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Union

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

Session 4: IMT Technologies

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

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- Some Technological Background Basics


- Why IMT & IMT Standards Evolution Briefing

- Relevant ITU Recommendations, Reports & WRC-12 Outcome

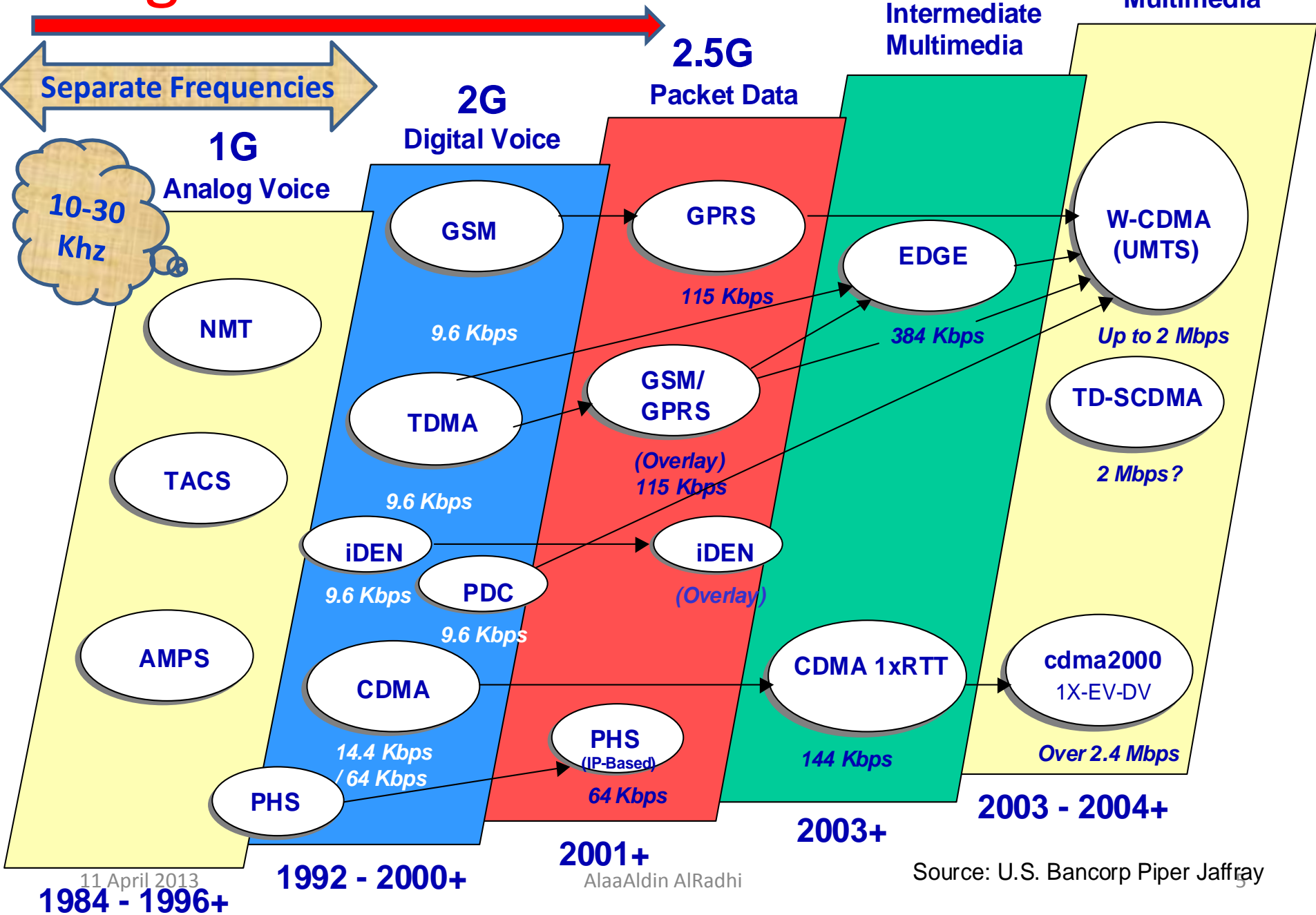
- Additional Slides & Some References

- 
- Some Technological Background Basics

Generations of Cellular Technologies

Generation	Year	Network	Technology	Data
1G	Early 1980s	Circuit switched	TACS, AMPS	Analog Voice
2G	Early 1990s	D-AMPS, GSM, CDMA	D-AMPS, GSM, CDMA	Digital Voice
2.5G	1996	Circuit switched or Packet switched	GPRS, EDGE, EVDO, EVDV	Digital Voice + Data
3G	2000	Non IP, Packet switched / Circuit switched	W-CDMA, CDMA2000	Digital Voice + High speed Data + video
4G	2012	IP based, Packet switched core network.		Digital Voice, High speed Data, Multimedia, Security

Migration To 3G



Complimentary to 3G = WLANs & WIMAX

- Faster than 3G: 11 or 56 Mbps vs. <2 Mbps for 3G when stationary
- Low cost, low barriers to entry
- Easy for Organizations to build own networks
- WLAN gives “hot spot” coverage
- WIMAX extends coverage to MANs
- 3G gives full mobility
- WLAN & WIMAX coupled/combined with 3G will offer mobile broadband for EVERYBODY & EVERYWHERE, whatever the technology and access mode

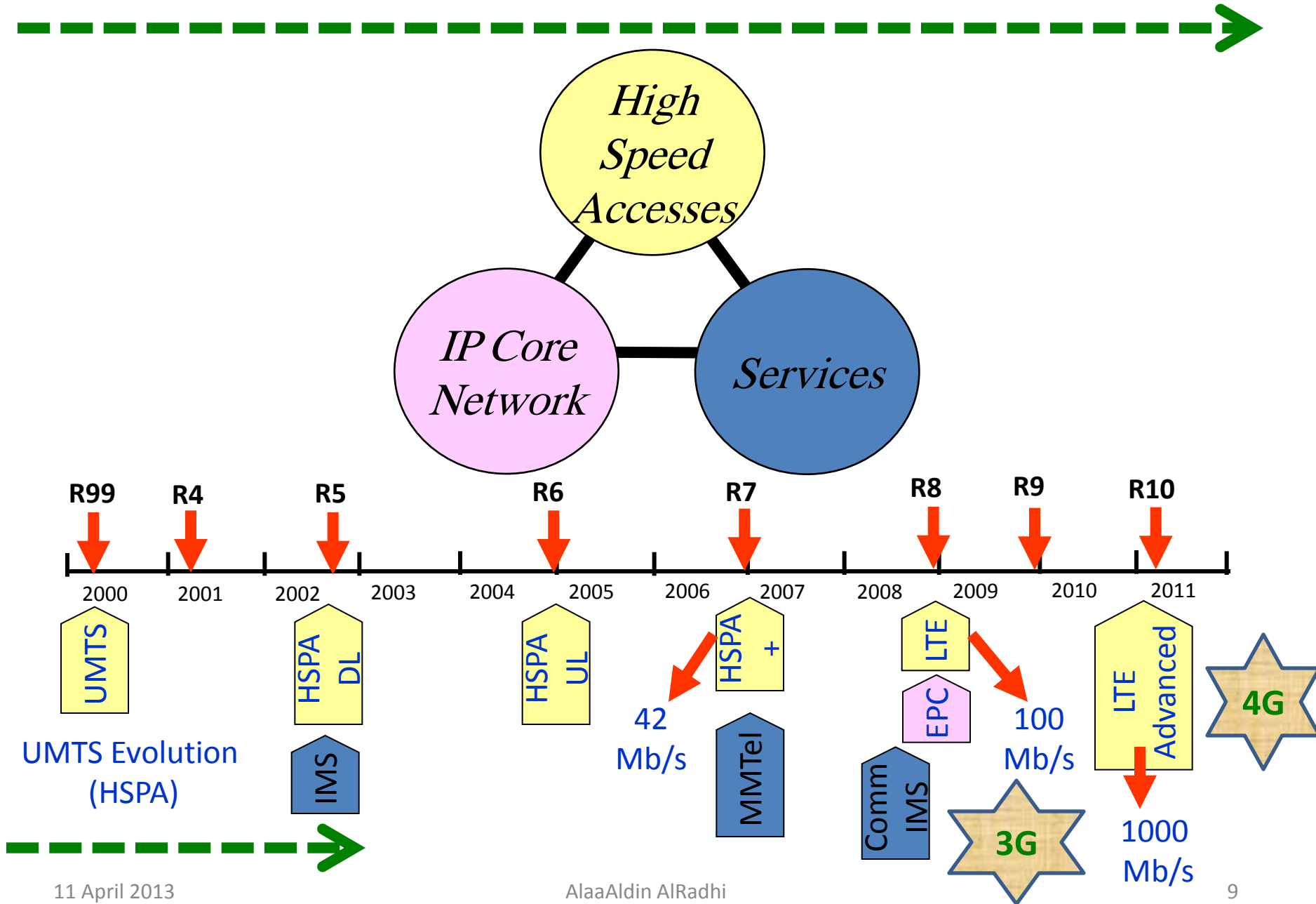
UMTS = Universal Mobile Telecom System

- The most important International Mobile Telecommunications-2000 (IMT-2000) proposals are the UMTS (W-CDMA) as the successor to 3G GSM.
- UMTS licenses have been awarded across Europe & Asia through 3GPP Group
- For interoperability with North American networks, another group known as 3GPP2 was formed to develop global specifications for 3G networks
- UMTS differs from GSM Phase 2+ (2.5 & 2.75 G) mostly in the new principles for air interface transmission, (W-CDMA instead of TDMA/ FDMA).

3GPP: 3rd Generation Partnership Project

- 3GPP Specified Radio Interfaces:
 - 2G radio: GSM, GPRS, EDGE
 - 3G radio: WCDMA, HSPA, LTE
 - 4G radio: LTE Advanced
- 3GPP Core Network:
 - 2G/3G: GSM core network
 - 3G/4G: Evolved Packet Core (EPC)
- 3GPP Service Layer:
 - GSM services
 - IP Multimedia Subsystem (IMS)
 - Multimedia Telephony (MMTEL)
 - Support of Messaging and other OMA functionality
 - Emergency services and public warning
 - Etc.

3GPP Release Concept



General Directions of 3GPP Evolution

- Radio Interfaces:
 - Higher Data Throughput
 - Lower Latency
 - More Spectrum Flexibility
 - Improved CAPEX and OPEX
- IP Core Network:
 - Support of non-3GPP Accesses
 - Packet Only Support
 - Improved Security
 - Greater Device Diversity
- Service Layer:
 - More IMS Applications (MBMS, PSS, mobile TV now IMS enabled)
 - Greater session continuity

LTE (Long Term Evolution)

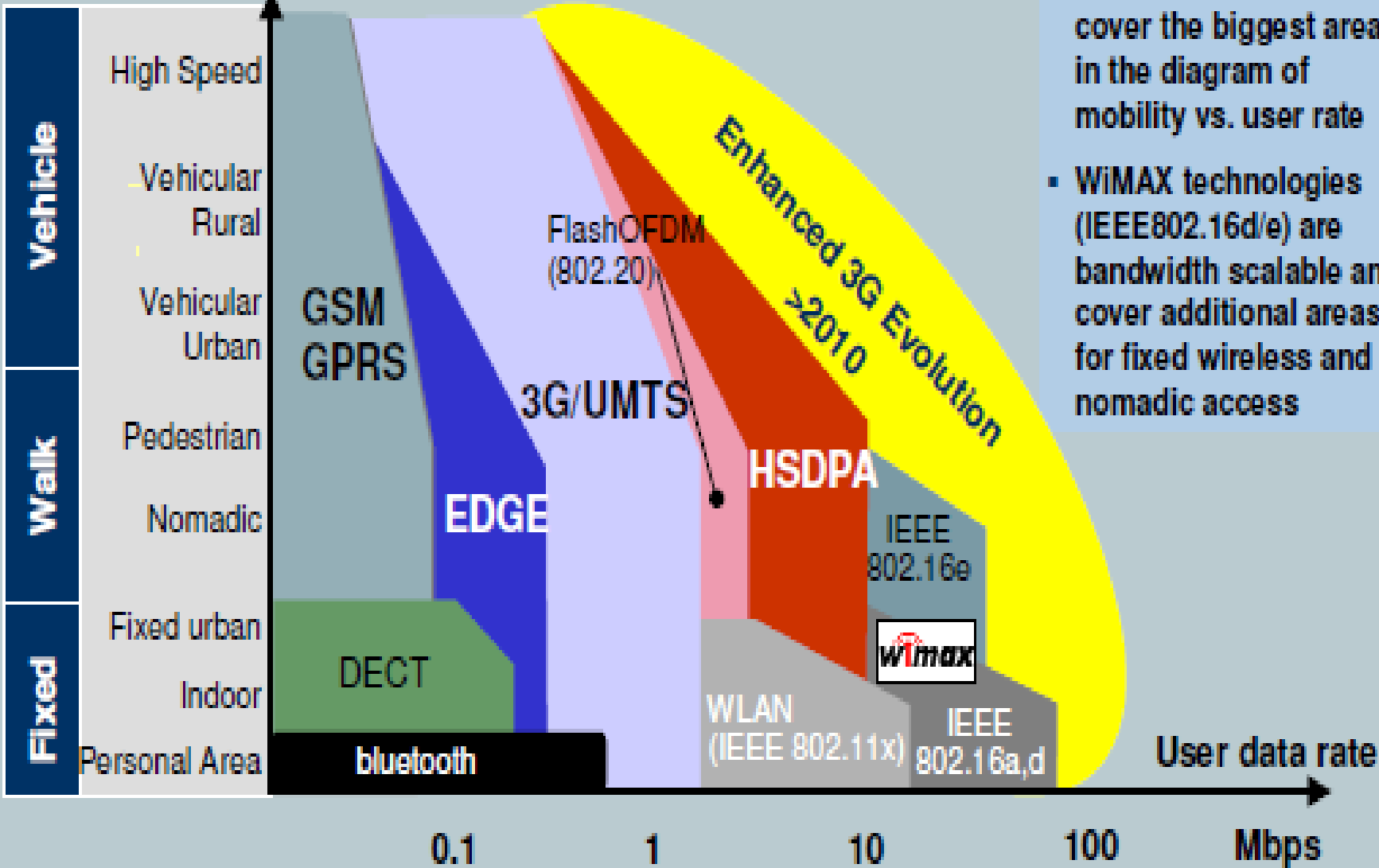
- A standard, defined by **3GPP**, is a highly flexible radio interface for wireless communication with high-speed data for mobile phones and data terminals.
- It is based on the GSM/EDGE and UMTS/HSPA network technologies, **increasing the capacity and speed using new modulation techniques.**
- Supports smooth evolution from earlier 3GPP system (**TD-SCDMA, WCDMA/HSPA**) & **3GPP2** systems: **cdma2000**.
- Also constitutes a major step towards **IMT-Advanced**
- Cell ranges up to:
 - **5 km**; with best throughput, spectrum efficiency & mobility.
 - **30 km**; Mobility with some degradation in throughput and spectrum efficiency permitted.

LTE – Advanced

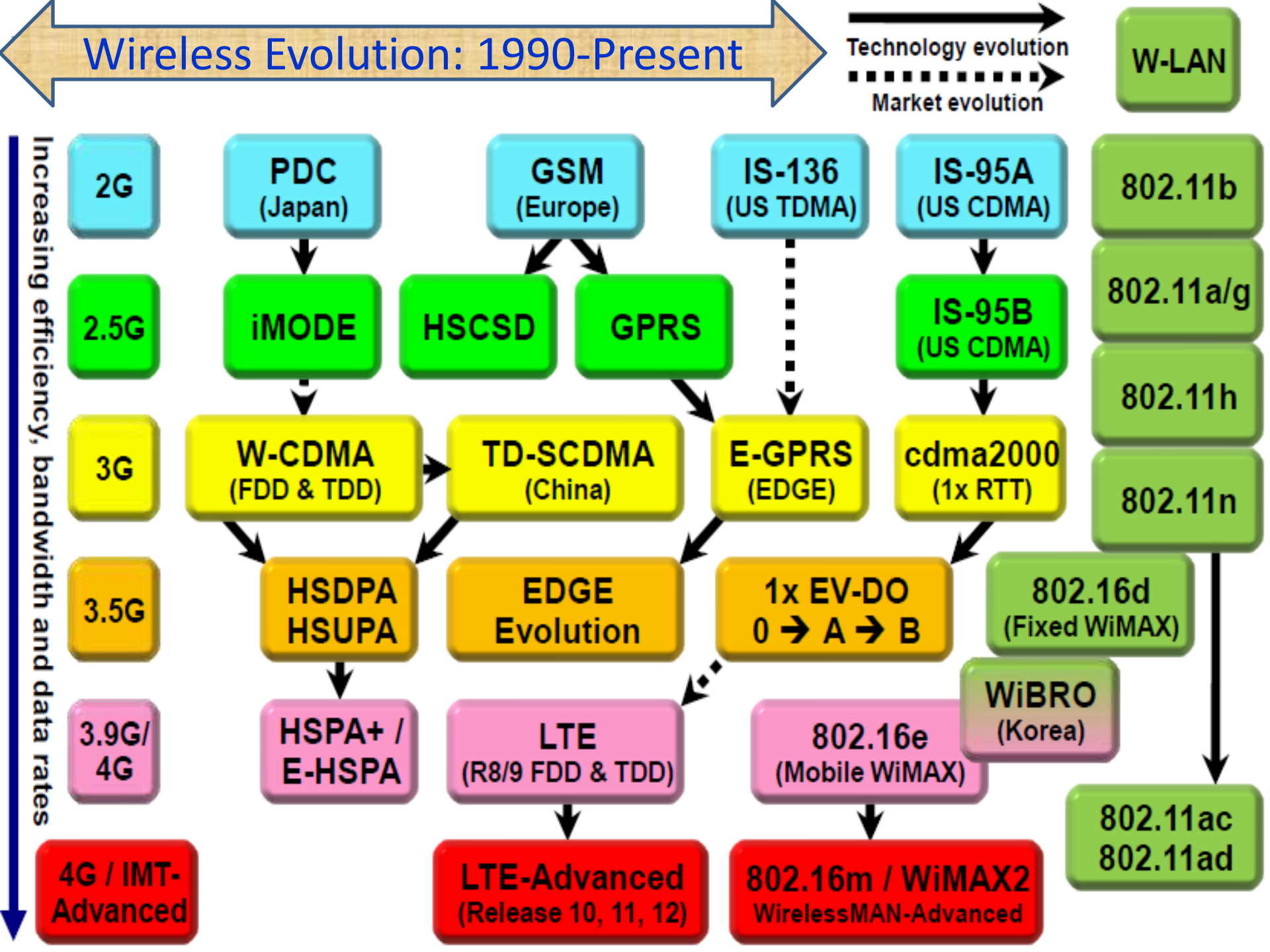
- Is to provide higher bitrates in a cost efficient way, and at the same time completely fulfill the requirements set by ITU for **IMT- Advanced**, also referred to as **4G**
- Focuses on higher capacity by adding more bandwidth:
 - Increased peak data rate, DL 3 Gbps, UL 1.5 Gbps
 - Higher spectral efficiency to 30 bps/Hz
 - Increased number of simultaneously active subscribers
- Uses **MIMO (Multiple Input Multiple Output)** or **Spatial Multiplexing**, to increase the overall bitrate through transmission of two (or more) different data streams on two (or more) different antennas

Wireless Technology Positioning

Mobility / Range



- W-CDMA and its enhancement HSDPA cover the biggest area in the diagram of mobility vs. user rate
- WiMAX technologies (IEEE802.16d/e) are bandwidth scalable and cover additional areas for fixed wireless and nomadic access



CR: Cognitive Radio = New ways of Using Spectrum

- Spectrum has been & will continue to be a scarce resource for the mobile-communication industry. So we need developed ways to use spectrum
- So **CR** technology allows different radio technologies to share the same spectrum efficiently by adaptively finding unused spectrum & adapting the transmission scheme to the requirements of the technologies currently sharing the spectrum.
- This dynamic radio resource management is achieved in a distributed fashion, & relies on **Software-Defined Radio SDR**
- **SDR** benefits from today's high processing power to develop multiband, multi-standard base stations & terminals.

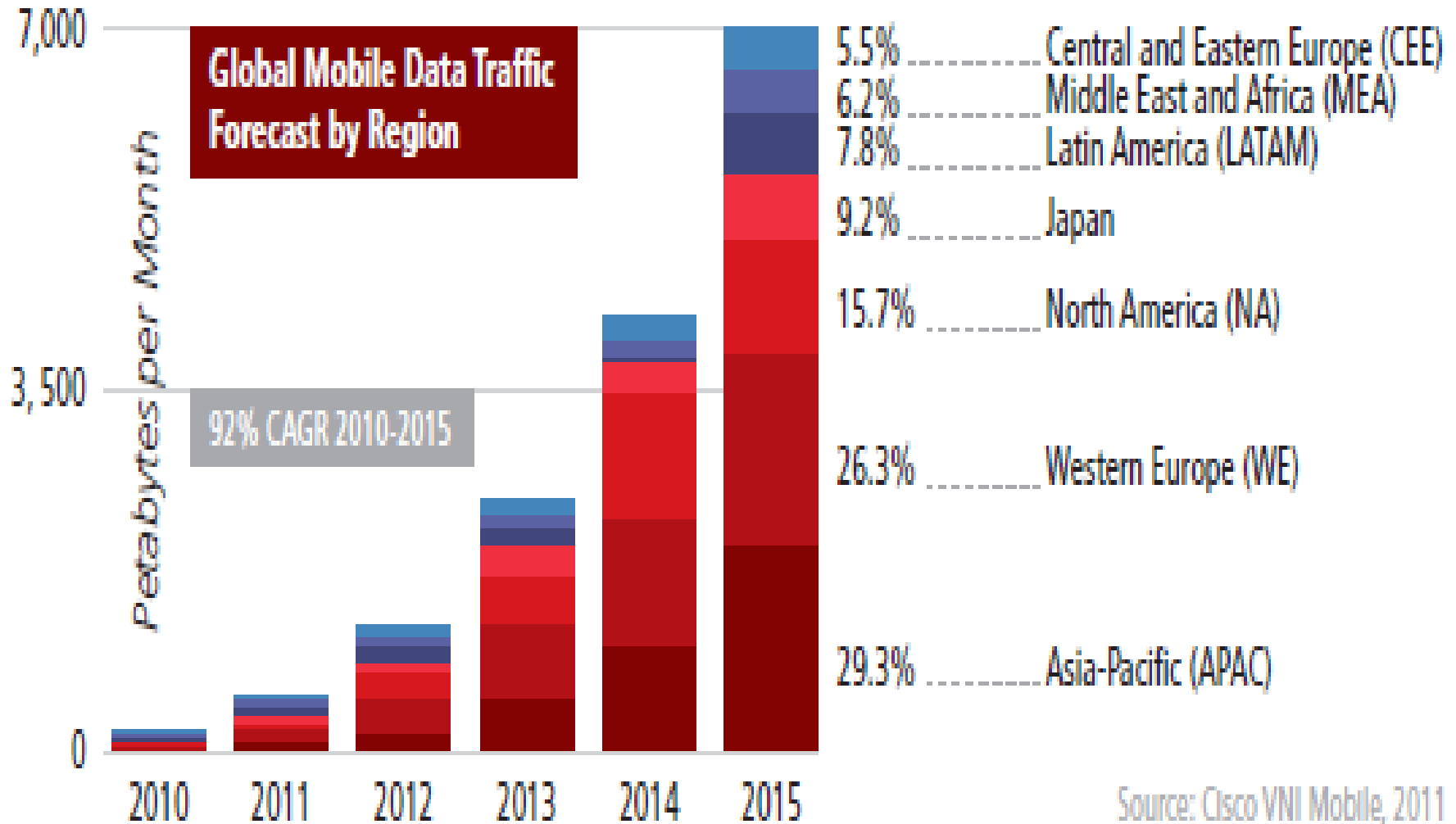


- Why IMT & IMT Standards Evolution Briefing

Facing up to the Mobile Data Explosion: *Stats*

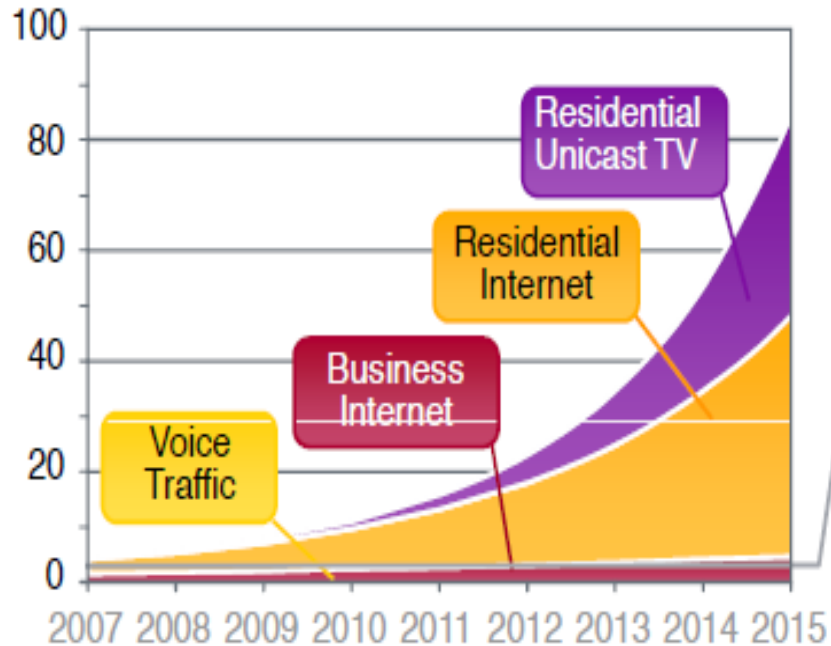
- As of today there are more than:
 - 1 billion 3G subscriptions
 - 400 3GPP-family networks of **HSPA** technology with data speeds in the **2-14 Mbps** range.
 - 140 networks of **HSPA+** technology with data speeds of up to **42 Mbps**
 - 50 **LTE** already installed networks (started commercially 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

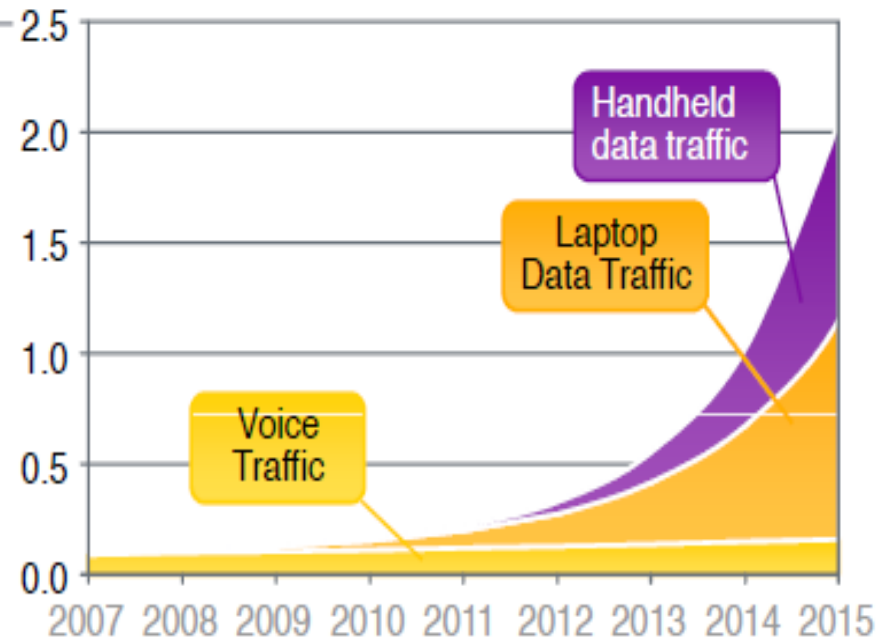


Internet Traffic Growth is Huge

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

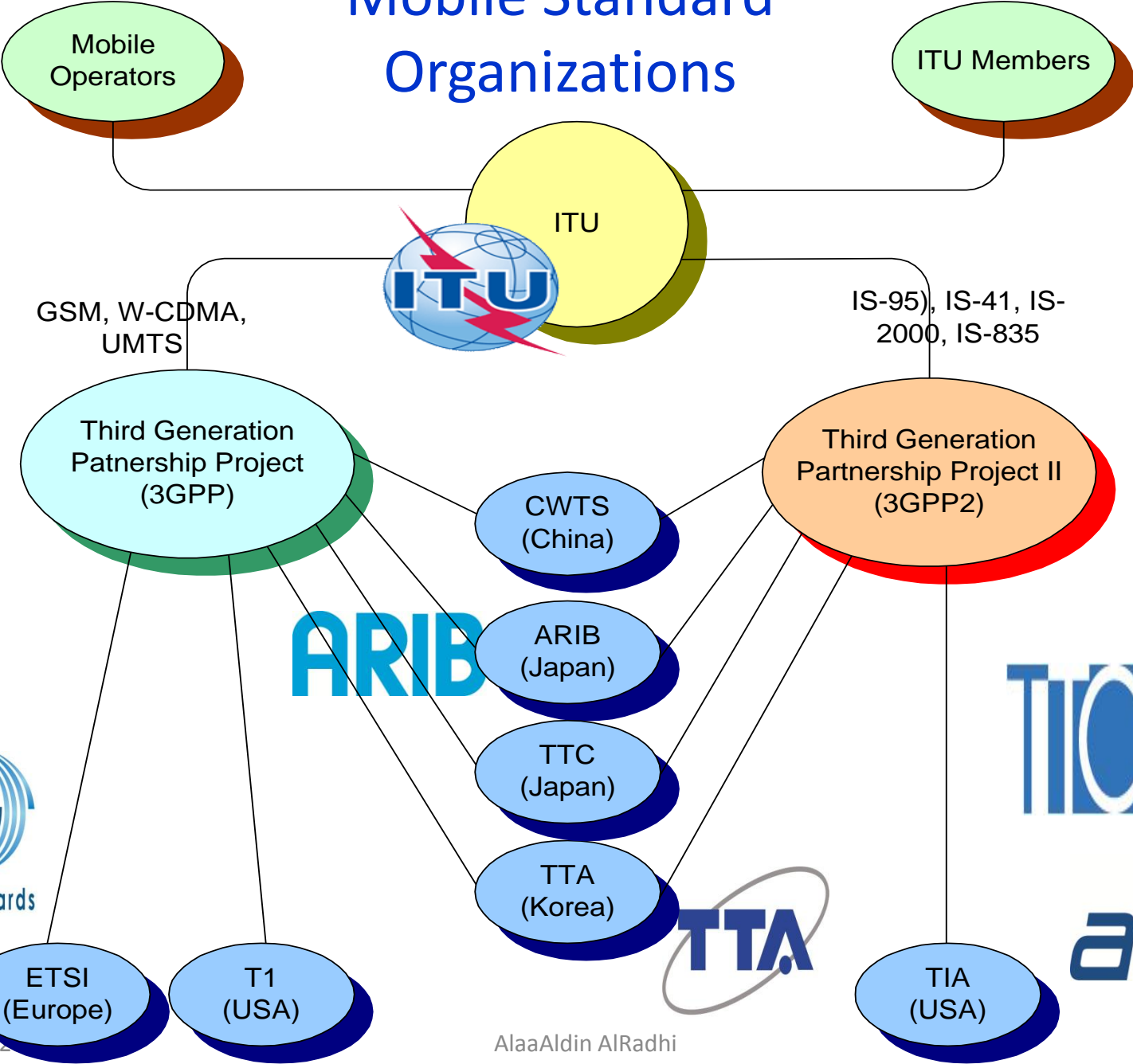


WIRELESS ACCESS
FOR THE 21ST
CENTURY

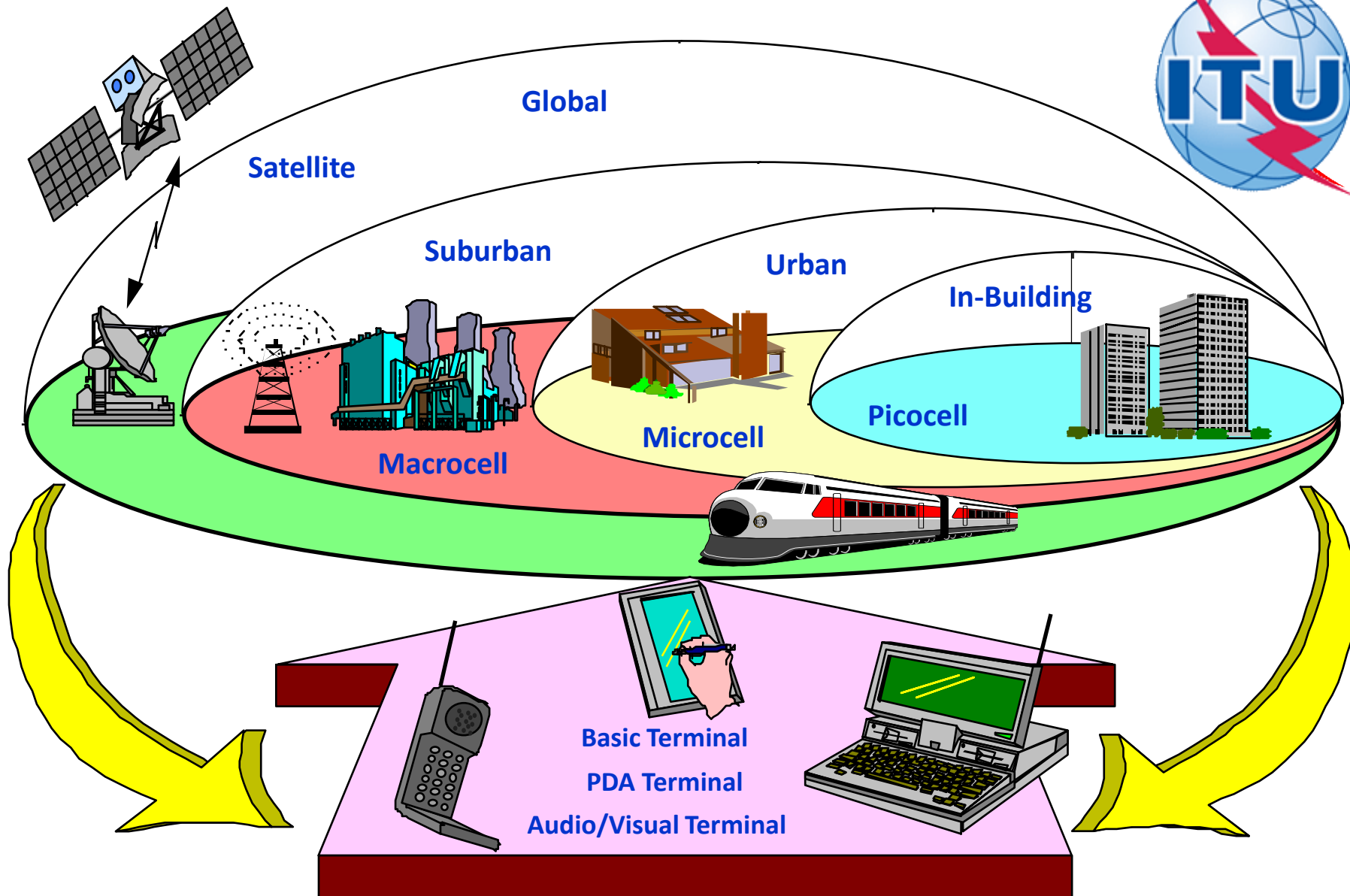
Anywhere - Anytime

- **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

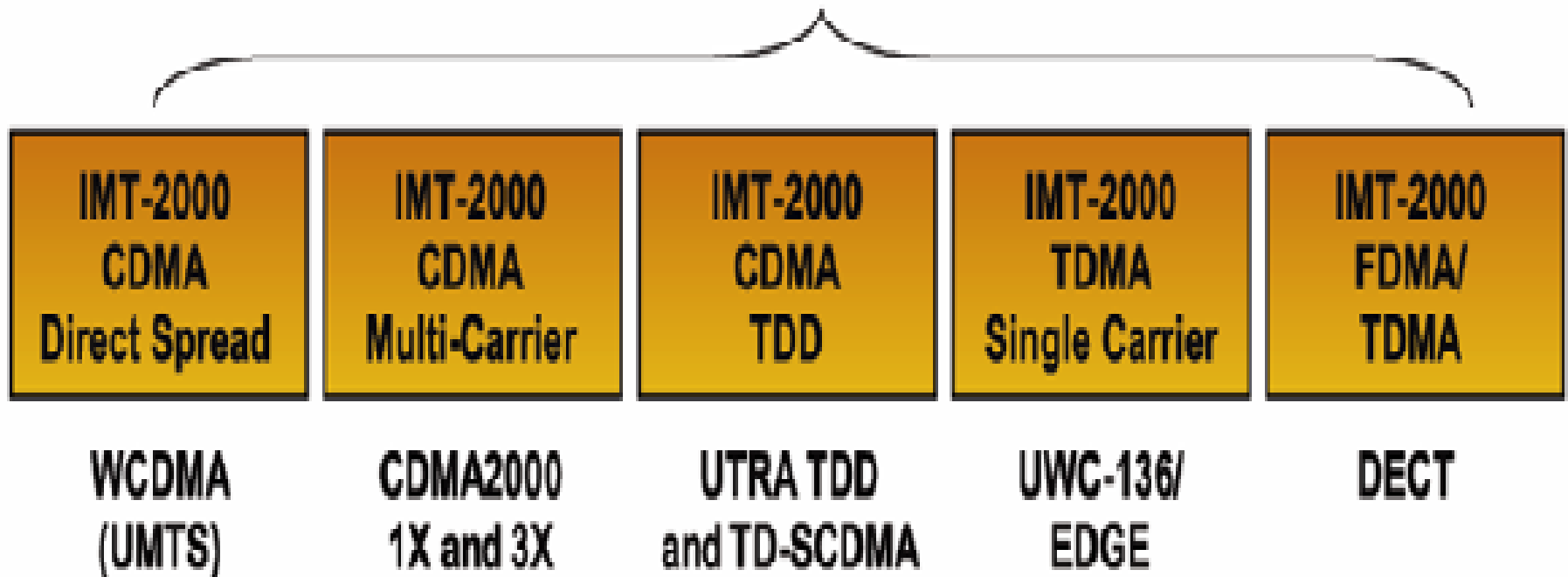


IMT-2000 Radio Access Standards

(Source: ITU)



IMT 2000 Terrestrial Radio Interfaces



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

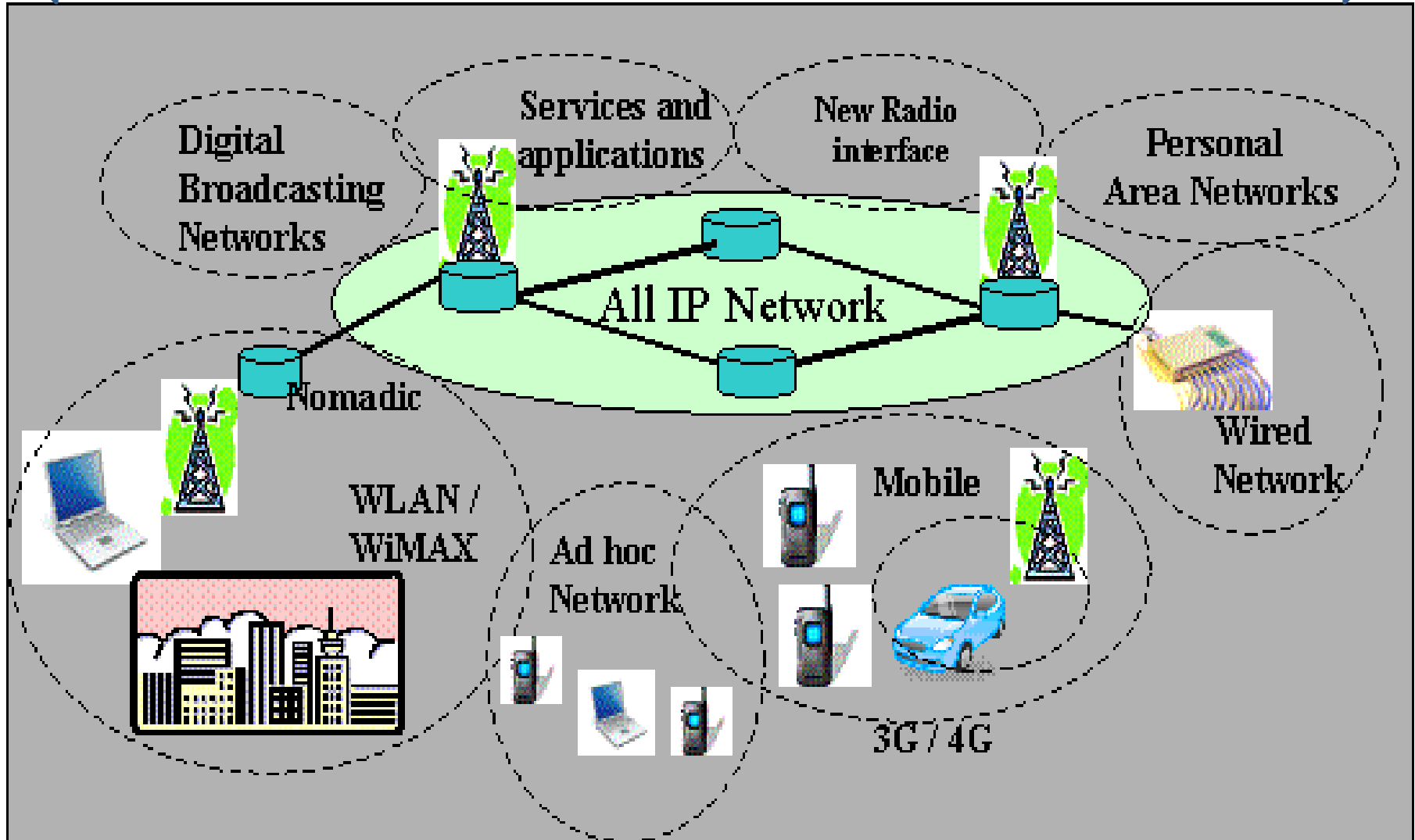


IMT – Advanced: *Summary of Major Improvements Over IMT-2000*

- 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*

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

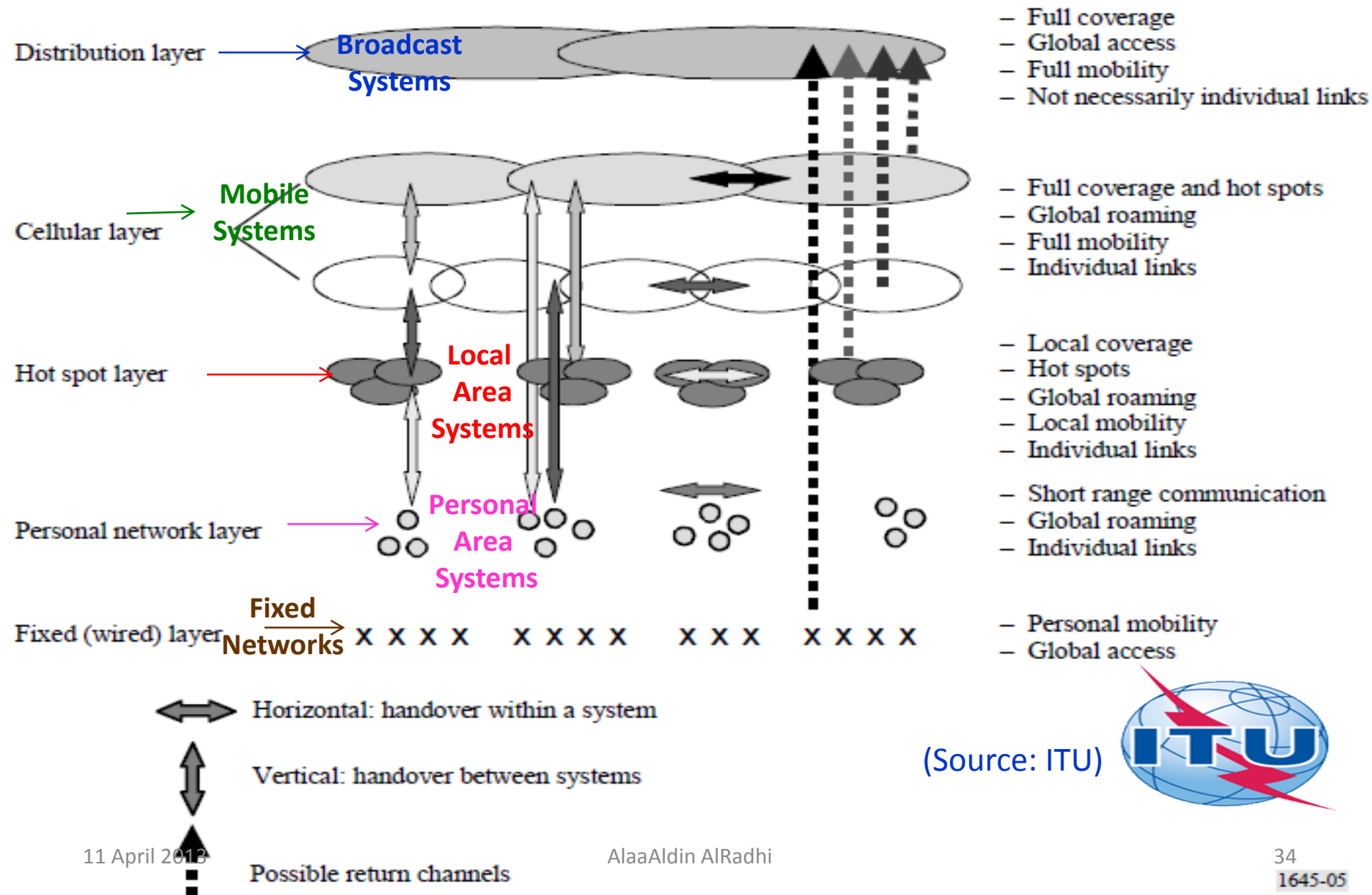
IMT – Advanced: *Bandwidth & Spectrum Requirements 2*

<i>Spectrum</i>	<i>Current Use</i>	<i>Advantages</i>	<i>Disadvantages</i>
<i>2700 - 2900 MHz</i>	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
<i>3400 - 4200 MHz</i>	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*

<i>Spectrum</i>	<i>Current Use</i>	<i>Advantages</i>	<i>Disadvantages</i>
<i>4400 - 4990 MHz</i>	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



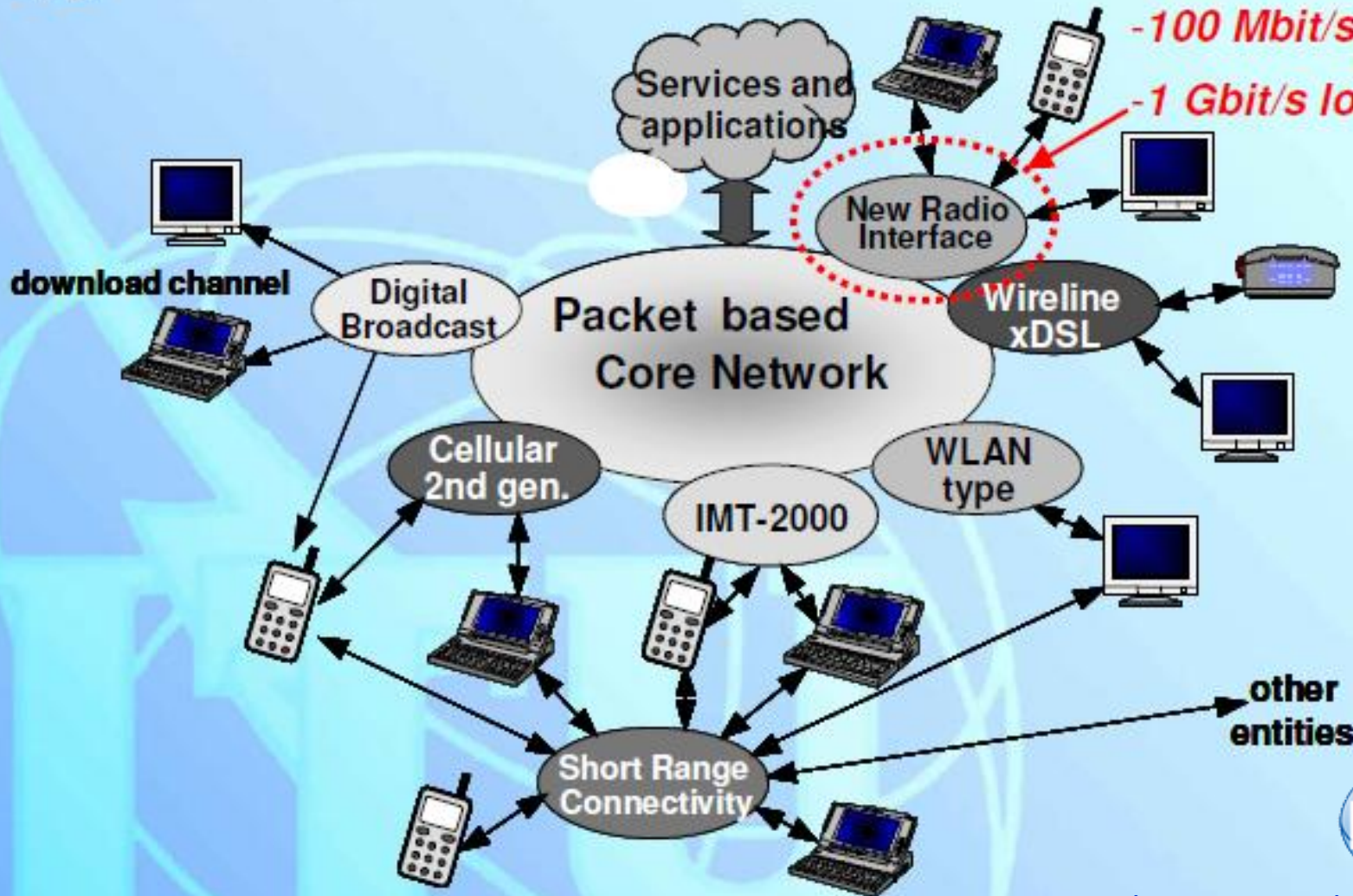
New Radio Interface(s) - Variety of Access Networks

New radio interface(s)

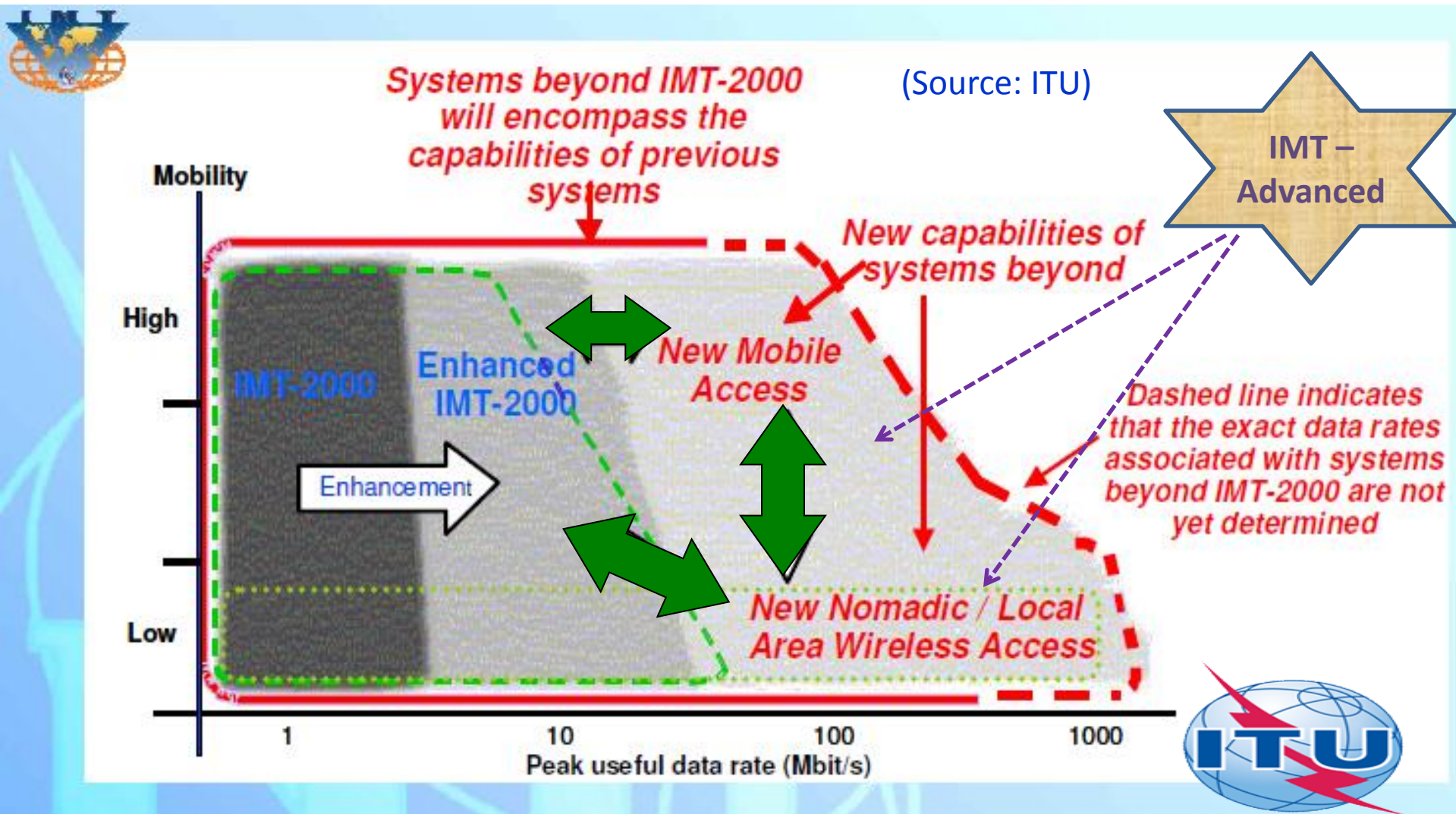
Research Goals:

-100 Mbit/s full mobility

-1 Gbit/s low mobility

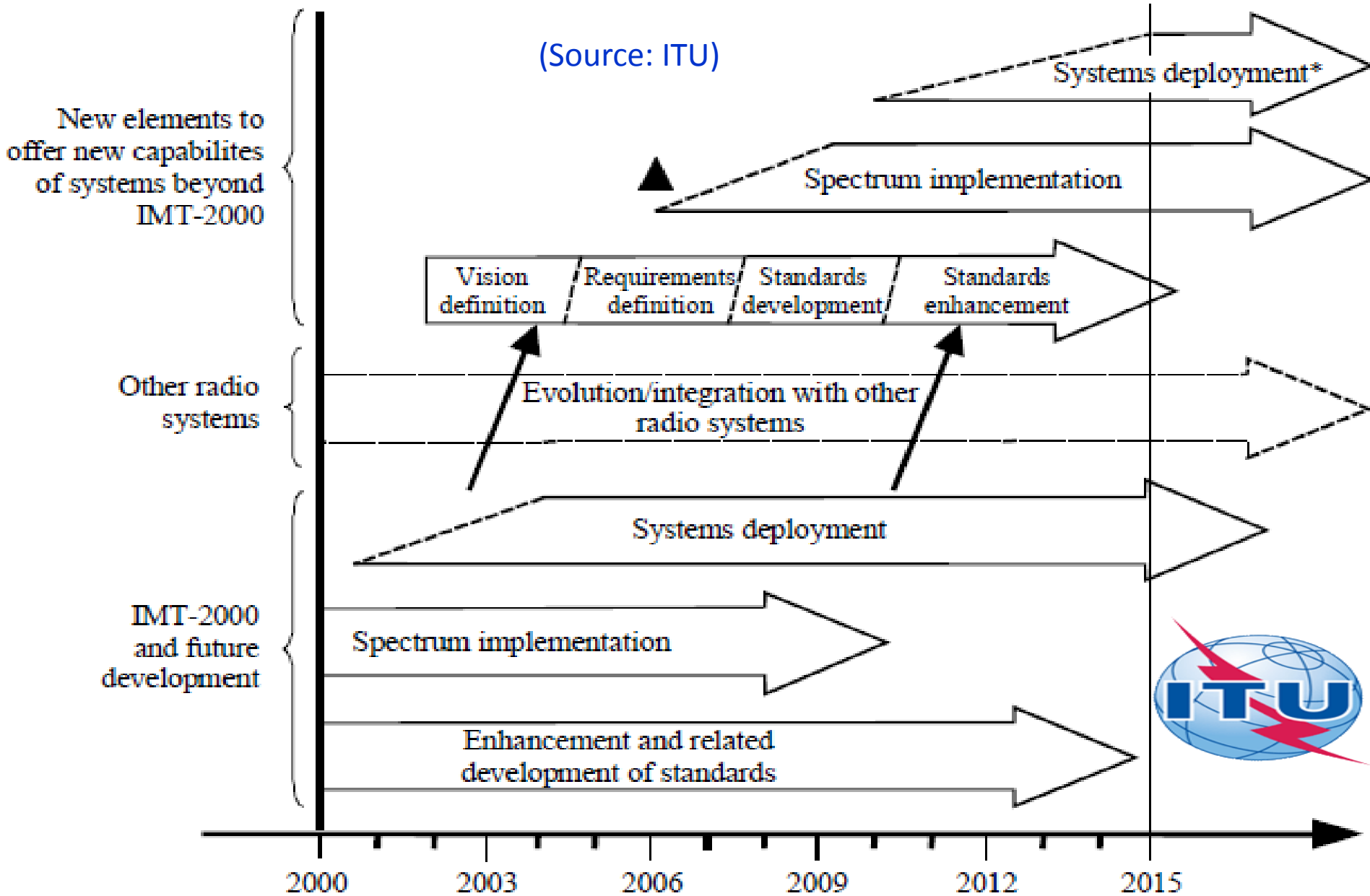


Capabilities of IMT-2000 & IMT-Advanced: The Van



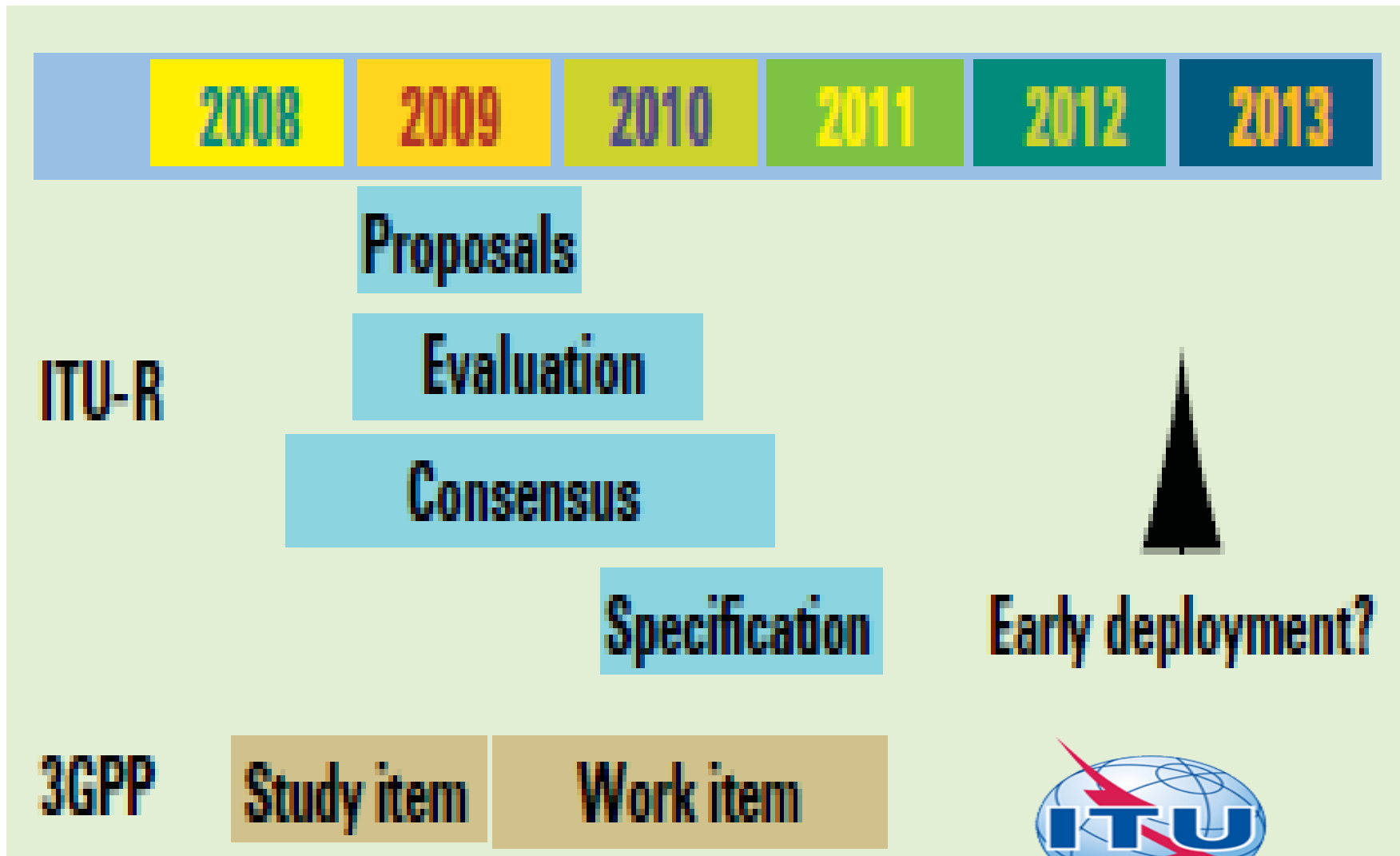
IMT – Advanced: *Timelines*

(Source: ITU)



IMT – Advanced:

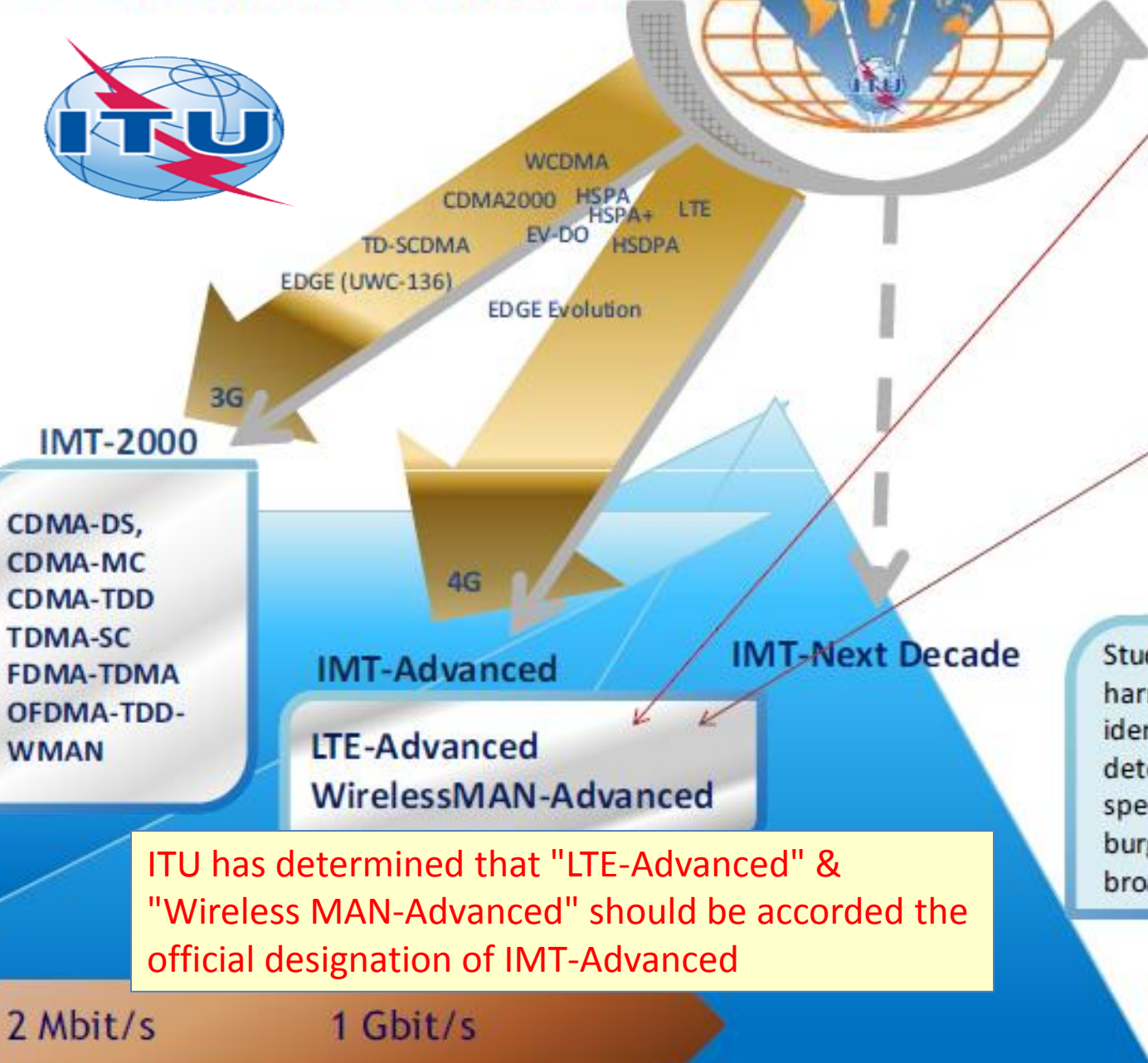
Projected ITU timeline & links into 3GPP



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.

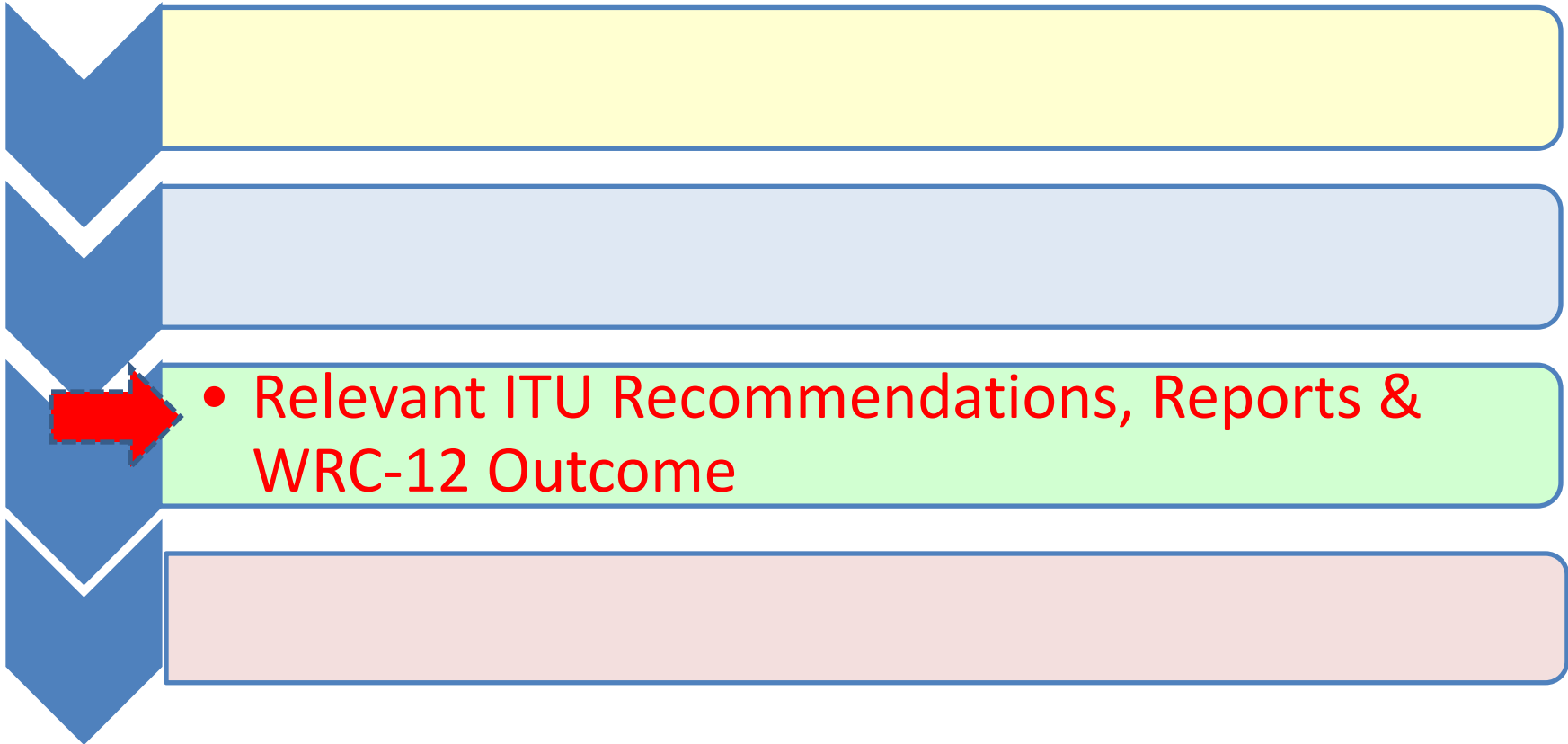
Following a detailed evaluation against stringent technical and operational criteria, ITU has determined that "LTE-Advanced" and "WirelessMAN-Advanced" were accorded the official designation of IMT-Advanced.

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

2 Mbit/s

1 Gbit/s

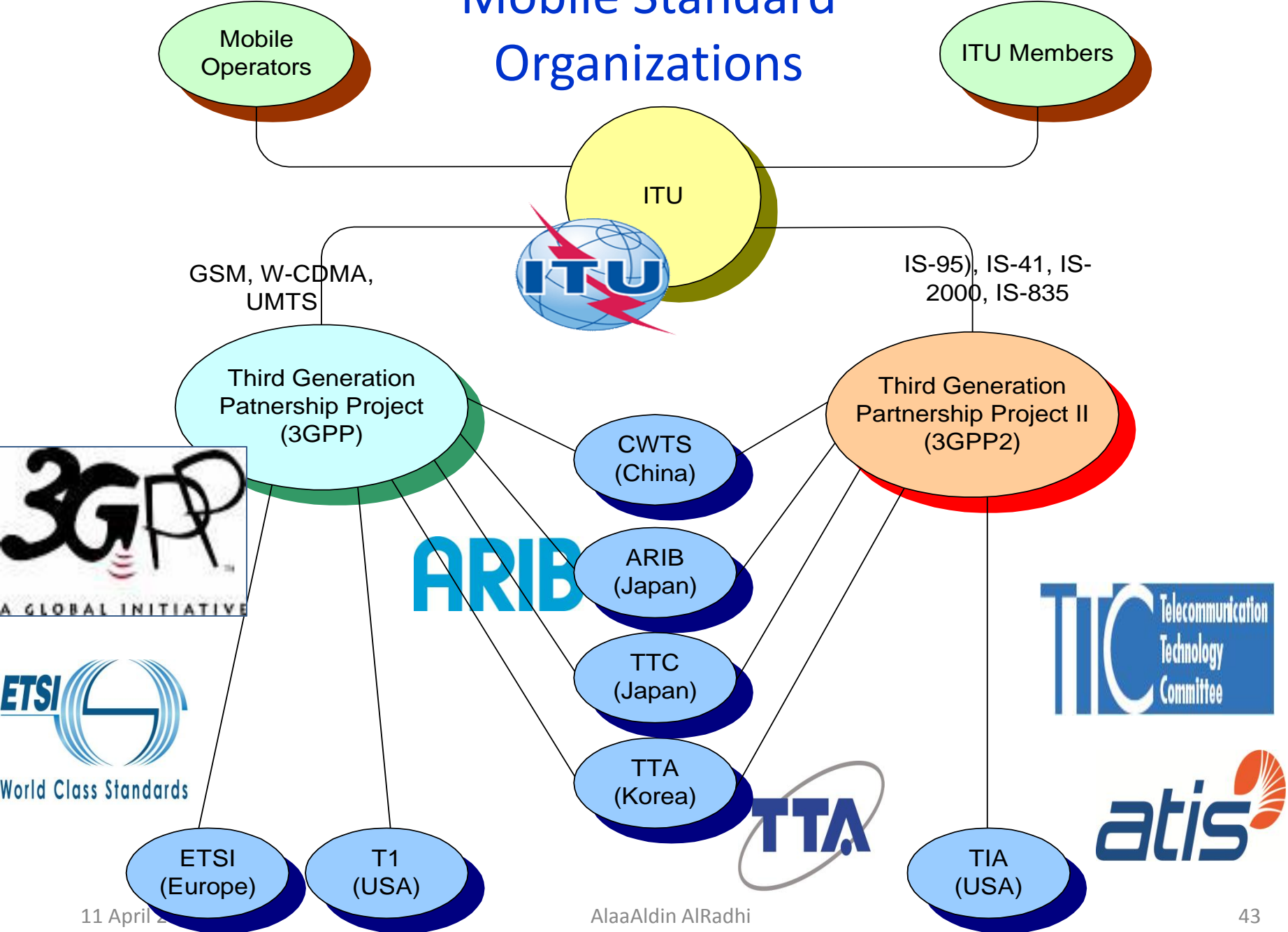


Role of ITU

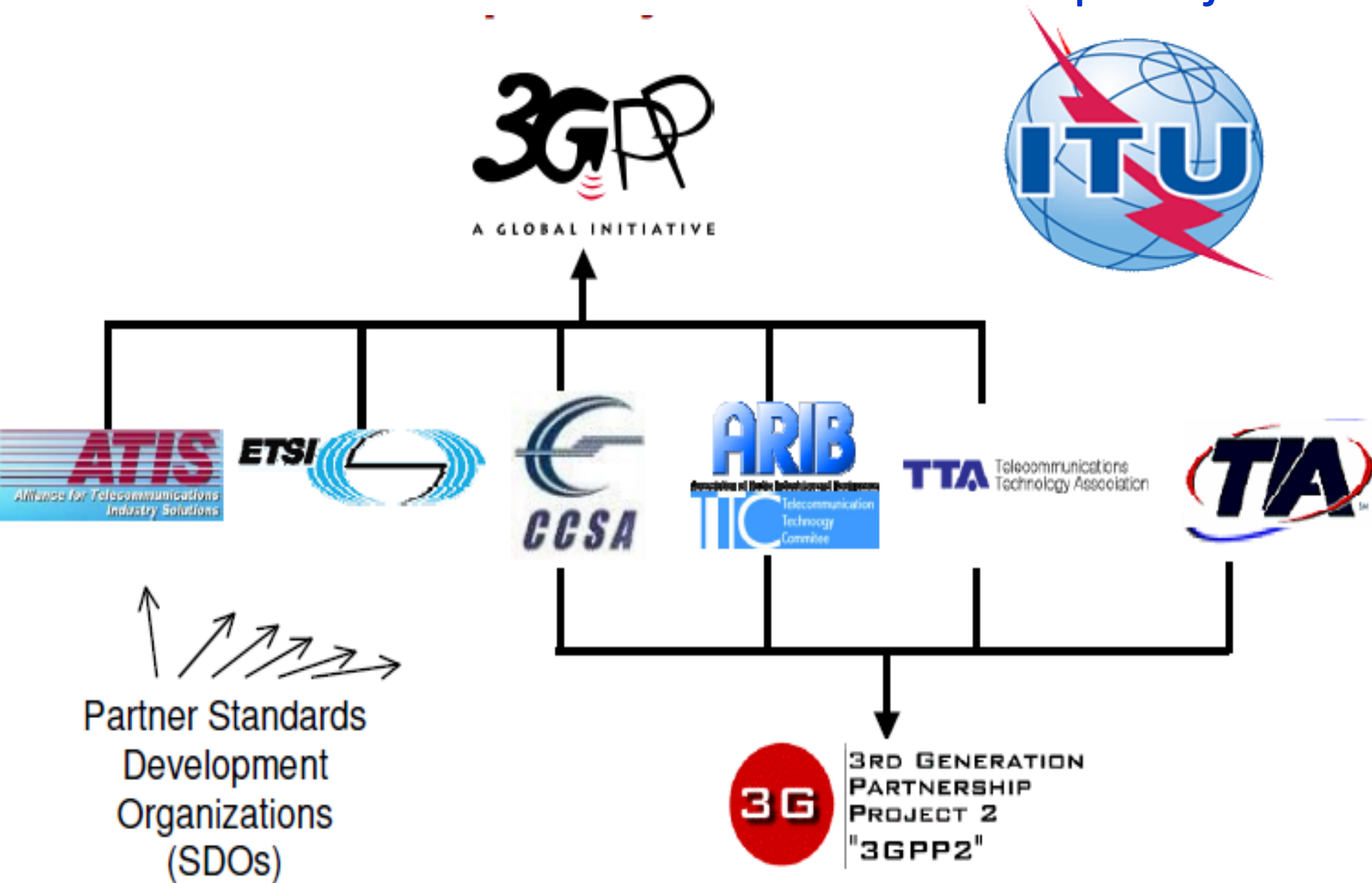


- World-Wide Spectrum Efficiency Coordination & Improvements
- Policy & Regulatory Harmonization
- International Standards for Key Access and Network Interfaces
- Provide Foundation, Framework & Catalyst For 3G Convergence Across Regions & Technologies
- Harmonize Regional Input Contributions & Consensus 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

Mobile Standard Organizations

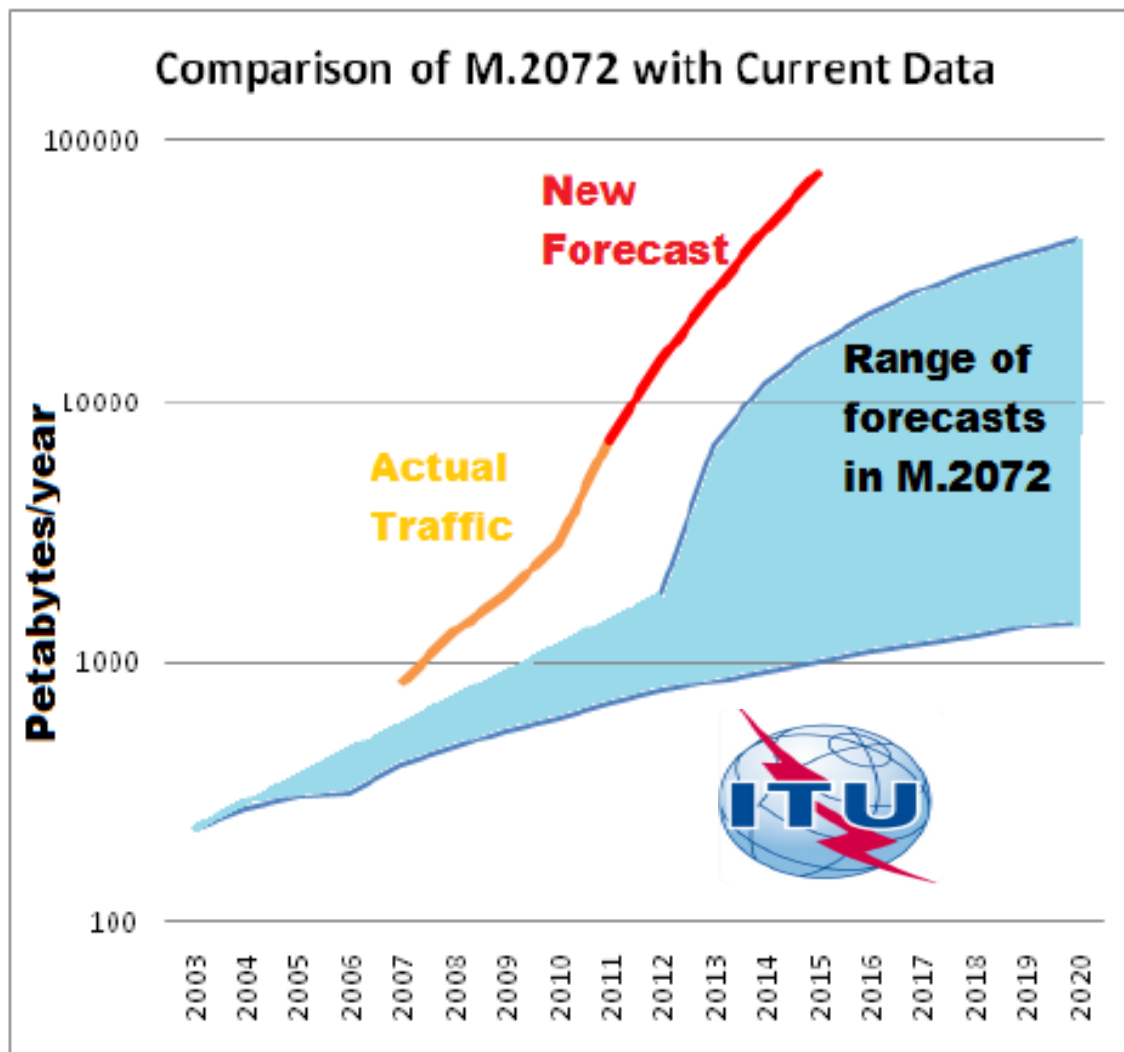


ITU & SDO Partners of the 3G Partnership Projects



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.

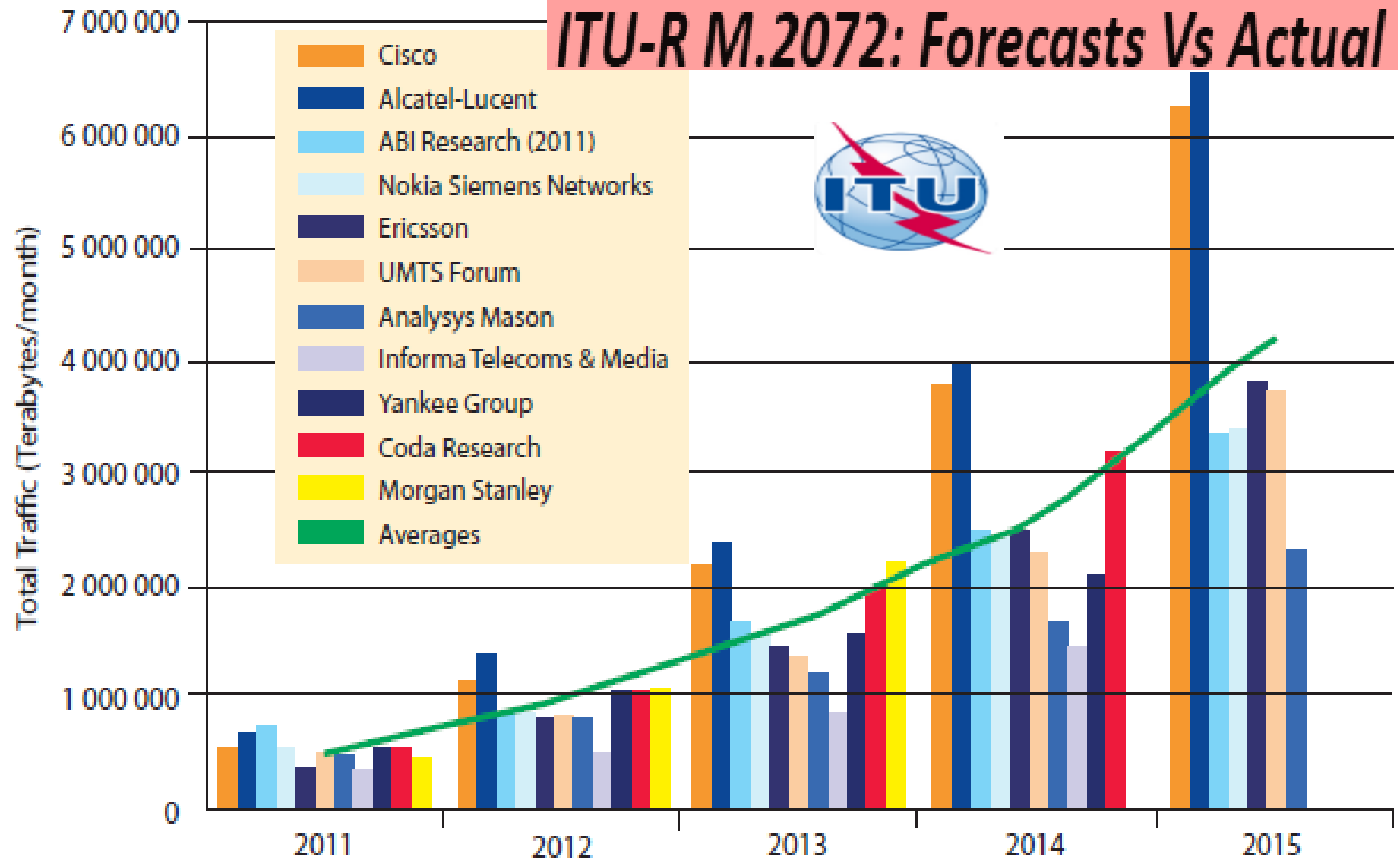
Moreover, the actual traffic being experienced by the operators today is even greater than some of the forecasts in Report ITU-R M.2072 for the year 2020.

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

ITU-R M.2072: Forecasts Vs Actual

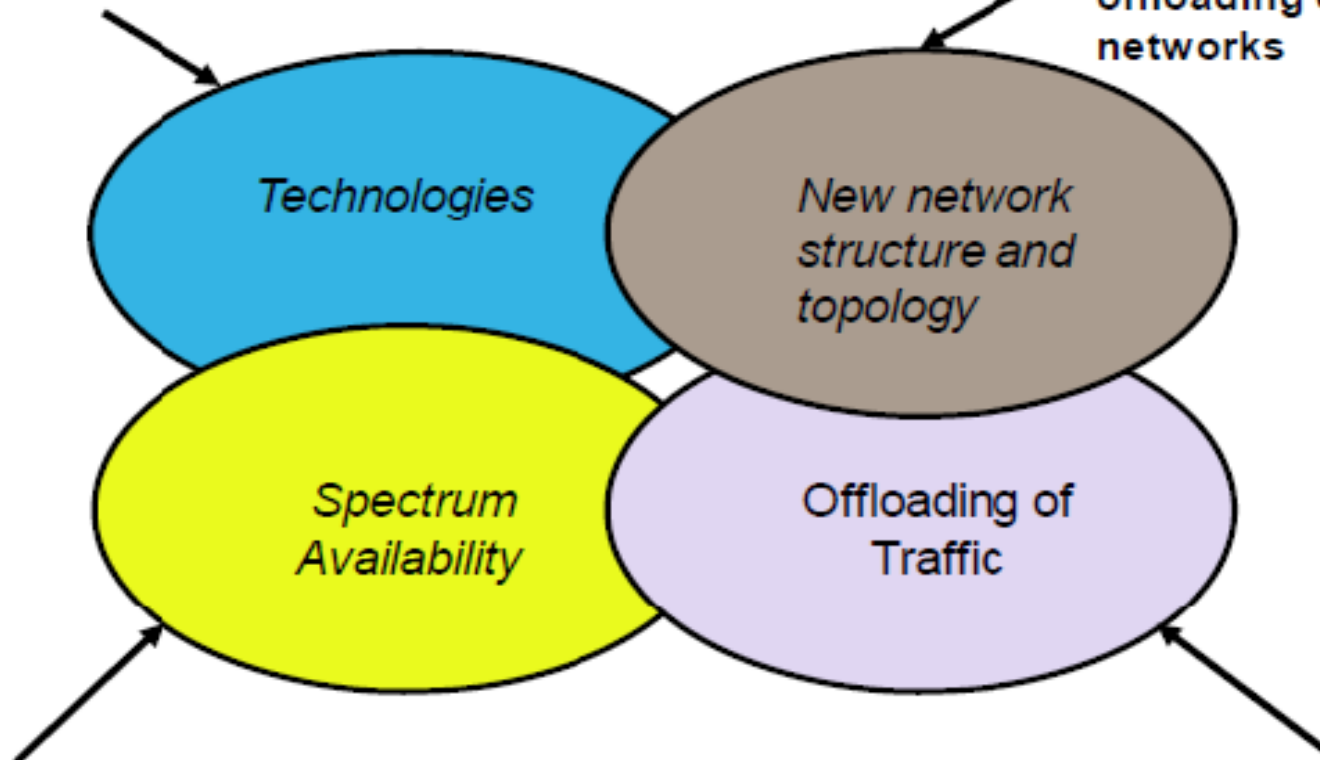


Options to manage mobile demand



Migration to innovative, more efficient technologies

Number of radio sites and Smaller cell sizes for more local capacity and for offloading of traditional networks



Amount of spectrum used by radio interface

Wi-Fi or any type of traffic offloading

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

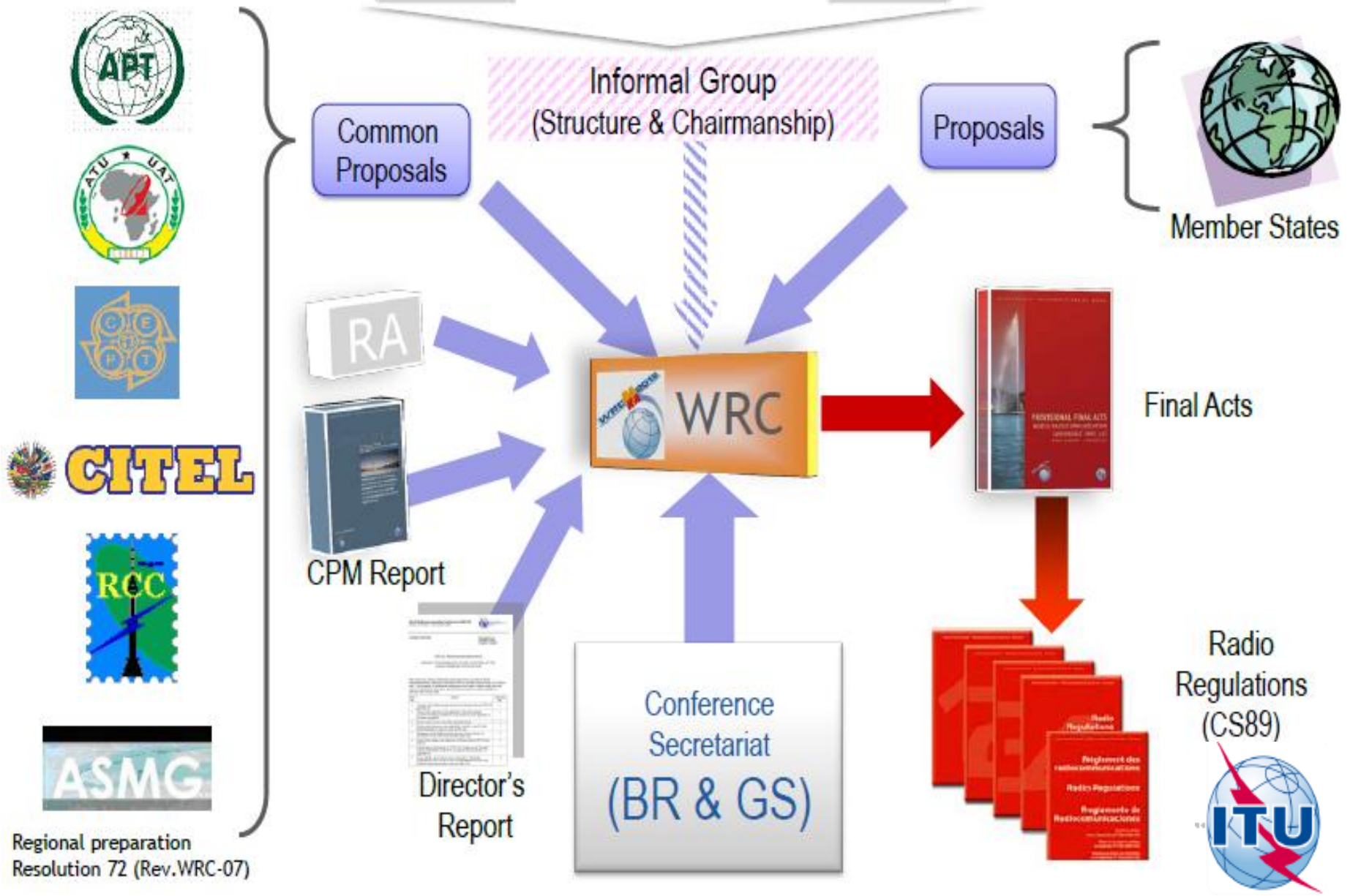
North America (CITEL)

478 MHz

Latin America (CITEL)

Between 270 MHz and 360 MHz

WRC-12: Preparations





Mobile Broadband / IMT Spectrum

- ✓ **800 MHz:** sharing problems resolved
- ✓ **700 MHz:** allocation to MS globally available from 2015
- ✓ **Additional spectrum:** to be considered by WRC-15

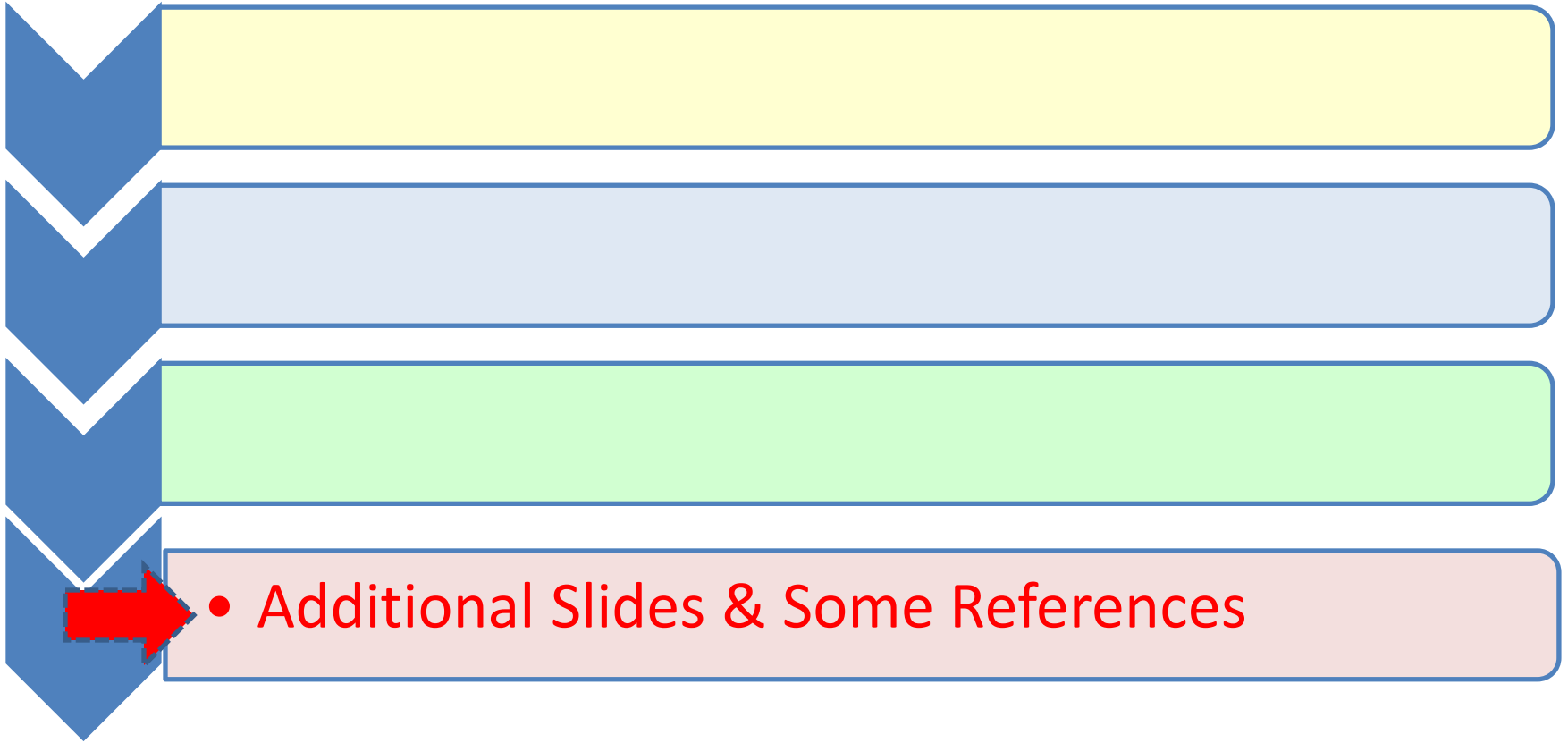
In addition to establishing the conditions to use of the 800 MHz band (i.e., 790-862 MHz) in Region 1 (the “first “ digital dividend), WRC-12 considered further spectrum allocations to the mobile service, including International Mobile Telecommunications (IMT) to facilitate the development of terrestrial mobile broadband applications; thus the extension of the 800 MHz band, i.e., 694-790 MHz (the “second“ digital dividend) in Region 1 will be available from 2015.

WRC-12 & IMT: *Results*

Spectrum Bands for IMT



- WARC-92, WRC-2000, WRC-2007, WRC-2012 identified the following bands:
 - 450-470 MHz,
 - 698-960 MHz,
 - 1710-2025 MHz,
 - 2110-2200 MHz,
 - 2300-2400 MHz,
 - 2500-2690 MHz,
 - 3400-3600 MHz
- Actual allocation may differ across Region 1, 2 and 3



- Additional Slides & Some References



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>

- [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)

- [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

- [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

- [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



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&rlink=imt-advanced-rep&lang=en>

- [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

- [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

- [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

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.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):
 - <http://www.ttc.or.jp/e/index.html>
- The Telecommunication Technology Association (Korea):
 - http://www.tta.or.kr/english/e_index.htm