New spectrum for future mobile broadband services

Presentation to 3GPP/PCG

Jean-Pierre Bienaimé

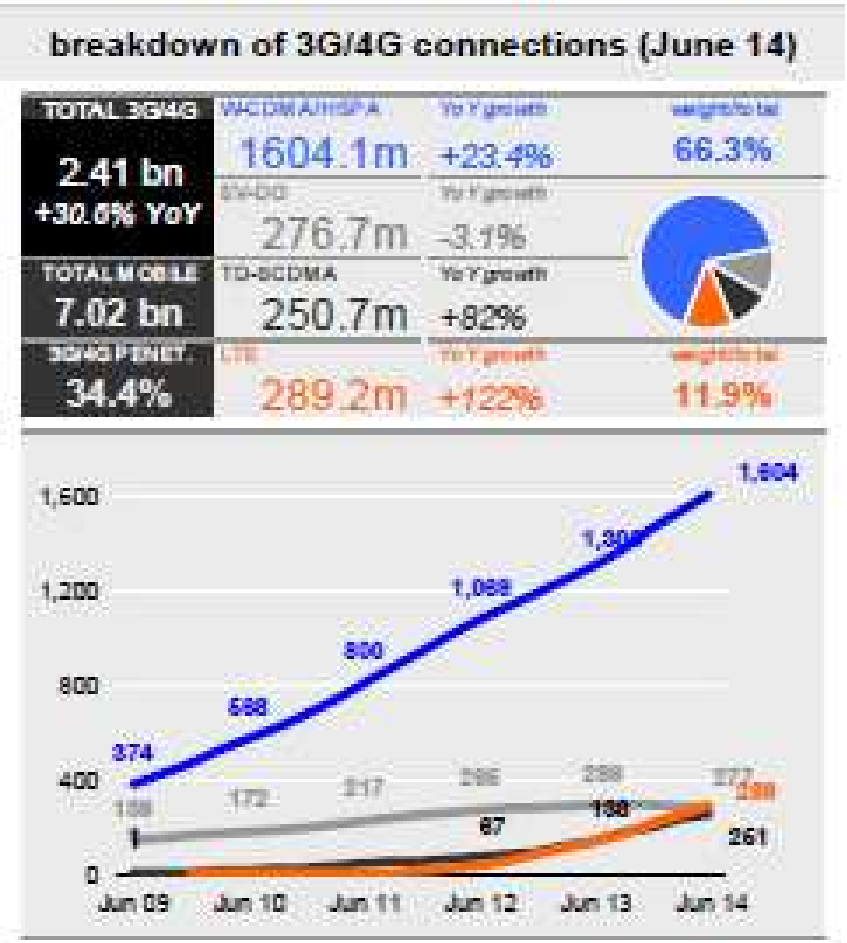
Chairman, UMTS Forum

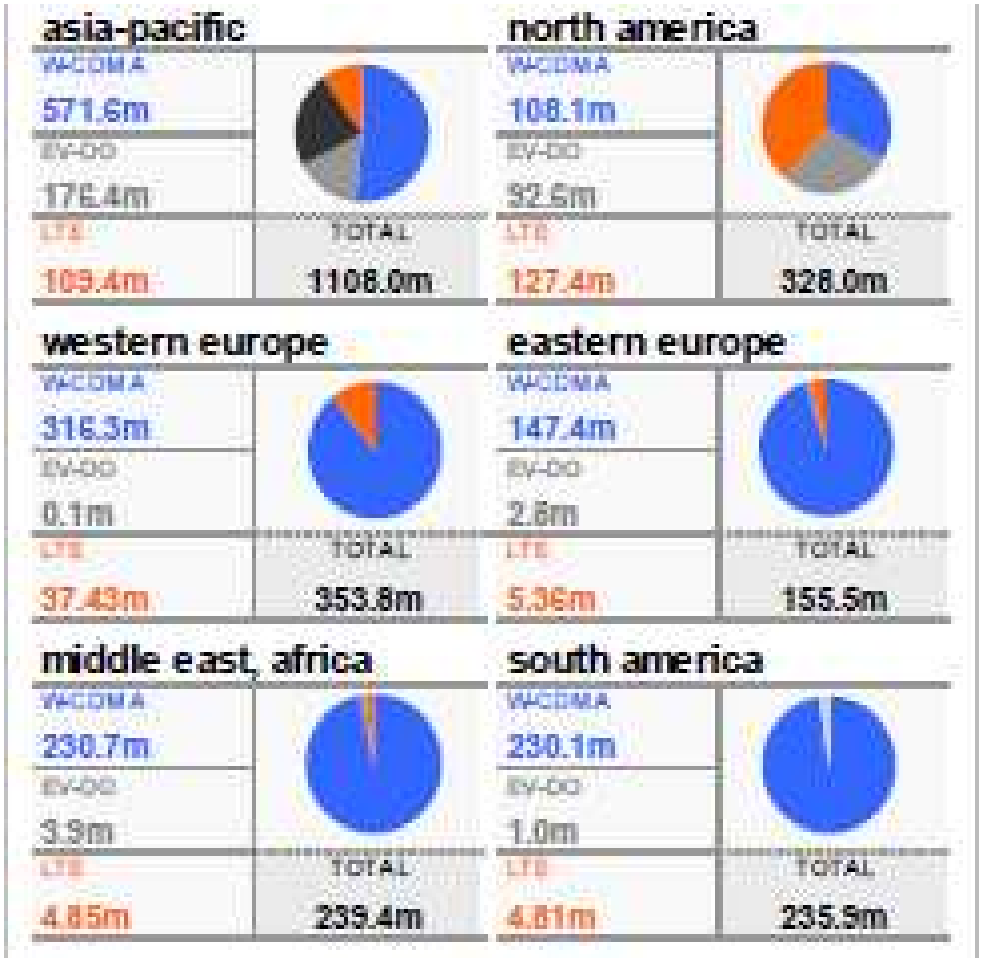
3GPP/PCG#33, 28 October 2014, Bundang, South Korea

Summary

- **3G/4G LTE global market overview**
- **UMTS Forum contributions to the work on IMT mobile broadband**
- **Mobile data traffic strong expected growth ➔ towards WRC-15**
- **Future technology evolutions & services ➔ new spectrum needs**

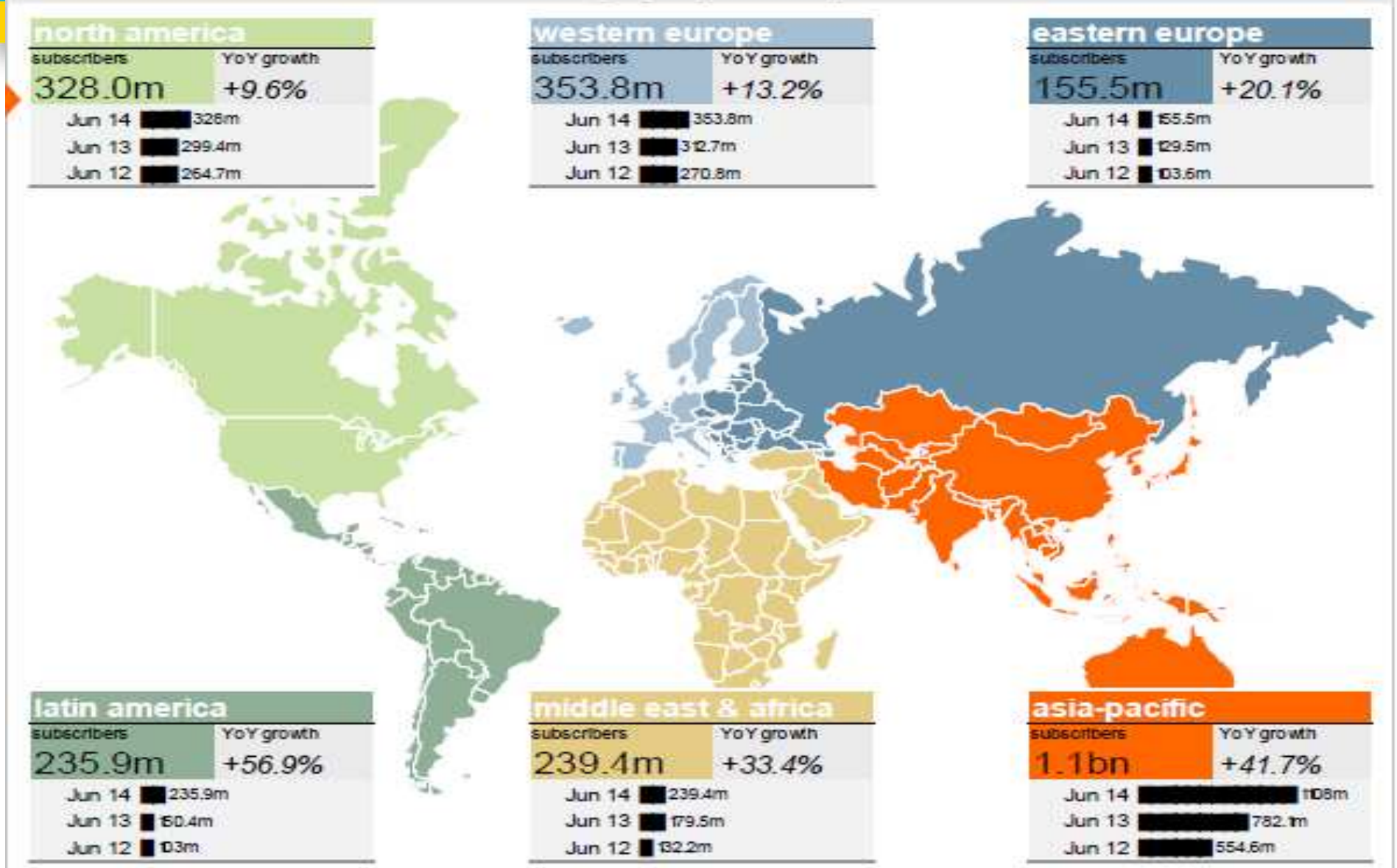
3G/4G global deployment





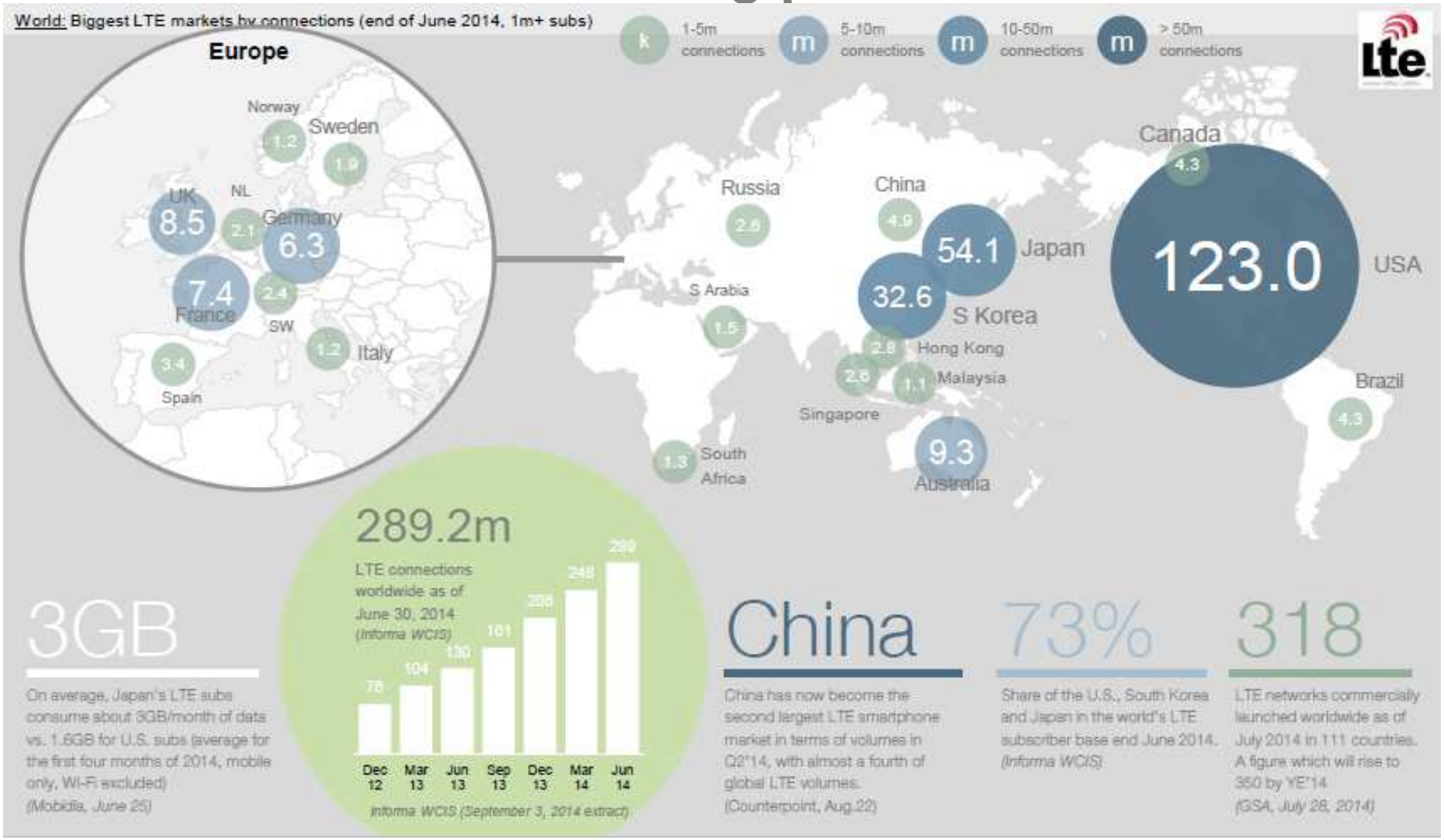
Promoting mobile broadband evolution

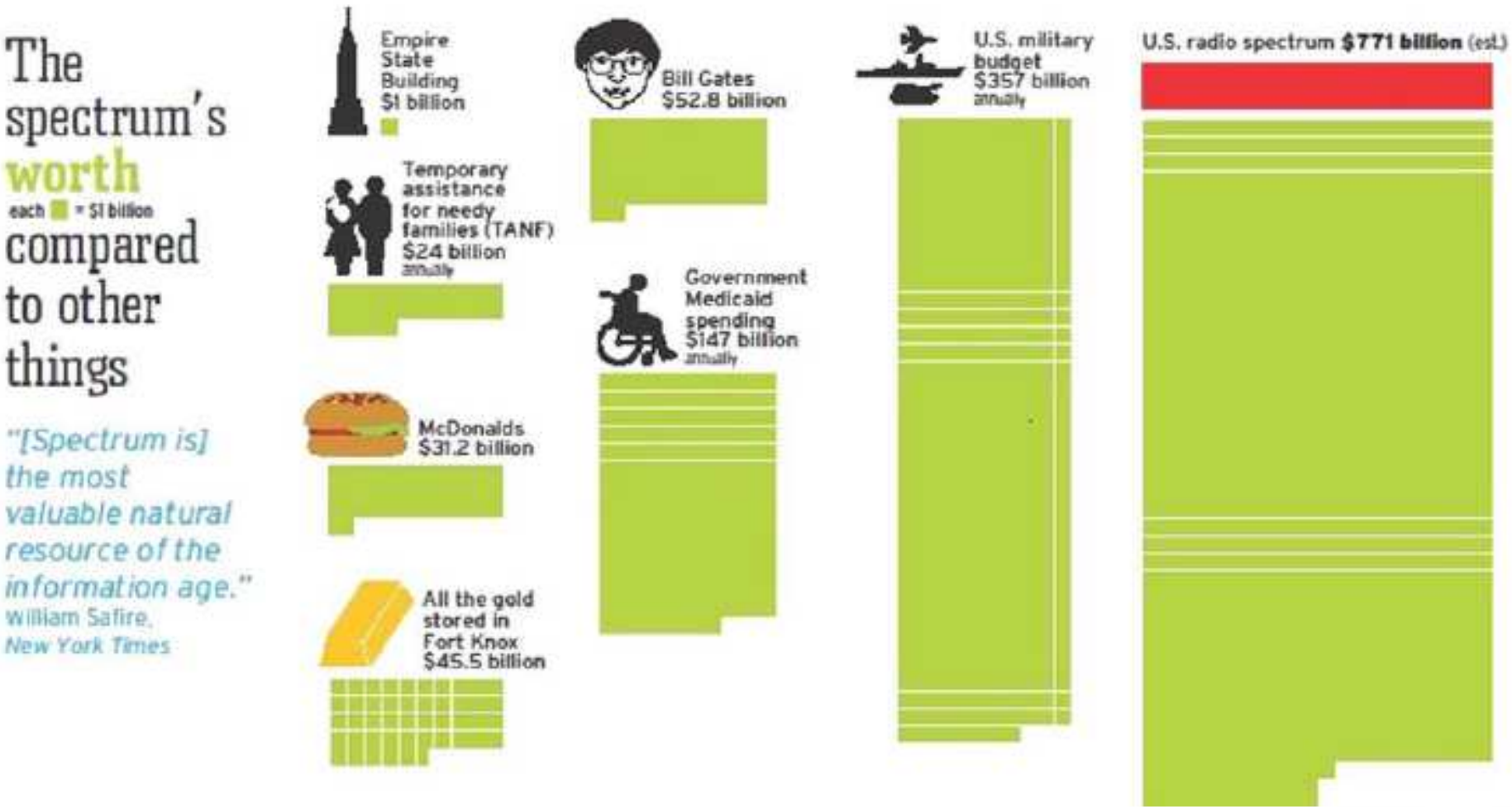
breakdown and evolution of 3G/4G connections by region (June 2014)



Data: Informa WCIS (September 3, 2014 extract), TeleGeography. Subscribers bars at scale for all regions

4G LTE: the big picture





Eli M. Noam, Proceedings of the IEEE, 2012

UMTS Forum is a long-standing trade organization supporting UMTS / IMT/IMT Advanced technologies, the 3GPP mobile broadband roadmap – as well as, in the ITU context

UMTS Forum developed **Report 07** for WRC-2000

- where the band 2500 – 2690 MHz was identified to UMTS/IMT

Report 07

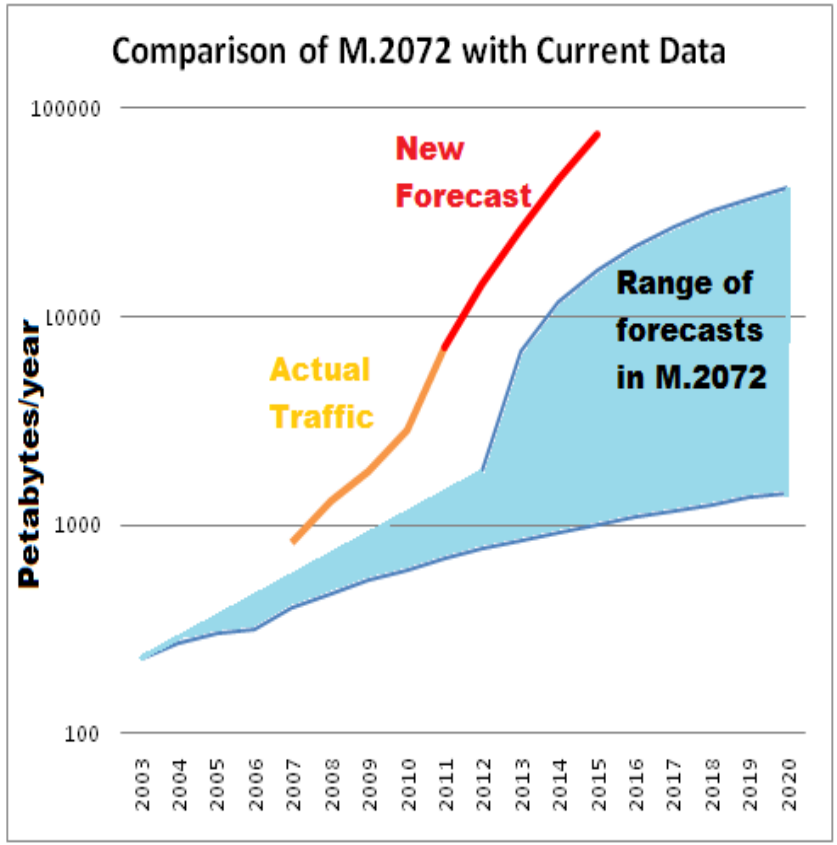
UMTS Forum developed **Report 40** for WRC-07

- for the **Report ITU-R M.2072** on the future mobile market, estimates the total volume of mobile traffic will reach about **60 EB per year around 2020**
- in support of **Report ITU-R M.2078** estimating the total UMTS/IMT spectrum requirements in 2020; **1280 MHz** for a “low market” and **1720 MHz** for a “high market”

Report 40

UMTS Forum developed Report 44 for WRC-12 / 15 (for an agenda item)

- forecasts addressing the **year 2020** (2025)
- for a diverse range of applications and services that require very high peak data rate delivery
- in support of the new Report ITU-R M.2243 [IMT.UPDATE] **forecasting the future mobile market**



Report ITU-R M.2243

Report 44

WRC-15 preparatory activities for the mobile service

Agenda Items

1.1 Additional frequency allocations for broadband mobile and identifications for IMT
1.2 700 MHz band/broadcasting and ARNS
1.3 PPDR

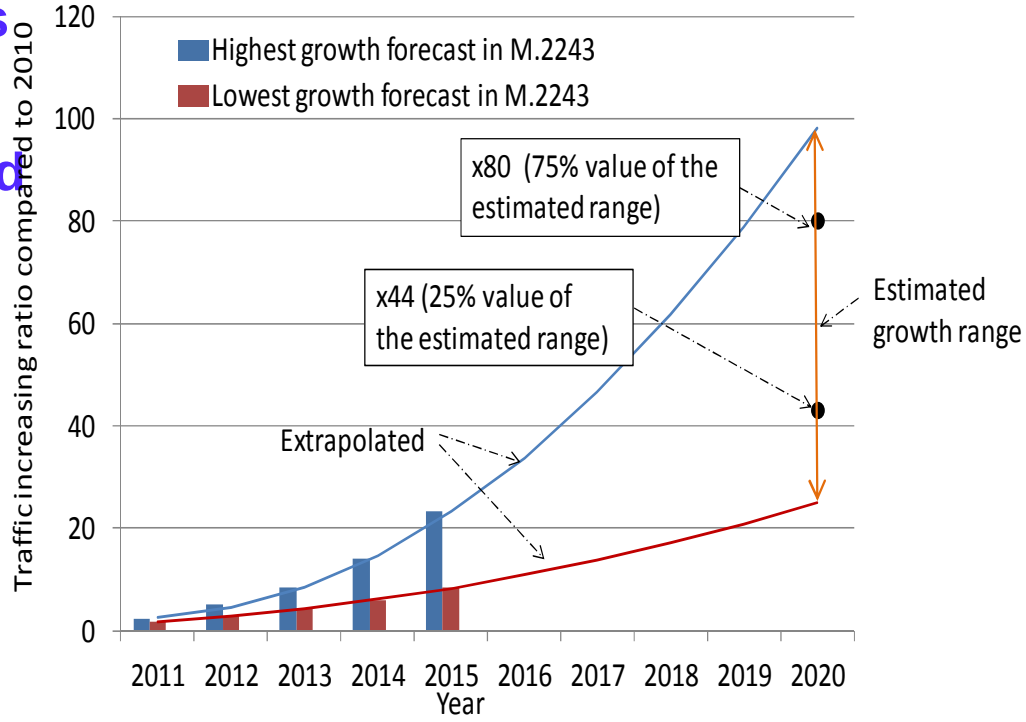
Source : ITU-R

Towards WRC-15

ITU-R Report M.2243 highlighted **trends** of **fast growing mobile data traffic, very high peak data rates,** and **need for capacity and coverage:**

- new types of devices, smartphone and tablets
- increased mobile Internet usage
- more mobile software application offerings (Apps)
- growth of video traffic
- expansion of M2M traffic

ITU-R WP5D extrapolation for year 2020



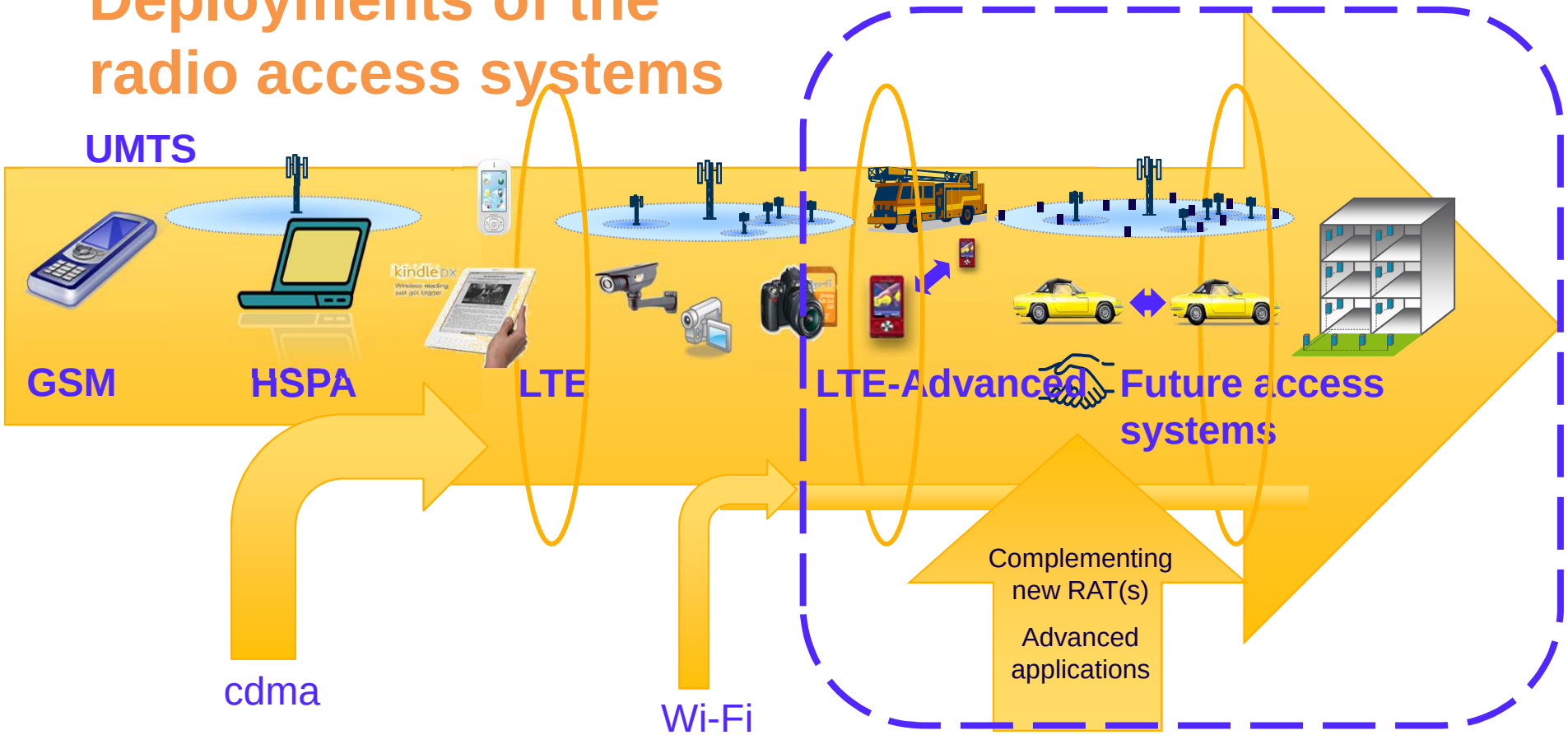
➔ it is predicted that **mobile traffic in 2020 would increase by 44 – 80 times** subject to market developments, compared to year 2011

Spectrum requirements for mobile broadband

	Total spectrum requirements	Traffic growth ratio in 2020 compared to 2010
Lower user density settings	1 340 MHz	44-fold
Higher user density settings	1 960 MHz	80-fold

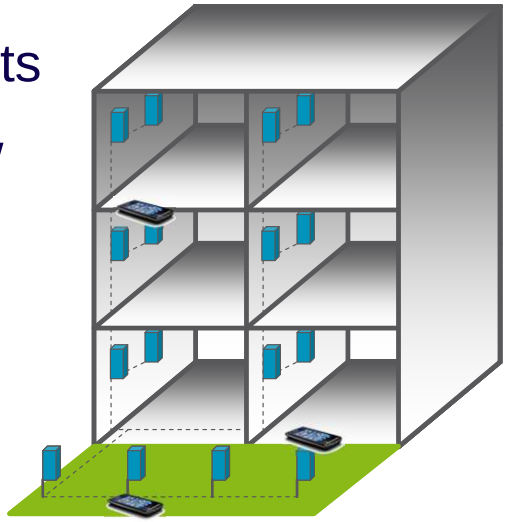
Source : ITU-R

Deployments of the radio access systems



Ultra dense deployments

- **order of magnitudes more dense** than most dense networks of today
- locally, infrastructure density of the **same order or higher than device density**
- **both indoor and outdoor,** very dense environments
- **extreme peak data rates** and traffic capacity a few gigabits per second
- minimized **energy consumption**
- very **low cost** deployments and maintenance



Additional communications

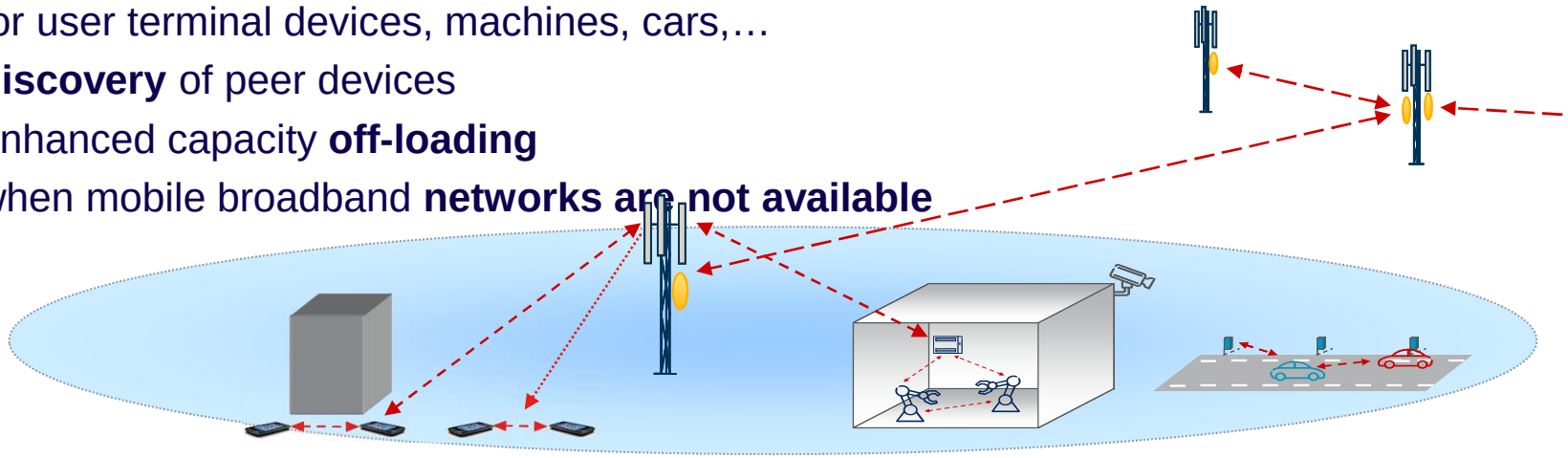
Backhauling, for the gigabit cell sites, **multi-gigabit backhaul** is needed

M2M communication, **an integrated part of future networks**

- communication link partly under network control, that is to say - **network assisted**
- quality of service in **licensed spectrum**, but **also in other spectrum**

D2D direct peer to peer communications, **network assisted**

- for user terminal devices, machines, cars,…
- **discovery** of peer devices
- enhanced capacity **off-loading**
- when mobile broadband **networks are not available**



Future challenges to mobile network operations

- significant **increase of subscriptions and traffic** placing demands for **more spectrum** resources
- in addition, more spectrum is also driven by demand for **low latency and high peak data rates**
- more bandwidth is needed for the **advanced gigabit services and applications,** and **dedicated spectrum is fundamental** for serving quality consumer needs
- **complementary and supplemental use of spectrum** would also be needed
  - downlink only (SDL) for broadcasting and unicasting
  - small cells (heterogeneous networks)
  - unlicensed indoor (RLAN)

Facts and figures

- UK Ofcom predicts x45 growth by 2030 (pre-offloading) and x25 growth by 2030 (post-offloading)[1]
- Cisco predicts amount of mobile traffic increases from 2.7 exabytes/month in 2014 to 33.27 in 2018[2]

Objectives

- Coverage
- Capacity
- Performance

Levers

- Deploy more spectrally efficient technologies
- Refarming of existing spectrum
- Use of alternative networks (when viable)
- New spectrum (low and high frequency)

Spectrum is clearly a scarce resource and there are many competing demands, but ultimately allocation should be made on basis of quantifiable benefit (efficiency)

Source: Orange

[1] Mobile Data Statement, May 2014
[2] Cisco VNI Mobile 2014

5G development

METIS: Objectives

- 10 times longer battery life for low power MMC
  - Up to 10 years time (for sensors/pagers)
- 10 to 100 times higher number of connected devices
  - 300,000 devices per access node

New applications

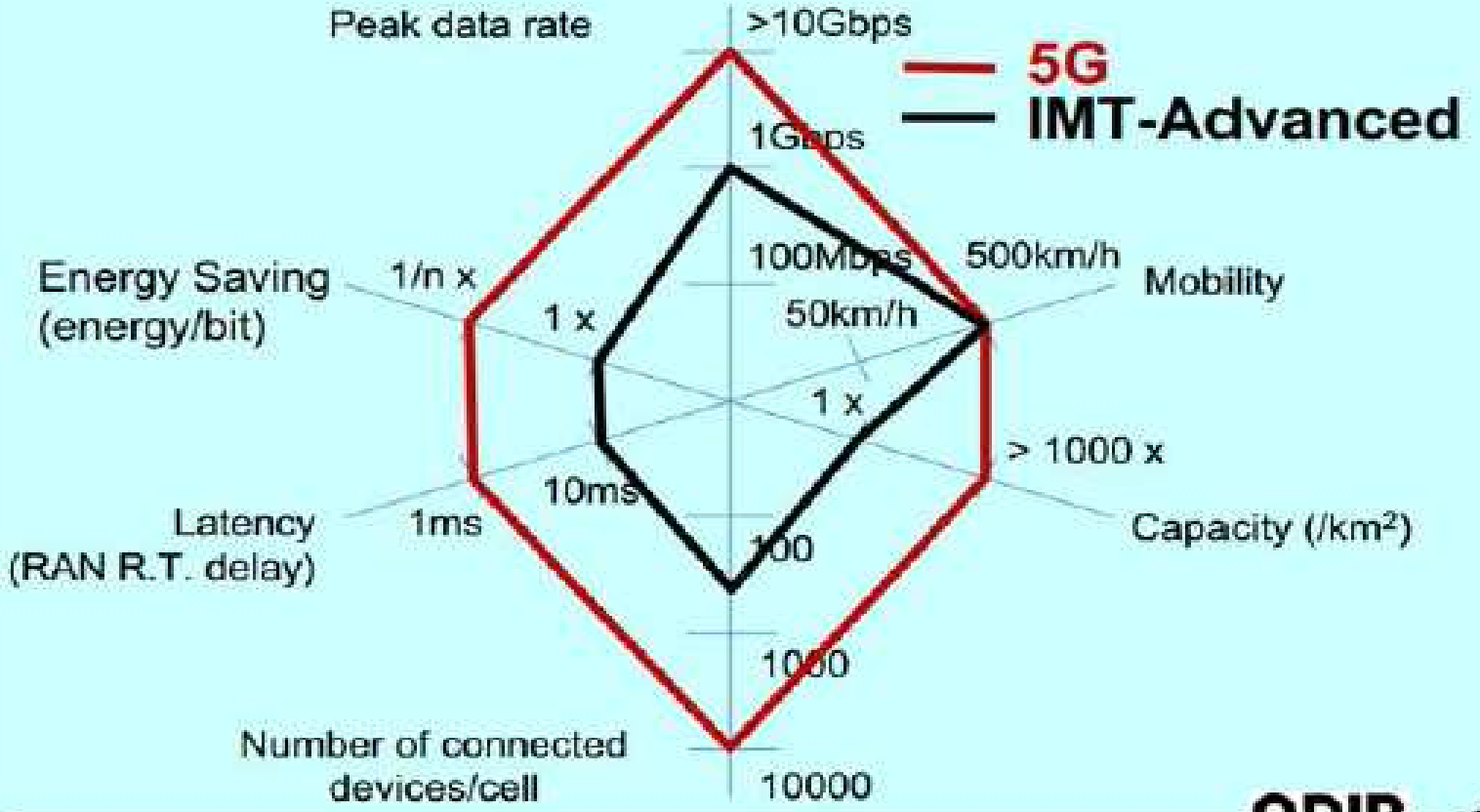
- Support of ultra-fast application response times
  - E2E latency < 5 ms with high reliability

Traffic Volume

- 1000 times higher mobile data volume per area / subscriber
  - over 100 Gbps/km² and 500 Gbyte/subscriber/month
- 10 to 100 times higher typical user data rate
  - over 1 Gbps as typical user data rate

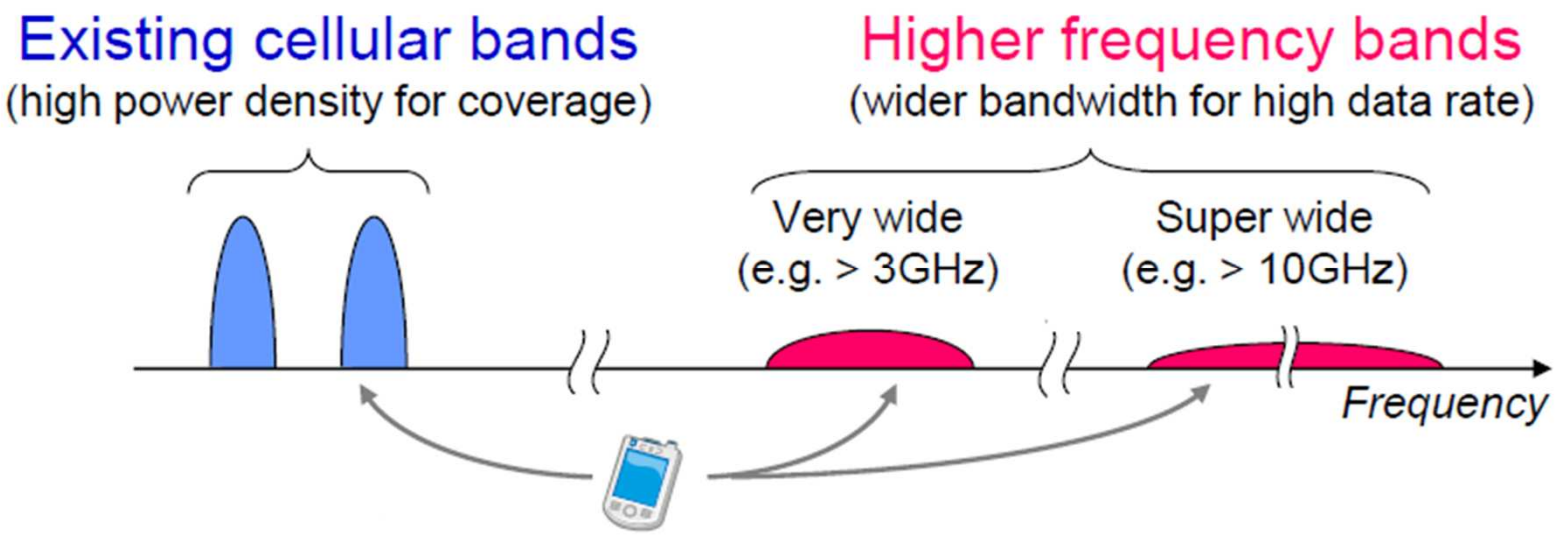
Source: METIS

Example of Framework for 5G (3)
Maximum system capabilities



ARIB 31

Future 5G spectrum: combined usage of lower and higher frequency bands



Source: NTT DOCOMO

Suitable new additional spectrum for future IMT systems

470-698 MHz (TV UHF)

1.4 GHz (L-band)

2.8 GHz (S-band)

3.6 GHz (C-band)

UMTS Forum presses for acceleration of EC's 700 MHz review

Spectrum policy on UHF band must not put Europe behind other regions

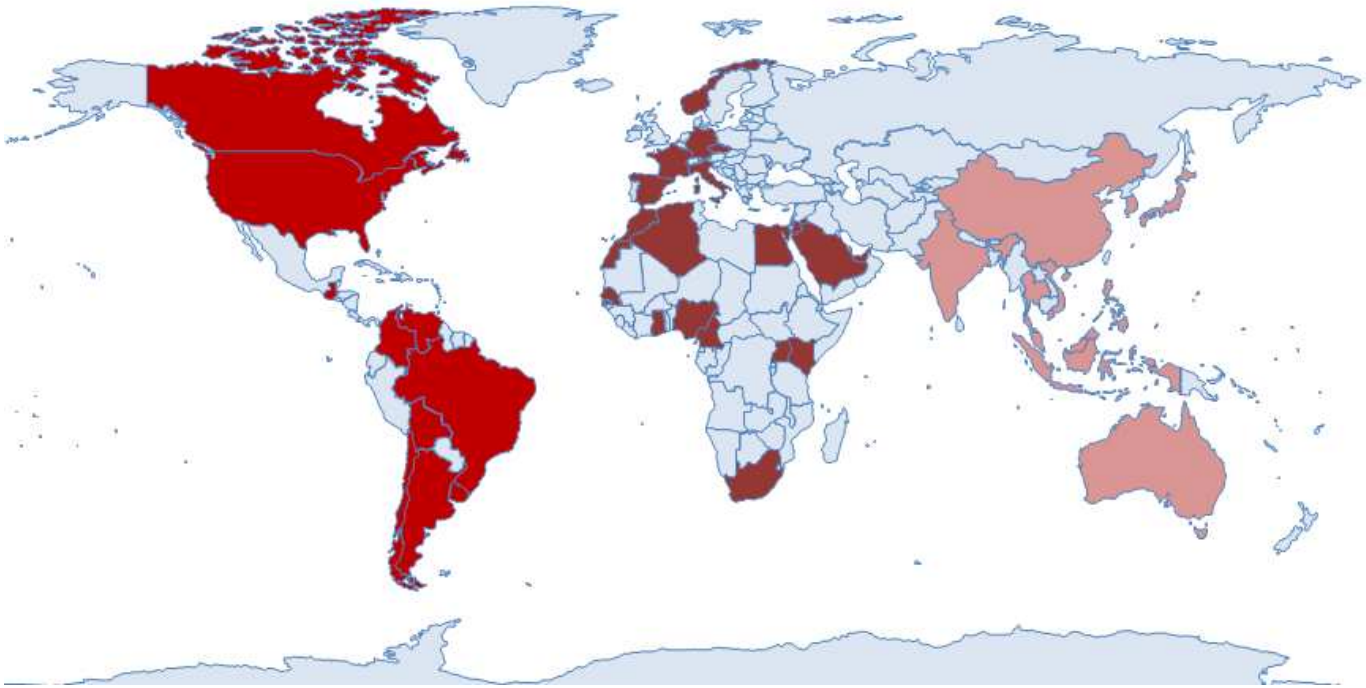
09 September 2014: The UMTS Forum has welcomed a new report to the European Commission on future use of the UHF spectrum band (470-790 MHz).

A number of high-level technical initiatives in Europe have already identified various long-term scenarios for use of the 470-694 MHz band, including one where **broadcast and broadband services can safely co-exist with significant benefits for consumers**. The report to the European Commission endorses such a scenario through its proposal to **adopt a 'flexibility option'**, giving European countries greater freedom about which technologies to deploy in the 470-694 MHz band.

In advance of next year's WRC-15 meeting in Geneva, the UMTS Forum advocates the timely implementation of the 700 MHz band for mobile use, and by 2020 at the very latest. Furthermore, **the Forum calls for a positive decision on co-primary allocation of the band 470-694 MHz for mobile services** in ITU Regions 1 and 2 at WRC-15 and supports the 'flexibility option' proposed by the report.

UMTS Forum Study of allocations and usage of spectrum in the C-band (3400-4200MHz) – February 2014

40 representative countries from all ITU regions



Context and objectives of the study

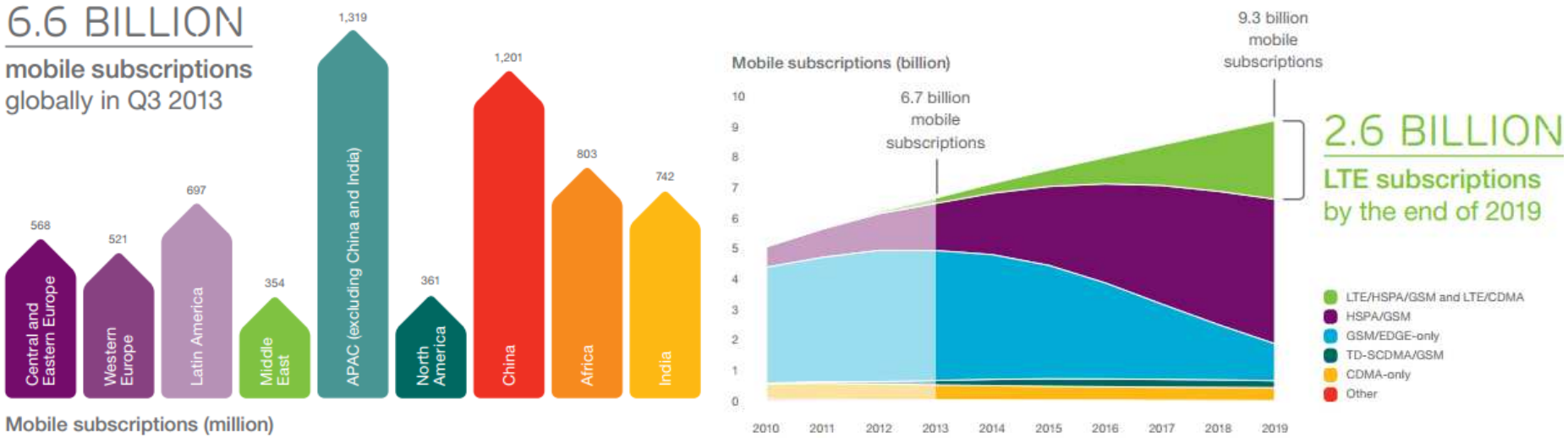
The radio frequency range 3400–4200MHz, the C-Band, is currently used worldwide for various radio communication services, involving satellite, fixed, nomadic, and mobile or radar systems.

In order to prepare for future spectrum usage for high peak data rate mobile broadband systems, the UMTS Forum has commissioned CGI Business Consulting to conduct a study of the allocations and usage in the C-Band, on a worldwide basis (target of 40 representative countries).

The present document is a summary of the Study of allocations and usage of spectrum in the C-Band (3400-4200MHz), which was conducted from October 2013 to January 2014.

General findings (1)

Considering the acceleration of mobile traffic growth, the importance of spectrum harmonization is more than ever a crucial question. Moreover, the long time between the identification of frequency bands and the deployment of system on those bands leads to a mandatory anticipation discussion to be able to face these challenging requirements.



Source: Ericsson Mobility Report, ON THE PULSE OF THE NETWORKED SOCIETY, Nov 2013

General findings (2)

This study is based on 40 representative but not exhaustive countries. Indeed, each country is having specific use and views on the C-Band. On a national level, climate conditions, the size of country, the quality of terrestrial networks and population density are key differentiation factors related to the use of the C-Band.

The usage in the C-Band and the market circumstances have changed considerably since 2010. Several new technologies have appeared or are being deployed in the satellite industry allowing for a gradual shift from the C-band to higher frequency Ka- and Ku-Bands. These new satellite technologies are more cost efficient.

In a global perspective, there are opportunities for mobile broadband services in the C-Band as there are already proposals under consideration in some countries. Indeed some countries will try in the coming years to introduce IMT-Advanced in the whole range or in parts of the range 3400–4200 MHz band, subject to sharing with FSS.

General findings (3)

Regarding the forecast of transpondeur utilization in C-Band, we observed very different - and still unexplained - information from NSR and Euroconsult. This confirms that estimating the actual utilization and forecast by 10 years for transpondeur demand is a complicated exercise that needs to be reviewed each year, with no exception of assumptions and chosen mathematic model.

According to Euroconsult, the demand in C-Band should increase at a relatively slow pace in the next eight years. The growth is expected to be reported in emerging regions, where low sensitivity to rain fade is considered as a key advantage.

On the other hand, NSR explains that global C-band transponder demand is predicted to remain relatively stable/increase slightly between 2011 and 2016, and then demand will begin to drop off from 2017 onwards.

Concerning the applications, NSR and Euroconsult agree that C-Band should be used primarily for the delivery of TV channels to terrestrial networks in certain regions (Americas and Asia, in particular).

Conclusions

The trends of increased mobile broadband usage and numbers of subscriptions are confirming the need for urgent reviews of spectrum allocations. Otherwise, as traffic grows the frequency bands below 3GHz will be congested.

The C-Band which is a contiguous band with other bands suitable for the evolution of mobile broadband can play a significant role in the 4G/LTE evolution and future innovation of the IMT- Advanced technology.

Based on the studied countries (all ITU Regions), our findings are suggesting that there is already a dynamic move in some countries that will try in the coming years to introduce IMT-Advanced in the whole range or in parts of the range 3400–4200 MHz band, subject to sharing with FSS.

UMTS Forum

For more information

www.umts-forum.org

twitter.com/umtsforum