in Report ITU-R M.2072 for the year 2020.

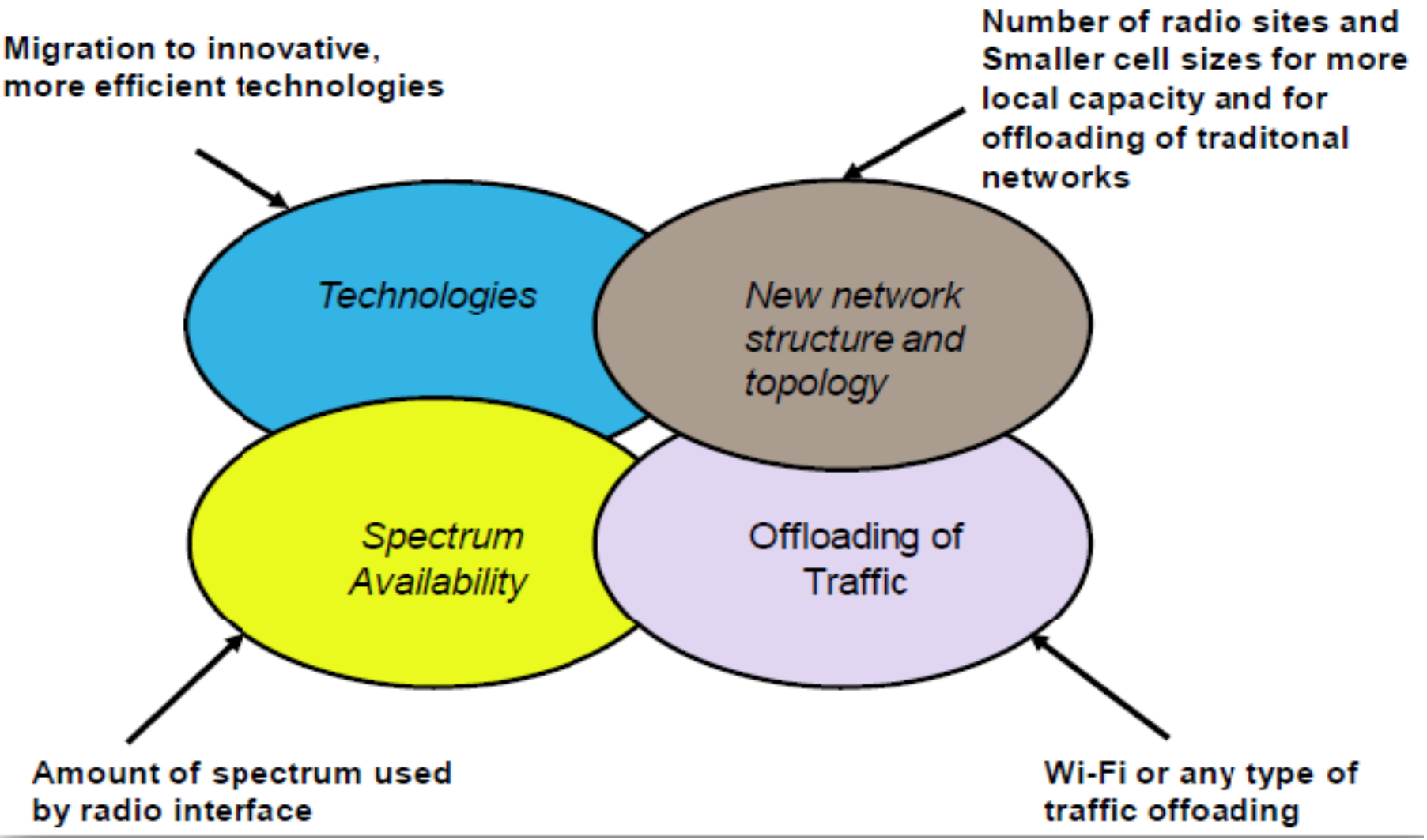
One Report ITU-R M.2072 forecast also anticipated that in 2015 data traffic would be equal to voice traffic for the first time, but, in reality, the proportion of traffic from mobile data already exceeded mobile voice in 2009.

Source: Report ITU-R M.2243 (00/2011)

ITU-R Study on IMT Forecasts: ITU-R M.2243 Report: Mobile Global Data Traffic estimates 2011-2015



Options to manage mobile demand

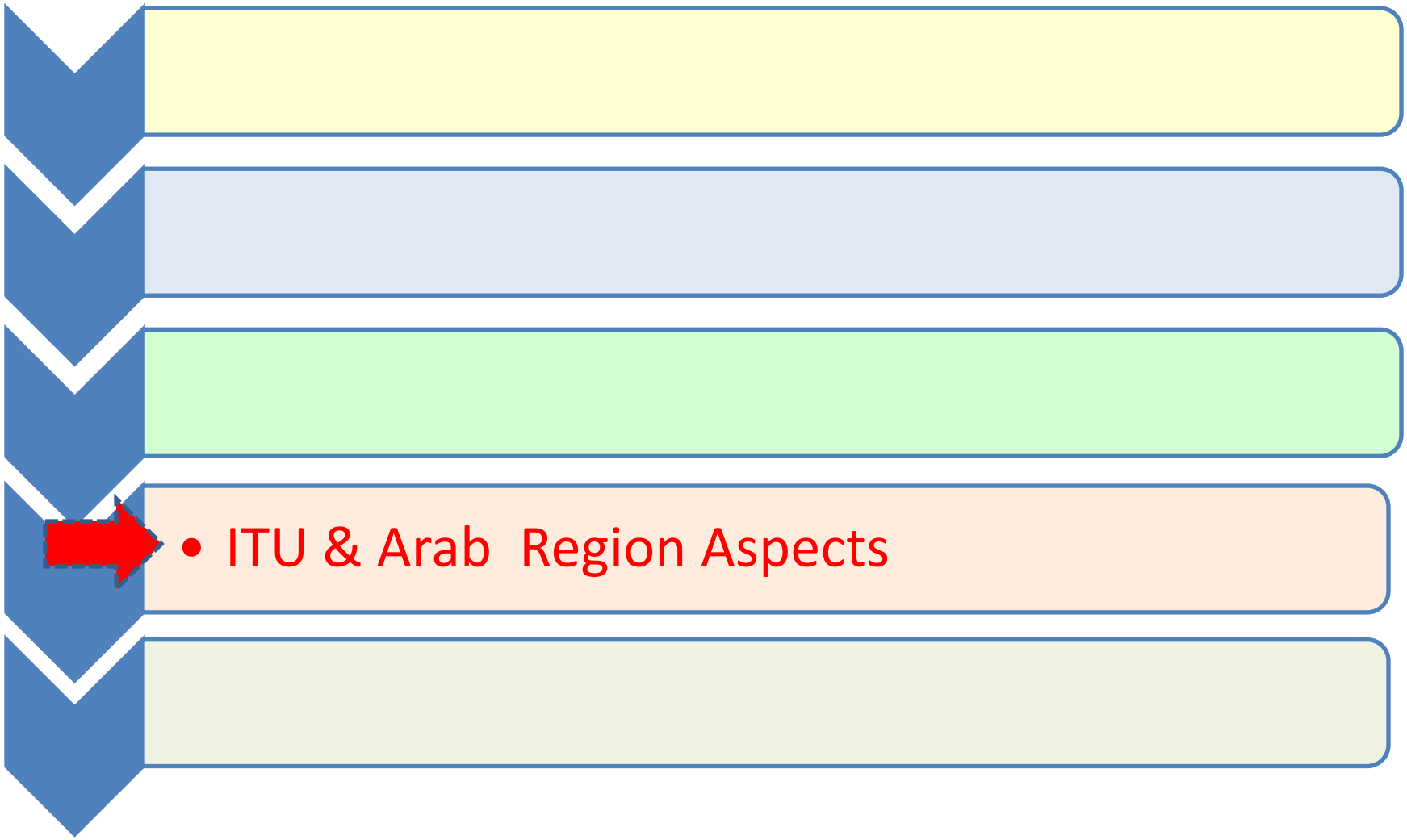


Source: Report ITU-R M.2243 (00/2011)

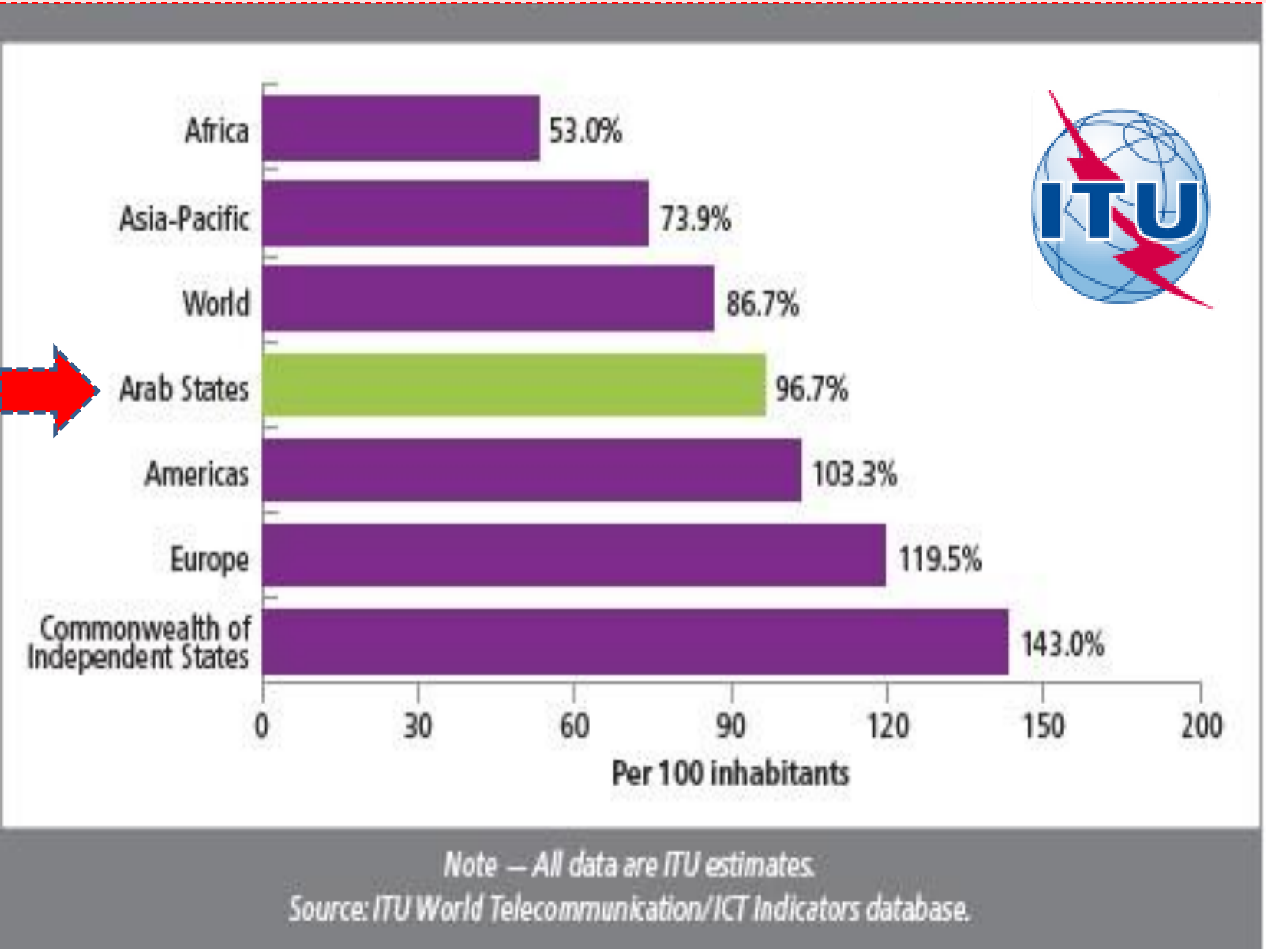
Ensuring Full Availability of IMT Identified Spectrum

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

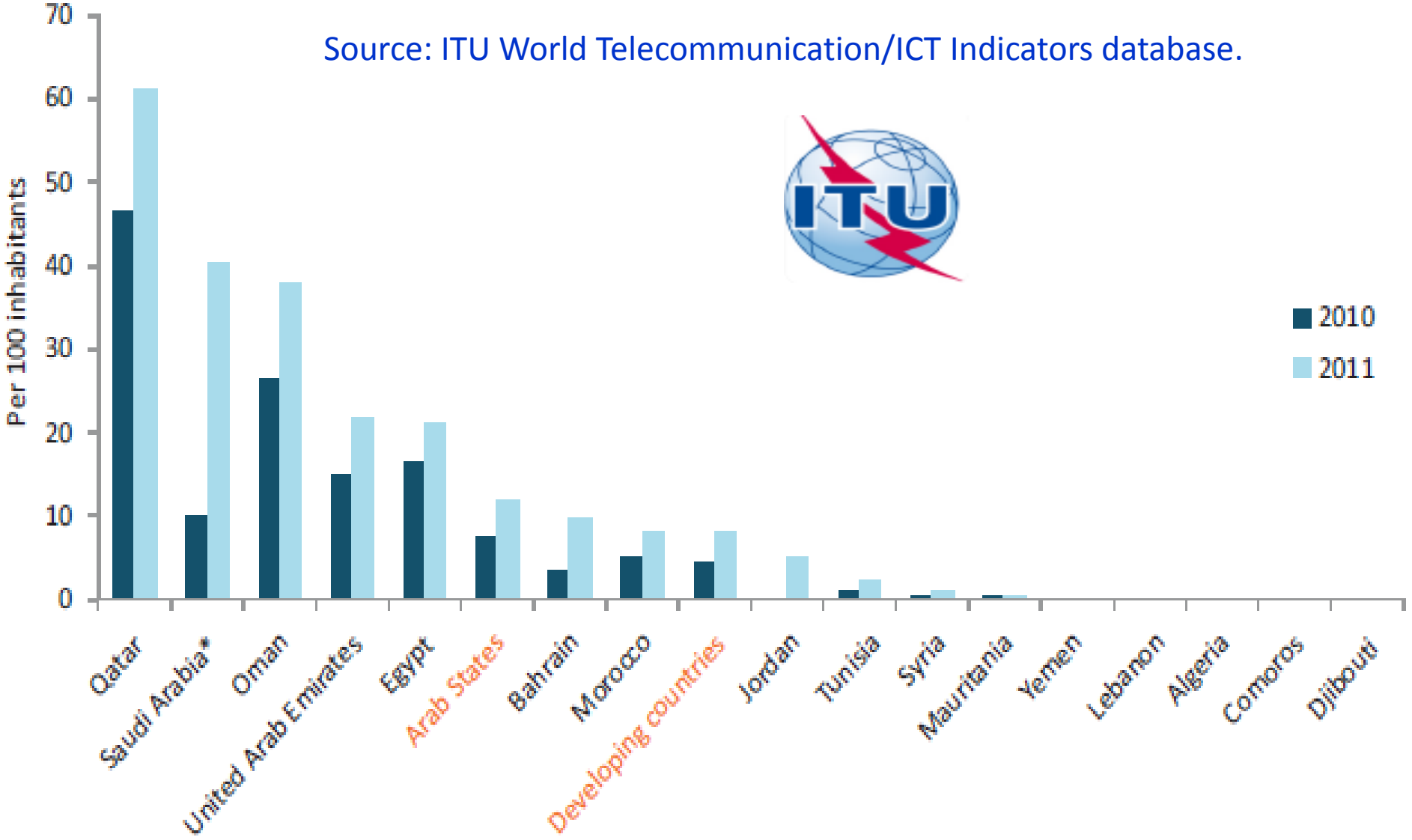

• ITU & Arab Region Aspects

Mobile Subscriptions Penetration Rates

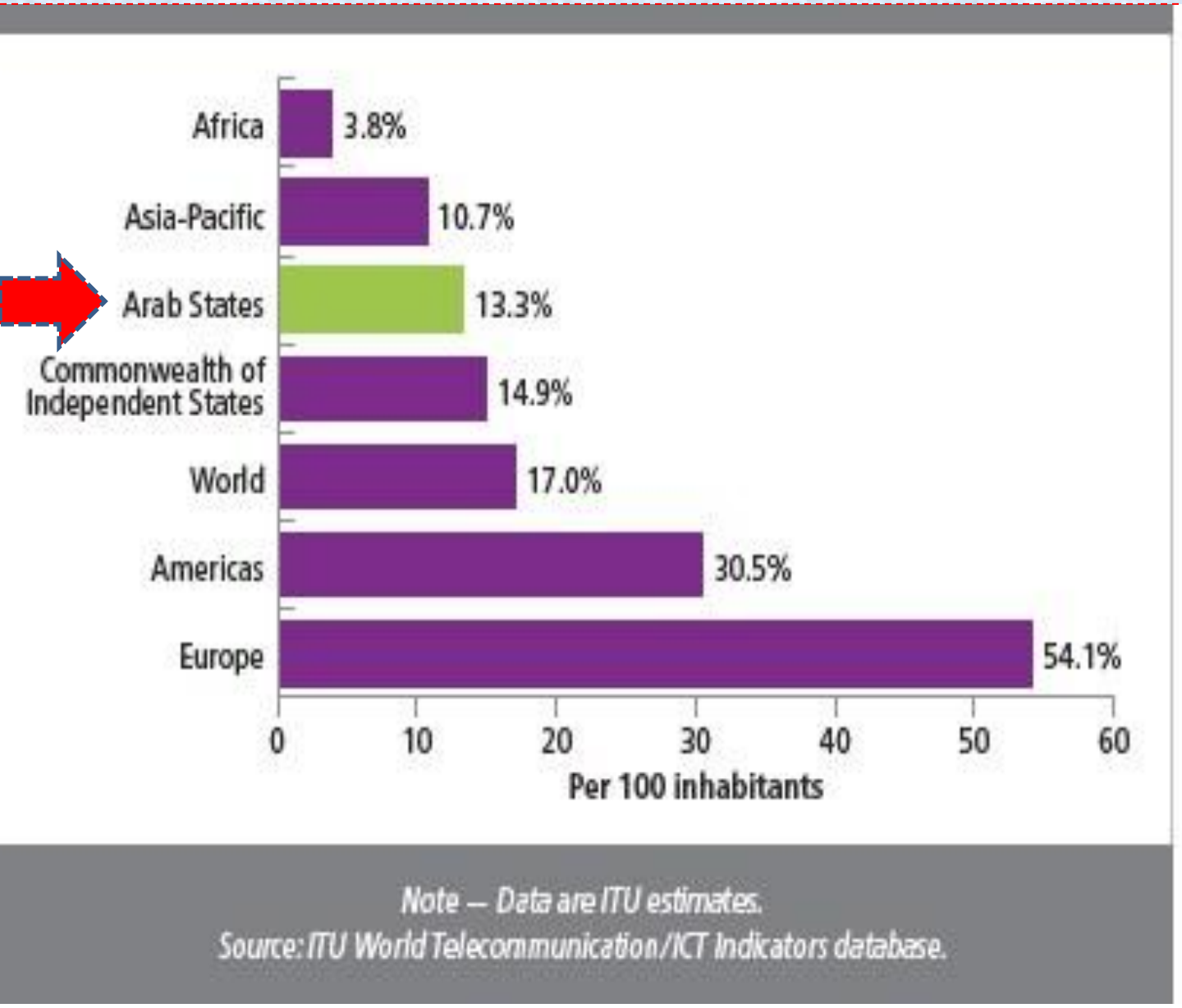


Active Mobile-broadband Penetration: Arab States, 2010 & 2011

Source: ITU World Telecommunication/ICT Indicators database.

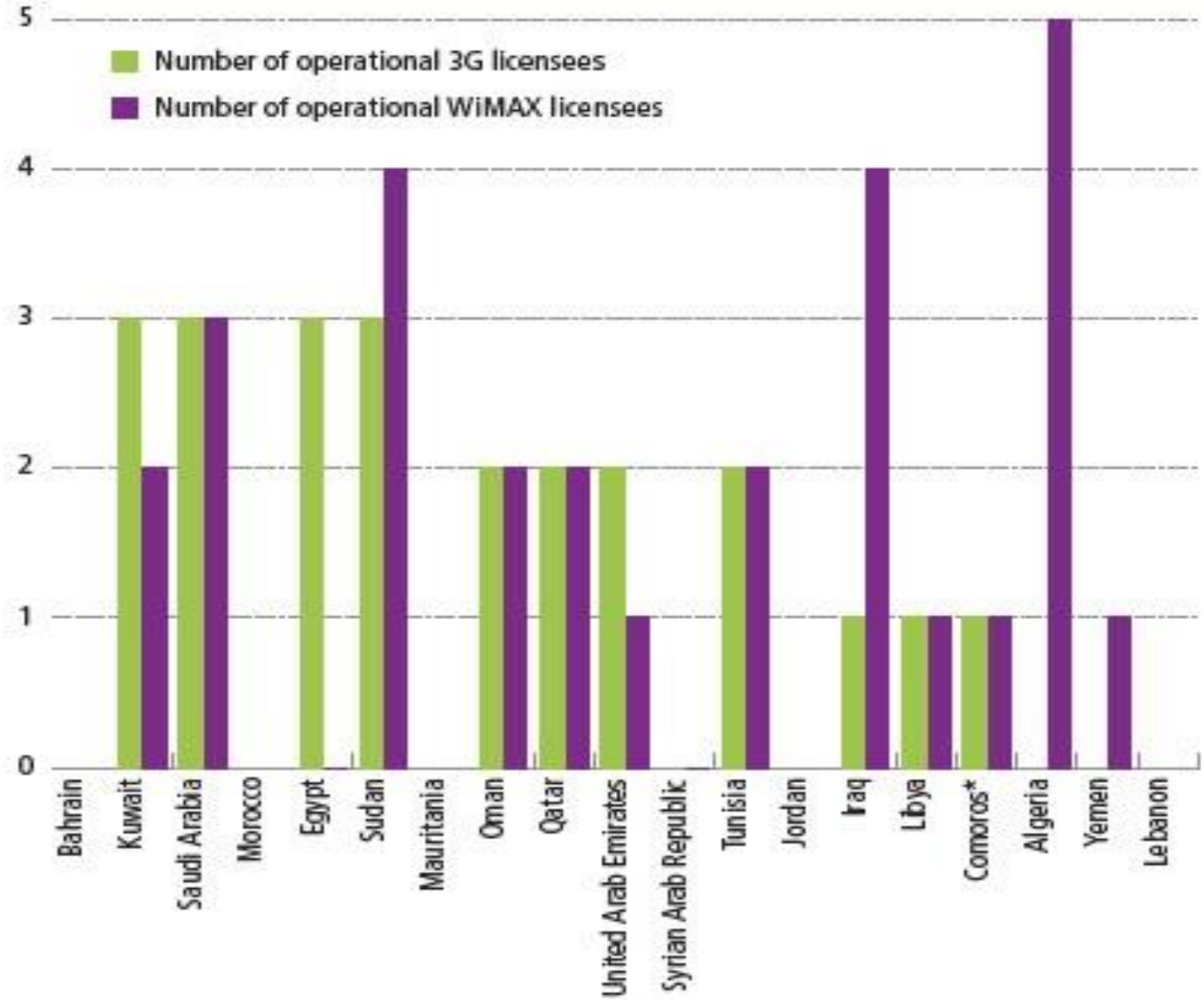


Mobile Broadband Subscriptions



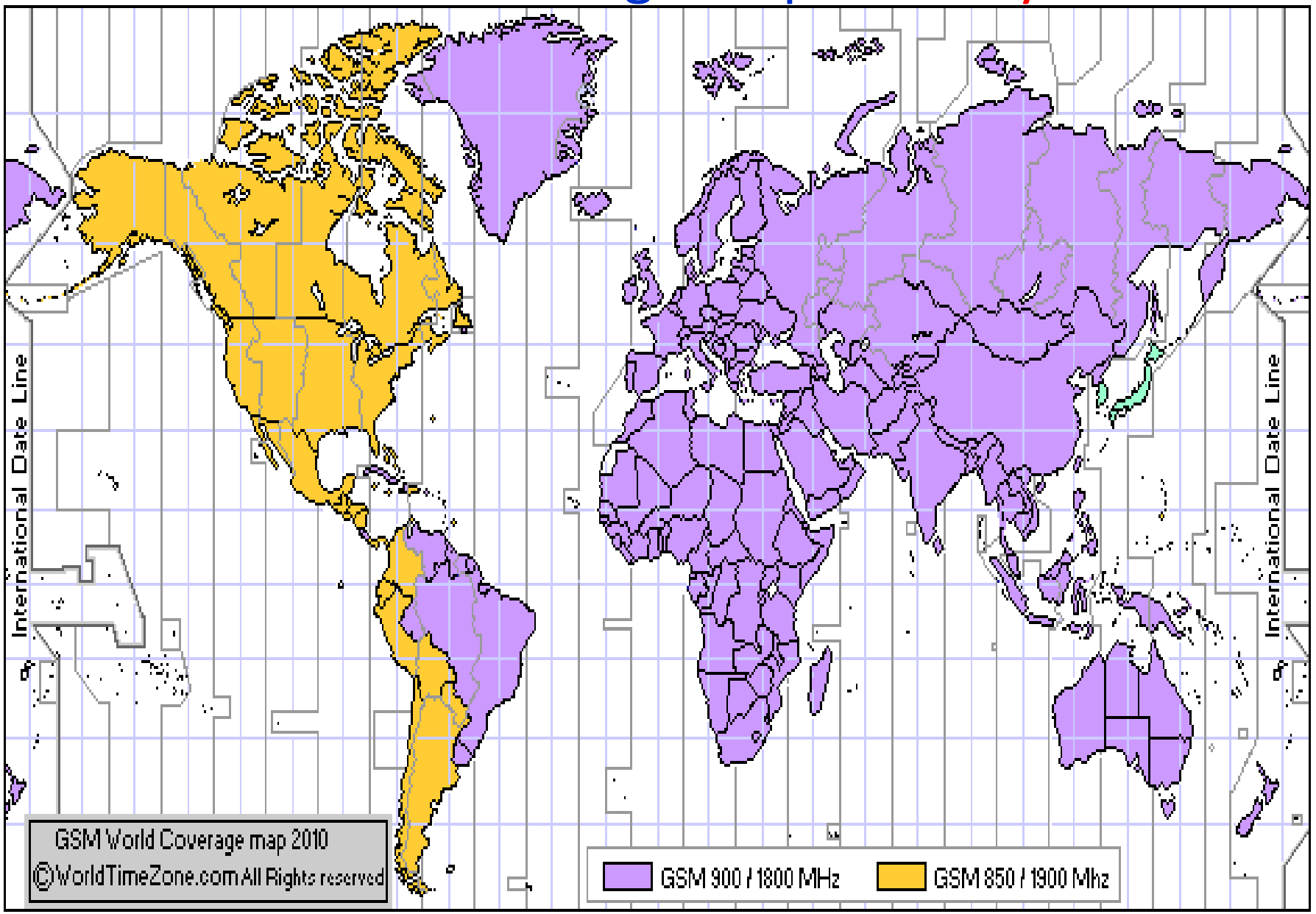
Note – Data are ITU estimates.
Source: ITU World Telecommunication/ICT Indicators database.

Number of Operational WIMAX & 3G Licensees in Arab Countries

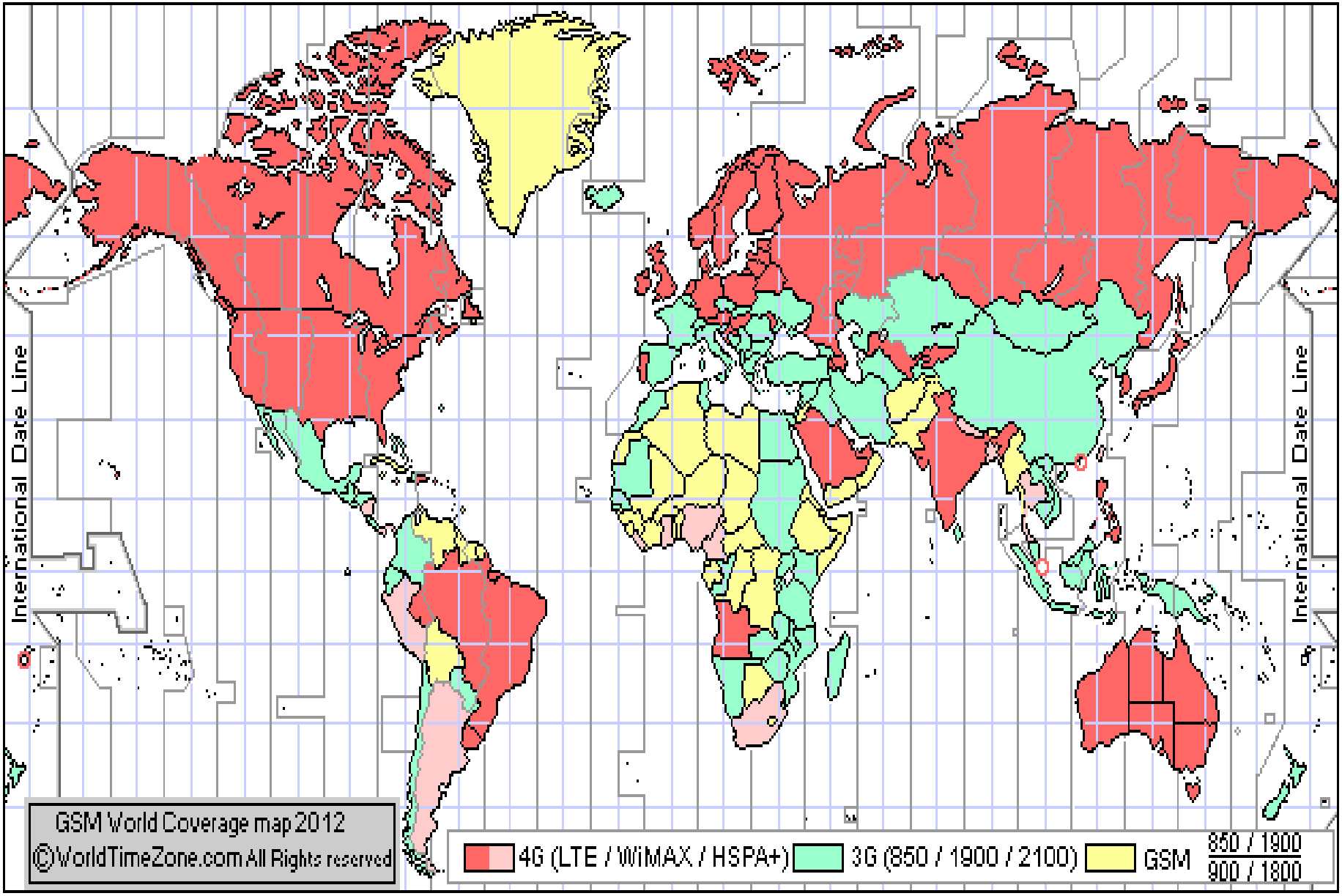


*Note — *3G services were not available in 2011.*
Source: ITU, operators, Arab Advisors Group.

GSM World Coverage Map: January 2013



4G LTE World Coverage Map: January 2013



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

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

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

www.itu.int/ITU-D/connect/arabstates/

- Follow-Up Mechanism:
  - Will be implemented by ITU in collaboration with the League of Arab States & relevant stakeholders
  - Identify gaps & overlaps, if applicable

Connect Arab Summit
Doha Qatar
March 2012

Projects / Concepts Papers:

- ARAB ICT HIGHWAY Theme
- E-SERVICES EVERYWHERE FOR A BETTER LIFE
- EMPOWERING PEOPLE: CAPACITY BUILDING INITIATIVE
- EMPLOYMENT CREATION: UNLEASHING FUTURE ICT GENERATION
- SECURING THE CYBER-HIGHWAY: PROTECTING PEOPLE

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

Connect Arab Summit Doha Qatar March 2012

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

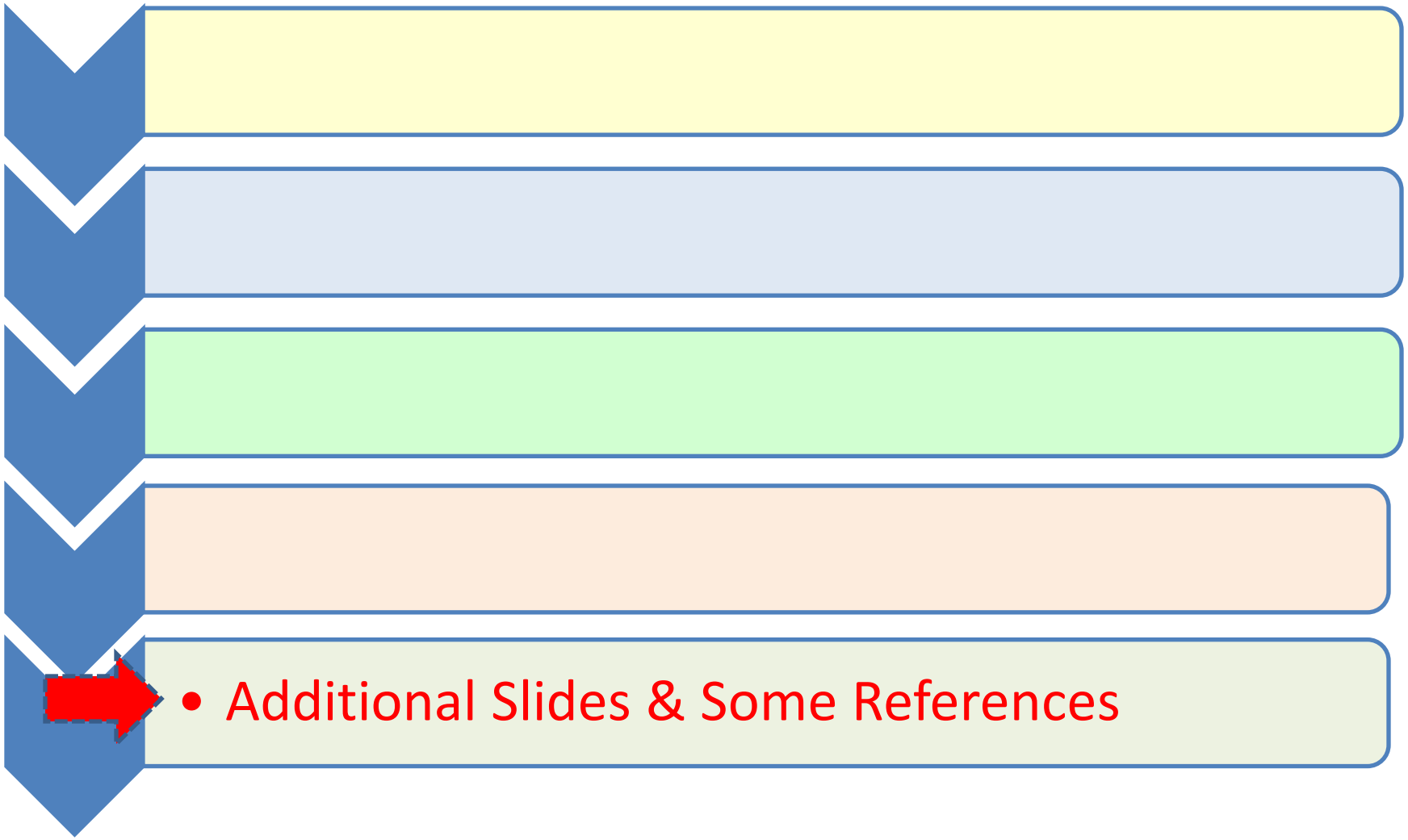
Connect Arab Summit Doha Qatar March 2012

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


• Additional Slides & Some References

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

Radiocommunication Sector (ITU-R)

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

- 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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- 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.umts-forum.org
  - GSM Forum: http://www.gsmworld.org
  - Universal Wireless Communication: http://www.uwcc.org
  - Global Mobile Supplier: http://www.gsacom.com

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):
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- The Telecommunication Technology Association (Korea):
  - http://www.tta.or.kr/english/e_index.htm