# *International Telecommunication Union*

## *Americas Regional Office*

www.itu.int

*June 2015*

# The International Telecommunication Union in a world with a rapid evolution of ICTs

- Part 1: General Structure of ITU
- Part 2: World Radiocommunication Conference
- Part 3: Internet of Things
- Part 4: A Review of 5G Technology
- Part 5: Open the Floor for questions

# General Structure of ITU

- Brief history
- Global presence
- Process of decision-making
- PP-2014 and Elected Officials
- Development Sector
- Radiocommunication Sector
- Standardization Sector

# The ITU is the oldest UN specialized agency

- Founded in 1865 in Paris as "International Telegraph Union" ➔

  We are celebrating 150 years in 2015. ITU adopted its current name in 1932 and in 1947 became a specialized agency of the United Nations
- ITU is headquartered in Geneva, Switzerland
- 193 Member States and ~700 Sector members and associates.
- 87 members of Academy
- ~760 employees from 80 different nationalities.
- Organized in three sectors:
  - Radiocommunication (ITU-R)
  - Standardization (ITU-T)
  - Development (ITU-D)

# ITU has a global presence

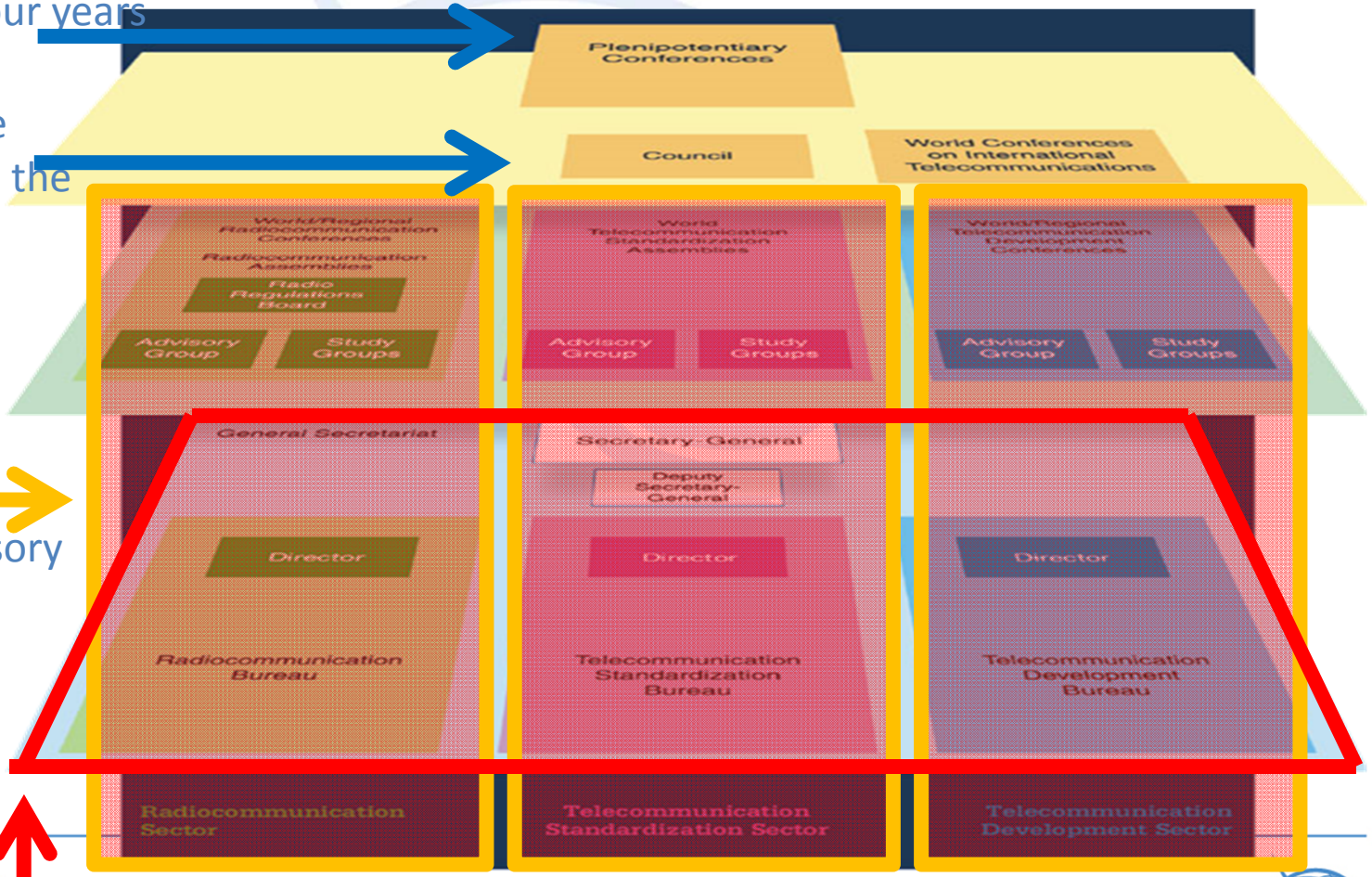

**5 Regional Offices, 8 Area Offices**

# Process of decision-making of the ITU...

The Plenipotentiary Conference is the top policy-making body of the ITU. Held every four years

The Council, is the governing body in the interval between Plenipotentiary Conferences

Each sector is overseen by advisory groups and world conferences




**(This is us, the ITU Secretariat)**

Las Américas

Telecomunicaciones de emergencia

Gestión del espectro y adopción de la radiodifusión digital

Desarrollo del acceso a la banda ancha y adopción de la banda ancha

Reducción de los precios de los servicios de telecomunicación y de los costos de acceso a Internet

Creación de capacidades para la participación en las políticas mundiales en materia de tecnologías de la información y la comunicación, dando especial prioridad a la mejora de la ciberseguridad y de la participación de los países en desarrollo en las instituciones actuales de gobernanza de Internet

# PP-2014

- Broadband networks connectivity
- Agenda connect 2020 for the global development of telecommunications/ICT;
- Strategic plan. AMS regional initiatives;
- Priority: Young people, girls and women in ICT.

# Elected Officials PP-14

From left to right:

Brahima Sanou
UIT-D
Francois Rancy
UIT-R
Houlin Zhao
SG
Malcolm Johnson
USG
Chaesub Lee
UIT-T

# Development Sector

# Who we are

- ITU-D strives to spread **equitable and affordable access to** telecommunications as a means of stimulating broader **social and economic development.**

# World Telecommunication Development Conference / WTDC

- WTDC is held **every four years**.

  It mandates an **Action Plan** – the strategic direction and international programme of BDT's activities for the next four years, and sets the Bureau's **Study Group questions**. It also reviews the outcomes of the Action Plan set at the previous WTDC.

# Gender

Through **Girls in ICT Day**, over 100,000 girls in 140 countries around the world have been encouraged to study Science, Technology, Engineering and Math (STEM) and take up ICT careers. BDT and **Telecenter.org Foundation have 1,000,000 women become ICT literate**.

# Youth

- ITU-D shares strategies with both national governments and young people about how to use ICTs to promote youth employment and entrepreneurship at specialized events, including through its report Digital Opportunities: Innovative ICT Solutions to Youth Employment.

# Accessibility

- ITU-D promotes the digital inclusion of persons with disabilities by assisting ITU members to better understand the ICT accessibility needs of persons with disabilities, existing **technical solutions** and policy, regulatory and business solutions to ensure accessible ICTs are available in ITU Member States at **affordable prices**.

# Spectrum and Digital Broadcasting

- ITU-D has developed the **Spectrum Management System for Developing Countries (SMS4DC)** and assists in the transition to digital broadcasting.

# ICT Data

- Tracking ICT data enables the monitoring of the advancing information Society.

The **'Measuring the Information Society' (MIS) Report** has been published annually since 2009. The 6th edition of the Report was launched on November 24th, in Tbilisi, Georgia at the **12th ITU World Telecommunication/ICT Indicators Symposium (WTIS** – the main global event to discuss emerging ICT trends and the role of information society measurement.

# Capacity Building

- ITU-D is engaged in extensive ICT skills development outreach through the ITU Academy, where 60 Centres of Excellence have trained 2,500 professionals per year over the past 12 years.

# Cybersecurity

- To help prepare national governments, ITU-D has so far conducted **56 cybersecurity country assessments**, set up **8 national Computer Incident Response Teams (CIRTs)** with 6 underway and carried out **Cyberdrills** in more than 60 countries. Additionally, the **Global Cybersecurity Index** helps measure each nation state's level of cybersecurity development.

# Emergency Telecommunications and Climate Change

- ITU-D provides assistance to developing countries in the use of ICTs to **mitigate and address** the effects of climate change. ITU-D **sends telecommunication equipment** to disaster-affected areas to help with organizing rescue operations and humanitarian relief.

# LDCs – LLDCs – SIDs

- ITU-D delivers **targeted and highly differentiated assistance** to LDCs, LLDCs and SIDs in a number of key **priority areas** such as ICT training and restoring telecommunications infrastructure.

# ICT Applications

- The **"Be He@lthy, Be Mobile" initiative** looks at developing best practices related to the use of mobile for non-communicable diseases and bringing them to scale with **mHealth projects** initiated in Costa Rica, Senegal, Zambia, Philippines, UK and Norway so far.

# Regulatory Environment

- **Global Symposium for Regulators** is the industry's flagship regulatory event, attracting representatives from the world's national regulatory bodies as well as private companies enabling ITU members to **meet and exchange views and experiences.**

# Membership

- 340 Sector Members
- 10 Associates
- 22 Academia

To find out more, please visit: www.itu.int/itu-d

# Radiocommunication Sector

# Who We Are

- ITU-R defines and manages the international regulatory framework for the use of **spectrum and satellite orbits by radiocommunication services.**
- ITU-R also develops **worldwide standards on radiocommunications**. More than **1,500 standards** are currently in force and available online for free

# World Radio Communication Conference/WRC
# Radio Regulations/RR

- The Radio Regulations (RR), the **international treaty governing the use of spectrum**, are revised and updated during the World Radiocommunication Conferences (WRCs) every 3-4 years.

# Master International Frequency Register / MIFR

- The Master International Frequency Register (MIFR) **records the use of spectrum by radiocommunication stations worldwide** to provide international recognition and **protection against harmful interference**. MIFR contains 2 million records for terrestrial stations and 1460+ satellite networks.

# Managing Geostationary Satellite Orbits / GEO and Other Orbits

- ITU-R applies the provisions of the **Radio Regulations** for coordination and recording of satellite frequency assignments and orbits in the **Master International Frequency Register** (MIFR) and protecting these assignments from harmful interference.

# Managing Interference and Infringements

- The Radiocommunication Bureau (BR) assists ITU-R membership in resolving cases of harmful interference. BR also organizes monitoring programs to prevent and eliminate such cases. In 2013 more than **2,500 interference and infringements reports** were processed.

# Maritime Services

- **The Maritime mobile Access and Retrieval System (MARS)** provides access to operational information concerning ship, coast stations, search and rescue aircraft, accounting authorities, etc. The MARS database contains **more than 720,000 ship stations and 2,000 coast stations** around the world.

# Aeronautical Services

- Radio frequencies for aeronautical communications and navigation are considered as safety of life requiring **special protection.**
- The ITU-R Radio Regulations reserve specific frequency bands exclusively for communications related to safety of flight worldwide (both route and off-route services).

# Mobile and Wireless Broadband Communications

- All **3G and 4G mobile systems** are based on ITU's International Mobile Telecommunications – **IMT-2000 and IMT-Advanced** standards for mobile broadband. Studies have begun on **IMT for 2020 and beyond.**

# Television and Sound Broadcasting

- ITU-R released the standards for **HDTV, 3DTV (Three Dimensional Television)** and **UHDTV (Ultra High Definition Television)**. ITU-R won **two Emmy Awards** for its' work on broadcasting standards. Around 300,000 broadcasting Television and Sound frequencies are managed by ITU.

# Radio Navigation Satellite Systems

- ITU-R coordinates the use of frequencies and orbits by Radionavigation-Satellite Systems (RNSS) so that they can operate without harmful interference. As of now **353 satellite filings representing 240 RNSS networks** (24 N-GS) and 216 GSO) **from 23 administrations** are under coordination within ITU-R.

# Climate Change Monitoring

- Recent ITU-R achievements include worldwide allocations of spectrum for operation of **24-hour thunderstorm/lightning detection system** and **oceanographic radars**.

# Coordinated Universal Time / UTC

- Coordinated Universal Time (UTC) is the primary time standard or international time scale by which the world regulates clocks and time. **UTC is defined by the ITU-R**, and determined by the International Bureau of Weights and Measures (BIPM), in cooperation with the International Earth reference and Rotation Service (IERS).

# Leap Second

- "Leap second" is adding or deleting a second on the Coordinated Universal Time (UTC) to compensate for variations in the speed of the Earth's rotation. **WRC-15 considered the possible suppression of the "leap second"** which may benefit electronic navigation and computed systems, but also may have social and legal consequences.

# Emergency Communications and Disaster Relief

- ITU-R develops standards on the use of fixed and mobile satellite systems for **warning, disaster response and relief operations**. ITU-R also assists emergency communication activities of Members by maintaining databases of available frequencies/bands for use in **emergency situations**.

# Intelligent Transportation System/ITS

- WRC-15 considered worldwide spectrum requirements for **high resolution 79 GHz automotive sensors** envisaged for improved road safety and security, which will contribute to **reduce automotive-related accidents and mortality.**

# Membership

- 257 Sector Members
- 19 Associates
- 23 Academia

To find out more please visit: www.itu.int/itu-r

# Standardization Sector

# Who We Are

- ITU-T develops international standards that underpin global communications networks
- 200 to 300 new standards approved every year
- More than 4,000 standards in use today

# World Telecommunication Standardization Assembly / WTSA

- Held every four years to decide the **strategic priorities** of ITU standardization

# Bridging the Standardization Gap

- Remote participation (1,300 e-meetings in 2013)
- Fellowships
- Interpretation & translation
- e-learning and mentoring programmes
- Guidelines on establishing a national standardization secretariat.

# Multimedia

- Common platforms for multimedia innovation
- Prime-time Emmy award for video coding standard
- Speech, audio and video coding
- e-health
- IPTV
- Digital signage
- Voice over IP (VoIP)

# Transport and Access

- 95% of international Internet traffic is carried on **submarine fibre cables** that have been built using our standards
- ITU-T standards are used for the world's 700+ million fixed broadband subscriptions:
  - Ultra-fast broadband for fibre-to-the-home (FTTH)
  - Fibre-like speeds with G.fast, maximizing copper infrastructure.

# Quality of Service/QoS - Conformance and Interoperability/C&I

- ITU-T standards assess the quality of voice conversations, AV media streaming and mobile phones connected to hands-free systems in vehicles.
- C&I action plan for conformity assessment and interoperability events.

# Green ICTs

- Smart Grids, smart sustainable cities, Intelligent Transport Systems, universal charges for mobile and laptops, energy-efficient data centres and power-feeding systems, rare-metal recycling, eco-friendly management of e-waste, and green cables

# Numbering Resources

- ITU-T standards define international numbering resources, enable international mobile roaming, and counter misuse.

# Security

- **Cybersecurity Information Exchange** (CYBEX) provides a standardized means for **Computer Incident Response Teams** (CIRTs) to exchange warnings of cyber threats.
- ITU-T X.509 digital certificates and the broader public-key infrastructure (PKI) are central to e-commerce.

# Digital Financial Services

- Focus Group to develop a standardization roadmap and regulatory guidance for interoperable mobile money services.

# Pricing

- ITU provides an open forum to study **mobile roaming tariffs**, alternative calling procedures, **the cost of international Internet connectivity**, dispute resolution and fraud mitigation , adaptation to the growth of IP and OTT services, and the economic impact of the transition from **IPV4 to IPV6**

# Cloud Computing

- Data traffic drives cloud computing
- ITU-T standards provide the requirements and functional architectures to ensure **interoperability and security in the cloud** computing ecosystem

# Accessibility

- Accessibility work in ITU-T mainstreams the inclusion of accessibility features in ICT policy, technologies and standards.
- ITU-T standards uphold the principles of **'universal design'**.
- Standards are developed in line with the ITU **Telecommunications Accessibility Guidelines** and **Checklist.**

# Internet of Things IoT

- ITU-T standards for **Internet of Things (IoT)** and **machine to machine communications (M2M)** increase efficiency by exploiting the potential of networking in areas such as transportation, energy, and industrial robotics.

# Membership

- More than 450 Members of which 59 Academia
- New Members include:
  - America Movil, Apple, SAP, Bill and Melinda Gates Foundation, HP and Sony

To find out more please visit: www.itu.int/itu-t

# World Radiocommunication Conference

- Radiocommunication Assemblies
- World Radiocommunication Conference
  - Agenda items revision

# Radiocommunication Assemblies

Are responsible for the structure, programme and approval of radiocommunication studies. They are normally convened every three or four years and may be associated in time and place with World Radiocommunication Conferences (WRCs). The Assemblies provide the necessary technical basis for the work of WRCs, respond to other requests from ITU conferences, and suggest suitable topics for the agenda of future WRCs. They also approve and issue ITU-R Recommendations and Questions developed by the Study Groups, set the programme for and disband or establish Study Groups according to need.

# Radiocommunication Assembly 2015 (RA-15)

The Radiocommunication Assembly 2015 will be held from 26-30 October 2015, in Geneva, Switzerland. The duties and functions of the Radiocommunication Assembly are defined in Article 13 of the Constitution and Article 8 of the Convention, while the working methods of the Assembly are described in § 1 of Resolution ITU-R 1-6.

# World Radiocommunication Conferences

Review and revise the Radio Regulations, on the basis of an agenda determined by the ITU Council, which takes into account recommendations made by previous world radiocommunication conferences.

Consider the results of the studies on options to improve the international spectrum regulatory framework based on the effectiveness, appropriateness and impact of the Radio Regulations with respect to the evolution of existing, emerging and future applications, systems and technologies. Make decisions on the most profitable and efficient ways to exploit the limited resource of radio frequency spectrum and manage satellite orbits, which will be critical and increasingly valuable for the development of the global economy in the 21st Century.

Also address any radiocommunication matter of worldwide character, instruct the Radio Regulations Board and the Radiocommunication Bureau, and review their activities, determine the Questions for study by Radiocommunication Assemblies and the Study Groups in preparation for future radiocommunication conferences.

# World Radiocommunication Conference 2015 (WRC-15)

- The World Radiocommunication Conference 2015 (WRC-15) will be held in Geneva, Switzerland, from 2 to 27 November 2015.


International Telecommunication Union
WORLD
RADIOCOMMUNICATION
CONFERENCE 2015
GENEVA, SWITZERLAND
2 – 27 NOVEMBER 2015
ITU
WRC-15
150 1865 2015
www.itu.int/go/ITU-R/WRC-15
ITU

# Agenda items

- **Mobile & Fixed**
  - 1.1, 1.2, 1.3
- **Radiolocation, Amateur, Maritime & Aeronautical**
  - 1.4, 1.5, 1.15, 1.16, 1.17, 1.18
- **Space Science & MSS**
  - 1.10, 1.11, 1.12, 1.13, 1.14, 1.9.2, 9.1.1

# Agenda items

- **FSS & Satellite Regulatory**
  - 1.6.1, 1.6.2, 1.7, 1.8, 1.9.1, 7, 9.1, 9.1.2, 9.1.3, 9.1.5, 9.1.8, 9.1*, 9.2*, 9.3 *Satellite issues
- **General  Regulatory, Future Work & Other**
  - 2, 4, 8, 9.1.4,  9.1.6, 9.1.7, 9.2**, 10  **Non-satellite issues

# Agenda Item 1.1

- to consider additional spectrum allocations to the mobile service on a primary basis and identification of additional frequency bands for International Mobile Telecommunications (IMT) and related regulatory provisions, to facilitate the development of terrestrial mobile broadband applications, in accordance with Resolution 233(WRC-12)

# Agenda Item 1.1

**Summary of Studies**

- Section 1/1.1/3 describes:
  - the results of ITU-R studies that estimate the global spectrum requirements for International Mobile Telecommunications (IMT) to be in the range of 1340 to 1960MHz for the year 2020, the first number being for lower user density settings and the second number for higher user density settings;
  - the results of ITU-R studies that indicate the minimum spectrum requirement for radio local area networks (RLANs) using the 5GHz frequency range in the year 2018 is estimated to be 880MHz;
  - the sharing and compatibility studies conducted by the ITU-R for various frequency ranges.

# Agenda Item 1.2

- to examine the results of ITU-R studies, in accordance with Resolution **232 (WRC-12)**, on the use of the frequency band 694-790 MHz by the mobile, except aeronautical mobile, service in Region 1 and take the appropriate measures

# Agenda Item 1.2

## Summary of Studies

- Section 1/1.2/3 describes:
  - Spectrum requirements for the BS and the MS;
  - Sharing and compatibility studies between the BS and the MS;
  - Sharing and compatibility studies between the ARNS and the MS;
  - Solutions for SAB/SAP.

# Agenda Item 1.3

- 1.3to review and revise Resolution 646 (Rev.WRC-12) for broadband public protection and disaster relief (PPDR), in accordance with Resolution 648 (WRC-12); Resolution 648 (WRC-12): Studies to support broadband public protection and disaster relief.

# Agenda Item 1.3

Studies presented a review of requirements and potential bands that can be harmonized in some regions.

- All studies considered under this agenda item were developed regionally
- All studies indicate the need for harmonization to the extent possible for PPDR frequencies
- All existing methods maintain the regional harmonization as global harmonization was not feasible

# Agenda Item
# 1.4

- to consider possible new allocation to the amateur service on a secondary basis within the band 5250-5450kHz in accordance with Resolution 649 (WRC-12): Possible allocation to the amateur service on a secondary basis at around 5300kHz

# Agenda Item 1.4

Studies presented a collection of analyses performed by several administrations considering the ability of amateur service links to share with fixed service / Mobile service links

- The feasibility of sharing varied in the studies with some showing a complete lack of sharing being possible while others showed a more favorable environment
- Sharing may only be feasible with some technical and operational limits

# Agenda Item 1.11

- to consider a primary allocation for the Earth exploration-satellite service (Earth-to-space) in the 7-8GHz range, in accordance with Res. 650 (WRC-12)

# Agenda Item 1.12

- to consider an extension of the current worldwide allocation to the EESS(active) in the frequency band 9300-9900MHz by up to 600MHz within the frequency bands 8700-9300MHz and/or 9900-10500MHz, in accordance with Res. 651 (WRC-12)

# Agenda Item 1.14

- to consider the feasibility of achieving a continuous reference time-scale, whether by the modification of coordinated universal time (UTC) or some other method, and take appropriate action, in accordance with Res. 653 (WRC-12)

# Agenda Item
# 1.5, 1.15, 1.16, 1.17 and 1.18

- **AI 1.5** to consider the use of frequency bands allocated to the fixed-satellite service not subject to Appendices 30, 30A and 30B for the control and non-payload communications of unmanned aircraft systems in non-segregated airspace
- **AI 1.15** to consider spectrum demands for on-board communication stations in the maritime mobile service
- **AI 1.16** to consider regulatory provisions and spectrum allocations to enable possible new automatic identification system technology applications and possible new applications to improve maritime radiocommunication
- **AI 1.17** to consider possible spectrum requirements and regulatory actions, including appropriate aeronautical allocations, to support wireless avionics intra-communications
- **AI 1.18** to consider a primary allocation to the radiolocation service for automotive applications in the 77.5-78.0 GHz frequency band

# Agenda Item
# 1.6, 1.6.1, 1.6.2, 1.7, 1.8 and 1.9.1

- AI 1.6 –To consider possible additional primary allocations:
  - AI 1.6.1 –Primary FSS allocation (Earth-to-space and space-to-Earth) of 250 MHz in the range between 10 GHz and 17 GHz in Region 1
  - AI 1.6.2 –Primary FSS allocation (Earth-to-space) of 250 MHz in Region 2 and 300 MHz in Region 3 within the range 13-17 GHz
- AI 1.7 –Review the use of 5 091-5 150 MHz by FSS (Earth-to-space), limited to feeder links of the non-GSO MSS systems
- AI 1.8 –Review the provisions relating to earth stations located on board vessels (ESVs)
- AI 1.9.1 –Consider possible new allocations to FSS in7 150-7 250 MHz (space-to-Earth) and8 400-8 500 MHz (Earth-to-space)

# Agenda Item
# 1.9.2 and 1.10

- A.I. 1.9.2: the possibility of allocating the bands 7375-7750MHz and 8025-8400MHz to the maritime-mobile satellite service and additional regulatory measures
- A.I. 1.10: possible additional spectrum allocations for the mobile-satellite service within the frequency range from 22 GHz to 26 GHz

# Agenda Item
# 7, 9.1.1, 9.1.2, 9.1.3, 9.1.5, 9.1.8 and 9.3

- AI 7–Consider possible changes in advance publication, coordination, notification and recording procedures for frequency assignments pertaining to satellite networks
- AI 9.1.1–Protection of the systems operating in the mobile-satellite service in the band 406-406.1MHz
- AI 9.1.3–Use of satellite orbital positions and associated frequency spectrum to deliver international public telecommunication services in developing countries
- AI 9.1.5–Consideration of technical and regulatory actions to support existing and future operation of FSS within the band 3400-4200MHz as an aid to the safe operation of aircraft and reliable distribution of meteorological information in some countries in Region1
- AI 9.1.8–Regulatory aspects for nanosatellites and picosatellites
- AI 9.3 –Due diligence in applying the principles embodied in the Constitution

# Internet of Things

- Definition
- Technical overview
- Reference model
- ITU-T Activities related to IoT

# IoT in ITU-T: definition

**Recommendation ITU-T Y.2060 defines the Internet of Things as:**

"A global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on, existing and evolving, interoperable information and communication technologies.

NOTE 1 - Through the exploitation of identification, data capture, processing and communication capabilities, the IoT makes full use of things to offer services to all kinds of applications, whilst ensuring that security and privacy requirements are fulfilled.

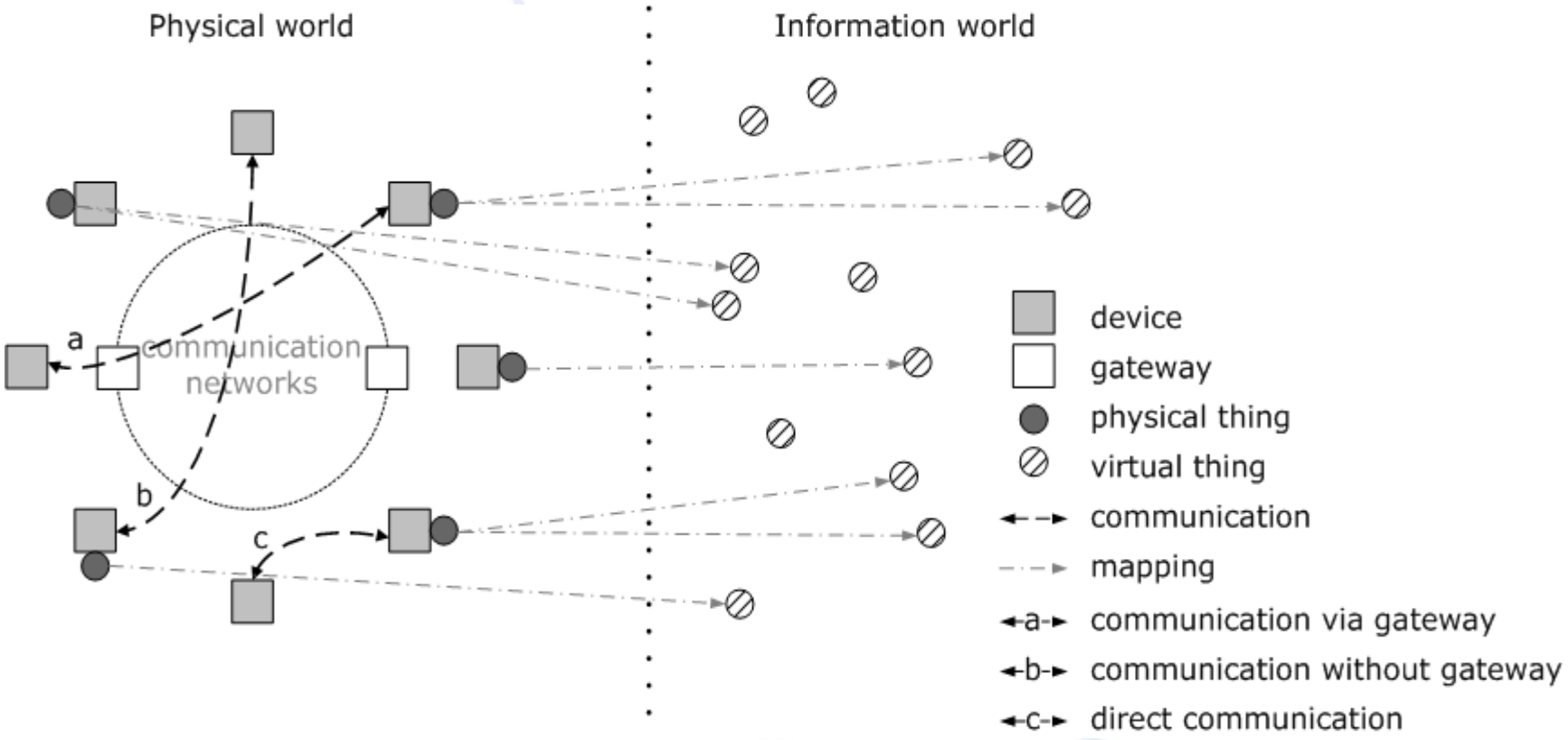
NOTE2 - In a broad perspective, the IoT can be perceived as a vision with technological and societal implications."

***Above definition is fundamentally aligned with the IoT concepts and terminology developed in other key SDOs and communities***

***Thing:*** *In the Internet of Things, object of the physical world (physical thing) or of the information world (virtual thing), which is capable of being identified and integrated into the communication networks.*

***IoT versus M2M (Machine to Machine):*** *the M2M communication technologies are "a key enabler of the IoT" (but not the only one)*

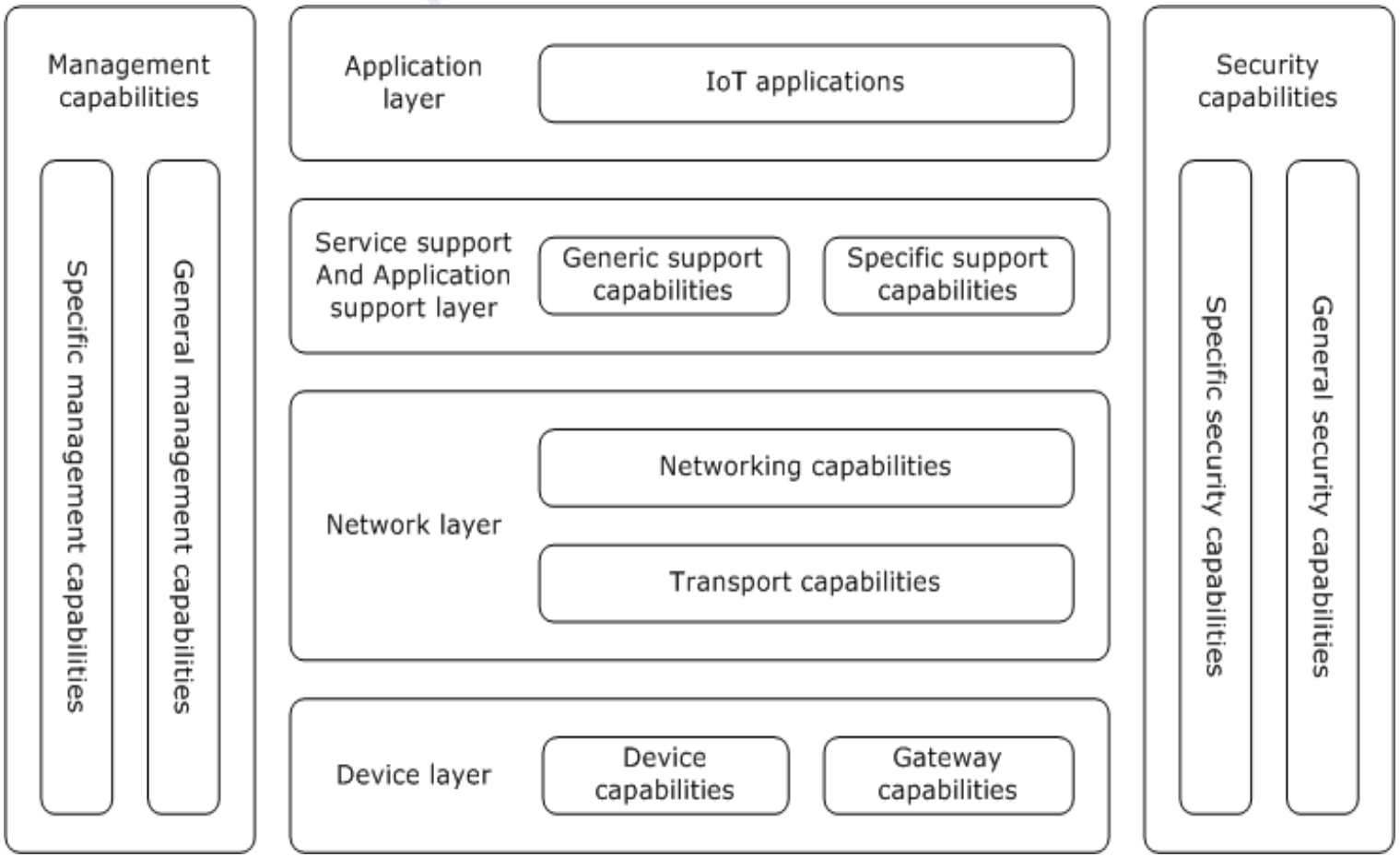
# IoT in ITU-T: Technical Overview




**Device:** In the Internet of Things, a piece of equipment with the mandatory capabilities of communication and the optional capabilities of sensing, actuation, data capture, data storage and data processing

Source: ITU-T Y.2060, 2012

# IoT in ITU-T: IoT Reference Model




Source: ITU-T Y.2060

# ITU-T activities related to IoT

## *Within IoT-GSI [numerous Recommendations completed]*

***SG11*** → **APIs and protocols for IoT** *(activity started 07/2014),* **IoT Testing**

***SG13*** → **Focus on Network Aspects of IoT**

***SG16*** → **Focus on IoT applications, including e-health**

***SG17*** → **Security and privacy protection aspects of IoT** *(already published some specs related to USN and services using tag-based identification)*

## *Other activities*

***SG15*** → ***Smart Grids, Home Networks***

***SG5*** → ***Focus on Smart Sustainable Cities and Communities (Q20/5)***

**Focus Group on Smart Sustainable Cities (FG SSC)** *(since 02/2013)*

**Focus Group on Smart Water Management (FG SWM)** *(since 06/2013)*

**Focus Group on M2M Service Layer (FG M2M)** *(closed 03/2014)*

**Collaboration on ITS Communication Standards** *(also some past FGs on Cars)*

# ITU-T IoT Global Standards Initiative (IoT-GSI)

**www.itu.int/itu-t/gsi/iot**

Established in May 2011

The banner for the effective IoT standardization work

Visible single location for information on/development of IoT standards

Initial key efforts have included:

- ***IoT terminology*** (including the definition of "IoT")
- ***IoT overview*** (Y.2060 "Overview of IoT", 06/2012)
- ***IoT work plan*** (potential study items within ITU-T)

**The success of the Internet of Things in business and social communities will depend strongly on the existence and effective operation of global standards**

# IoT work plan

Living document containing potential study items for possible launch as new IoT standardization work items within ITU-T (cooperation with other SDOs is not excluded). Once a potential item is actually launched, it moves to the JCA-IoT standards roadmap.

| Item | Potential study item |
|---|---|
| 1 | Identification and addressing aspects in IoT - *Note: partially under work* |
| 2 | Requirements and capabilities for energy saving using smart objects - *Note: partially under work* |
| 3 | APIs and protocols for IoT – *Note: started at July SG11 meeting* |
| 4 | IoT functional architecture - *Note: "IoT functional framework "already under work* |
| 5 | Data centric capabilities for IoT - *Note: partially under work (Big Data)* |
| 6 | IoT and general Service Delivery Platforms (SDP) (common SDP capabilities for support of multiple IoT applications) - *Note: partially under work within the "IoT functional framework " item* |
| 7 | IoT application domains and related use cases - *Note: some domains already under work* |
| 8 | Support of Inter- provider application scenarios |
| 9 | IoT management and provisioning |
| 10 | Quality of Service for IoT |
| 11 | Security and privacy protection in IoT - *Note: partially under work* |
| 12 | IoT and Cloud *Note: partially under work within the "IoT functional framework " item* |
| 13 | IoT and Peer2Peer/DSN |
| 14 | Conformance and interoperability testing in IoT |
| 15 | IoT Governance |
| 16 | IoT terminology (incl. update of last version of IoT terminology Recommendation Y.2069) |
| 17 | Plug and Play for IoT - *Note: partially under work* |
| 18 | Semantic and syntax aspects of IoT - *Note: partially under work* |

http://ifa.itu.int/t/2013/iot-gsi/docs/1402/TDs/ iotgsi-td-222r1

# Many groups are involved with IoT standardization ITU-T collaborates with SDOs to avoid overlap




**40+ formal partnerships**











# ITU-T Focus Group on M2M Service Layer

Established in 2012, closed on March 2014

**Key goal: study of the requirements and specifications for a common M2M Service Layer**

**Focused its developments** – from the point of view of use cases and derived requirements for the common M2M service layer – **on the "e-health" application domain** (specifically, remote patient monitoring and assisted living services)

Targeted the inclusion of vertical market stakeholders not part of the traditional ITU-T membership, such as the World Health Organization (WHO), and the collaboration with M2M and e-health communities and SDOs [and it has actually liaised with various SDOs, fora and consortia, including for the completion of an e-health standards repository]

Completed five deliverables (transferred to ITU-T SGs)

- **E-health use cases**
- **E-health ecosystem**
- **M2M service layer requirements and architectural framework**
- **Overview of M2M service layer APIs and protocols**
- **E-health standards repository and gap analysis**


# Personal health devices

Recommendation **ITU-T H.810**

Transposition of the Continua Health Alliance Design Guidelines

Cooperation with IEEE PHD WG

Consultation with WHO

**ITU-T H.810 (2013)**

Interoperability of devices used for applications monitoring personal health.

Defines the interfaces between:

- Touch area network (TAN) health devices and application hosting devices (AHDs)
- Personal area network (PAN) health devices and AHDs
- Local area network (LAN) health devices and AHDs
- AHDs and wide area network (WAN) health devices
- WAN health devices and Health Record Network

Test suites completed: 32 specs covering 1500+ test cases

New edition expected in 4Q 2015

# Future SG on IoT ?

IoT-GSI may form the bases of a new SG on IoT.

RevCom discussed this in January and invited Contributions to TSAG (June 2015)

IoT is playing an increasingly important role in enabling cities and communities to become smarter.

ITU-T's FG-SSC, to conclude in May 2015, is producing over 20 technical reports

Proposal (March 2015): FG-SSC to become the driving part of a new SG on *"IoT & Smart Cities and Communities"*

Contributions to TSAG (June 2015) are invited

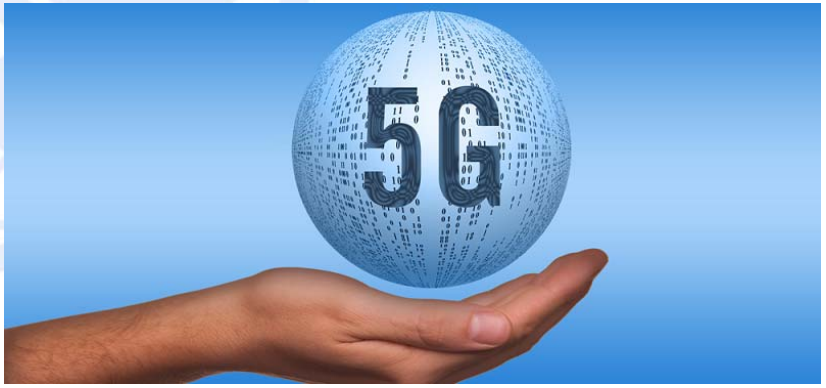
# Worldwide IoT initiatives


**And many others …**

**Everybody wants to standardize IoT !**
**Collaboration and coordination to avoid overlap and reach consensus is a must!**

# A Review of 5G Technology

- The evolution of Wireless Technology
- Mobile Communications
- What is Next Generation of Mobile Communications
  - 5G System Architecture
  - 5G Requirements
  - 5G Impact



# The Evolution of Wireless Technology

## HOW DID WE GET WHERE WE ARE?

We've come a long way since the first mobile phone. **Released in 1984, the first mobile phone weighed a whopping 2 pounds and cost almost $4,000.** Since then, the wireless communications infrastructure has enabled mobile devices to become an integral part of our lives, in both personal and business usage.

*Just how did we get here and, more importantly, where are we going?*
*What will wireless tech allow us to do in the near future?*

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## 1984 1G

No download capacity

-- Kbps.

Est. time to download a 100-minute HD movie
*sized at 1.4GB

**The first generation** of mobile phones (lovingly referred to as "bricks") are analog phones with limited capabilities due to size, weight, and technology.


Americans with mobile subscriptions

## 1991 2G

10:22:12

300 Kbps.

10 Hours
22 Minutes

2 hours | 4 hours | 6 hours | 8 hours | 10 hours | 12 hours

The cellular market really starts to pick up with 2G technology, running on a digital network and **enabling us to use digital data services** (such as text messaging and email) on the go for the first time.


Americans with mobile subscriptions

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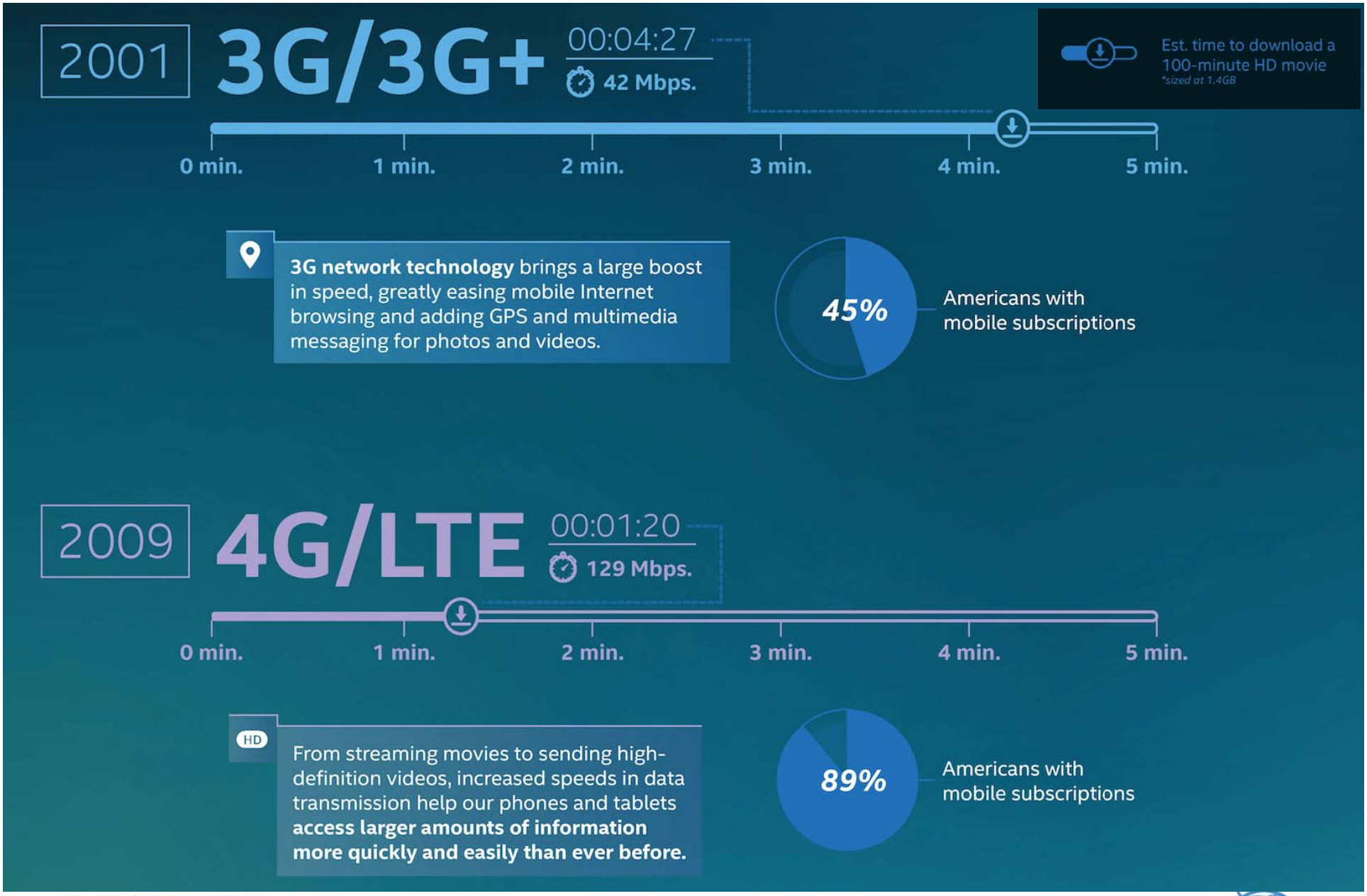


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2014
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# LTE-ADVANCED

## THE NEXT GENERATION

00:00:37
300 Mbps.

Est. time to download a 100-minute HD movie
*sized at 1.4GB


LTE-Advanced helps operators use bandwidth more efficiently through a technology called **Carrier Aggregation.**

- Carrier Aggregation lets wireless operators stitch together multiple radio frequency channels to more quickly gather and send more data.
- In the same way that more lanes on a highway enable more cars to pass through more quickly, carrier aggregation creates wireless traffic lanes for faster data speeds. Intel's LTE-Advanced modem platform, the Intel XMM 726x, supports carrier aggregation and Category 6 speeds.


Americans with mobile subscriptions

***6.9 billion*** mobile subscriptions worldwide in 2014

**LTE-Advanced is bringing even faster speeds to improve things like 4K Ultra HD video**, real-time gaming, and video conferencing. Enhanced connection management and HD voice support will also mean fewer dropped calls and better voice quality—so it's like they're right there with you.

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# Mobile Communications

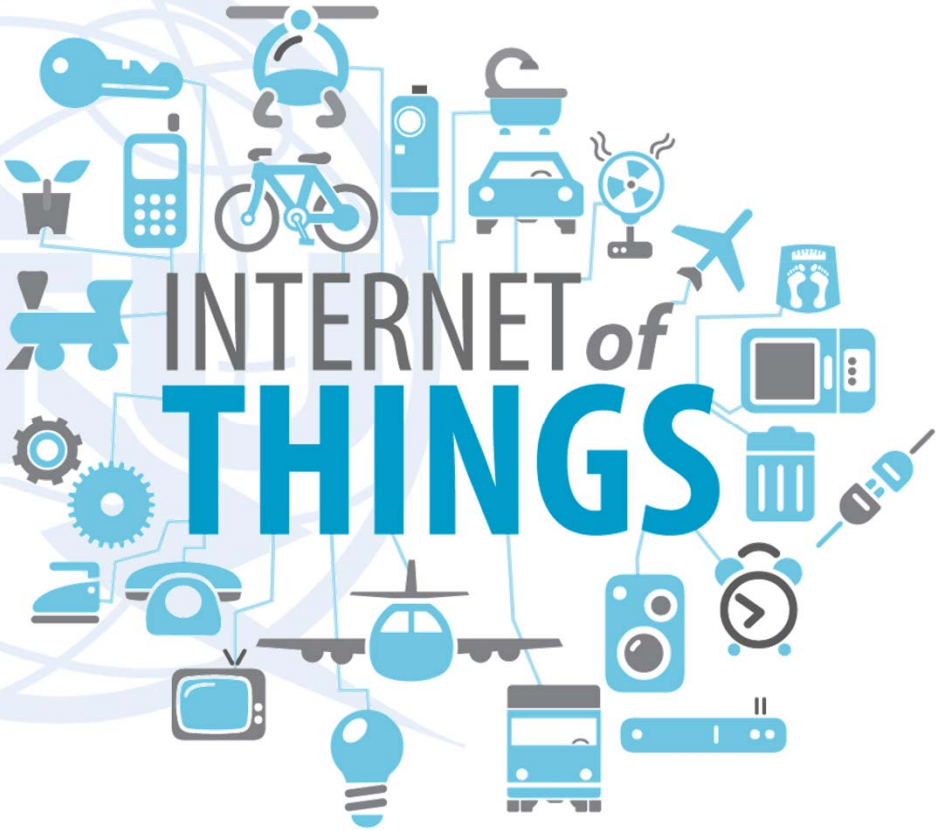
- Mobile communications have become part of our lives, and their development has changed our lives dramatically, the 5G technology once again will change our vision of the communication.

# Mobile Communications

- We are looking forward to this rapid mobile communications technology, because it will make our imagination a reality!
  - Soon we can use smart phones to work anywhere, anytime
  - And soon we will be able to make 3D video calls and hologram phone calls

# Mobile Communications

- And “Internet of Things” will soon become a reality



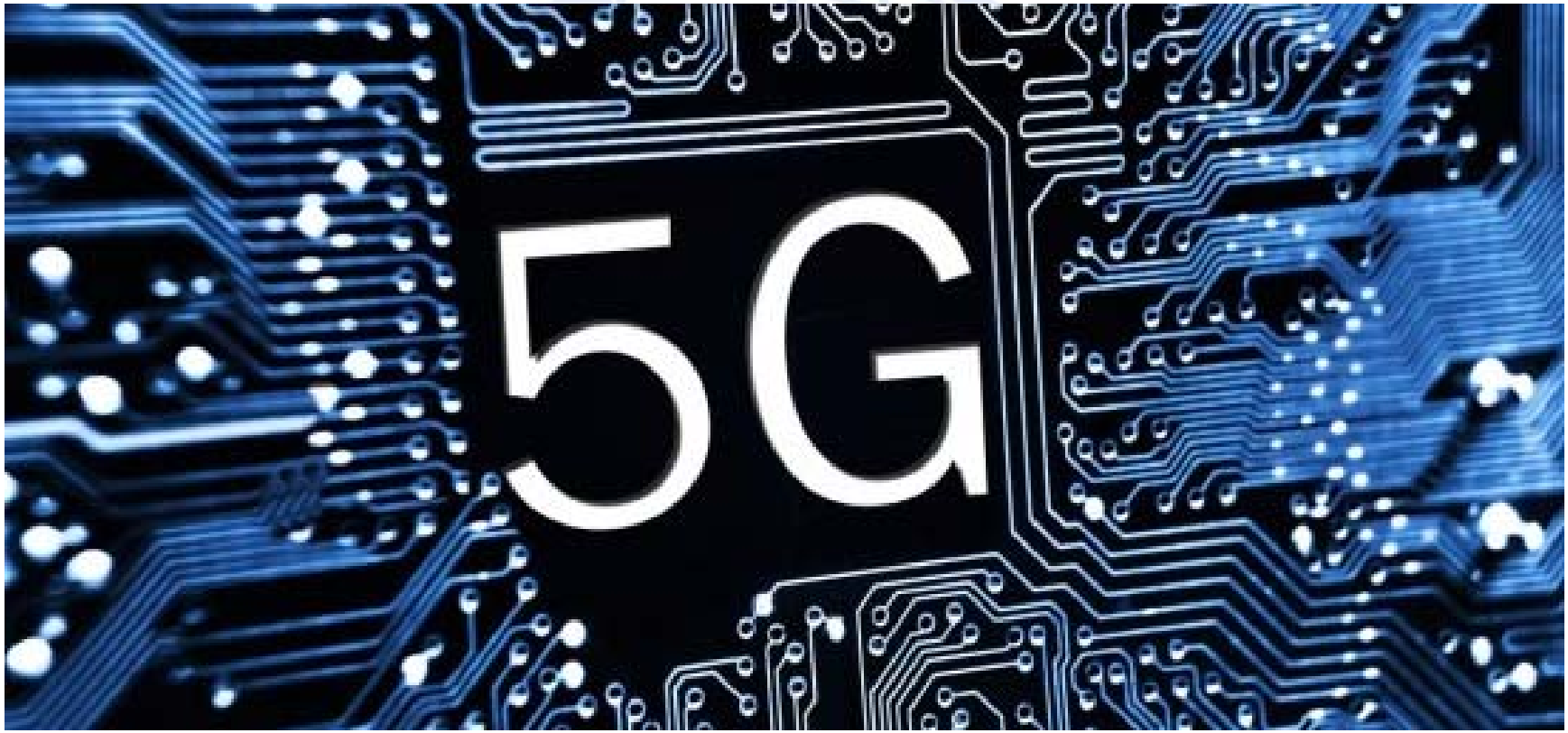
# Mobile Communications

- Allowing things in our lives such as healthcare devices, smart home smart car, etc.

# Mobile Communications

- The mobile communications were mostly focused on phone calls and SMS messages, now are changing to make our lives more convenient and smarter as the mobile speed gets faster and faster.
- The 5G technology brings a tremendous change one more time.
- The key that makes the impossible possible is the Gbps anywhere

# What is Next Generation Mobile Communication



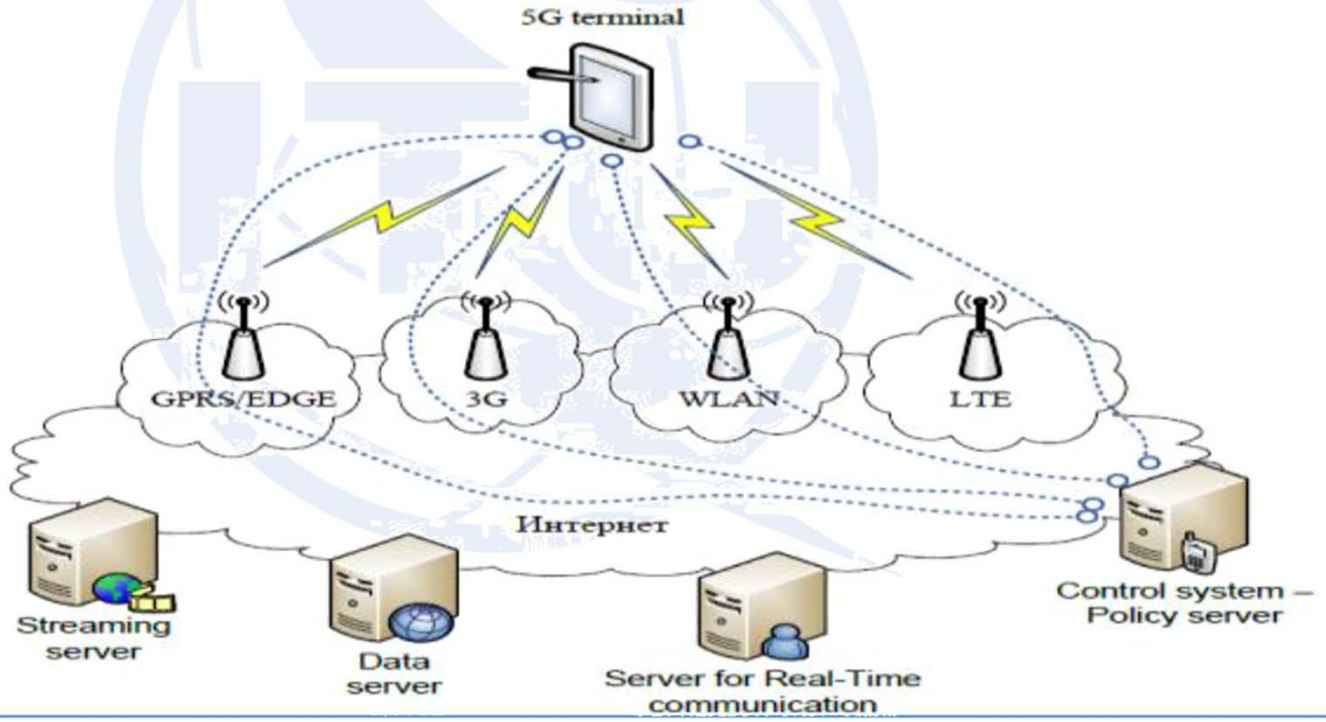
- Constantly increasing volume of data transmitted through the mobile communication networks and the needs of users to increase the data rates cause the rapid development of mobile networks.
- During 2012 and 2013 many vendors, operators, universities, research centers, as well as standardization and regulatory bodies have announced the beginning of their work on the development of a new generation of 5G mobile communications.

- Emergence of mobile 5G technologies on the telecommunication market that expected in 2020 should significantly improve the quality of service provided to users under fast growing data volumes in mobile networks, as well as the growing number of wireless devices and the variety of wireless services.
- The main goal of 5G technology developers is to provide data rates of more than 10 Gbit/s in the mobile wireless access networks.
- Considering the spectrum utilization in the frequency range up to 6 GHz, increasing of data rates will require the employment of new frequency ranges between 6-95 GHz.

- It is supposed that the equipment on the basis of 5G technologies will be capable of transmitting data at speeds of more than 10 Gbit/s in mobile wireless networks.
- The implementation of 5G technologies is aimed at increasing the efficiency of radio spectrum utilization in comparison with 4G mobile technologies (LTE Advanced).
- Considering the need of large frequency resources for a single channel 5G, exceeding 100 MHz, one of the most likely options for the development of a new generation of mobile communications will be the employment of higher frequency ranges between 6 - 95 GHz.
- These issues have become a primary for the future World Radiocommunication Conferences (WRC) - 15 (Agenda item 1.1) and WRC-18.

# 5G System Architecture

- All-IP based model for wireless and mobile networks interoperability



# 5G System Architecture

- The system consists of a user terminal and a number of independent, autonomous radio access technologies.
- Within each of the terminals, each of the radio access technologies is seen as the IP link to the outside internet world.
- However, there will be different radio interface for each Radio Access Technology (RAT) in the terminal.
- For example, if we want to have access to four different RATs, we need to have four different access specific interfaces in the terminal, and to have all of them active at the same time, with aim to have this architecture to be functional

# 5G System Architecture

- Application connections are realized between clients and servers in the Internet via sockets. Internet sockets are endpoints for data communication flows.
- Each socket of the web is a unified and unique combination of local IP address and appropriate local transport communications port, target IP address and target appropriate communication port, and type of transport protocol.

# 5G System Architecture

- Considering that, the establishment of communication from end to end between the client and server using the Internet protocol is necessary to raise the appropriate Internet socket uniquely determined by the application of the client and the server.
- This means that in case of interoperability between heterogeneous networks and for the vertical handover between the respective radio technologies, the local IP address and destination IP address will be fixed and unchanged.

# 5G System Architecture

- Fixing of these two parameters will ensure handover transparency to the Internet connection end-to-end, when there is a mobile user at least on one end of such connection.
- In order to preserve the proper layout of the packets and to reduce or prevent packets losses, routing to the target destination and vice versa will be uniquely using the same path.

# 5G System Architecture

- Each radio access technology that is available to the user in achieving connectivity with the relevant radio access is presented with appropriate IP interface.
- Each IP interface in the terminal is characterized by its IP address and net mask and parameters associated with the routing of IP packets across the network. In regular inter-system handover the change of access technology (i.e., vertical handover) would mean changing the local IP address.

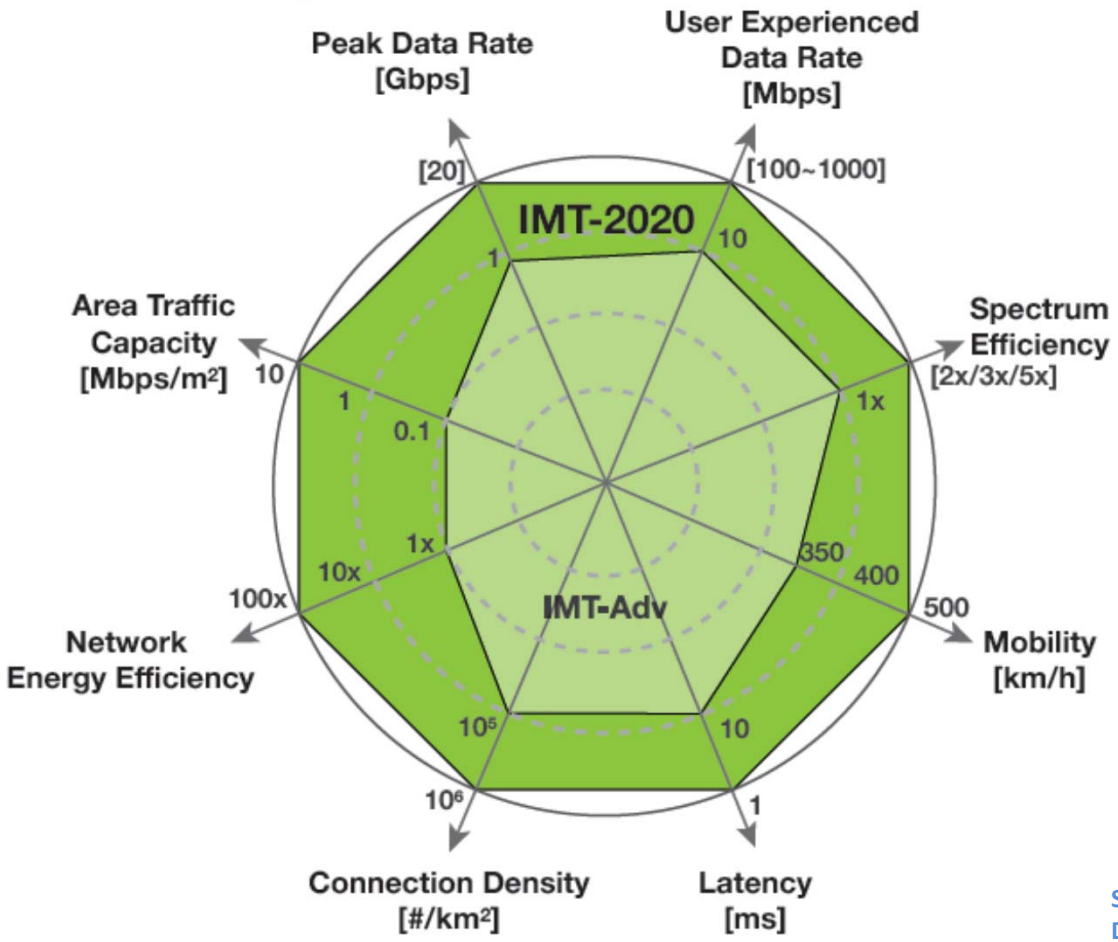
# 5G System Architecture

- Then, change of any of the parameters of the socket means closing the socket and opening a new one. This means, ending the connection and starting a new one. This approach is not-flexible, and it is based on today's Internet communication.
- To enable the functions of the applied transparency and control or direct routing of packets through the most appropriate radio access technology, in the proposed architecture, a control system is introduced in the functional architecture of the networks, which works in complete coordination with the user terminal and provides a network abstraction functions and routing of packets based on defined policies.

# 5G System Architecture

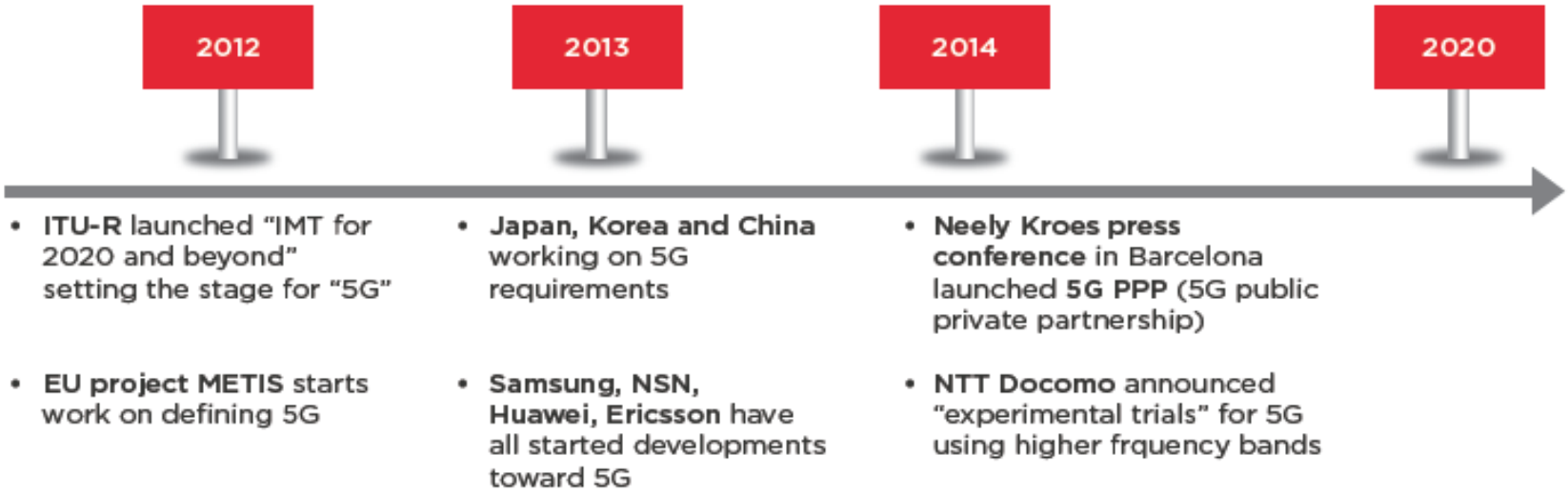
- At the same time this control system is an essential element through which it can determine the quality of service for each transmission technology.
- It is on the Internet side of the proposed architecture, and as such represents an ideal system to test the qualitative characteristics of the access technologies, as well as to obtain a realistic picture regarding the quality that can be expected from applications of the user towards a given server in Internet (or peer).

# 5G Requirements




Source:
Draft ITU-R M.IMT-Vision

# 5G Requirements




Timeline of key events in 5G developments

*Source: GSMA Intelligence*

In early 2012, ITU-R began a programme to develop "IMT-2020" (International Mobile Telecommunications 2020), setting the stage for the 5G research activities that have since emerged across the world.

**Source: GSMA Intelligence**
**Understanding 5G Perspectives on future technological advancements in mobile**
**December 2014**

# 5G impact to Smart Cities

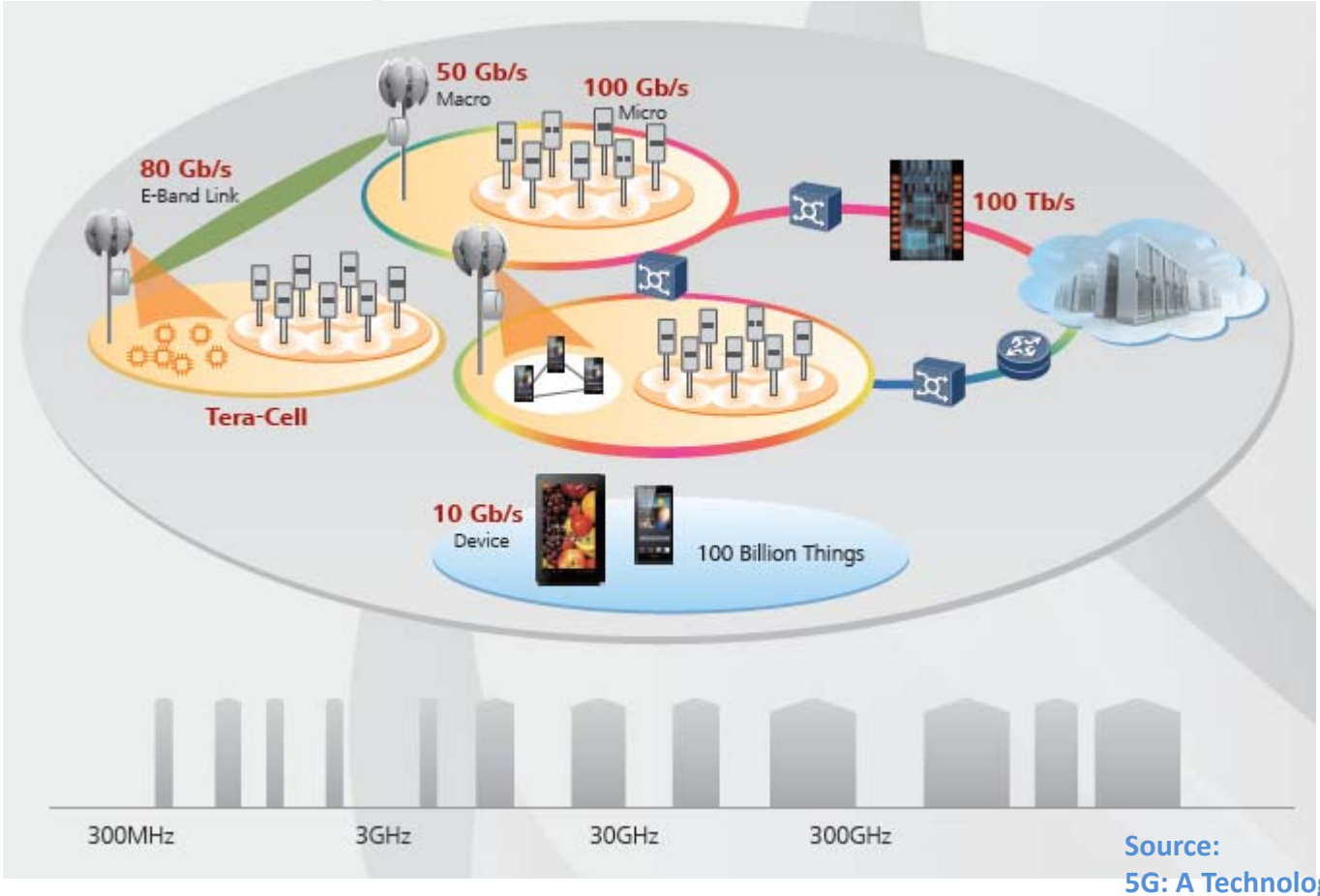
5G will be a pillar for the infrastructure for smart cities' mobile network. Low latency and extremely high reliability are essential requirements for mobile industrial automation, vehicular connectivity, and other IoT applications. Big data transmission, high volume applications of industrial sensors that will require very low data rates and will not be sensitive to latency.

Spectrum efficiency will be necessary to be capable of mapping service requirements. The integration of cloud architecture technologies will facilitate the on-demand customization of mobile network technologies that better ensure QoS, and reduce energy consumption.

New designs for all-spectrum radio access nodes will require breakthroughs in fundamental radio technologies like the air interface, RAN, radio frequency transceiver and devices. New radio backhaul and new fiber access for the fixed network will be an integral part of next generation commercial network solutions. The following figure gives a basic overview of such a 5G radio access architecture

**Source:**
**5G: A Technology Vision**
**Huawei**

# 5G impact to Smart Cities




Source:
5G: A Technology Vision
Huawei

# 5G impact to Smart Cities

| | | | |
|---|---|---|---|
| **Broadband access in dense areas**<br>PERVASIVE VIDEO<br>  | **Broadband access everywhere**<br>50+ MBPS EVERYWHERE<br>  | **Higher user mobility**<br>HIGH SPEED TRAIN<br>  | **Massive Internet of Things**<br>SENSOR NETWORKS<br>  |
| **Extreme real-time communications**<br>TACTILE INTERNET<br>  | **Lifeline communications**<br>NATURAL DISASTER<br>  | **Ultra-reliable communications**<br>E-HEALTH SERVICES<br>  | **Broadcast-like services**<br>BROADCAST SERVICES<br>  |

**Source:**
**NGMN 5G With Paper**
**17 Feb 2015**

# Questions

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