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| report of Activities in ITU-T over the 2013-2016 Study Period | | | |
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| **Abstract:** | This report highlights the key results achieved in ITU-T standardization over the 2013-2016 study period, as well as steps taken by ITU members to ensure that ITU-T is well-positioned to serve emerging standardization demands. The report also draws attention to innovations to the portfolio of services offered by the ITU-T secretariat to facilate the standardization work of the membership. |

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# Foreword

The 2013-2016 study period has seen key results achieved in standardization areas characterized by ITU leadership, and ITU members have taken bold steps towards ensuring that ITU-T is well-positioned to serve emerging standardization demands. WTSA-16 will consolidate the progress that we achieved over the past four years, refining the strategic direction and structure of ITU-T to support the next phase of innovation in information and communication technology (ICT).

ITU leadership in standardization for an interconnected world

ITU-T is a renowned centre of excellence in standardization for transport and access technologies. ITU members have completed a set of highly anticipated broadband access technologies in G.fast, a new broadband standard capable of achieving up to 2 Gbit/s access speeds over traditional telephone wires; as well as 40-Gigabit-capable Fibre to the Home, the first series of standards to provide fibre-optic access speeds beyond 10 Gbit/s. ITU members also boast a major recent achievement in the revision of a key ITU standard underlying the Optical Transport Network, concluding a three-year process to enable optical transport at rates higher than 100 Gbit/s.

ITU H.265 'High Efficiency Video Coding' – the successor to the Primetime Emmy award-winning ITU H.264 'Advanced Video Coding' – offers double the compression power of H.264 to provide the platform for the next decade of innovation in video. A new standard defining the requirements for high-quality 4G mobile communications has joined ITU's portfolio of standards to assist operators in their work to offer services of the quality necessary to attract and retain customers in today's competitive business environment.

We have achieved considerable progress in our efforts to provide an enabling environment for ICT standardization to support the convergence of technologies and industry sectors.

The collaboration of telecommunications and over-the-top players has ushered concepts rooted in data-centre networking into the telecoms industry, with new ITU standards in areas such as software-defined networking easing the migration to new ways of networking.

The wide array of industry sectors now in demand of ICT standards has drawn great value from ITU, with new standards agreed in areas such as e-health, smart grid and intelligent transport systems. Collaboration with e-health players, for example, has delivered ITU standards providing interoperability design guidelines for personal health systems, supporting the development of medical-grade e-health devices.

Our recent achievements in increasing the capacity and intelligence of ICT networks and devices, as well as our successes in building cooperation between various vertical sectors, have established a strong basis to support the next five years of ICT innovation.

The approach to 2020: Trusted information infrastructure for 5G, IoT and smart cities

The years approaching 2020 will be a pivotal period in the development of the global ICT ecosystem. We will see 5G systems beginning to take shape, and investments in long-lived urban infrastructure will incorporate investments in ICTs to build IoT-enabled smart cities. ITU is supporting the ICT community in its work to create a post-2020 environment where we will all have access to affordable, reliable communications; where highly-reliable ICTs will be core to innovation in all industry sectors.

Our Focus Group on IMT-2020 (5G) has undertaken a preliminary study into the wireline networking innovations required to support the ambitious performance targets of 5G systems. The formation of the new ITU-T Study Group 20 has contributed to the consolidation of over ten years of ITU activity in IoT standardization and the group's work targeted towards smart cities will provide valuable stimulus to this key IoT application area. ITU members are also engaged in a new standardization effort to define the principles of a trusted ICT environment, one that will be integral to the achievement of our priorities in the spheres of 5G, IoT and smart cities.

Our technical standardization work in these and other high-priority domains will receive strong support from the leading role that ITU plays in crafting the policies that govern the interplay of standards and intellectual property rights. ITU standardization work on economic and policy issues relevant to international communications will also make an essential contribution to ensuring that technical developments of coming years are supported by innovation in overarching policy frameworks.

WTSA-16 to fortify the globally inclusive ITU standardization platform

Standardization is a tool that offers vital assistance to ICT development. Bringing cohesion to the unceasing innovation of the ICT community, international standards provide an equitable basis for ICT development worldwide. The task of WTSA-16 is to ensure that ITU provides its members with a standardization toolkit optimized to assist government and industry in achieving their ambitions for year 2020 and beyond.

The principles underlying the ITU standardization process ensure that all voices are heard, that our standards efforts do not favour particular commercial interests, and that resulting standards have the consensus-derived support of the diverse set of stakeholders that comprise the ITU membership. This inclusivity of ITU's standardization platform – supported by our Bridging the Standardization Gap programme – will assist in offering all the world's countries equal opportunity to benefit from the ICT advances to be achieved in the approach to year 2020. In 2016, the number of texts approved will very likely surpass 400, making 2016 the year that produced the most ITU-T standards since the year 2000 when we started measuring these data. I am certain that we will see the inclusivity and efficiency of this platform fortified by the decisions of WTSA-16.

**Chaesub Lee, Director, ITU Telecommunication Standardization Bureau, 30 September 2016**

# Executive Summary

*Achievements in ITU standardization*

ITU-T continues to provide leadership in the standardization of **broadband access and home networks** andinfrastructures for **ultra-high-speed transport**; as well as **future networks including 5G** andnetworking innovations in fields suchas **software-defined networking** and **cloud computing.** See sections 1, 2 and 3.

ITU **multimedia** standards offer a common platform for innovation and are essential in easing the burden on global networks increasingly geared towards the massive exchange of video traffic. See section 4.

ITU standards supporting the wide range of technologies under the banner of the **Internet of Things** will assist both developed and developing countries in transforming city infrastructure, benefiting from the efficiencies of intelligent buildings and transportation systems; smart energy and water networks; and innovation in the field of e-health. For example, ITU standards providing interoperability design guidelines for **personal health systems** aresupporting the development of medical-grade e-health devices such as blood pressure cuffs, glucose monitors, weight scales and a wide range of activity trackers. See section 5.

ITU work to build **confidence and security in the use of ICTs** continues to intensify in a bid to facilitate more secure network infrastructure, services and applications, and ITU members are engaged in a new standardization effort to describe the fundamentals of a trusted ICT environment. See section 6.

ITU's **'green ICT'** standards are contributing to the reduction of the ICT sector's environmental footprint as well as those of other industry sectors. ITU standards to assist in the responsible **management of electromagnetic fields** include measuring techniques, procedures and numerical models for evaluating the electromagnetic fields stemming from telecommunication systems and radio terminals. The **ITU/WMO/UNESCO-IOC Joint Task Force on SMART Cable Systems** is leading an ambitious new project to equip submarine communications cables with climate and hazard-monitoring sensors. ITU standardization continues to tackle **disaster relief, network resilience and recovery**, recognizing that the 21st century is playing host to an increasing prevalence of extreme weather events. See section 7.

The international community is looking to ITU's unique, globally representative public-private for a neutral platform to **strengthen the ties between technical innovation, business needs and economic and policy requirements**. ITU members have agreed a Technical Paper putting forward an **“ITU Technical Guide for National Regulatory Authorities on International Mobile Roaming Cost analysis”**. The guide is accompanied by an online tool which provides a model to calculate the costs to operators of providing mobile-roaming voice services. See Section 8.

ITU standardization work on **performance, quality of service (QoS) and quality of experience (QoE)** spans the full spectrum of terminals, networks and services, ranging from speech over fixed circuit-switched networks to multimedia applications over mobile and packet-based networks. See sections 9.

The **ITU conformity and interoperability (C&I) programme** is of particular value to developing countries in their efforts to increase conformance with ITU standards and benefit from the improved interoperability that results from this conformance. See section 10.

ITU plays a leading role in crafting the **policies that govern the interplay of standards and intellectual property rights**. TSB Director's Ad Hoc group on Intellectual Property Rights (IPR AHG) continues its work to protect the integrity of the standards-development process by clarifying aspects of the ITU-R/ITU-T/ISO/IEC Patent Policy and related Guidelines. See section 11.

ITU technical work to **combat ICT counterfeiting** continues to gain momentum with new standards under development, supported by ongoing studies into the scale and dynamics of the counterfeiting challenge. See section 12.

**ITU-T Focus Groups** have proven effective in responding to immediate ICT standardization demands, establishing the basis for subsequent standardization work in ITU-T Study Groups. Focus Groups are open to ITU members as well as organizations outside ITU's membership, and these groups are afforded great flexibility in their chosen deliverables and working methods. See section 13.

**ITU-T Technology Watch reports** explore emerging ICT trends and associated demands on international standardization, determining how these trends can be supported by the ITU-T work programme. See section 14.

ITU continues to provide leadership in **building cooperation** among the many bodies active in ICT standardization. **ITU-T is a strong advocate of “Universal Design”** and has developed standardization guidelines to produce solutions that are inherently accessible to persons with and without disabilities. See section 15.

ITU-T is leading efforts to improve the capacity of developing countries to participate in the development and implementation of ICT standards, using the vehicle provided by **ITU's Bridging the Standardization Gap (BSG) programme**. See section 16.

***The ITU standardization platform***

The **ITU-T membership trend** has continued to increase over the 2013-2016 study period, confirming the positive trend that began in 2011. ITU-T is carrying out various activities to encourage and facilitate **the participation of academia** in the work of the Sector, as well as to benefit from their technical and intellectual expertise. TSB continues its efforts to include a **gender perspective** in all of its activities and programmes under the umbrella of the ITU Gender Task Force. See section 17.

Over **50,000 pages of ITU-T Recommendations and Supplements** were published over the 2013-2016 study period, as well as Technical Papers, Technical Reports, Operational Bulletins and Focus Group deliverables. 2016 has been the year to produce the most ITU-T standards over the period from year 2000 to 2016. See section 18.

The consistent output of **ITU-T news content**, coupled with a coordinated social media strategy led by the ITU General Secretariat, continues to see news of ITU-T's work feature in a variety of mainstream publications. In 2015, the celebrations of **ITU's 150th anniversary** took the theme, “ICTs as Drivers of Innovation”. **2016 marks 60 years since the 1956 establishment of the International Telegraph and Telephone Consultative Committee (CCITT)**, the precursor to ITU-T, established in 1992. See section 19.

**Electronic working methods** offer crucial support to members engaged in ITU standardization work. The ITU secretariat continues to develop new applications and services to maintain and expand ITU's advanced electronic working environment. See section 20.

ITU-T's work contributes to the implementation of ITU mandates of the **World Summit on the Information Society (WSIS)**. In line with the WSIS process' efforts to promote the pursuit of the UN Sustainable Development Goals (SDGs), ITU-T has undertaken a mapping of its activities to the SDGs to highlight the ITU-T activities most relevant to the SDGs and propose actions for ITU-T to expand its contribution to the achievement of these goals. See section 21.

The **ITU-T Review Committee (RevCom)** was established to undertake a review of ITU's strategy, structure and working methods to assist related studies in TSAG. RevCom recommended that ITU-T develop guidelines to fast-track the transfer of Focus Group output into standards developed by Study Groups, and also called for ITU members to explore the establishment of a strategic coordination function to identify and initiate new ITU standardization work on topics of particular strategic importance to industry and government. See section 22.

# 1 Broadband access

## 1.1 G.fast: Breathing new life into existing copper infrastructure

**G.fast is a new ITU-T broadband standard that allows delivery of up to 2 Gbit/s** over the traditional telephone lines that still make up a substantial proportion of so-called "last-mile" networks.

*Within 400 metres of a distribution point,* ***G.fast******provides fibre-like speeds*** *matched with the customer self-installation of DSL, resulting in cost-savings for service providers and an improved customer experience.*

G.fast will enable flexible upstream and downstream speeds to support bandwidth-intensive applications such as streaming Ultra-HDTV movies, uploading high-resolution video and photo libraries to cloud-based storage, and communicating via HD video.

We are seeing excellent take-up of the G.fast standard, with trials already launched in a diverse set of countries including Australia, Brazil, Croatia, the Republic of Korea, Norway, Panama, Switzerland, the UK and the US. Major operators such as AT&T, BT and Orange have highlighted their ambitions to deploy G.fast as a complement to their Fibre to the Home strategies.

[Full text of press release](http://www.itu.int/net/pressoffice/press_releases/2014/70.aspx#.V96LiFt9600)

## 1.2 10-Gigabit-capable symmetric fibre to the home: XGS-PON

New ITU-T standard **"10-Gigabit-capable symmetric passive optical network" (XGS-PON)** provides for optical access at the rate of 10 Gbit/s both downstream and upstream. The standard will be particularly beneficial to operators as a cost-effective means of upgrading the capacity of the connections provided to businesses in need of symmetrical service.

XGS-PON offers a point-to-multipoint optical access system to support a wide range of broadband and narrowband services to homes and businesses, as well as mobile backhaul and other applications.

The ITU-T family of 10 Gbit/s PON standards now offers both asymmetric and symmetric transmission for broadband services, with XG-PON enabling downstream service at 10 Gbit/s and upstream service at 2.5 Gbit/s, and XGS-PON enabling 10 Gbit/s bi-directional service.

[Full text of press release](http://newslog.itu.int/archives/1213)

## 1.3 Cable

**1.3.1 Renewable conditional access system in Smart Cable**

A conditional access system (CAS), based on cryptographic technologies, restricts/‌determines/‌governs viewers' access to particular programmes. Renewable CAS (RCAS) technology reduces the maintenance of these systems to upgrade software and replace components. RCAS enables cable service providers to download new conditional access client software (CACS) securely, with CACS embedded in the secure area in the set-top box, through digital cable two-way communication channels.

**ITU-T J.1004** **describes the RCAS authentication center interface specification**, responsible for specifying the interface between central authentication center (CAC) and distributed authentication center (DAC) in RCAS. ITU-T J.1004 complements the previous Recommendations ITU-T J.1001 (functional and security requirements for RCAS), ITU-T J.1002 (RCAS pairing protocol), and ITU-T J.1003 (Specifications of network protocol for renewable conditional access system).

**ITU-T J.1005 and J.1006 provide the architecture, requirements and specifications for a digital rights management (DRM) system** for a cable television content delivery service including multiple-device viewing experiences. The architecture, requirements, and specifications identified can be applied to a DRM service that covers protected IP-type content (IP VoD, IP linear TV, etc.) delivery from a content provider or cable operator to terminal devices (PC, tablet, smartphones, etc.) via a cable television network.

* ITU-T J.1005 "Architecture and requirements of digital rights management (DRM) for cable television multiscreen"
* ITU-T J.1006 "Specification of IP-VOD DRM for cable television multiscreen system in Multi-DRM environment"

**ITU-T J.1010 and J.1011 detail the architecture and requirements of downloadable multi-CA/DRM systems**, enabling CPE, which are capable of receiving broadcast and broadband content, to download CA/DRM clients under a trusted environment. By utilizing downloadable multi-CA/DRM service, entitled consumers can consume broadcast and broadband content, which is controlled by DRM and/or CAS, even though a CPE does not have a required content-related CA/DRM client available by downloading it from a trusted source into various types of CPEs including set-top boxes, smart TVs, PCs, smartphones and/or smart tablets. Key standards include:

* ITU-T J.1010 "Embedded Common Interface (ECI) for exchangeable CA/DRM solutions; Use cases and requirements"
* ITU-T J.1011 "Embedded Common Interface (ECI) for exchangeable CA/DRM solutions; Architecture, Definitions and Overview"

**1.3.2 High speed transmission over coaxial networks in buildings**

High speed transmission over coaxial networks (HiNoC) is a high-speed data transmission technology based on Fibre to the Building (FTTB) and coaxial cable architecture. It utilizes the unassigned spectrum of the "last 100-metre" coaxial network to provide broadband service and improve spectral efficiency for cable multiple-system operators (MSOs).

HiNoC supports any IP-based service, such as SD/HD TV, 3DTV, UHDTV, interactive services, VoIP and Internet access. Furthermore, it can coexist with existing broadcast services.

**ITU-T J.196.1, J.196.2 and J.196.3 provide for second-generation high performance network over coax (HiNoC2) supporting 1 Gbit/s data transmission over coaxial networks:**

* ITU-T J.196.1 "Functional requirements for second-generation HiNoC"
* ITU-T J.196.2 "Physical layer specification of second generation HiNoC2"
* ITU-T J.196.3 "Media Access Control (MAC) layer specification of second generation HiNoC2"

## 1.4 Powerline communications for home networking & smart grid

ITU members have agreed a family of orthogonal frequency-division multiplexing (OFDM)-based narrowband powerline communication (NB-PLC) standards that reuse the electric grid as a telecommunication medium, primarily to monitor, analyse and control power supply/usage.

*ITU-T experience in optimizing the communication capabilities of wired infrastructure makes it a natural home of standardization work on Smart Grid.*

This work builds on G.hn (ITU-T G.996x series) which provides broadband home-networking over telephone wiring, coaxial cable and power-line wiring.

**1.4.1 Narrowband PLC for smart grid**

ITU members continue to progress G.primex, which specifies an improved mode of operation of ITU-T G.9904 "Narrowband orthogonal frequency division multiplexing power line communication transceivers for PRIME networks".

Recommendations ITU-T G.9901/02/03/04 provide for OFDM-based NB-PLC transceivers.

**1.4.2 Broadband PLC for home networking**

ITU members have approved Amendment 1 to ITU-T G.9979 (Implementation of the generic mechanism in the IEEE 1905.1a-2014 Standard to include applicable ITU-T Recommendations). It makes use of the generic extension mechanism defined in the IEEE 1905.1a 2014 standard to include the ITU-T G.9960/61/62/63/64 series of Recommendations (unified high-speed wireline-based home networking transceivers) and ITU-T G.9954 (Home networking transceivers – Enhanced physical, media access, and link layer specifications) as supported networking technologies under the IEEE 1905 abstraction layer.

The ITU-T G.996x series of standards on G.hn (unified high-speed wireline-based home networking transceivers) has been updated with the addition of a 200 MHz bandplan for telephone line baseband, specification of longitudinal conversion loss, and increased granularity of the PSD fields.

**1.4.3 Coexistence with DSL**

**ITU-T G.9977 "Mitigation of interference between DSL and PLC"** specifies the functionality of a mechanism to mitigate interference caused by in-home powerline communication devices to xDSL network termination (implementing transceivers in compliance with standards such as ITU-T G.993.2 and ITU-T G.9701). It addresses various in-home network types and wiring topologies.

# 2 Ultra-high-speed networks

ITU members continue to make considerable progress on a number of high-speed transport network technology fronts, including Optical Transport Network (OTN) and coaxial cable, providing the backbone networks crucial to the successful operation of mobile-wireless networks.

***The standards developed by ITU-T Study Groups 9 and 15 detail technical specifications giving shape to global high-speed communication infrastructure****.*

*The group's standards define technologies and architectures of high-speed transport networks enabling long-haul global information exchange.*

Results of ITU standardization for **Networks, Technologies and Infrastructures for Transport, Access and Home** are detailed by the Executive Summaries of meetings of ITU-T Study Group 15:

* [Executive Summary, 19-30 September 2016](http://www.itu.int/en/ITU-T/studygroups/2013-2016/15/Pages/exec-sum.aspx)
* [Executive Summary, 15-26 February 2016](http://www.itu.int/en/ITU-T/studygroups/2013-2016/15/Pages/exec-sum-201602.aspx)
* [Executive summary, 22 June - 3 July 2015](http://www.itu.int/en/ITU-T/studygroups/2013-2016/15/Pages/ExecSum150703.aspx)
* [Executive summary, 24 November - 5 December 2014](http://www.itu.int/en/ITU-T/studygroups/2013-2016/15/Pages/ExecSum141205.aspx)
* [Executive summary, 24 March - 4 April 2014](http://www.itu.int/en/ITU-T/studygroups/2013-2016/15/Pages/ExecSum140324.aspx)
* [Executive summary, 1-12 July and 6 December 2013](http://www.itu.int/en/ITU-T/studygroups/2013-2016/15/Pages/summary-Jul_Dec_2013.aspx)
* [Executive summary, 1 February 2013](http://www.itu.int/en/ITU-T/studygroups/2013-2016/15/Documents/Meeting%20executive%20summary%20-%201%20February%202013.pdf)

## 2.1 Ultra-high-speed optical core network: OTN beyond 100G

The arrival of the **5th edition of ITU-T G.709/Y.1331 "Interfaces for the Optical Transport Network"** signals the conclusion of a three-year process to enable optical transport at rates higher than 100 Gbit/s. The completion of the revised ITU-T G.709/Y.1331 marks the arrival of a foundational element to the next generation of optical transport, meeting industry demand for increased capacity in metro and long-haul transport networks to support the unceasing growth of video and data traffic.

The revised ITU-T G.709/Y.1331 extends OTN with a new, flexible n x 100G frame format (OTUCn) designed for use at beyond 100G line-side and client-side interfaces.

The OTUCn format can be used for line-side interfaces up to 25.6 Tbit/s, giving system vendors the ability to develop higher-rate OTUCn line-side interfaces at their own pace over the coming 15 to 20 years, in line with market demand and technology availability and independently of progress in standardization.

[Full text of press release](http://newslog.itu.int/archives/1214)

## 2.2 Ultra-high-speed access NG-PON2

ITU standards for **"40-Gigabit-capable passive optical networks" (NG-PON2)** provide for passive optical network systems with a nominal aggregate capacity of 40 Gbit/s in the downstream direction and 10 Gbit/s in the upstream direction.

The new series of standards addresses operators' need for common technologies to support the optical-access demands of homes and businesses, mobile backhaul and fronthaul and other applications. Major operators are testing NG-PON2 systems with the intention of deploying these systems in the near future.

***NG-PON2*** *is a major milestone in the field of access networking as the first series of standards to provide ultra-high-speed access beyond 10 Gbit/s.*

NG-PON2 is a flexible optical fibre access network capable of supporting the bandwidth requirements of mobile backhaul, business and residential services. Furthermore, ITU-T G.989.2 describes optional configurations to extend beyond this nominal capacity as the G.989 series of standards allows for multiple upstream and downstream line rates.

The NG-PON2 series consists of three standards:

* ITU-T G.989.1 describes the general requirements of NG-PON2 systems.
* ITU-T G.989.2 specifies characteristics of the NG-PON2 physical media dependent (PMD) layer.
* ITU-T G.989.3 specifies the NG-PON2 frame formats, messages, and protocols for data transmission.

ITU members have also initiated a study of 25 Gbit/s per wavelength over PON with the aim of enhancing the capacity of PON systems to beyond 100 Gbit/s.

[Full text of press release](http://newslog.itu.int/archives/1212)

## 2.3 High speed transmission over coaxial networks in buildings

High speed transmission over coaxial networks (HiNoC) is a high-speed data transmission technology based on Fibre to the Building (FTTB) and coaxial cable architecture. It utilizes the unassigned spectrum of the "last 100-metre" coaxial network to provide broadband service and improve spectral efficiency for cable multiple-system operators (MSOs).

HiNoC supports any IP-based service, such as SD/HD TV, 3DTV, UHDTV, interactive services, VoIP and Internet access. Furthermore, it can coexist with existing broadcast services.

**ITU-T J.196.1, J.196.2 and J.196.3 provide for second-generation high performance network over coax (HiNoC2) supporting 1 Gbit/s data transmission over coaxial networks:**

* ITU-T J.196.1 "Functional requirements for second-generation HiNoC"
* ITU-T J.196.2 "Physical layer specification of second generation HiNoC2"
* ITU-T J.196.3 "Media Access Control (MAC) layer specification of second generation HiNoC2"

## 2.4 Ultra-high-speed structured information exchange

Abstract Syntax Notation One (ASN.1) is a standardized notation used to describe the data structures representing messages exchanged between communicating parts. Alongside its standardized encoding rules, ASN.1 enables information exchange among heterogeneous information systems.

The standardization of ASN.1 Octet Encoding Rules (OER) embodied by **ITU-T X.696 "Information technology – ASN.1 encoding rules: Specification of Octet Encoding Rules (OER)"** responds to the financial services sector's need for interoperability and ultra-high-speed structured information exchange, providing an effective means to gain crucial fractions of a second on the (electronic) trading floor. [Read an ITU blog piece on ASN.1 OER here...](http://itu4u.wordpress.com/2013/11/13/asn-1-driving-innovation-for-30-years/)

# 3 Smart 5G networks and networking solutions

## 3.1 Smart ubiquitous networks, next-generation networks evolution, and future networks

New ITU-T Technical Papers detail "Migration scenarios from legacy networks to NGN in developing countries", "How to increase QoS/QoE of IP based Platform", "Mobility Management in ITU-T: Its Current development and Next Steps Heading Towards Future Networks", and "Applications of Wireless Sensor Networks in Next Generation Networks".

ITU standards for future networks include a framework of data-aware networking for future networks (ITU-T Y.3033); requirements of network virtualization for future networks (ITU-T Y.3012); socio-economic assessment of future networks by tussle analysis (ITU-T Y.3013); and a functional architecture of network virtualization for future networks (ITU-T Y.3015).

**ITU-T Y.3015 "Functional architecture of network virtualization for future networks"** describes the overall functional architecture of network virtualization, user's roles, interfaces, relations among physical resources, virtual resources, and logically isolated network partitions, providing an implementation example of node architecture as illustration.

**ITU-T Y.3014 "Resource control and management function for virtual networks for carriers"** covers resource control and management issues in Virtual Networks for Carriers (VNCs) which represent a network aspect of carrier infrastructure (e.g., virtual networks in data centers and virtualized transport networks).

Studies related to distributed service networking (DSN) were conducted as a part of future network activities and led to the development of several Recommendations such as ITU-T Y.2082 on DSN relay functions; ITU-T Y.2083 on multimedia telephony over DSN; ITU-T Y.2084 on DSN content distribution functions; and ITU-T Y.2085 on DSN service routing.

Study Group 13 continued to develop the concept of smart ubiquitous networks (SUN) in greater depth, by means of five Recommendations listed below. SUN is seen as a short-term realization of future networks.

ITU-T Y.3041 "Smart Ubiquitous Networks – Overview"

ITU-T Y.3042 "Smart Ubiquitous Networks – Smart Traffic Control and Resource Management Functions"

ITU-T Y.3043 "Smart Ubiquitous Networks – Context awareness framework"

ITU-T Y.3044 "Smart Ubiquitous Networks – Content awareness framework"

ITU-T Y.3045 "Smart Ubiquitous Networks – Functional architecture of content delivery"

## 3.2 IMT-2020/5G networks

Active from 2015-05 to present, [the ITU-T Focus Group on IMT-2020 (FG IMT-2020)](http://www.itu.int/en/ITU-T/focusgroups/imt-2020/Pages/default.aspx) is studying the networking innovations required to support the ambitious performance targets of IMT-2020. The group has focused mainly on identifying the standards gaps for non-radio elements of the '5G' development of International Mobile Telecommunications (IMT) for 2020 and beyond.

Particular attention has been paid to aligning ITU-T's IMT-2020-relevant timelines and deliverables with related IMT-2020 activities in ITU-R and other key organizations active in the field.

The Focus Group submitted its preliminary report on standards gaps (see [TD PLEN208](http://www.itu.int/md/T13-SG13-151130-TD-PLEN-0208/en)) to the November/December 2015 meeting of its parent group, ITU-T Study Group 13.

The Focus Group continues to achieve strong progress in the development of six baseline documents, which the group is working to progress to close-to-final state with the aim of having these documents ready for adoption by ITU-T Study Group 13 in early 2017. The six baseline documents focus on:

1. Network Management Framework for IMT-2020
2. IMT-2020 Network Management Requirements
3. Framework of IMT-2020 network architecture
4. Requirements of IMT-2020 from network perspective
5. Requirements of IMT-2020 fixed-mobile convergence
6. Application of network softwarization to IMT-2020

The Focus Group will remain active until the end of 2016, with the following terms of reference:

1. Explore demonstrations or prototyping with other groups, notably the open-source community
2. Enhance aspects of network softwarization and information-centric networking
3. Continue to refine and develop the IMT-2020 network architecture
4. Continue to study fixed-mobile convergence
5. Continue to study network slicing for the fronthaul/backhaul network
6. Continue to define new traffic models and associated aspects of QoS and operations, administration and management (OAM) applicable to IMT-2020 networks

The Focus Group's final face-to-face meeting is planned for December 2016 in Geneva, and will run for five days, including one day dedicated to presentations, demonstrations and proofs of concept.

## 3.3 Home network

**ITU-T Y.2070 "Requirements and architecture of home energy management system and home network services"** puts forward a home energy management system (HEMS) that supports energy efficiency and the reduction of energy consumption. It is performed by monitoring and controlling devices such as home appliances, storage batteries and sensors connected to the home network (HN) from the HEMS application with the HN service architecture. The HEMS is one of the HN services. Other HN services such as home security and healthcare are provided with the same architecture as the HEMS and by monitoring and controlling the devices from the application specific to the services. ITU-T Y.2070 describes the requirements, reference architecture and functional architecture (including functional relationships) to support the HEMS and other HN services.

**ITU-T H.622.2 "Service capabilities and framework for virtual home networks"** describes a virtual home network that extends access to home network services in ubiquitous environments (e.g., using fixed and wireless connectivity) beyond the physical home.

## 3.4 Software-defined networking

Expanding and accelerating standardization work on software-defined networking (SDN) was one of the key directives issued by ITU's membership at WTSA-12 in Resolution 77 ("Standardization work in ITU-T for software-defined networking").

***SDN is a promising route towards more dynamic network management-control****, enabling operators to establish and manage-control virtual network resources without introducing new specialized hardware. SDN answers industry's need for a flexible, cost-efficient means of accommodating large fluctuations in bandwidth use by offering an alternative to overprovisioning of dedicated transport resources.*

The [Joint Coordination Activity on SDN (JCA-SDN)](http://www.itu.int/en/ITU-T/jca/sdn/Pages/default.aspx) maintains a global SDN standardization roadmap, available for download on the homepage of JCA-SDN.

**ITU-T Y.3300, Y.3301 and Y.3302 specify the framework, functional requirements and functional architecture of SDN, respectively.**

**ITU-T G.7711/Y.1702 "Generic protocol-neutral information model for transport resources"** has resulted from the natural progression of the group's work on Operation Support Systems (OSS) and Automatically Switched Optical Networks (ASON). The new ITU-T core information model for transport resources will enable smooth transition from traditional management using an OSS to SDN architectures. The new standard gives operators the ability to deploy SDN selectively, migrating parts of the infrastructure to SDN without nullifying the value of investments in legacy OSS infrastructure. [Full text of press release](http://newslog.itu.int/archives/1016).

**ITU-T G.7701 “Common Control Aspects”**, undergoing approval at the time of writing (consented September 2016), describes common aspects of the control of SDN and ASON, covering common SDN and ASON control approaches as they relate to aspects including transport resources and their representation, control components, control communications, and naming and addressing.

**ITU-T Y.3321 and ITU-T Y.3322 provide the requirements and capability framework and functional architecture, respectively, for NICE implementation making use of software-defined networking technologies (S-NICE)**. S-NICE refers to Software-defined Network Intelligence Capability Enhancement. NICE (see ITU-T Y.2301) is an enhanced next generation network (NGN) supporting extended or additional intelligent capabilities for the provisioning of services according to requirements of users and application providers. S-NICE is a specific implementation of NICE, making use of software-defined networking technologies.

**ITU-T Y.3323 "Requirements for Soft network Architecture for MobilE (SAME)".** SAME is a mobile packet core network, which bridges current legacy mobile networks towards future networks. This standard defines the design principles and requirements of SAME, i.e., flexible traffic steering, virtualization of SAME network functions, SAME network slice, and the separation of the control function and forwarding function.

**ITU-T Y.3320 "Requirements for applying formal methods to software-defined networking"** provides a descriptive overview and requirements for applying formal methods to SDN. Formal methods are mathematics-based techniques used for specifying, developing and verifying software and hardware systems and are expected to increase the reliability and robustness of the system. The use of formal methods in SDN environments can make an effective contribution to ensuring the consistency, reliability and security of applications.

**ITU-T Q.3711 "Signalling requirements for software-defined broadband access network"** provides the overview of software-defined broadband access network (SBAN) and its procedures, and specifies the signalling requirements of the northbound and southbound interfaces of the SBAN model. SBAN simplifies network configuration, easing the deployment of new services and improving broadband service provision

**ITU-T Q.3712 "Scenarios & signalling requirements of unified intelligent programmable interface for IPv6"** describes the scenarios and signalling requirements of unified intelligent programmable interface for IPv6 service deployment.

**ITU-T Supplement 67 to Q-series "Framework of signalling for SDN"** specifies the signalling requirements and architecture for SDN, as well as the interfaces and signalling protocol procedures. This Supplement will also be of value in enabling the development of a signalling protocol(s) capable of supporting traffic flows.

**Work-in-progress ITU-T Recommendations for SDN** include two standards detailing signalling requirements for Broadband Network Gateway (draft Q.BNG-DBoD and Q.BNG-IAP), as well as standards on mapping physical vs. virtual networks (Q.PVMapping), metro orchestration (Q.SMO) and central office (Q.SCO).

***ITU members are in the process of developing a new standard describing the reference architecture for SDN control of transport networks applicable to both connection-oriented circuit and/or packet transport networks****. This architecture is described in terms of abstract components and interfaces that represent logical functions (abstract entities versus physical implementations).*

## 3.5 Cloud computing

*Cloud computing is a model offering users ubiquitous, convenient, on-demand network access to a shared pool of configurable cloud resources: networks, servers, storage, applications, and services provided rapidly and released with minimal management effort or service provider interaction.*

The **Cloud Computing Roadmap** is a collection of information from ITU-T and other standards bodies documenting their work to develop technical standards for cloud computing. It is a live document with global scope that captures both published and ongoing work on cloud computing.

Key cloud computing standards released in the 2013-2016 study period:

ITU, ISO and IEC approved two common international standards fundamental to the cohesion of cloud computing's development:

* **Recommendation ITU-T Y.3500 | ISO/IEC 17788** **"Information technology – Cloud computing – Overview and vocabulary"** provides the cloud computing overview and a terminology foundation to be applied universally across the industry.
* **Recommendation ITU-T Y.3502 | ISO/IEC 17789** **"Information technology — Cloud computing - Reference architecture"** provides a reference architecture to enable the development of interoperable cloud computing systems and services.

**ITU-T Y.3501** **"Cloud computing – Framework and high-level requirements"** provides a cloud computing framework by identifying high-level requirements for cloud computing. The requirements specified are derived from an analysis of several use cases.

**ITU-T Y.3503 "Requirements for Desktop as a Service"** details the conceptual underpinnings of DaaS, specifies its general and functional requirements and capabilities, and also provides illustrations of these requirements and capabilities with relevant use cases. DaaS, recognized as one of cloud computing's core service categories, refers to services in which cloud service customers are provided with desktop functions remotely delivered by cloud service providers.

**ITU-T Y.3504 "Functional architecture for desktop as a service"** provides Desktop as a Service (DaaS) functions and functional architecture for DaaS. The standard also describes the relationship between the DaaS functional architecture and the cloud computing reference architecture.

**ITU-T Y.3510** **"Cloud computing infrastructure requirements"** provides requirements for cloud computing infrastructure, including the essential capabilities for processing, storage and networking resources, as well as the capabilities of resource abstraction and control.

**ITU-T Y.3511 "Framework of inter-cloud computing"** provides astandardized framework for inter-cloud computing, an architecture whereby cloud service providers (CSPs) benefit from the services or resources of partnering CSPs to satisfy customer needs as dynamically as possible. The standard describes the framework for the interaction of multiple CSPs that might underlie the fulfilment of a single CSP's service contracts with its customers.

**ITU-T Y.3512 "Cloud computing - Functional requirements of Network as a Service"** describes the concept of Network as a Service (NaaS) and its functional requirements. The standard provides typical use cases of NaaS and specifies the functional requirements of three aspects – NaaS application, NaaS platform and NaaS connectivity – based on the corresponding uses cases and cloud capabilities types.

**ITU-T Y.3513 "Cloud computing - Functional requirements of Infrastructure as a Service"** introduces the concept of Infrastructure as a Service (IaaS) and describes its functional requirements. As one of the cloud computing service categories, IaaS provides cloud service customers with computing, storage and network services by cloud service providers. To derive those requirements, relevant use cases are also presented.

**ITU-T Y.3520 "Cloud computing framework for end to end resource management"** presents general concepts of end-to-end resource management in cloud computing; a vision for adoption of cloud resource management in a telecommunication-rich environment; and multi-cloud, end-to-end resource management for cloud services, i.e., management of any hardware and software used in support of the delivery of cloud services.

**ITU-T M.3070/Y.3521 "Overview of end-to-end cloud computing management"** presents the conceptual view and the common model of end-to-end cloud computing management based on the service management interface (SMI) and cloud computing reference architecture, from the perspective of the telecommunications industry.

**ITU-T Y.3522** **"End-to-end Cloud Service Lifecycle Management Requirements"** provides an overview of end-to-end cloud service lifecycle management by specifying cloud service lifecycle metadata, cloud service lifecycle management framework, cloud service lifecycle management stages, and relationship with cloud computing reference architecture. It also provides end-to-end cloud service lifecycle management functional requirements derived from the corresponding typical use cases.

**ITU-T Y.3600 "Big Data – cloud computing based requirements and capabilities"** – the first ITU-T standard on Big Data – details the requirements, capabilities and use cases of cloud-based Big Data. It outlines how cloud computing systems can be leveraged to provide Big Data services, assisting industry in the management of large datasets incapable of being transferred and analysed using traditional data-management technologies. [Full text of press release](http://newslog.itu.int/archives/1189).

**ITU-T X.1601 "Security framework for cloud computing"** describes security threats in the cloud computing environment and, through a framework methodology, matches threats with the security capabilities advised to be specified in mitigating them. ITU-T X.1601 will act as a 'blueprint' guiding the future standardization of identified threat-mitigation techniques; in addition providing an implementation reference for systems-level cloud security.

**ITU-T Q.4040 "The framework and overview of Cloud Computing interoperability testing"** describes the framework including general scenarios and examples of measurements to support interoperability testing of cloud computing.

**Q Supplement 65 "Cloud computing interoperability activities"** provides the list of existing cloud computing testing activities and to provide tools for considering potential technical area of cloud interoperability testing.

# 4 Media networking/broadcasting solutions

## 4.1 Video and image coding

### 4.1.1 ITU-T H.265 HEVC

*Estimates suggest that video already accounts for more than 50 per cent of bandwidth use, a figure expected to rise to over 80 per cent by 2018.*

Now in its fourth edition, **ITU-T H.265 'High Efficiency Video Coding' (HEVC)** is the successor to the Primetime Emmy award-winning standard ITU-T H.264, which remains the most-deployed video codec worldwide and accounts for some 80 per cent of today's web video.

With double the compression power of its predecessor, ITU-T H.265 HEVC will unleash a new phase of innovation in video production spanning the whole ICT spectrum, from mobile devices through to Ultra-High Definition TV. The standard will also assist in easing the burden on global networks increasingly geared towards a massive exchange of video traffic.

Known formally as ITU-T H.265 | ISO/IEC 23008-2, HEVC is the product of collaboration between the ITU Video Coding Experts Group (VCEG) and the ISO/IEC Moving Picture Experts Group (MPEG).

[Full text of press release](http://www.itu.int/net/pressoffice/press_releases/2013/01.aspx#.V96eUVt9600)

### 4.1.2 Studies on future video coding

The Joint Video Exploration Team (JVET) was established in October 2015 with MPEG to consider the large volume of contributions addressing the next generation of video coding. This informal joint activity will be succeeded by a formal collaboration when sufficient evidence supports the development of a new generation of video compression standard. These discussions on the future of video are also ongoing within the formal Joint Collaborative Team (JCT) on Video Compression, which has to date focused on HEVC. The group held several meetings until the end of the study period and achieved significant progress that is expected to become a formal collaboration in the beginning of the new study period.

## 4.2 Intelligent, interoperable visual surveillance systems

Key ITU standards for visual surveillance released in the 2013-2016 study period:

**ITU-T F.743.1 "Requirements for intelligent visual surveillance"** defines the scenarios, the reference architecture and the requirements for IVS. The requirements are based on identifying specific objects, behaviours or attributes in video signals. The IVS system transforms the video signals into structured data, which can be transmitted or archived so that the video surveillance system can act accordingly.

**ITU-T F.743.2 "Requirements for cloud storage in visual surveillance"**. Cloud storage enables the service users to have ubiquitous, convenient and on-demand network access to a shared pool of configurable storage resources, which can be rapidly provisioned and released with minimal management effort or service-provider interaction. Cloud storage can realize flexible and reliable data storage for large scale visual surveillance, and its component is modularized and allocated dynamically based on the real usage. ITU-T F.743.2 provides the application scenarios and the requirements for cloud storage in visual surveillance.

**ITU-T F.743.3 "Requirements for visual surveillance system interworking"**.The visual surveillance system interworking mechanism can achieve the cross-system scheduling of the multimedia (such as video, audio, image), and enables the resource and data sharing of different visual surveillance systems. ITU-T F.743.2 provides the service scenarios and the functional requirements for visual surveillance system interworking.

## 4.3 Smart television systems

**ITU-T J.207 "Specification for Integrated Broadcast and Broadband DTV application control framework"** – in accordance with ITU-T J.205 "Requirements for Integrated Broadcast and Broadband DTV application control framework", and based on the viewpoint of architecture defined in ITU-T J.206 "Architecture for Integrated Broadcast and Broadband DTV application control framework" – provides guidance for administrations and entities who intend to provide Integrated Broadcast-Broadband DTV services in the development of Integrated Broadcast-Broadband system solutions,  and defines high level APIs needed to implement an Application Control Framework for DTV enabled devices. This framework is responsible for managing, integrating and controlling the interactive content and applications available through DTV Services, installed by the end user or embedded by the device manufacturers and providing a unified execution environment for them.

**ITU-T J.230 "Requirements for platform functionalities on the integration of cable STB and mobile second screen devices"** assists industry players in capitalizing on the ability of mobile devices to act as companions to TV. The integration of TV and mobile devices – second screens to TV and cable STB platforms – supports scenarios based on content sharing, synchronization, user interaction and customized presentations. This integration creates opportunities to deliver enriched, customized content and user experiences. ITU-T J.230 defines high-level requirements for the cable STB and mobile platforms involved in these scenarios, and also provides example application cases.

**ITU-T J.301 "Requirements for augmented reality smart television systems"** specifies requirements of augmented reality (AR) smart television systems and is designed to realize new broadcasting services providing AR technologies. To realize this kind of service, the system needs to meet several technical requirements defined by ITU-T J.301.

In line with AR smart cable television, ITU-T will continue studying multiscreen systems in multi-DRM environment as well as requirement and functional specifications for ultra-high definition television.

## 4.4 IPTV and digital signage

*ITU continues to develop standards enabling IPTV services and terminals, detailed by the ITU-T H.700-series. Some of them – ITU-T H.721, H.761 and H.762 – are already employed by millions of users in Asia.*

ITU-T's suite of IPTV standards includes standards such as [ITU-T H.721](http://itu.int/ITU-T/H.721) for IPTV set-top boxes, [ITU-T H.761](http://itu.int/ITU-T/H.761) for Ginga/NCL, and [ITU-T H.762](http://itu.int/ITU-T/H.762) for Lightweight Interactive Multimedia Environment (LIME) for IPTV services.

Strong progress was achieved in IPTV standardization in the 2013-2016 study period:

**ITU-T H.751 "Metadata for rights information interoperability in IPTV services"** – which is technically aligned with IEC 62698 "Multimedia home server systems - Rights information interoperability for IPTV" – targets interoperability to ensure that service providers and device manufacturers can easily exchange rights information across their current content management systems. [Full text of press release](http://www.itu.int/ITU-T/newslog/New+ITUIEC+Metadata+Standard+For+Crossplatform+IPTV.aspx#.V9-211t97mE).

**The revised ITU-T H.721, the basic IPTV terminal device specification,** adds support for more efficient streaming of content and support for ITU-T H.265, which will enable efficient transmission of UHDTV content ('4K' in particular) over managed IPTV services. The associated conformance testing specification was also updated.

**ITU-T H.722 specifies IPTV terminal devices (such as smart TVs and set-top boxes)**. ITU-T H.722 complements the basic model specified in ITU-T H.721, which provides for linear TV and video-on-demand (VoD) services and has been successfully deployed in several million homes in Japan.

Various updates have been made to the series of **IPTV audience measurement Recommendations (ITU-T H.741.x series)** to improve their usability and interoperability.

The **Technical Paper ITU-T HSTP-MCTB** that describes a media coding toolbox for IPTV was revised to include a description of the use of ITU-T H.265 HEVC in IPTV systems (see [TD 559/Plen](http://www.itu.int/md/meetingdoc.asp?lang=en&parent=T13-SG16-160523-TD-PLEN-0559)).

**Profiles for accessibility features in IPTV terminals: New standard ITU-T H.702** defines three accessibility profiles for IPTV systems: Basic, Enhanced and Main, in increasing level of support for accessibility features. While the Basic profile allows for an entry level of accessibility features that can be provided by a good number of equipment in the market, it is expected that by 2020 all IPTV sets and set-top boxes in the market would support the Main level.

**ITU-T H.752 defines an interface for multimedia content provisioning in IPTV services**. The standard gives a description of the metadata elements that are necessary for multimedia content provisioning, such as content description, distribution conditions and usage log report. Compared with the high-level specification of metadata for IPTV services defined in ITU-T H.750, the multimedia content provisioning interface for IPTV services defined by ITU-T H.752 focuses on the metadata elements to be used at the interface between content providers and IPTV service providers. ITU-T H.752 specifies the requirement for AV content metadata provisioning, AV content metadata elements and data structure, procedure of exchanges for content between the content providers and IPTV service providers.

**ITU-T H.772 describes the mechanism of the IPTV terminal device discovery**, making IPTV terminal devices discoverable and selectable for one another within a public or local network environment. ITU-T H.772 also describes the connection model and functional architecture for IPTV terminal device functional blocks to support IPTV terminal device discovery mechanism. The standard specifies the procedure of IPTV terminal device discovery, as well as the Reference Point, the related protocols, elements and attributes to be used in the communication messages.

**ITU-T H.703 defines an enhanced user interface framework for IPTV terminal devices**, covering functional elements supporting enhanced capabilities with respect to user interactions over an IPTV terminal device. The enhanced UI functions are located in the end-user functions of a terminal device, and coordinates together with IPTV terminal functions. The enhanced UI functions include user interfaces of touchscreens and speech. This Recommendation also describes the event features, general requirements and functionalities of the framework to support enhanced UI for IPTV terminal devices, which are recommended on the basis of IPTV architecture (ITU-T Y.1910).

**ITU-T H.723 provides the characteristics and requirements for mobile IPTV terminal devices**. The standard describes the functionalities of the mobile model IPTV terminal device for IPTV basic services defined in ITU-T H.720. The meaning of the mobile model IPTV TD is that IPTV terminal function (ITF) is implemented on a mobile device such as a smart phone or tablet, and it is connected to an IPTV service provider through wireless or mobile access networks. The quality of IPTV service depends on various factors such as network conditions and terminal capability.

**ITU-T H.742.0 specifies the architecture and requirements for the use of video sensor devices for IPTV services**. A video sensor is a device for the technology to extract useful information, for examples, number, gender, and age of persons in front of camera, by processing video data captured by a camera. ITU-T H.742.0 describes an architecture and requirements on IPTV application events extracted by video sensor devices. The requirements regards to general functionalities, delivery mechanisms, metadata, and functions to mitigate the risk of privacy infringements.

*A large push for standardized digital signage solutions came after the Great East Japan Earthquake and Tsunami in 2011, as standards-based digital signage systems can be a powerful vehicle for public announcements in the event of public emergencies.*

Proprietary digital-signage solutions are available, but there is agreement that globally defined solutions have the potential to lower the cost entry point through, for example, the federation of content and reaching wide audiences.

Key ITU standards for digital signage:

* ITU-T H.780 describes a **general framework for digital signage services** based on IPTV architecture from the viewpoint of technical and service aspects.
* ITU-T H.781 defines a **detailed functional architecture** to provide digital signage services.
* ITU-T H.785.0 provides for **disaster information services** provided using digital signage, describing overall aspects of these services and their high-level requirements.

## 4.5 ITU IPTV IPv6 global testbed

The ITU IPTV IPv6 global testbed ([I3GT](http://www.itu.int/en/ITU-T/C-I/interop/I3GT/Pages/default.aspx)), a project supported by the ITU secretariat, encourages the establishment of IPTV testbed sites implementing ITU-T’s IPTV Recommendations. These testbed sites are connected over IPv6 research networks and test various aspects of IPTV solutions built in conformance with ITU standards, including their interoperability, in different environments, countries or regions. The project is also aimed at training academia on the latest IPTV technologies, showcasing standardized IPTV to stakeholders, and promoting IPTV capability enhancement especially in developing countries. A number of testbeds have been established since 2012 at sites in countries including Japan, Switzerland, Singapore, Thailand, Philippines, Malaysia, South Africa and Rwanda. A project is ongoing with academia in Brazil.

## 4.6 New work on immersive live experience

ITU members have launched new standardization work on systems for Immersive Live Experience (ILE), which will bring the sensation of live events to remote audiences, replicating the experience of being present at the event venue. This work will create a multimedia environment in which viewers will experience realistic perceptions of sound, lighting and space. [Full text of press release](https://newslog.itu.int/archives/1293).

A mini-worshop on ILE was held in Geneva, 14 September 2016, and the programme and report can be found on the [event’s webpage](http://www.itu.int/en/ITU-T/gsi/iptv/Pages/201609WSILE.aspx).

# 5 Hyperconnected smart world

## 5.1 Internet of Things and Smart City

ITU put forward a vision of IoT in the landmark ["Internet of Things" report](http://www.itu.int/pub/S-POL-IR.IT-2005/e) published in 2005 as part of a series of ITU reports on the Internet, and has since built-up over ten years of experience in international standardization for IoT. This experience includes the activities undertaken by the [Internet of Things Global Standards Initiative (IoT-GSI)](http://www.itu.int/en/ITU-T/gsi/iot/Pages/default.aspx) as well as the Joint Coordination Activity on Internet of Things (JCA-IoT; renamed JCA-IoT and SC&C), which assisted in initiating active collaboration with relevant SDOs.

ITU-T continues to advance IoT standardization work in the fields of definition, overview, requirements, functional frameworks, architectures, identification, applications and services.

*IoT technologies offer both developed and developing countries an opportunity to spur smart transformations of city infrastructure, benefiting from the efficiencies of intelligent buildings and transportation systems, and smart energy and water networks. ITU is well-positioned to assist government and industry in capitalizing on this opportunity.*

The **IoT and Smart Cities and Communities Standards Roadmap** documents complete as well as ongoing work on IoT and Smart Cities and Communities by ITU-T as well as a range of standards other standards bodies.This roadmap is maintained by the [Joint Coordination Activity on Internet of Things and Smart Cities and Communities (JCA-IoT and SC&C)](http://www.itu.int/en/ITU-T/jca/iot/Pages/default.aspx).

[*A flipbook on “Unleashing the potential of the Internet of Things”*](http://wftp3.itu.int/pub/epub_shared/TSB/2016-07-11-ITU-T-Compendium/index.html#p=1) *presents a compendium of all ITU standards on IoT, providing a resource of great value to standards experts interested in contributing to ITU-T's standardization work for IoT. The flipbook is also expected to assist the wide variety of stakeholders interested in implementing these IoT standards or calling for adherence to standards in policy and regulatory frameworks relevant to IoT.*

Approved ITU standards for IoT specify an IoT framework (e.g., basic concepts and terminology, common requirements and capabilities, ecosystem and business models, etc.); various areas of applications and services (e.g., networked vehicles, e-health, home networks, machine-oriented communications, sensor control networks, gateway applications, etc.); as well as testing aspects.

Ongoing ITU-T work on IoT spans the areas of future networks, service delivery platforms, smart sustainable cities, smart grids, intelligent transport systems, cloud computing, and big data.

In accordance with Plenipotentiary Resolution 182 (Busan, 2014), ITU is working with various partners to assess the complete-lifecycle GHG emissions of telecommunication/ICT equipment including to combat e-waste using various IoT solutions taking into account Recommendation ITU-T X.1255. Other IoT applications and initiatives including Digital Object Architecture (DOA) are being developed to discover, authenticate, track and trace objects to combat counterfeit products and to ensure interoperability of heterogeneous IoT identity management (IdM) systems.

ITU members at the TSAG meeting in June 2015 established **ITU-T Study Group 20 "IoT and its applications, including smart cities and communities" (ITU-T SG20)**, responsible for international standards to enable the coordinated development of IoT technologies, including machine-to-machine communications and ubiquitous sensor networks.

[*ITU-T Study Group 20*](http://www.itu.int/en/ITU-T/about/groups/Pages/sg20.aspx) *develops standards that leverage IoT technologies to address urban-development challenges. A key part of this study will be the standardization of end-to-end architectures for IoT and mechanisms for the interoperability of IoT applications and datasets employed by various vertically oriented industry sectors.*

Executive summaries of ITU-T SG20 meetings can be found on the group's [homepage](http://www.itu.int/en/ITU-T/studygroups/2013-2016/20/Pages/default.aspx) for the 2013-2016 study period.

*New standards developed by ITU-T SG20 include:*

**ITU-T Y.4702 "Common requirements and capabilities of device management in the Internet of Things"** identifies common parameters for remote activation, diagnostics, software upgrades and security management to improve the efficiency with which IoT devices and applications are managed. This new standard is expected to provide the basis for the development of further standards to enable the large-scale deployment of IoT and M2M communications.

**ITU-T Y.4553 "Requirements of the smartphone as sink node for IoT applications and services"** provides for smartphones to collect IoT data such as monitored health parameters, device status, video and audio feeds. Smartphones provide Internet connectivity for wearable technologies and home-monitoring devices, giving this new standard the potential to support a range of smart healthcare initiatives.

**ITU-T Y.4113 "Requirements of the network for the Internet of Things"** enhances the common requirements identified in ITU-T Recommendation Y.2066. The requirements focus on the transport functions of the network, but also cover service support functions.

**ITU-T Y.4451 "Framework of constrained device networking in the IoT environments"** describes the concept of constrained device networking in IoT environments and communication of constrained devices, as well as network architectures and mechanisms of constrained device networking.

**ITU-T Y.4452 "Functional framework of Web of Objects"** provides the concept, reference model, functional capabilities and information models of Web of Objects.

**ITU-T Y.4453 "Adaptive software framework for IoT devices"** addresses the concept of the adaptive software framework, identifies high-level requirements and provides a reference functional architecture for the IoT devices.

**ITU-T Y Supplement 42 to ITU-T Y.4100 series "Use cases of User-Centric work Space (UCS) Service"** provides a description of the UCS concept and its associated enhanced user experience. This Supplement also provides use cases of UCS service to illustrate how this service can be implemented.

**ITU-T Y.4454 "Platforms interoperability for smart cities"**, undergoing approval at the time of writing (determined August 2016), provides for an interoperable platform of smart city services that ensures the required service functionality, as well as efficiency, performance, security and scalability. The platform provides a comprehensive system for smart city management.

## 5.2 Smart sustainable cities global initiative

ITU and UNECE have launched the [United for Smart Sustainable Cities (U4SSC)](http://www.itu.int/en/ITU-T/ssc/united/Pages/default.aspx), a global initiative which advocates for public policy to encourage the use of ICTs in enabling the transition to smart sustainable cities.

*U4SSC is assisting the response to Goal 11 of the United Nations Sustainable Development Goals (SDGs): to “Make cities and human settlements inclusive, safe, resilient and sustainable”.*

U4SSC is privileged to have the support of 17 other United Nations Agencies and Regional Commissions, and is open to all United Nations agencies, municipalities, industry, academia and other relevant stakeholders. It focuses on the integration of ICTs in urban operations, building on existing international standards and key performance indicators (KPIs).

The [Advisory Board for Smart Sustainable Cities](http://www.itu.int/en/ITU-T/ssc/united/Documents/ToR-AdvisoryBoard-and-TechnicalAdvisoryGroup-30may2016.pdf) within the U4SSC initiative consists of members from 17 other UN agencies and representatives of cities involved in a pilot project to implement ITU-standardized KPIs for smart sustainable cities (see section 5.3).

[Full text of press release](http://www.itu.int/net/pressoffice/press_releases/2016/CM10.aspx#.V9qTJVt9600)

## 5.3 Cities trialing ITU key performance indicators for smart sustainable cities

Dubai and Singapore were the world's first cities to join a two-year pilot project to implement ITU-standardized KPIs for smart sustainable cities. This pilot project will assist ITU in ensuring that any future refinement of these indicators is undertaken on the basis of cities' experiences with their implementation.

*Singapore's 'Smart Nation' vision aims to enrich citizens' lives by capitalizing on the potential of ICT to improve environmental sustainability, resilience, and equitable social and economic growth.* [Full text of press release](http://www.itu.int/net/pressoffice/press_releases/2015/43.aspx)*.*

*The collaboration between Smart Dubai, an initiative to convert Dubai into a smart city, and ITU is part of ITU's efforts to encourage the adoption of master plans for sustainable urban development by city administrations. The 'Smart Dubai' initiative's extensive application of ICT makes the city an ideal test bed for the use of the indicators and their subsequent refinement.* [*Full text of press release*](http://www.itu.int/net/pressoffice/press_releases/2015/12.aspx)*.*

The ITU standards detailing these KPIs are:

* ITU-T Y.4900/L.1600 "Overview of key performance indicators in smart sustainable cities"
* ITU-T Y.4901/L.1601 "Key performance indicators related to the use of information and communication technology in smart sustainable cities"
* ITU-T Y.4902/L.1602 "Key performance indicators related to the sustainability impacts of information and communication technologies in smart sustainable cities"
* ITU-T L.1603 "Key performance indicators for smart sustainable cities to assess the achievement of sustainable development goals", undergoing approval at the time of writing (consented April 2016)

*Manizales, Montevideo, Buenos Aires, Valencia, Rimini and other selected cities have also agreed to trial these KPIs.*

## 5.4 Methodologies to assess the environmental impact of ICTs

***ITU-T has developed standardized methodologies to assess the environmental impacts of ICTs****, both in terms of ICT greenhouse gas (GHG) emissions and the emissions savings created through green ICT applications in other industry sectors.*

*These methodologies were developed in cooperation with over 60 organizations including major ICT private sector organizations, the United Nations Framework Convention on Climate Change (UNFCCC), the United Nations Environmental Programme (UNEP) and the European Telecommunications Standards Institute (ETSI).*

**Assessing the environmental impacts of cities attributable to ICTs**, ITU-T L.1440 "Methodology for environmental impact assessment of information and communication technologies at city level", is the latest addition to ITU-T's L.1400 series of standardized methodologies to assess the environmental impact of ICTs.

The ITU-TL.1440 methodology provides cities with a uniform means of quantifying ICTs' energy consumption and greenhouse gas (GHG) emissions. The methodology will assist in making the case for Smart Sustainable Cities, providing an internationally recognized means of quantifying the extent to which the application of ICTs can improve the environmental sustainability of city infrastructures and operations.

The ITU-T L.1400 series also includes:

* A methodology for environmental life cycle assessments of **ICT goods, networks and services** (ITU-T L.1410)
* A methodology for energy consumption and GHG emissions impact assessment of **ICTs in organizations** (ITU-T L.1420)
* A methodology for the assessment of the environmental impact of **ICT greenhouse gas and energy projects** (ITU-T L.1430)

## 5.5 Connected vehicles, automated driving and intelligent transport systems

[*The Collaboration on ITS Communication Standards (CITS)*](http://www.itu.int/en/ITU-T/extcoop/cits/Pages/default.aspx) *provides a globally recognized forum for the creation of an internationally accepted, globally harmonized set of ITS communication standards of the highest quality in the most expeditious manner possible to enable the rapid deployment of fully interoperable ITS communication-related products and services in the global marketplace.*

Much of the ITS work is coordinated and channeled through CITS, which also serves as ITU's interface to the UNECE World Forum for Harmonization of Vehicle Regulations (WP.29) and its informal working groups (e.g., ITS/Automated Driving; Accident Emergency Call System). The role played by CITS is to bring activities to ITU and support ITU initiatives. CITS is not a standardization working group, but rather a mechanism to coordinate the work of standardization working groups.

**Cooperation with the UNECE Transport Division** has made good progress. WP.29 now looks to ITU to provide communications standards in support of vehicle regulations. The standards will be performance standards. For example, new global regulation on vehicle emergency calls (Automatic Emergency Call Systems (AECS)) is nearing approval and is expected to reference an ITU-T voice-quality performance standard (ITU-T P.1140).

**ITU/UNECE Symposium on** [The Future Networked Car](http://www.itu.int/en/fnc/2016/Pages/default.aspx) held within the Geneva International Motor Show brings together representatives of vehicle manufacturers, the automotive and ICT industries, governments and their regulators to discuss the status and future of vehicle communications and automated driving. 2017 will host the 12th edition of the symposium.

The 2013 [World Telecommunication and Information Society Day](http://www.itu.int/en/wtisd/Pages/default.aspx) on 17 May was themed "[ICTs and improving road safety](http://www.itu.int/en/wtisd/Pages/2013theme.aspx)". A highlight of the event was ITU's presenting the annual World Telecommunication and Information Society Award[[1]](#footnote-1) to eminent personalities in recognition of their leadership and dedication to the field.

**New standards for Intelligent Transport Systems (ITS):**

**ITU-T P.1130 "Subsystem requirements for automotive speech services"** defines test methodologies for and standard behaviour of subsystems used in automotive speakerphone terminals. This standard provides guidance on the design and optimization of such subsystems, as well as the diagnostic capabilities needed to give a consistent and high quality of service of the overall speakerphone terminal to the users of such devices. ITU-T P.1130 is intended to give guidance to all parties involved in the design and integration of speakerphone terminals. It covers both narrowband and wideband systems.

**ITU-T P.1140 "Speech communication requirements for emergency calls originating from vehicles"** focuses on achieving a sufficient level of speech intelligibility and communication efficiency in the context of vehicle emergency calls. The standard supports road-safety initiatives such as Europe's eCall regulation which will require that all new cars be equipped with eCall technology from April 2018. In the event of a serious accident, a vehicle's eCall system will automatically dial 112, Europe's single emergency number, in addition to alerting emergency services to the severity of the impact and the affected vehicle's location. Drivers witnessing an accident will also have the ability to make an eCall manually, at the push of a button.

**The performance of mobile phones when connected via Bluetooth to vehicle hands-free terminals:** ITU is engaged in the assessment of the compatibility of mobile phones with vehicle hands-free terminals, based on Recommendations ITU-T P.1100 and P.1110. See sections 9.4 and 10.2.2.

**Requirements and architecture of a Vehicle Gateway / Vehicle Gateway Platform:** Recommendation ITU-T F.749.1 defines the functional requirements for a vehicle gateway that enables real-time communications between an object in the vehicle and another object located either inside or outside the vehicle (e.g., roadside station, cloud-based server, etc.).

Ongoing ITU-T work for ITS includes:

**ITS security:** ITU members are making progress in their development of new ITU standards for the security of remote software updates for connected vehicles (X.itssec-1) and security guidelines for V2X communication systems (X.itssec-2).

**Taxonomy for ICT-enabled motor vehicle automated driving systems:** An overview/review of documents that describe levels of automation with respect to motor vehicles and driving (see work item [F.AUTO-TAX](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=10436) in Q27/16).

## 5.6 Connected health: e-Health

**ITU-T H.810 contains the Continua Design Guidelines providing "Interoperability design guidelines for personal health systems"**. The Continua Design Guidelines provide for end-to-end, plug-and-play connectivity in personal connected health devices, which are based on global industry standards for interoperability. [Full text of press release](http://www.itu.int/net/pressoffice/press_releases/2013/75.aspx).

The ITU-T H.820-H.850 series presents a suite of conformance-testing specifications for ITU-T H.810 comprising over 1,000 test cases (ITU-T H.820-H.850 series).

In cooperation with the Personal Connected Health Alliance (formerly Continua Health Alliance), a list of devices previously tested according to these new Recommendations were included in ITU's ["ICT product conformity database"](http://www.itu.int/net/itu-t/cdb/ConformityDB.aspx) at its launch. See section 10.2.1.

Additionally, Technical Paper ITU-T HSTP-H810-XCHF explains the fundamentals of data exchange within ITU-T H.810 architecture.

**ITU-T H.860 approved in April 2014 will enable different e-health systems to exchange patient health data smoothly** in both low- and high-resource settings, making it ideal for applications in both developed and developing countries. [Full text of press release](http://www.itu.int/net/pressoffice/press_releases/2014/08.aspx).

**ITU-T Y.2065 "Service and capability requirements for e-health monitoring services"** will push the evolution of IoT technologies for e-health towards lower cost, higher efficiency, enhanced quality of experience and diversified smart services for health professionals, health organizations and consumers. The standard classifies e-health monitoring (EHM) services as EHM Healthcare, EHM Rehabilitation and EHM Treatment services, and describes service requirements according to different roles involved in the provisioning of these services (i.e. EHM customer, EHM device provider, network provider, platform provider and EHM application provider). It specifies the EHM capability requirements with respect to different layers of the IoT reference model specified ITU-T Y.2060 "Overview of the Internet of Things".

*ITU-T collaboration with WHO continues on the development of technical standards for the* ***safe listening of music players****. An* [*ITU workshop*](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/safelistening/Pages/default.aspx) *on the topic was organized in June 2016.*

# 6 Security and trust

*ITU work to build confidence and security in the use of information and communication technologies (ICTs) continues to intensify in a bid to facilitate more secure network infrastructure, services and applications.*

ITU security standardization work focuses on topics including:

* Cybersecurity
* Security management
* Security architectures and frameworks
* Countering spam
* Identity Management
* Protection of Personally Identifiable Information

This work also includes the development of standards for the security of applications and services for IoT, smart grid, smartphones, web services, social networks, cloud computing, mobile financial systems, IPTV, telebiometrics and more.

## 6.1 6th edition of the ITU-T Security Manual

The ITU-T Security Manual offers a comprehensive overview of ITU-T's work to build confidence and security in the use of information and communication technologies (ICTs). The 6th edition of the manual is available free of charge [here](http://www.itu.int/pub/T-TUT-SEC-2015).

The manual documents ITU-T's efforts to respond to global cybersecurity challenges with international standards, complementary guidance documents and outreach to build capacity in the application of advanced ICT security mechanisms.

## 6.2 New security standards

**ITU-T's Cybersecurity Information Exchange (CYBEX)** offers the tools to ensure rapid, internationally-coordinated responses to cyber threats. The always-expanding ITU-T X.1500 CYBEX ensemble of techniques is a collection of best-of-breed standards from government agencies and industry. It presents a standardized means to exchange the cybersecurity information demanded by Computer Incident Response Teams (CIRTS), and is an essential tool to prevent the contagion of cyber attacks from nation to nation.

**ITU-T X.1631 | ISO/IEC 27017, "Information technology – Security techniques – Code of practice for information security controls for cloud computing services based on ISO/IEC 27002"** provides guidelines supporting the implementation of information security controls for cloud service providers and cloud service customers of cloud computing services. Selection of appropriate controls and the application of the implementation guidance provided will depend on a risk assessment as well as any legal, contractual or regulatory requirements. ISO/IEC 27005 provides information security risk management guidance, including advice on risk assessment, risk treatment, risk acceptance, risk communication, risk monitoring and risk review.

**ITU-T X.1602 "Security requirements for software as a service application environments"** analyzes the maturity levels of software as a service (SaaS) application and proposes security requirements to provide a consistent and secure service execution environment for SaaS applications

**ITU-T X.1033 "Guidelines on security of the individual information service provided by the operators"** addresses the aspects of security of the information service provided by the telecommunication operators, and which classifies individual information services, the security requirements, the mechanisms, and the coordination. States security requirements of traditional telecommunication service (from regulators, for operators, for third-party service providers, by users, for content services, for informationization services).

**Revised ITU-T X.1051 | ISO/IEC 27011 "Information technology – Security techniques – Information security management guidelines for telecommunications organizations based on ISO/IEC 27002"** provides guidelines and general principles for initiating, implementing, maintaining, and improving information security controls in telecommunications organizations based on ISO/IEC 27002; and provides an implementation baseline of information security controls within telecommunications organizations to ensure the confidentiality, integrity and availability of telecommunications facilities, services and information handled, processed or stored by the facilities and services.

**ITU-T X.1247 "Technical framework for countering mobile messaging spam"** which gives an overview of mobile messaging anti-spam processes, and proposes a technical framework for countering mobile messaging spam; including specification of entity functions and processing procedures. In addition, this Recommendation provides information sharing mechanisms against mobile messaging spam within the anti-spam domain and among anti-spam domains.

**ITU-T X.1256 "Guidelines and framework for sharing network authentication results with service applications"** provides guidelines for network operators and service providers to share network authentication results, as well as a framework for sharing minimum attributes across multiple services within an established trust relationship.

**ITU-T X.1257 "Identity and access management taxonomy"** addresses the lack of business meaning in IAM roles and permissions which has led to unnecessary complexity in the operation of IAM systems, and brings greater business relevance to the identity and access management (IAM) systems employed by enterprises to manage electronic identities and control access to ICT resources. The standard will enable more intuitive, cost-effective assignment and management of IAM roles and user permissions. X.1257 details requirements for a "task-based access management" framework. [Full text of press release](http://newslog.itu.int/archives/1283).

**Revised ITU-T X.1521 "Common vulnerability scoring system 3.0"** standardizes the characteristics and severity of software vulnerabilities and produces a numerical score quantifying the vulnerability and reflecting its severity, as well as a textual representation of that score. This helps organizations properly assess and prioritize their vulnerability management processes.

**ITU-T X.1602 "Security requirements for software as a service application environments"** analyzes the maturity levels of software as a service (SaaS) application and proposes security requirements to provide a consistent and secure service execution environment for SaaS applications. These proposed requirements originate from cloud service providers (CSP) and cloud service partners (CSN) as they need a SaaS application environment to meet their demands on security. The requirements are general and independent of any service or scenario specific model (e.g. web services, or representational state transfer (REST)), assumptions or solutions.

**ITU-T X.1642 "Guidelines for the operational security of cloud computing"** provides generic operational security guidelines for cloud computing from the perspective of cloud service providers (CSPs). It analyses the security requirements and metrics for the operation of cloud computing. A set of security measures and detailed security activities for the daily operation and maintenance are provided to help CSPs mitigate security risks and address security challenges for the operation of cloud computing.

## 6.3 Trust

ITU has held two workshops on ["Future Trust and Knowledge Infrastructure"](http://www.itu.int/en/ITU-T/Workshops-and-Seminars/01072016/Pages/default.aspx).

Future networks will need to support an enormous volume of ICT applications and a very broad spectrum of services. Billions of networked devices, things and objects will enable systems to communicate and learn from one another, creating intelligent ecosystems that adapt their behavior in the interests of efficiency. The next generation of communications will see applications in areas spanning from voice and video to industrial robotics, intelligent transport, remote medical surgery, virtual reality and much more.

This increasing sophistication of ICTs and unprecedented level of ICT ubiquity will demand significant transformations in network infrastructure and services. We are on course for a world in which nearly every aspect of economic and social activity will depend on ICTs, making it essential that we build ICT infrastructure and services deserving of our trust.

*ITU members are engaged in a new standardization effort to describe the fundamentals of a trusted ICT environment.*

The [ITU-T Technical Report on "Trust Provisioning for future ICT infrastructures and services"](file:///C:\Users\dalais\Documents\2016\ITU-T%20Technical%20Report%20on%20%22Trust%20Provisioning%20for%20future%20ICT%20infrastructures%20and%20services%22) describes the importance and necessity of trust in the ICT context, highlighting its relevance to emerging knowledge societies and describing the concepts and key features of trust. Following its identification of key challenges and technical issues, the report presents an architectural overview of trusted ICT infrastructures. It goes on to introduce trust-based ICT service models and use cases, and proposes strategies for future standardization on trust. Appendices to the report summarize trust-related activities in other standardization bodies, and provide background information on ICT service model analysis frameworks and detailed use cases.

*The ITU-T Technical Report on "Trust Provisioning for future ICT infrastructures and services" provides a* ***definition of trust in the context of ICT:***

*Trust is an accumulated value from history and the expecting value for future. Trust is quantitatively and/or qualitatively calculated and measured, which is used to evaluate values of physical and logical components, value-chains among multiple stakeholders, and human behaviours including decision making.*

ITU-T Study Group 13 has begun to explore requirements, capabilities and service scenarios for trust provisioning; the architectural framework for trustworthy telecommunication networks; technical solutions for trust provisioning; trust provisioning in Big Data analytics; and inter-cloud trust management.

# 7 Environment and emergency communications

## 7.1 Green ICT standards

New ITU green ICT standards include environmentally friendly universal power adapter solutions for portable ICT devices (ITU-T L.1002), green batteries for smartphones and other handheld ICT devices (ITU-T L.1010) and a test suite for assessment of the ITU-T L.1000 universal charger for mobile phones (ITU-T L.1005).

ITU members have also agreed a standardized methodology for manufacturers to report the quantity of rare metals contained in their ICT devices (ITU-T L.1101), a standard intended to affect an increase in the efficiency of recycling schemes.

**ITU-T Y.3022 "Measuring energy in networks"** defines a reference model, functional architecture, energy efficiency metrics and energy measurement methods.

**ITU-T L.1302 "Assessment of energy efficiency on infrastructure in data centre and telecom centre"** specifies an energy efficiency assessment methodology for data centres and telecom centres, including assessment conditions and calculation methods for infrastructure/facilities such as cooling systems.

**ITU-T Y.2071 "Framework of Micro Energy Grid"** provides the framework of micro energy grids for interconnected local energy generation and distribution, covering these grids' features and requirements, architecture, control and management services, and core systems and components.

***ITU and the European Telecommunications Standards Institute (ETSI) continue to collaborate on the development of Green ICT Standards.***

*ITU and ETSI have aligned their methodologies to assess the environmental impact of ICT goods, networks and services. The methodology for environmental Life Cycle Assessment (LCA) of ICT goods, networks and services is known as ITU-T L.1410 in ITU-T and ES 203 199 in ETSI.*

*This collaboration between ITU-T and ETSI has given rise* ***new standard to measure the energy efficiency of mobile radio access networks (RANs)****, the wireless networks that connect end-user equipment to the core network. The standard, Recommendation ITU-T L.1330, is the first to define energy-efficiency metrics and measurement methods for live RANs, providing a common reference to evaluate their performance. Its application will build uniformity in the methodologies employed by such evaluations, in parallel establishing a common basis for the interpretation of the results.*

*One area of ongoing ITU-ETSI collaboration looks to standardize measurement methods for the* ***energy efficiency of network function virtualization.***

*Additionally, ITU-T has published eight* [reports on smart cities, environment and climate change](https://www.itu.int/en/ITU-T/climatechange/Pages/publications.aspx) *in collaboration with other United Nations bodies and entities including UNFCCC, UNESCO, UNU, COMTELCA and CITEL among others.*

## 7.2 Electromagnetic fields

**ITU-T K.100 "Measurement of radio frequency electromagnetic fields to determine compliance with human exposure limits when a base station is put into service"** provides information on measurement techniques and procedures for assessing compliance with EMF limits when a new base station is put into service, taking into account effects of the environment and other relevant radiofrequency sources present in its surroundings.

***ITU standards to assist in the responsible management of electromagnetic fields (EMF)*** *include measuring techniques, procedures and numerical models for evaluating the electromagnetic fields stemming from telecommunication systems and radio terminals.*

**ITU-T K.113 "Generation of radiofrequency electromagnetic fields (RF-EMF) level maps"** provides guidance on how to develop RF-EMF maps for assessing existing exposure levels over large areas of cities or territories and for an appropriate public disclosure of the results, in a simple and understandable way.

*The* [*ITU 'EMF Guide mobile app'*](http://emfguide.itu.int/emfguide.html) *provides an up-to-date reference of the EMF information provided by the World Health Organization and ITU. The app is available in the 6 official languages of the Union and Malay.*

**Supplement 2 to ITU-T K.91 on Electromagnetic field (EMF) considerations in smart sustainable cities** provides guidance on implementation, and promotes efficient deployment, of wireless networks in smart sustainable cities. It features a 'Smart Sustainability City EMF Check-list' designed to provide an easy to use reference for city officials and planners to ensure smart city policies operate most efficiently and comply with EMF exposure standards.

[*Report on Monitoring of Electromagnetic field levels in Latin America*](http://www.itu.int/dms_pub/itu-t/oth/0b/11/T0B110000283301PDFE.pdf)*presents case studies on the continuous monitoring systems installed in some countries in Latin America, as well as the policies adopted at governmental level for the implementation of Recommendation ITU-T K.83.*

## 7.3 SMART\* ocean cables systems

The [ITU/WMO/UNESCO-IOC Joint Task Force on SMART\* Cable Systems](http://www.itu.int/en/ITU-T/climatechange/task-force-sc/Pages/default.aspx) is leading an ambitious new project to equip submarine communications cables with climate and hazard-monitoring sensors to create a global observation network capable of providing earthquake and tsunami warnings as well as data on ocean climate change and circulation. These new 'green cables' would collect data of great value to the scientific community, as well industries such as fisheries and energy.

*Continents are connected by information superhighways of fibre-optic submarine cables that span our oceans to provide the backbone of the global telecommunications system. The first submarine communication cable was deployed across the English Channel in 1850, and since, more than a million kilometres of cable have been laid on the ocean floor, covering a significant portion of the globe.*

The JTF is developing a pilot project (a so-called 'wet demonstrator') with the active participation of cable suppliers, owners and researchers from existing ocean observatories. Experts have deemed the project to be technically feasible with the JTF members now working to solve business, legal and economic challenges.

Find the JTF's annual reports and other studies on the group's homepage.

\*Science Monitoring and Resilient Telecommunications

## 7.4 Emergency communications & disaster relief

***The 21st century is playing host to an increasing prevalence of extreme weather events.*** *ITU standards include technical mechanisms to ensure the prioritization of emergency calls, and ITU members continue to develop new standards to improve the resilience of ICT networks to natural disasters and to assist the recovery of communications capabilities when disaster strikes.*

New ITU standards for emergency communications and disaster relief include:

**ITU-T X.1303bis "Common alerting protocol (CAP 1.2)"** is a key standard in the dissemination of emergency warnings. ITU-T X.1303bis is the second edition of CAP, a simple but general format for exchanging all-hazard emergency alerts and public warnings, disseminated simultaneously over all kinds of networks.

**ITU-T Y.1271 "Framework(s) on network requirements and capabilities to support emergency telecommunications over evolving circuit-switched and packet-switched networks"** presents an overview of the basic requirements, features and concepts for emergency telecommunications that evolving networks are capable of providing.

**ITU-T 2074 "Requirements for Internet of Things devices and operation of Internet of Things applications during disasters"** describes requirements for the use of IoT devices and IoT applications for evacuation and rescue processes during disasters, adding to the common requirements of IoT in ITU-T Y.2066.

**ITU-T Y.2705 "Minimum security requirements for the interconnection of the Emergency Telecommunications Service (ETS)"**. ETS is a national service, providing priority communications services to ETS-authorized users in times of disaster and emergencies. ITU-T Y.2705 provides minimum security requirements for the inter-network interconnection of ETS. This will allow ETS to be supported with the necessary security protection between different national networks with bilateral and/or multilateral agreements in times of disaster and emergencies.

**ITU-T Y.4250/Y.2222 "Sensor control networks and related applications in a next generation network environment"** provides an introduction to sensor control networks (SCNs) and related applications in an NGN environment. It provides an overview of SCNs, configurations for SCN applications and service requirements of SCN applications for support in a NGN environment.

**ITU-T L.392 "Disaster management for improving network resilience and recovery with movable and deployable ICT resource units"** introduces an approach for improving network resilience against disasters and assisting network recovery after disaster strikes, an approach that involves the mobilization of units and facilities that package movable and instantaneously deployable ICT resources.

**ITU-T E.108 "Requirements for a disaster relief mobile message service"**. In the aftermath of a disaster, communication facilities are often overloaded due to many users attempting to contact friends or relatives to determine the safety of people who may have been affected by disasters. As a result, communication attempts often fail. The intent of a disaster messaging service is to allow an alternate method to communicate safety status information. ITU-T E.108 presents two approaches: the first being a text-based messaging system, and the second a voice-based messaging system.

**ITU-T Q.3615 "Protocol for GeoSMS"** standardizes the communication of location information between various location-based services (LBSs) over short message service (SMS). The protocol for GeoSMS can be supported by existing telecommunication network infrastructures, further facilitating the advantage of interoperability.

**Q Supplement 68 "ETS interoperability limitations"** describes possible limitations in the interoperability of ETS (Emergency Telecommunications Service) that may prevent ETS users from taking full advantage of new capabilities in smartphones, public communication networks and applications (e.g., 4G mobile broadband networks using VoLTE/RCS applications).

**ITU-T E.119 "Requirements for Safety Confirmation and Broadcast Message Service for Disaster Relief"**, undergoing approval at the time of writing (determined September 2016), will help public organizations to realize their business continuity plans when disaster strikes. Organizations such as telecommunication companies, electric utilities, hospitals, fire departments and local governments will use to ITU-T E.119 to confirm the safety of their staff as they work to assist victims of a disaster.

**Q Supplements 62 "Overview of the work of standards development organizations and other organizations on the emergency telecommunications service"** provides a convenient reference to assist ITU-T and other national and international standards bodies as they develop standards for ETS. It identifies published ETS-related standards as well as those currently in work programmes.

**Q Supplements 63 "Signalling protocol mappings in support of the Emergency Telecommunications Service in IP networks"** provides guidance for mapping-required signalling protocol attributes to support the proper set-up and admission of ETS for various protocols. The set of protocols include ISDN user part (ISUP), session initiation protocol (SIP), ITU-T H.248, ITU-T H.225 and Diameter.

ITU members are also in the process of developing the following three new standards:

ITU-T L.380 (ex. L.nrr-frm) "Framework of disaster management for network resilience and recovery"

ITU-T E.TD-DR "Terms and definitions for DR&NRR"

ITU-T E.RDR "Requirements for Disaster Relief Systems"

## 7.5 Symposia on ICT, Environment and Climate Change

ITU Symposia on ICT, Environment and Climate Change raise awareness of the potential of ICTs to address environmental challenges, encouraging decision-makers to integrate ICTs into their efforts to create smart, sustainable economies and societies.

* [8th ITU Sympsosium on ICT Environment and Climate Chang: Smart Sustainable Cities](http://www.itu.int/en/ITU-T/climatechange/symposia/201305/Pages/default.aspx), 6-7 May 2013, Turin, Italy. The Symposium was dedicated to the theme of Smart Sustaianable Cities and was kindly hosted by Telecom Italia.
* [9th ITU Symposium on ICT Environment and Climate Change](http://www.itu.int/en/ITU-T/climatechange/symposia/201412/Pages/default.aspx),15 December 2014, Kochi, India, hosted by the Ministry of Communications and Information Technology, Law and Justice of India.
* [10th ITU Symposium on ICT Environment and Climate Change: From the New Climate Agreement to the New Urban Agenda](http://www.itu.int/en/ITU-T/Workshops-and-Seminars/gsw/201512/Pages/programme-20151214.aspx), 14 December 2015, Nassau, The Bahamas, hosted by the Government of the Commonwealth of Bahamas.
* [11th ITU Symposium on ICT Environment and Climate Chang: Celebrate the Earth – Towards a Sustainable Future](http://www.itu.int/en/ITU-T/climatechange/symposia/201604/Pages/default.aspx), 21 April 2016, Kuala Lumpur, Malaysia, hosted by the Ministry of Communications and Multimedia Malaysia and the Malaysian Communications and Multimedia Commission.

## 7.6 Green Standards Week

[ITU Green Standards Week](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/gsw/Pages/default.aspx) is a global platform for discussion and knowledge-sharing on means of capitalizing on ICTs and supporting technical standards in building smart sustainable cities and ensure a sustainable future.

* [3rd ITU Green Standards Week: Innovating Today for a Sustainable Tomorrow](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/gsw/201309/Pages/default.aspx), 16-20 September 2013, Madrid, Spain, hosted by Telefónica. [Full text of press release](http://www.itu.int/net/pressoffice/press_releases/2013/40.aspx#.V_YWGFt97mE) reporting on the outcomes of the event.
* [4th ITU Green Standards Week: Setting the Vision for Smart Sustainable Cities](http://www.itu.int/en/ITU-T/Workshops-and-Seminars/gsw/201406/Pages/default.aspx), 22-26 September 2014, Beijing, China, hosted by Huawei in close cooperation with the China Academy of Telecommunication Research (CATR) of the Ministry of Industry and Information Technology (MIIT) of the Government of the People's Republic of China. The event concluded with the adoption of a [Call to Action](http://www.itu.int/en/ITU-T/Workshops-and-Seminars/gsw/201406/Documents/SSC-Call-For-Action(24September2014).pdf).
* [5th ITU Green Standards Week: Cities and Climate Change: From the New Climate Agreement to the New Urban Agenda](http://www.itu.int/en/ITU-T/Workshops-and-Seminars/gsw/201512/Pages/default.aspx),14-18 December 2015, Nassau, The Bahamas, hosted by the Government of the Commonwealth of Bahamas. The 5th ITU Green Standards Week was co-organized with the Basel Convention Regional Centre for the Caribbean Region (BCRC-Caribbean), the Basel Convention Regional Centre for the South American Region (CRBAS), the Economic Commission for Latin America and the Caribbean (ECLAC), the Regional Bureau for Sciences in Latin America and the Caribbean of the United Nations Educational, Scientific and Cultural Organization (UNESCO), the United Nations Human Settlements Programme (UN-Habitat), the United Nations Industrial Development Organization (UNIDO) and the United Nations University (UNU). The event concluded with the adoption of the [Bahamas Declaration](http://www.itu.int/en/ITU-T/Workshops-and-Seminars/gsw/201512/Documents/The%20Bahamas%20Declaration.docx).
* [6th ITU Green Standards Week: Shaping Smart Sustainable Cities: Towards Habitat III](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/gsw/201609/Pages/default.aspx), 5 to 9 September 2016, Montevideo, Uruguay, hosted by the Municipality of Montevideo, Uruguay. The 6th ITU Green Standards Week was co-organized with the Inter-American Association of Telecommunication Enterprises (ASIET), the Economic Commission for Latin American and the Caribbean (ECLAC), the Basel Convention Regional Centre for the South American Region (CRBAS) and the Development Bank of Latin America (CAF). [Full text of press release](http://www.itu.int/en/mediacentre/Pages/2016-PR34.aspx) highlighting the event’s conclusion with the adoption of the [Montevideo Declaration](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/gsw/201609/Documents/Montevideo-declaration-9-09-2016.docx).

# 8 Accounting, charging, tariffs and other economic and policy issues

## 8.1 International Mobile Roaming

ITU members have agreed the Technical Paper, ["ITU Technical Guide for National Regulatory Authorities on International Mobile Roaming Cost analysis"](http://www.itu.int/pub/T-TUT-ROAMING-2015-03), to assist regulators in their efforts to create an enabling environment for fair and affordable tariffs for international mobile-roaming voice services. The new technical guide is accompanied by an [online tool](http://www.itu.int/net4/roamingtool/) which provides a model to calculate the costs to operators of providing mobile-roaming voice services. The new technical guide and companion online tool were developed in response to calls from ITU members for greater clarity on the degree to which the prices that consumers pay for roaming services are commensurate with their costs.

[Full text of press release](http://www.itu.int/net/pressoffice/press_releases/2015/63.aspx#.V_uE3OV97mE)

## 8.2 Strengthening the ties between the progress of technology and policy

The international community is looking to ITU's unique, globally representative public-private partnership of members for a neutral platform to strengthen the ties between technical innovation, business needs and economic/policy requirements.

Growing interest among ITU members in building greater cohesion in the progression of technology and policy has led ITU-T Study Group 3 to work towards providing ITU's standardization expert groups with economic and policy baselines to be considered in the development of new technical standards.

Topics studied by ITU-T SG3 during the 2013-2016 study period include, inter alia, NGN charging and accounting, international Internet connectivity, international mobile roaming, economic impact of over-the-top (OTT), identification of relevant markets and significant market power (SMP), use of commercial agreements for international telecommunication services arrangements, international aspects of universal service, dispute resolution related to charging and invoicing, and alternative calling procedures.

ITU-T SG3 has also accelerated its study of mobile financial services (MFS), working towards international standards to empower consumers and encourage a level playing field for MFS competition and market entry in close collaboration with the ITU-T Focus Group on Digital Financial Services (see section 13.2).

ITU members participating in ITU-T SG3 have achieved first-stage approval ("determined") of five international standards, which were forwarded to WTSA-16 for final approval:

**ITU-T D.52 "Establishing and connecting regional Internet Exchange Points (IXPs) to reduce costs of international Internet connectivity"** will guide regional collaboration to establish central hubs (IXPs) that enable local Internet traffic to be routed locally, saving international bandwidth and reducing the costs of international Internet connectivity.

**ITU-T D.53 "International aspects of Universal Service"** offers guidelines to increase compliance with Universal Service policies as well as the extent to which they achieve their goal of delivering a minimum level of ICT services to every inhabitant of a country.

**The revised ITU-T D.271 "Charging and accounting principles for Next-Generation Network (NGN)"** sets out the general principles and conditions applicable to the use of packet-based networks to transport packets between standards-based interfaces and the services that they support.

**ITU-T D.97 "Methodological principles for determining international mobile roaming rates"** proposes a possible approach to the reduction of excessive roaming rates, highlighting the need to encourage competition in the roaming market, educate consumers and consider appropriate regulatory actions such as the introduction of caps on roaming rates.

**ITU-T D.261 "Principles for market definition and identification of operators with significant market power"** proposes principles and guidelines to assist countries in defining and identifying significant market power and assess whether or not, and the degree to which, this power has been abused by international telecommunications companies.

ITU SG3 has also reached agreement on the launch of a large volume of new work, including:

* Quantifying cross-border market power in telecommunications
* Impact of dynamic tariffing on market competitiveness
* Partnerships between OTT players and mobile network operators
* Guidelines for digital identity
* Consumer Protection in Mobile Financial Services
* Infrastructure sharing
* Roaming for IoT and M2M communications

[Full text of press release](http://www.itu.int/net/pressoffice/press_releases/2016/09.aspx#.V_uFK-V97mE)

# 9 Quality of service and experience

## 9.1 Models and tools for quality assessment of streamed media

ITU members have completed a family of **video quality monitoring standards in the ITU-T P.1200 series** of Recommendations. Standards in the ITU-T P.1201 series (i.e., ITU-T P.1201, ITU-T P.1201.1 and ITU-T P.1201.2) specify algorithmic models for non-intrusive monitoring of the audio, video, and audiovisual quality of IP-based video services based on packet-header information. Standards in the ITU-T P.1202 series (i.e., ITU-T P.1202, ITU-T P.1202.1 and ITU-T P.1202.2) specify algorithmic models for non-intrusive monitoring of the video quality of IP-based video services based on packet-header and bitstream information.

## 9.2 New standard to address quality of service (QoS) in mobile networks

**ITU-T E.804 defines QoS parameters and their computation for popular services in mobile networks, such as e-mail, video streaming and voice**. It also describes the measurement procedures needed to perform the measurements of QoS parameters.

ITU-T E.804 defines the minimum requirements of QoS measurement equipment for mobile networks in such a way that the values and trigger points needed to compute the QoS parameter can be measured following the procedures defined. In addition, it specifies typical measurement profiles that are required to enable benchmarking of different mobile networks both within and outside national boundaries.

**ITU-T E.800-series Supplement 9 provides "Guidelines on Regulatory Aspects of QoS"** to assist regulators or administrations in their pursuit of desired levels of QoS for one or more ICT services under their jurisdiction.

## 9.3 High-quality Voice over LTE

**ITU-T G.1028 "End-to-end QoS for voice over 4G mobile networks"** highlights the key factors influencing end-to-end Quality of Service (QoS) with respect to voice communications over 4G mobile networks. The new standard will form the basis of future ITU-T standards on specific aspects of QoS for VoLTE.

The entrance of 4G mobile-wireless communications signalled the arrival of a multimedia-rich user experience enabled by the advances in packet-based radio transmission introduced by IMT-Advanced (4G). Despite its significant advances over previous generations of mobile-wireless technology, ensuring high-quality voice communications over 4G networks remains a significant challenge to which industry continues to devote attention. Voice communications cannot tolerate packet loss or delay, making high-quality voice a significant challenge in the packet-based 4G environment.

## 9.4 Performance of mobile phones as gateways to car hands-free systems

*A mobile phone connected via short-range wireless communication (Bluetooth) to a vehicle's hands-free telephone system must satisfy certain requirements to achieve high-quality voice conversations. Hands-free communications in cars is gaining traction but low implementation of standards means imperfect performance across different vehicle and handset brands.*

Speech quality tests for vehicle-mounted hands-free systems are defined in **ITU-T P.1100 "Narrow-band hands-free communication in motor vehicles"** and **ITU-T P.1110 "Wideband hands-free communication in motor vehicles"**. These tests generate results that provide important information for car manufacturers, hands-free terminals (HFT) system suppliers, mobile network operators and mobile phone vendors on how to configure their products for greater interoperability, ultimately to improve the performance of mobile phones as gateways to car hands-free systems.

The 1st ITU test event on the performance of mobile phones as gateways to car hands-free systems, 12-16 May 2014, brought car manufacturers including Mercedes, Toyota, Volvo, Renault as well as Bosch together with makers of HFT and mobile phones to test their products according to ITU standards and encourage a new era of trouble-free hands-free communications. Of the 35 phones tested, roughly 30 per cent passed the tests (complying with the requirements of ITU-T P.1100 and P.1110). The remaining 70 per cent were found to produce performance degradation that would be noticeable to drivers and conversational partners.

The 2nd ITU test event on the performance of mobile phones as gateways to car hands-free systems, 23-25 May 2016, saw the participation of Bosch, Toyota, Jaguar Land Rover Limited, and Continental Automotive GmbH. The event carried out tests on 18 state-of-the-art mobile phones from 11 mobile phone vendors. A total of 34 tests (18 narrowband and 16 wideband) were carried out on 18 state-of-the-art mobile phones from 11 mobile phone vendors. Of the mobile phones tested, 22 per cent were found to comply with the requirements of ITU-T P.1100 and P.1110.

Learn more about the HFT testing from the relevant [web page](https://www.itu.int/en/ITU-T/C-I/Pages/HFT-mobile-tests/HFT_testing.aspx).

*ITU also organizes* ***on-demand testing of mobile phones*** *on the request of clients interested in determining which mobile phones perform as required when functioning as gateways to car hands-free telephone systems.*

# 10 Conformity, interoperability and testing

The [ITU Conformity and Interoperability (C&I) programme](http://www.itu.int/en/ITU-T/C-I/Pages/default.aspx) entered the 2013-2016 study period with a strengthened mandate resulting from WTSA-12's revision of [Resolution 76](http://www.itu.int/en/ITU-T/wtsa12/Documents/resolutions/Resolution%2076.pdf) ("Studies related to conformance and interoperability testing, assistance to developing countries, and a possible future ITU Mark programme").

***The ITU conformity and interoperability (C&I) programme is of particular value to developing countries*** *in their efforts to increase conformance with ITU standards and benefit from the improved interoperability that results from this conformance.*

ITU-T Study Group 11 (SG11) supports the coordination of ITU's C&I activities while also acting as the first point of contact for organizations interested in contributing to this work.

ITU-T SG11 maintains a list of key technologies within its mandate which the group considers suitable for C&I testing. This remains a living list and forms input to the first pillar of the four-pillar C&I programme which delineates C&I work into four separate but interdependent categories:

1. Conformity database
2. Interoperability events
3. Capacity building
4. Establishment of test centres in developing countries.

Actions 1 and 2 are led by the Telecommunication Standardization Bureau (TSB), actions 3 and 4 by the Telecommunication Development Bureau (BDT).

## 10.1 Conformance Assessment Steering Committee (CASC)

The main objective of ITU-T CASC is to set up criteria, rules and procedures to recognize Test Laboratories (TL) with competence in ITU-T Recommendation(s) and register these TLs in the ITU recognized TL list. This effort is supported by a guideline "Testing laboratories recognition procedure" agreed by ITU members, as well as a guiding conformance assessment roadmap. According to requests received from ITU members and ITU-T Study Groups, ITU-T CASC established a list of ITU-T Recommendations (e.g., ITU-T P.1140, ITU-T P.1100 and P.1110, and ITU-T K.116) which may become subjects of the future joint certification schemes.

ITU-T CASC is currently developing guidelines to detail collaboration mechanisms with accreditation bodies such as IECEE and ILAC. More details are available on the ITU-T CASC [web page](https://www.itu.int/en/ITU-T/studygroups/2013-2016/11/Pages/CASC.aspx).

## 10.2 ICT Product Conformity Database

In December 2014, ITU launched the ["ICT product conformity database"](http://www.itu.int/net/itu-t/cdb/ConformityDB.aspx) to provide industry with a means to publicize the conformance of ICT products and services with ITU-T Recommendations. The database assists users in their efforts to select standards-compliant products.

### 10.2.1 e-Health solutions

Information was provided on 95 e-health products for inclusion in the database at its launch. The e-health devices populating the database were tested for compliance with the specifications of the [ITU-T H.810 "Interoperability design guidelines for personal health systems"](http://eu.vocuspr.com/Tracking.aspx?Data=HHL%3d%3d%2f41A%26JDG%3c%3d2%3f27%2f.LP%3f%40185%3e&RE=IN&RI=740110&Preview=False&DistributionActionID=26956&Action=Follow+Link) sub-series, which are a transposition of the Continua Design Guidelines as international standards. The testing procedures are specified in the ITU-T H.820-H.850 sub-series of Recommendations.

### 10.2.2 Mobile phones compatible with Bluetooth-enabled vehicle hands-free terminals

The database includes mobile phones found to be compatible with Bluetooth-enabled vehicle hands-free terminals, compatibility determined in accordance with the 'Chapter 12 tests' ("Verification of the transmission performance of short-range wireless (SRW) transmission enabled phones") of ITU-T P.1100 and ITU-T P.1110. See section 9.4.

### 10.2.3 Ethernet services

Products found to comply with ITU-T G.8011/Y.1307 "Ethernet Services Characteristics" have also been added to the database. This standard as well as the corresponding tests are based on the work of MEF (formerly called Metro Ethernet Forum).

## 10.3 SIP-IMS conformity assessment

The direct "IP-IP" interconnection of fixed network operators using the IP Multimedia Subsystem (IMS) through Inter-IMS Network to Network Interface (NNI) is a complex issue due to differences in IMS implementations.

Addressing this challenge, fixed network operators have initiated a Session Initiation Protocol – IMS (SIP-IMS) standardization plan in ITU-T ([web page](http://www.itu.int/en/ITU-T/C-I/Pages/SIP/IMS.aspx)). The plan is guiding ITU-T's development of a set of international standards and related test specifications to provide a unified international reference for the implementation of SIP-IMS on fixed networks. These standards may be used for the conformity assessment of SIP-IMS-based equipment on fixed networks.

The plan provides for ITU-T to perform a gap analysis of all existing standards related to SIP-IMS profiles maintained by other standards-developing organizations (SDOs). Given the expectation that ITU-T will endorse certain ETSI standards during this standardization effort, ITU-T SG11 and [ETSI TC INT](https://portal.etsi.org/tb.aspx?tbid=715&SubTB=715) decided to hold joint meetings to ensure the involvement of all relevant parties.

57 new ITU-T standards on requirements and relevant test specifications for basic call and some supplementary services for SIP-IMS were finalized, according to the established standardization [work plan](http://www.itu.int/md/T13-SG11-160627-TD-GEN-1343/en).

ITU-T is inviting fixed network operators to establish an alliance to promote these basic requirements for IMS-based equipment. A plan to develop a list of terminal equipment compliant with the ITU-T Recommendations is also under discussion.

## 10.4 Internet-related performance measurements

**ITU-T Q.3960 "Framework of Internet related performance measurements"** is targeted at end-users of fixed and mobile networks for the assessment of Internet-related performance. This standard describes the framework for Internet-related performance measurements which can be established at the national or international level, providing customers of the existing public telecommunication operator's networks the possibility to measure their connection to the Internet. OECD and ETSI TC INT have supported this activity.

## 10.5 Benchmarking of IMS platform

A [work plan](http://www.itu.int/md/T13-SG11-160324-TD-WP4-0041/en) to standardize the benchmarking of IMS platform was finalized. 10 new ITU-T standards (ITU-T Q.3930; Q.3931.1/2/3/4; Q.3932.1/2/3/4; and Q.3933) were approved, covering basic concepts of benchmark testing and detailing the benchmark testing for PSTN/ISDN emulation, IMS/NGN/PES and VoLTE, as well as the reference benchmarking for VoIP and Fax over IP in fixed networks.

## 10.6 IPTV testing events

An ITU-T series of regular IPTV testing events ([web page](http://www.itu.int/en/ITU-T/C-I/interop/Pages/IPTV201609.aspx)) offers a continuous platform to test products based on both existing and developing ITU-T IPTV standards, to meet rapidly growing market needs. Recent events in October 2015 and June and September 2016 focused on ITU-T H.702 and ITU-T H.721, and the findings of these events contributed to discussions in ITU-T SG16. Experts expect that tested products will soon be on the market.

## 10.7 ITU-T studies on interconnection/interoperability of VoLTE/ViLTE services

2016 kicked-off with a new, high-priority ITU-T standards initiative to broker the international agreement of a framework for the interconnection of Voice and Video over LTE (VoLTE/ViLTE)-based networks. The framework will assist in expanding industry's offer of VoLTE/ViLTE 'roaming', where interactions between subscribers of different networks will be supported by seamless packet-based, high-quality voice and video communications. [Full text of press release](http://newslog.itu.int/archives/1203).

New ITU-T standards in this arena are expected to build greater uniformity in the use of existing, feature-rich standards capable of enabling VoLTE/ViLTE interconnection. The initiative is being undertaken in close cooperation with other standards bodies, building on existing standards and answering to industry's need for a unified international reference for VoLTE/ViLTE interconnection.

*The span of ITU-T work on VoLTE/ViLTE includes the deployment of signalling protocols for VoLTE interconnection, relevant numbering issues, quality of service (QoS) considerations, and emergency calls on VoLTE-based networks.*

# 11 Intellectual property rights

***Introduction to intellectual property in the context of ICT standardization***

[*An ITU publication on standard-essential patents, “Understanding patents, competition and standardization in an interconnected world”*](http://www.itu.int/en/ITU-T/ipr/Pages/Understanding-patents,-competition-and-standardization-in-an-interconnected-world.aspx) *provides an introduction to standardization and intellectual property systems and the various means with which ICT standards bodies manage their intersection.*

## 11.1 TSB Director's Ad Hoc Goup on Intellectual Property Rights

The [TSB Director’s Ad Hoc Group on Intellectual Property Rights (IPR AHG)](http://www.itu.int/en/ITU-T/ipr/Pages/adhoc.aspx) continues its work to protect the integrity of the standards-development process by clarifying aspects of the [ITU-R/ITU-T/ISO/IEC Patent Policy and related Guidelines](http://www.itu.int/en/ITU-T/ipr/Pages/revpatent.aspx) – the Union's main tool to manage the challenges associated with the incorporation of patents in [ITU-T and ITU-R Recommendations](http://www.itu.int/en/ITU-T/publications/Pages/recs.aspx).

Following the high-profile [ITU Patent Roundtable](http://www.itu.int/en/ITU-T/Workshops-and-Seminars/patent/Pages/default.aspx) in October 2012, striking the right balance between the owners and users of intellectual property was the subject of an accelerated series of meetings of the IPR AHG.

At its 2014 session, TSAG approved the proposal of the [IPR AHG](http://www.itu.int/en/ITU-T/ipr/Pages/adhoc.aspx) to clarify that reasonable and non-discriminatory (RAND) licensing commitments made to ITU are intended to bind both the current patent holder and subsequent purchasers of the patents.

At its meeting in Sophia Antipolis, 15-17 April 2015, the IPR AHG agreed to changes proposed by ISO and IEC to the Guidelines for the implementation of the ITU-R/‌ITU‑T/ISO/IEC Common Patent Policy.

## 11.2 Patents in Telecoms Conference

On 5-6 November 2015, ITU, in collaboration with ETSI, the GSM Association (GSMA), University College London and George Washington University, co-organized the second edition of the Patents in Telecoms Conference.

This event, which took place at George Washington University, Washington DC, USA, brought together key representatives of a wide range of industry, standards bodies, judges and competition authorities to discuss the topics of innovation and standardization, standard essential patents, non-practicing entities and privateering.

Approximately 180 participants have been able to engage with internationally renowned experts and exchange views and experiences and identify possible solutions to the key issues affecting the industry in the field of competition, patents and standards. Additional details about the event can be found at: <http://www.ucl.ac.uk/laws/patents-in-telecoms-2015/>.

## 11.3 Workshop on "Open Source and Standards for 5G"

A workshop on "Open Source and Standards for 5G" was organized in partnership by ITU and NGMN Alliance on 25 May at Qualcomm Headquarters in San Diego, California.

The ITU-NGMN event gathered a diverse mix of participants to forecast the technical characteristics of the 5G era, sharing expert views on the expected interplay between standards and open-source developments and the modes of collaboration we may see emerging between standards and open-source communities.

The event built on this technical discussion by exploring related legal challenges, tackling questions such as whether standards and open-source licensing regimes are compatible and whether open-source licenses should be pre-defined or left open to negotiation. Experts weighed-up the relative merits of open-source and patent-pool licenses, as well as how we might mitigate the threat of 'patent ambush' in the 5G context.

At the heart of these discussions was the question of what impact IPR will have on the efficiency of collaboration between standards and open-source communities, particularly with respect to implications for the incentive to innovate and contribute to standards development.

# 12 Combating counterfeit ICT devices

The revised ITU Technical Report on Counterfeit ICT Equipment approved by ITU members in December 2015 is now available for download free of charge in the six official languages of the Union. The report offers background information on the nature and scale of the challenges posed by ICT counterfeiting, including a review of the ICT products vulnerable to counterfeiting and the various countermeasures employed by ICT manufacturers, industry associations and intergovernmental bodies. [Download the Technical Report here...](https://www.itu.int/pub/T-TUT-CCICT-2014)

ITU members are achieving strong progress in its development of a new Recommendation detailing a "Framework for solution to combat counterfeit ICT Devices". This Recommendation will contain the reference framework with the requirements that should be considered when deploying solutions to combat counterfeit ICT devices. It responds to PP-14 Resolution 188 on Combating Counterfeit Telecommunication/ICT Devices. ITU members have also agreed to develop a new Technical Report on the "Use of anti-counterfeiting technical solutions relying on unique and persistent mobile device identifiers" and are in the process of developing a Technical Report outlining "Guidelines on Best Practices and Solutions in the Combating of Counterfeit ICT Devices".

TSB complemented this technical work with a survey in Africa, undertaken in collaboration with BDT, aimed at collecting information on the challenges faced by the region with respect to ICT counterfeiting and efforts underway to overcome these challenges. The survey will serve as a basis to develop anti-counterfeiting best practices, regulatory frameworks and technical specifications tailored to the African context. The first outcomes of the survey called for the establishment of a Regional Group for Africa within ITU-T Study Group 11, which will initiate activity in 2017.

***A joint ITU-OECD case study on the trade in counterfeit ICTs*** *will identify and quantify the categories of ICT products affected, and charts and analyzes the evolution of counterfeit trade routes in terms of origins, key transit points and destinations. The findings of the case study will include a set of policy questions to be considered by policymakers and industry.*

# 13 ITU-T Focus Groups: Exploring new directions in ITU standardization

Focus Groups are formed in response to immediate ICT standardization demands, tasked with establishing the basis for subsequent standardization work in ITU-T Study Groups. These groups are the place to explore new directions in ITU standardization.

Focus Groups are open to ITU members as well as organizations outside ITU's membership, and these groups are afforded great flexibility in their chosen deliverables and working methods.

## 13.1 Network aspects of IMT-2020

See section 3.2.

## 13.2 Digital Financial Services

Active from 2014-06 to present, the [ITU-T Focus Group on Digital Financial Services (FG DFS)](http://www.itu.int/en/ITU-T/focusgroups/dfs/Pages/default.aspx) addresses a series of critical issues currently preventing digital financial services from reaching unbanked or under-banked populations. FG DFS has worked to develop guidelines, principles and toolkits based on international best practices, which will be adapted and implemented by countries looking to capitalize on digital and mobile technologies in their efforts to increase access to basic financial services for people that today remain at the margin of society.

FG DFS is working in close collaboration with international organizations in the field of financial inclusion such as the World Bank and the Alliance for Financial Inclusion (AFI), the financial services and telecom regulators and the digital financial services players.

The Focus Group, incorporating 60 organizations from some 30 countries, aims to bridge the gap between telecommunications and financial services regulators, and the private and public sectors. Representatives from across the DFS ecosystem pragmatically address some of the major issues currently preventing DFS from serving the unbanked.

The Focus Group has created four thematic working groups covering the following areas:

* The DFS ecosystem
* Technology, Innovation and Competition
* Interoperability
* Consumer Experience & Protection

Each working group is composed of a diverse group of stakeholders consisting of regulatory authorities, mobile network operators, payment service providers, platform providers and consumer protection organizations to ensure balance.

Taking into account the findings of the working groups, FG DFS will recommend next steps and further work. [Full text of press release](http://www.itu.int/net/pressoffice/press_releases/2015/34.aspx) and [here](http://newslog.itu.int/archives/1176).

The Focus Group has endorsed a range of thematic reports:

1. [The Digital Financial Services Ecosystem](http://www.itu.int/en/ITU-T/focusgroups/dfs/Documents/09_2016/FINAL%20ENDORSED%20ITU%20DFS%20Introduction%20Ecosystem%2028%20April%202016_formatted%20AM.pdf) maps the overall ecosystem of DFS, identifying all key stakeholders, and looks at the critical elements necessary to make the ecosystem develop so that it encourages and enables financial inclusion policies.
2. [Enabling Merchant Payments Acceptance in the Digital Financial Ecosystems](http://www.itu.int/en/ITU-T/focusgroups/dfs/Documents/09_2016/FINAL%20ENDORSED%20Enabling%20Merchant%20Payments%20Acceptance%2030%20May%202016_formatted%20AM.pdf) describes the merchant services value chain, develops a segmentation scheme for different types of payments acceptors, and identifies the payments-related attributes of each segment. It also develops suggestions on ways to accelerate the adoption of electronic payments acceptance.
3. [Review of National Identity Programmes – A report from the Evans School of Public Policy and Governance](http://www.itu.int/en/ITU-T/focusgroups/dfs/Documents/09_2016/Review%20of%20National%20Identity%20Programs.pdf) looks at 48 national identify programmes in 43 developing countries. With identification systems becoming more common across Latin America, South and Southeast Asia, and Sub-Saharan Africa, the report concludes that not only is penetration much higher than expected, but so are the number of biometric national ID programmes. It evaluates how these programmes are being used to drive provision of DFS services.
4. [Quality of Service (QoS) and Quality of Experience (QoE) aspects of Digital Financial Services](http://www.itu.int/en/ITU-T/focusgroups/dfs/Documents/09_2016/FGDFSQoSReport.pdf): This Report identifies and proposes Key Performance Indicators (KPIs) to be considered for digital financial services.
5. [Regulation in the Digital Financial Services Ecosystem](http://www.itu.int/en/ITU-T/focusgroups/dfs/Documents/09_2016/Regulation%20and%20the%20DFS%20Ecosystem.pdf) identifies categories of regulation and addresses a number of issues relating to managing the regulatory environment. It includes an analysis of how regulators currently work together and provides a model memorandum of understanding that national regulators can adopt to formalise their collaboration and interaction in view of co-regulating the DFS marketplace.
6. [Commonly identified Consumer Protection themes for Digital Financial Services](http://www.itu.int/en/ITU-T/focusgroups/dfs/Documents/09_2016/ConsumerProtectionThemesForBestPractices.pdf) identifies four common themes that policy makers or regulators may want to consider when developing laws, regulations or guidelines around consumer protection. This includes provision of information and transparency, fraud prevention, dispute resolution and data privacy and protection.
7. [Access to Payment Infrastructures](http://www.itu.int/en/ITU-T/focusgroups/dfs/Documents/09_2016/Access%20to%20Payment%20Infrastructures.pdf) analyzes access-to-payment-infrastructure issues around the world, and how these can affect the development of safe, efficient, interoperable and financially inclusive payment services. The report focuses on non-banks that are playing an increasingly important role in payments, including the provision of payments services directly to end-users.
8. [Cooperation frameworks between Authorities, Users and Providers for the development of the National Payments System](http://www.itu.int/en/ITU-T/focusgroups/dfs/Documents/09_2016/Cooperation%20frameworks%20between%20Authorities%2c%20Users%20and%20Providers%20for%20the%20development%20of%20the%20National%20Payments%20System.pdf) analyzes the role and cooperation process of key stakeholders in the development of national payment systems (NPS), in particular of retail payments.

The final set of FG DFS deliverables is expected to be published in January 2017.

## 13.3 Aviation Applications of Cloud Computing for Flight Data Monitoring

Motivated by the events surrounding Malaysia Airlines flight MH370, ITU convened an [Expert Dialogue on Real-time Monitoring of Flight Data](http://www.itu.int/en/ITU-T/Workshops-and-Seminars/ccsg/expdial/Pages/default.aspx). Participants issued a [communiqué](http://www.itu.int/en/ITU-T/Workshops-and-Seminars/ccsg/expdial/Documents/communique.pdf) highlighting the future need for ICAO (International Civil Aviation Organization) and ITU to facilitate an open, multidisciplinary, multistakeholder and performance-based approach towards the establishment of international standards for the use of an aviation cloud for real-time monitoring of flight data.

Active from 2014-06 to 2016-02, the [ITU-T Focus Group on Aviation Applications of Cloud Computing for Flight Data Monitoring (FG AC)](http://www.itu.int/en/ITU-T/focusgroups/ac/Pages/default.aspx) identified the standardization requirements for an aviation cloud for the real-time monitoring of flight data.

The Focus Group's four deliverables:

*“I believe that data from aircraft, including from the black box could be continuously transmitted and stored in data centres on the ground” ~* H.E. Ahmad Shabery Cheek, Minister for Communications and Multimedia, Malaysia, 30 March 2014, at the ITU World Telecommunication Development Conference (WTDC-14).

* Existing and Emerging Technologies of Cloud Computing and Data Analytics
* Use cases and requirements
* Avionics and Aviation Communications Systems
* Key findings and recommendations for next steps and future work

FG AC has working in close collaboration with ITU-R and the aviation community, with meetings hosted by the Government of Malaysia in Kuala Lumpur, Malaysia), February 2015 (hosted by ICAO in Montreal, Canada), May 2015 (ITU Headquarters in Geneva), August 2015 (hosted by Teledyne Controls in Los Angeles, United States) and December 2015 (hosted by Deutsche Lufthansa in Frankfurt, Germany).

In related ITU work, [agreement was reached](http://www.itu.int/net/pressoffice/press_releases/2015/51.aspx) at the 2015 World Radiocommunication Conference (WRC-15) on the allocation of radiofrequency spectrum for global flight tracking in civil aviation.

## 13.4 Smart sustainable cities

Active from 2013-02 to 2015-05, the [ITU-T Focus Group on Smart Sustainable Cities (FG SSC)](http://www.itu.int/en/ITU-T/focusgroups/ssc/Pages/default.aspx) offered an open platform for smart-city stakeholders – such as municipalities; academic and research institutes; non-governmental organizations (NGOs); and ICT organizations, industry forums and consortia – to strengthen means of leveraging information and communication technologies (ICTs) in building sustainable urban environments and identifying the standardized frameworks needed to support the integration of ICT services in cities.

FG-SSC concluded its activity in May 2015 with the approval of 21 technical specifications and reports. The technical specifications and reports cover topics including, inter alia, climate change mitigation and adaptation, EMF considerations, key performance indicators for smart sustainable cities, cybersecurity and data protection, and smart water management.

The technical reports and specifications have assisted ITU-T Study Group 5 in the development of related Supplements or Recommendations. One of the reports, for example, provided the basis for development of ITU-T L.1503 "Information and communication technologies for climate change adaptation in cities", a standard developed with input from UNFCCC.

## 13.5 Smart Water Management

[*A flipbook on "Shaping smarter and more sustainable cities: Striving for sustainable development goals"*](http://wftp3.itu.int/pub/epub_shared/TSB/ITUT-Tech-Report-Specs/2016/en/flipviewerxpress.html) *provides a compendium of all the Technical Reports and Technical Specifications developed by FG-SSC.*

Active from 2013-06 to 2015-03, the [ITU-T Focus Group on Smart Water Management (FG SWM)](http://www.itu.int/en/ITU-T/focusgroups/swm/Pages/default.aspx) provided a platform to share views on smart water management, develop a series of deliverables and showcase initiatives, projects, policies and standards activities. FG-SWM worked in close collaboration with FG SSC.

FG SWM produced four final deliverables:

* Technical Report on "The Role of ICTs in Water Resource Management"
* Technical Report on "Requirements for water sensing and early warning systems"
* Technical Report on "Smart water management – Global initiatives and key stakeholders"
* Technical Report on "Standardization gap analysis for smart water management"

## 13.6 Bridging the Gap: from Innovation to Standards

Active from 2012-01 to 2015-05, the [ITU-T Focus Group on Bridging the Gap: from Innovation to Standards (FG Innovation)](http://www.itu.int/en/ITU-T/focusgroups/innovation/Pages/default.aspx) worked to document and analyze successful cases of ICT innovations and identify relevant standardization gaps which can lead to new study items for ITU-T. The group offered initial platform for recognition and identification of innovations emerging in developing countries that may benefit from standardization.

FG Innovation concluded its activities with release of two deliverables:

* Successful cases of ICT innovations for developing countries
* New Standardization Activities for ITU-T Study Groups

## 13.7 Disaster Relief Systems, Network Resilience and Recovery

Active from 2012-01 to 2014-06, the [ITU-T Focus Group on Disaster Relief Systems, Network Resilience and Recovery (FG-DR&NRR)](http://www.itu.int/en/ITU-T/focusgroups/drnrr) developed eight technical reports that provide a comprehensive view of the technical frameworks underlying emergency communications and their emerging standardization needs. These reports have offered stimulus to related standardization work in ITU-T Study Groups, in particular ITU-T Study Groups 2 and 15 (See section 7.4).

## 13.8 Smart Cable Television

Active from 2012-06 to 2013-12, the [ITU-T Focus Group on Smart Cable Television (FG SmartCable)](http://www.itu.int/en/ITU-T/focusgroups/smartcable) published its final deliverable, which comprises six technical chapters, to assist development of ITU standards by ITU-T Study Group 9 on the topic of "Smart Cable Television" – specifically, advanced technologies and services and improvements to deployed technologies to be carried over cable-broadband networks.

The charter of the FG SmartCable was to solicit and collect input from individuals and entities working on the forefront of these innovative technologies, and it received contributions from experts throughout the world.

## 13.9 Machine-to-Machine Service Layer

Active from 2012-01 to 2013-12, the [ITU-T Focus Group on M2M Service Layer (FG M2M)](http://www.itu.int/en/ITU-T/focusgroups/m2m) developed technical reports to drive progress on M2M APIs and protocols to support M2M services and applications.

FG M2M's five Technical Reports pinpoint M2M standardization gaps in the e-health field provide an overview of M2M-enabled e-health ecosystems and describe use-cases of e-health applications and services involving M2M technologies. Of the use-cases outlined, particular attention is paid to 'remote patient monitoring' and 'ambient-assisted living', areas well suited to ITU-T's standardization expertise.

The reports identify the requirements of the M2M service layer – common to all M2M verticals, and specific to e-health – to define an architectural framework of the M2M service layer and to analyse its application programming interface (API) and protocol requirements.

## 13.10 Audiovisual Media Accessibility

Active from 2011-05 to 2013-10, the [ITU-T Focus Group on Audiovisual Media Accessibility (FG AVA)](http://www.itu.int/en/ITU-T/focusgroups/ava) addressed the need to make audiovisual media accessible for persons with disabilities. The Focus Group also has the support and encouragement of ITU-R Study Group 6 which is responsible for broadcasting. The Group examines the situation for all audiovisual delivery media – broadcast, cable, IPTV, Internet, and mobile, and looks, where possible, for common solutions.

FG AVA saw the participation of experts with disabilities, and interest groups of those with disabilities, which is a major benefit to the work. The maxim of the disabled community for the development of access services is 'nothing for us without us', which FG AVA endeavoured to comply with as far as possible.

FG AVA produced 18 deliverables now the basis for related work in ITU-T Study Group 16. Some of the work was also reviwed by the Intersector Rapporteur Group on Audiovisual Media Accessibility (IRG-AVA) and transferred to ITU-R Study Group 6 (on broadcasting).

## 13.11 Driver Distraction

Active from 2011-02 to 2013-03, the [ITU-T Focus Group on Driver Distraction (FG Distraction)](http://www.itu.int/en/ITU-T/focusgroups/distraction) was instrumental in raising awareness around ITU-T activity on driver distraction and the scale of this workload, as well as in providing clear direction to ITU-T's driver-distraction work plan. The group was also successful in opening lines of communication with key organizations and drawing new expertise into the ITU-T standardization process.

The objective of FG Distraction was to reduce injuries and fatalities by minimizing the cognitive demands associated with both driving tasks (e.g., navigating, collision avoidance) and non-driving tasks (e.g., talking on the phone, checking meeting information).

***ITU's engagement with driver distraction originated with ITU Council Resolution 1318 on ITU's role in ICTs and improving Road Safety (April 2010)****.*

*The Resolution was made in response to the fact that, as stated in Resolution 1318, “driver distraction and road-user behaviour, which includes among many examples 'texting', 'text messaging', interfacing with in-vehicle navigation or communication systems, are among the leading contributors to road traffic fatalities and injuries.”*

FG Distraction's five technical reports describe user interface requirements for automotive applications; system capabilities for improving the safety of driver interaction with applications and services; and approaches being used to enable external applications to communicate with a vehicle.

The conclusions put forward by the reports have been taken up by the two groups leading ITU-T's standardization work on driver distraction, ITU-T Study Groups 12 and [16](http://www.itu.int/en/ITU-T/about/groups/Pages/sg16.aspx). New related work items calling for external coordination and collaboration may also be addressed by the [Collaboration on ITS Communication Standards](http://www.itu.int/en/ITU-T/extcoop/cits/Pages/default.aspx).

## 13.12 From/In/To Cars Communication

Active 2009-11 to 2013-03, the [ITU-T Focus Group "From/In/To Cars Communication" (FG CarCOM)](http://www.itu.int/ITU-T/focusgroups/carcom) released a final report documenting the group's work on the characterization of subsystems found in a car, including those used for hands-free communication. A concept was developed to describe the different subsystems in such a way that this concept can be applied for all types of implementations. The new concept of "performance class" was developed and applied to all individual parameters used to characterize the different subsystems.

New methods to simulate acoustics environments were developed and integrated in the Draft standard FG.VSSR. These methods take into account, for example, the time variant behavior of an acoustical transmission path and could be applied to a variety of other ITU-T standards. FG.VSSR has since been developed into Recommendation ITU-T P.1130 "Subsystem requirements for automotive speech services".

# 14 ITU-T Technology Watch reports

[Technology Watch](http://www.itu.int/en/ITU-T/techwatch/Pages/default.aspx) explores emerging ICT trends and associated demands on international standardization, determining how these trends can be supported by the ITU-T work programme. These reports are intended to provide an up-to-date assessment of new technologies in language that is accessible to non-specialists. Technology Watch has been successful in assessing the impact of new technologies both on developed and developing countries, as well in analyzing related implications for international standardization activities.

2015 hosted a change to the target audience, content and format of Technology Watch reports. Whereas in previous years the target audience was the ICT-savvy but non-expert reader and reports were written or co-written in part by TSB staff, reports issued since 2015 have been written by experts in specific fields in a format more relevant to the work of experts participating in ITU-T Study Groups or Focus Groups.

## 14.1 Technology Watch reports in 2013 and 2014

[The Tactile Internet](http://www.itu.int/en/ITU-T/techwatch/Pages/tactile-internet.aspx)

Extremely low latency in combination with high availability, reliability and security will define the character of the Tactile Internet. It will have a marked impact on business and society, introducing numerous new opportunities for emerging technology markets and the delivery of essential public services. This Technology Watch report outlines the potential of the Tactile Internet, exploring its promise in application fields ranging from industry automation and transport systems to healthcare, education and gaming. It goes on to describe the Tactical Internet's demands on future digital infrastructure and its expected impact on society, concluding with a brief discussion of the role to be played by the ITU framework.

[Big Data: Big today, normal tomorrow](http://www.itu.int/en/ITU-T/techwatch/Pages/big-data-standards.aspx)

As with many emerging technologies, several challenges need to be identified and addressed to facilitate the adoption of big data solutions in a wider range of scenarios. This Technology Watch report looks at different examples and applications associated with the big data paradigm, identifies commonalities among them by describing their characteristics, and highlights some of the technologies enabling the upsurge of big data.

[Location matters: Spatial standards for the Internet of Things](http://www.itu.int/en/ITU-T/techwatch/Pages/spatial-standards.aspx)

Precise and accurate location (spatial) information enhance our association with our natural and built environments. This report looks at the global effort to weave different sources and formats of spatial information together so that they can be useful to people wherever they are and whatever they are doing.

[The Mobile Money Revolution](http://www.itu.int/en/ITU-T/techwatch/Pages/mobile-money-standards.aspx)

"Mobile money" refers to financial transactions and services that can be carried out using a mobile device such as a mobile phone or tablet. These services may or may not be linked directly to a bank account. Previously, recharging your mobile meant adding more airtime but now increasingly you will be able to add money to it, keep all your credit cards and loyalty coupons, access your bank account and use it like your ordinary wallet for payments. Innovations in mobile money could lead to a drastic change in the way people pay for goods and services in the near future.

* [Part 1](http://www.itu.int/oth/T2301000020/en) of the report focuses on innovations in the mobile payments landscape, and in particular on NFC contactless mobile payments and the likely impact on future standardization activities.
* [Part 2](http://www.itu.int/oth/T2301000020/en) highlights mobile money transfer and mobile banking services and their link to enabling financial inclusion.

[Smart City Seoul](http://www.itu.int/en/ITU-T/techwatch/Pages/smart-city-Seoul.aspx)

Rapid urbanization is exerting growing pressure on cities' traditional infrastructures, and ICTs present very viable means of updating these infrastructures to reflect the demands of 21st century societies. This Technology Watch report analyzes Seoul's implementation of its "Smart Seoul 2015" project, providing a best-practice guide to the construction and operation of a smart city. The report investigates the conceptual underpinnings of Smart Seoul, the use of smart technologies and mobile-web applications to provide citizen-centric services, and the role of technical standards as the precondition for smart city functionality.​

## 14.2 Technology Watch reports in 2015 and 2016

[Standardization of MPTCP proxy-based LTE-WiFi aggregation](http://www.itu.int/md/T13-SG13-160627-TD-WP2-0588/en)

This report explores current trends and challenges in combining Wi-Fi with LTE. The three most popular LTE + WiFi aggregation solutions are: LTE in Unlicensed/Licensed Assisted Access (LTE-U/LAA), LTE-WiFi link aggregation (LWA) and Multipath TCP Proxy-based aggregation (MPTCP).

[Trust provisioning for future ICT infrastructures and services](http://www.itu.int/pub/T-TUT-TRUST-2016-1)

This report describes the importance and necessity of trust in the ICT context, highlighting its relevance to emerging knowledge societies and describing the concepts and key features of trust. Following its identification of key challenges and technical issues, the report presents an architectural overview of trusted ICT infrastructures. It goes on to introduce trust-based ICT service models and use cases, and proposes strategies for future standardization on trust. Appendices to the report summarize trust-related activities in other standardization bodies, and provide background information on ICT service model analysis frameworks and detailed use cases.

[Future social media and knowledge society](http://www.itu.int/pub/publications.aspx?lang=en&parent=T-TUT-TRUST-2015)

This report analyzes the trends of digital technologies and their impact on society and recommends pre-standardization areas for ITU-T such as data classification, types and formats; functional architecture and trust provisioning of a knowledge information infrastructure.

[Secure over-the-air vehicle software updates – operational and functional requirements](http://www.itu.int/md/T13-SG16-160523-TD-WP2-0476/en)

Proven techniques and technologies exist for designing secure on-board systems and for delivering firmware over-the-air (FOTA) and software over-the-air (SOTA) updates to vehicles, and these are the focus of intensive standardisation efforts at this time. This document addresses the business process issues of secure over-the-air updating. FOTA/SOTA telecommunications standardisation must be complemented by a set of business methods that on one hand are comprehensive enough to cover the full life-cycle of all vehicles and on the other can accommodate the individual practices of the vehicle OEMs from the time a vehicle is designed until it is taken out of service.  This document identifies and clarifies the business process issues that must function in parallel to the technical ones.

This was presented for information to ITU-T SG16 and SG17, and the two groups agreed that ITU-T SG16 would take the lead in transforming the information into an ITU-T Technical Report.

[Analysis of use cases, key performance indicators and white papers in 5G](https://extranet.itu.int/ITU-T/focusgroups/imt-2020/FG%20IMT2020%20Input%20Documents/I-030.docx?Web=1)

This paper was an input to the first meeting of the ITU-T Focus Group on IMT-2020. See section 3.2.

[Requirements for networks in Africa](http://www.itu.int/md/T13-SG13-151130-TD-WP1-0421/en)

This paper analyzes the current status of networks in Africa; the adaptability of the African networks to new technological advancements; the suitability of African networks to deliver new services and new applications; the success stories on setting up new/enhanced networks in Africa in accordance with the African continent requirements and network elements; the challenges faced while installing/transiting/migrating to new networks; forecasts of the future needs of African countries in terms of network requirements and their impact on the everyday life on the continent; and the possible roles of ITU in this arena.

[Mapping the Sustainable Development Goals to ITU-T](http://www.itu.int/md/T13-TSAG-160201-TD-GEN-0419/en)

The document, presented to the February 2016 meeting of TSAG, maps the SDGs to the work programme of ITU-T and proposes actions for ITU-T towards contributing to the SDGs. Following the presentation of this document to TSAG, ITU developed a mapping tool to map all ITU-wide objectives and outputs to SDG goals and targets.

Telco over Web

This report describes state-of-the-art Web technologies and examines new business opportunities for telco operators as the Web grows in its volume and evolves in its capability. (Report to come.)

The future of video

This report analyzes new consumption trends of video, taking into account the development of social media and web technologies. The standardization activities of N-screen environments, 4K/8K video coding including augmented and virtual reality, MPEG-DASH with the combination of MPEG and web technologies, metadata format and digital right management are investigated. (Report to come.)

# 15 Collaboration in standardization

Some 10 per cent of all ITU standards are common or aligned texts with the ISO/IEC Joint Technical Committee 1 on Information Technology (ISO/IEC JTC1). Highlights of IEC, ISO and ITU’s collaboration in the 2013-2016 study period include the release of ITU-T H.265 HEVC (see section 4.1.1) and two standards fundamental to the cohesion of cloud computing’s development (see section 3.5).

ITU collaboration with IEEE and MEF is crucial to ITU's work on Carrier-class Ethernet (see sections 10.2.3 and 15.8), and successful collaboration with the Broadband Forum was essential to the development of the ITU G.fast broadband standard (see section 1.1).

ITU-T collaboration with the Personal Connected Health Alliance (formerly Continua Health Alliance) led to the release of new ITU standards to support the development of medical-grade e-health devices (see section 5.6). ITU-T continues its longstanding collaboration with bodies active in the healthcare field, such as WHO, the Personal Connected Health Alliance, IEEE, the International Organization for Standardization (ISO), the European Committee for Standardization (CEN), Health Level Seven International (HL7), Joint Initiative Council (JIC), Digital Imaging and Communications in Medicine (DICOM), ETSI, GSMA, and the World Wide Web Consortium (W3C).

FG AC benefited from the participation of the International Civil Aviation Organization (ICAO) and the International Air Transport Association (IATA), as the participation of the aviation and avionics sectors was crucial to ITU-T's study of aviation applications of cloud computing for flight data monitoring (see section 13.3).

ITU-T has strengthened its cooperation with other bodies active in tackling environmental issues, including the European Telecommunications Standards Insitute (ETSI), the Institute of Electrical and Electronics Engineers (IEEE), the World Health Organization (WHO), the World Meteorological Organization (WMO), the UN Economic Commission for Europe (UNECE), the UN Educational, Scientific and Cultural Organization (UNESCO), the Intergovernmental Oceanographic Commission of UNESCO (UNESCO-IOC), United Nations University, the UN Industrial Development Organization (UNIDO), the UN Environment Programme (UNEP), the Economic Commission for Latin America and the Caribbean (ECLAC), the UN Framework Convention on Climate Change (UNFCCC), the Inter-American Telecommunication Commission (CITEL), the World Intellectual Property Organization (WIPO), the Basel Convention, the UN Development Programme (UNDP), UN-Habitat, the Comisión Tecnica Regional de Telecomunicaciones (Comtelca), the Global e-Sustainability Initiative (GeSI), Solving the e-Waste Problem (Step), and the Asociación Interamericana de Empresas de Telecomunicaciones (ASIET).

## 15.1 Chief Technology Officer meeting

[Chief Technology Officer (CTO) meetings](http://www.itu.int/en/ITU-T/tsbdir/cto/Pages/default.aspx) bring together industry executives to highlight their business priorities and supporting standardization strategies.

The fourth Chief Technology Officer (CTO) meeting, 2012, Dubai, United Arab Emirates, acknowledged increasing industry convergence powered in large part by ICTs. Industry leaders highlighted the need for standardization working methods that better engage vertical market players to support innovations in areas such as e-health, e-learning, intelligent transport systems, mobile money and smart grid.

CTOs also emphasized the need for collaboration between the mobile and transport and access standardization communities, calling this collaboration crucial to ensure a coordinated approach to the development of optical transport standards supporting the rollout of mobile broadband beyond 4G. The 2012 CTO meeting communiqué submitted to WTSA-12 also offered continued support for ITU's efforts to bridge the standardization gap.

[2012 CTO meeting communiqué](http://www.itu.int/en/ITU-T/tsbdir/cto/Documents/121118/CTO%20Communique%202012.pdf)

The fifth CTO meeting held in conjunction with [ITU Telecom World 2013](http://world2013.itu.int/) in Bangkok, Thailand highlighted Big Data and fibre-to-the-home (FTTH) technologies as areas where ITU is well positioned to lead the coordination of international standards development. CTOs also called for ITU to prioritize its development of standards targeting end-to-end Quality of Service/Experience (QoS/QoE) for fixed and mobile networks under pressure to deliver on escalating mobile data demand.

[2013 CTO meeting communiqué](http://www.itu.int/en/ITU-T/tsbdir/cto/Documents/131118/CTO%20MEETING%20COMMUNIQU%c3%89%20November%20final.docx)

IoT, ITS, access and transport networks, efficient video coding, SDN and NFV were among the key topics on the agenda of the sixth CTO Meeting, 2014, Doha, Qatar.

CTOs identified areas to be considered within ongoing ITU-T standardization efforts on IoT, namely architecture, capabilities, security, privacy, semantics, and interworking with cyber-physical systems. The TSB Director was thus requested to consider these aspects when carrying out the instructions of PP-14 Resolution 197 ("Facilitating the Internet of Things to prepare for a globally connected world").

[2014 CTO meeting communiqué](http://www.itu.int/en/ITU-T/tsbdir/cto/Documents/141206/Communique.pdf)

The seventh CTO meeting at ITU Telecom World 2015 reaffirmed that 5G research and development, and supporting standardization, will be industry's top priority over the coming five years.

CTOs also identified service interoperability in fixed-mobile hybrid environments, trusted information infrastructure and open-source solutions as topics of particular strategic importance to industry as we approach the 5G era.

[2015 CTO meeting communiqué](http://www.itu.int/en/ITU-T/tsbdir/cto/Documents/151011/Communiqu%c3%a9%20-%20CTO%20meeting%202015%20-%2011%20October%202015.pdf)

Following a call to action from the 2015 CTO meeting, ITU-T organized a workshop on 1 December 2015 on VoLTE/ViLTE ([web page](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/conformity-interoperability/20150112/Pages/default.aspx), [full text of press release](http://newslog.itu.int/archives/1163)) devoted to the interoperability and interconnection issues which impede operators to set up roaming for VoLTE/ViLTE services. [Full text of press release](http://www.itu.int/net/pressoffice/press_releases/2015/CM15.aspx) on results of 2015 CTO meeting.

***CJK regional CTO consultations***

*Consultations with CTOs of China, Japan and Korea – in 2015 (*[*communiqué*](http://www.itu.int/en/ITU-T/tsbdir/cto/Documents/150414/Final-communique.pdf)*) and 2016 (*[*press release*](http://newslog.itu.int/archives/1231)*), Seoul, Korea – called for standardization to support networking innovations to meet the demands of 5G systems, rapid growth in video traffic and ubiquitous smart technologies****.***

## 15.2 World Standards Cooperation: IEC, ISO and ITU

The World Standards Cooperation (WSC) is a partnership of ITU, ISO and IEC to promote international standards.

IEC, ISO and IEC collaboration to improve the accessibility of ICTs to persons with disabilities has given rise to a common guide to mainstream the consideration of accessibility in the development of international standards. See section 17.4.

In the domain of Accessibility to ICTs, ITU-T has strengthened its cooperation with the other UN Agencies and international organizations through active participation in the Inter-Agency Support Group (IASG) for the UN Convention on the Rights of Persons with Disabilities (UNCRPD).

The WSC Academic Day promotes dialogue between universities and the international standards community, raising awareness and fostering cooperation and joint initiatives. See section 17.3.4.

The first World Smart City online community was launched in January 2016 to assist city stakeholders in their efforts to develop Smart Sustainable Cities. The new community aims to identify the top 'pain points' presenting challenges to city development. Find the online community [here](http://www.worldsmartcity.org/).

The community launch was part of the build-up to the first World Smart City Forum, organized by IEC in partnership with ISO and ITU. The Forum was held in Singapore on 13 July 2016, co-located with the World Cities Summit [www.worldcitiessummit.com.sg/](http://www.worldcitiessummit.com.sg/) and Singapore International Water Week [www.siww.com.sg](http://www.siww.com.sgg).

World Standards Day is a UN-recognized international day of observance held each year on 14 October. The celebration of World Standards Day is led by IEC, ISO and ITU, paying tribute to the collaborative efforts of the thousands of experts worldwide who develop the voluntary technical agreements that are published as international standards. The #speakstandards video competition held in 2015 and 2016 has replaced the World Standards Day poster competition as the main effort to raise awareness of international standards in the build-up to World Standards Day.

## 15.3 Global Standards Collaboration

ITU-T continues to engage in many collaborative standardization efforts with other SDOs such as the [Global Standards Collaboration (GSC)](http://www.itu.int/en/ITU-T/gsc/Pages/default.aspx).

The 17th Global Standards Collaboration (GSC-17) was hosted by Telecommunications Technology Association (TTA) of Korea in 2013, Jeju, Korea. Topics discussed included IMT standardization, Lawful Interception, ICT and the Environment, Smart Grid, Cloud Services, Wireless Power Transmission, Cybersecurity, M2M Communications, Emergency Communications and Intelligent Transport System (ITS).

The 18th Global Standards Collaboration (GSC-18) was hosted by ETSI in 2014 at its premises in Sophia Antipolis, France. GSC-18 focused on three key standardization topics: the Internet of Things (IoT) and Machine to Machine Communications (M2M), Software Defined Networking (SDN) and Network Functions Virtualization (NFV); and Critical Communications.

Critical communications, the Internet of Things (IoT) and IMT-2020/5G were in focus at the 19th meeting of the Global Standards Collaboration (GSC) was hosted by ITU in 2015 at its headquarters in Geneva. IEEE and TSDSI were welcomed as a new GSC members.

IoT, 5G, Security and Privacy and SMEs were the focus of the 20th meeting of the Global Standards Collaboration (GSC-20), hosted by TSDSI in New Delhi, India, 26-27 April 2016. GSC-20 welcomed ISO and IEC as new GSC members.

ITU hosts the [repository](http://www.itu.int/en/ITU-T/gsc/Pages/meetings.aspx) of GSC-documents from past meetings.

## 15.4 ETSI & ITU

The ITU-ETSI MoU was reaffirmed in 2016. ETSI and ITU continue to enjoy successful collaboration in particular in the fields of green ICT standards. Topics of shared interest in this arena include, for example, ICT energy efficiency and methodologies to assess the environmental impacts. See section 7.1.

Standardization for C&I testing is another area supported by strong ETSI-ITU collaboration, with collaborative projects including SIP-IMS conformity testing; Internet-related performance measurement; and a framework for the interconnection of VoLTE/ViLTE-based networks. See sections 10.3, 10.4 and 10.7.

## 15.5 DOA and the master framework agreement between ITU and the DONA Foundation

### 15.5.1 Recommendation ITU-T X.1255 "Framework for the discovery of identity management information"

ITU-T X.1255 details an open architecture framework in which identity management (IdM) information – identifying 'digital objects' and enabling information sharing among entities including subscribers, users, networks, network elements, software applications, services and devices – can be discovered, accessed and represented by heterogeneous ID systems representing IdM information in different ways, supported by a variety of trust frameworks and employing different metadata schemas.

### 15.5.2 DOA and the master framework agreement between ITU and the DONA Foundation

The Digital Object Architecture (DOA) is an advanced open architecture that provides a means for enhanced information management. It was designed to enable all types of information, whether public, private, or a combination thereof, to be managed in a network environment over potentially long timeframes.

DONA Foundation, a Swiss-based not-for-profit organization, entered into an agreement with ITU called the Master Framework Agreement. The ITU Council in 2016 acknowledged that the MoU between ITU and the DONA Foundation shall continue. In accordance with the decision of Council 2016, TSB is engaging in dialogue with interested Member States to help increase the level of understanding on activities undertaken by ITU on DOA and ITU’s relationship with the DONA Foundation. The ITU Council confirmed that the study of technical aspects of DOA is a matter for the relevant ITU study groups.

## 15.6 ITU and Association for Information Systems (AIS)

AIS is a non-profit professional association for individuals and organizations who lead the research, teaching, practice, and study of information systems worldwide. Both parties will cooperate on technical challenges of ICT ecosystems and infrastructures that would bring greater certainty, confidence and predictability to our interactions within the Information Society.

## 15.7 ITU and Georgia Tech Applied Research Corporation (GTARC) sign MoU

GTARC is a non-profit supporting organization of the Georgia Tech Research Institute (Georgia Institute of Technology is an ITU academia member). Both parties will raise awareness for IoT standardization. [Full text of press release](http://newslog.itu.int/archives/1182).

## 15.8 ITU and MEF cooperate on standards that advance on-demand connectivity services

ITU and MEF concluded an agreement to advance the worldwide development and deployment of emerging connectivity services – designed to be agile, assured, and orchestrated – in addition to standardized CE 2.0 (Carrier Ethernet) services. The Memorandum of Understanding was signed by the Director of the ITU Standardization Bureau Chaesub Lee and MEF President Nan Chen on the eve of the opening of ITU Telecom World 2015 in Budapest. The agreement focuses on opportunities for mutual standards referencing for CE 2.0 and LSO (Lifecycle Service Orchestration), standards compliance/certification and global education as well as alignment in emerging areas, such as trust in the information society, orchestration and virtualization, as well as 5G Cloud Access. [Full text of press release](http://www.itu.int/net/pressoffice/press_releases/2015/41.aspx). See section 10.2.3 for Carrier Ethernet services included in ITU’s ICT Product Conformity Database.

## 15.9 ITU and IBM Watson AI XPRIZE

ITU has signed a cooperation agreement with [IBM Watson AI XPRIZE](http://ai.xprize.org/), a 5 million USD competition that aims to accelerate the development of scalable AI solutions to address humanity's grandest challenges. [Read an ITU blog piece on the agreement here…](https://itu4u.wordpress.com/2016/09/06/itu-partners-with-ibm-watsons-xprize-to-promote-ai-innovation/)

ITU will draw on its global network of ICT experts to propose judges to join the XPRIZE scientific advisory board, in addition assisting in the proposition of datasets, test environments and other resources to aid the research of XPRIZE entrants. ITU also plans to offer mentors and other technical experts to assist entrants in improving their applications and showcasing their work, and this offer of assistance will also extend to the provision of an ecosystem of technical tools and resources.

# 16 Bridging the standardization gap

ITU-T is leading efforts to improve the capacity of developing countries to participate in the development and implementation of ICT standards. The disparity between developing and developed countries in their standards capability continues to be a factor in the persistence of the digital divide. This disparity diminishes opportunities for economic development and technological innovation.

The goal of bridging the standardization gap has been moving up the ITU agenda since the 2002 Plenipotentiary Conference in Marrakesh (Morocco) which adopted Resolution 123 calling for initiatives to assist in closing this gap. Later, the 2004 World Telecommunication Standardization Assembly (WTSA) held in Florianopolis (Brazil) adopted Resolution 44 ("Bridging the standardization gap between developing and developed countries"). Resolution 44 was updated by WTSA in 2008, held in Johannesburg (South Africa) giving further impetus to the work of ITU-T in this area. More recently, in October 2010, the Plenipotentiary Conference held in Guadalajara (Mexico) established bridging the standardization gap (BSG) as one of the three strategic objectives of ITU-T. ITU's Plenipotentiary Conference in 2014 held in Busan (Korea) then confirmed BSG as one of the 5 strategic objectives of ITU's standardization sector (ITU-T).

**Reviewing progress of the Action Plan endorsed by WTSA-12**

WTSA-12 agreed on an Action Plan to address further the disparity in standardization between developed and developing countries, including least-developed countries, Small Island Developing States (SIDS) and countries with economies in transition. The plan outlines four major programmes, as follows:

1. Strengthening standards-making capabilities
2. Assisting developing countries with respect to the application of standards
3. Human resources capacity building
4. Fundraising for bridging the standardization gap

This section provides a brief report on the implementation of the Action Plan, as well as the main resolutions and instructions of Resolution 44, through the efforts of the implementation group established within TSB.

For the purpose of reporting, the classification of countries as developing and developed follows the UN M.49 classification used by the United Nations for statistical purposes. Country classifications by region and development status can be found at: [http://www.itu.int/ITU-D/ict/definitions/regions/](http://www.itu.int/ITU-D/ict/definitions/regions//).

## 16.1 BSG Programme 1: Strengthening standard-making capabilities

### 16.1.1 e-Learning courses

In 2014, TSB developed an e-learning course on the ITU-T Recommendation A.1 "Working methods of ITU-T Study Groups". This course is hosted on the [ITU Academy](https://academy.itu.int/index.php?lang=en) platform. The main objectives of the e-learning course are to introduce the structures, management, coordination mechanisms and operating procedures of ITU-T study groups as defined in Recommendation ITU-T A.1. It provides guidelines related to working methods, such as the conduct of meetings, preparation of studies, management of study groups, the role of Rapporteurs and the processing of ITU-T contributions and temporary documents. The course takes some two hours to complete and comprises six modules:

* Standardization in ITU-T
* Managing the study groups
* Coordination
* Inputs to the study groups
* Outputs of the study groups
* Further infrastructure supporting the study group process

Each module is a self-contained unit, including course content and quizzes. The course is followed by a final assessment exam online. Certificates of achievement are awarded for scores over 80 per cent.

### 16.1.2 Study Group Mentoring Programme

In 2011, a mentoring programme for ITU-T Study Groups was introduced. The objective of the mentoring programme is to provide a contact point to assist new delegates with the working methods of ITU-T and to facilitate participation and contributions from developing countries. It has since featured as an important part of the work of ITU-T Study Groups and TSAG. In the 2013-2016 study period, 56 per cent of the mentors were representative of industry (ITU-T Sector Members) and 44 per cent were representative of governments (ITU Member States).

### 16.1.3 Remote participation and e-meetings

TSB continues to improve electronic meeting facilities for the membership, assisting delegates in avoiding costly airfares and hotel expenses. See section 20.9.

## 16.2 BSG Programme 2: Assisting developing countries in the application of standards

### 16.2.1 National Standardization Secretariat

One of the findings of the ITU-T study on the "ICT Standardization Capabilities of Developing Countries" carried out in 2011 was the lack of proper coordination of standardization activities at the national level. In 2013, TSB developed ["Guidelines on the establishment of a National Standardization Secretariat (NSS) for ITU-T"](https://www.itu.int/dms_pub/itu-t/oth/0b/1f/T0B1F0000023301PDFE.pdf). Published in 2014, these guidelines consider the different capability levels for standardization across developing countries, showing how it is possible to establish an NSS at a basic level with very little new cost or resource requirements.

The guidelines are intended for countries that do not have a national standardization secretariat or are in the process of establishing an organization structure at the national level to coordinate standardization activities. The Annex to the Guidelines contains further practical information and examples of NSS implementation. ITU Member States wishing to establish an NSS that require additional assistance may contact the BSG Secretariat at [tsbbsg@itu.int](mailto:tsbbsg@itu.int) for more information.

In 2015, for instance, TSB provided technical assistance to the Zambia ICT Authority (ZICTA) in the assessment of the country's NSS. The NSS in Zambia has established technical committees mirroring Questions in ITU-T Study Groups 2, 5, 12, 13, 15 and 16. Training on how to establish an NSS was also given at the ITU Regional Standardization Forum for the Asia-Pacific Region from 27 to 28 October in Jakarta, Indonesia, attended by some 30 participants from 11 countries.

### 16.2.2 Technical Papers

A series of technical reports and papers produced during the period 2013-2016 provide additional information for developing countries on the best practices in implementing ITU-T Recommendations. See technical reports and papers [web page](http://www.itu.int/pub/T-TUT).

### 16.2.3 FAQ Forums and mailing lists

Electronic mailing lists for each study group and mailing lists for each regional group have been set up, where study group members can connect directly with each other. There was a live forum active between 2011 and 2015. An online FAQ has been maintained and can be accessed [here](http://www.itu.int/net/ITU-T/info/faqs.aspx).

### 16.2.4 Workshops and Tutorials

In the study period 2013-2016, ITU-T organized 46 workshops and seminars (see Figure 1) in developing countries for a duration of 87 days covering a wide array of topics in the field of ICT and attracting high-ranking experts as speakers, and more than 3000 attendees (see Figure 2) from engineers to managers from all industry sectors.

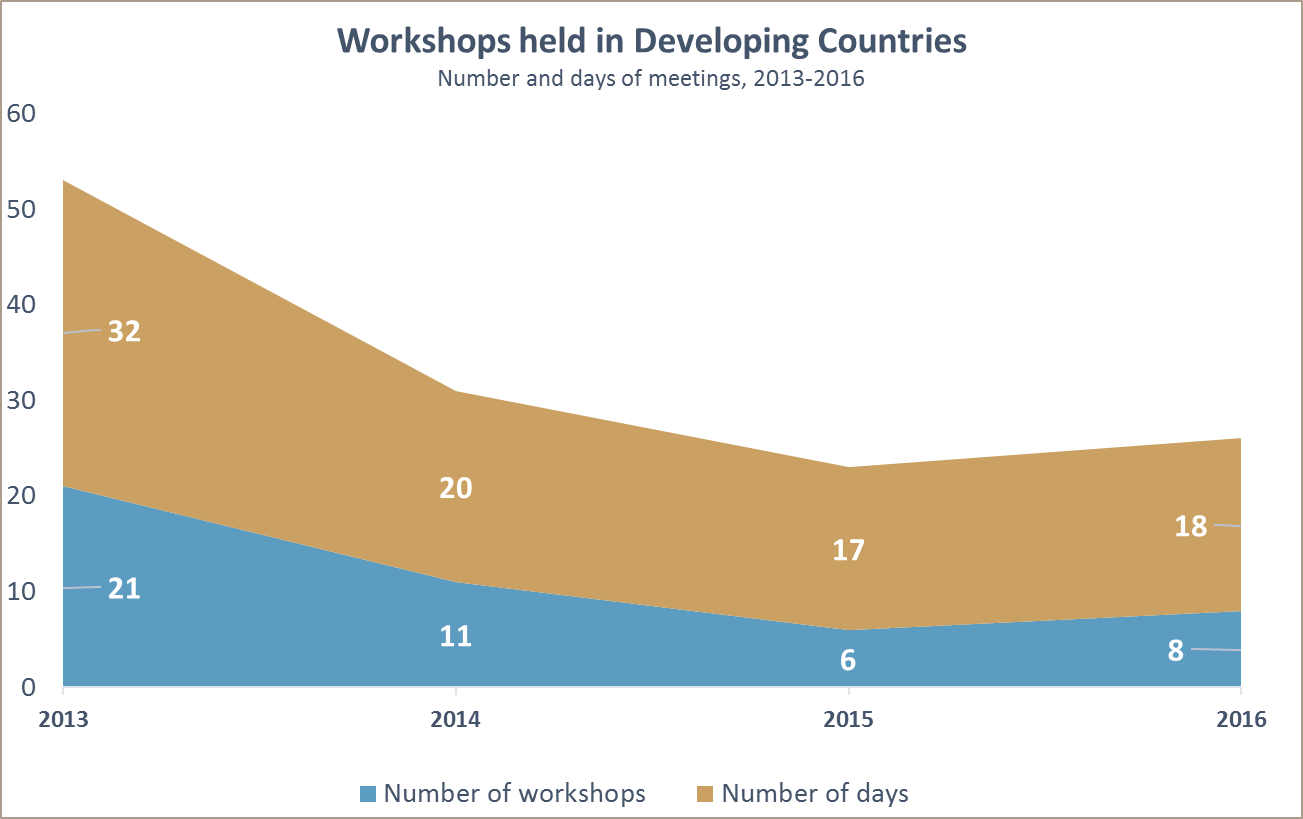


Figure 1: Workshops held in developing countries

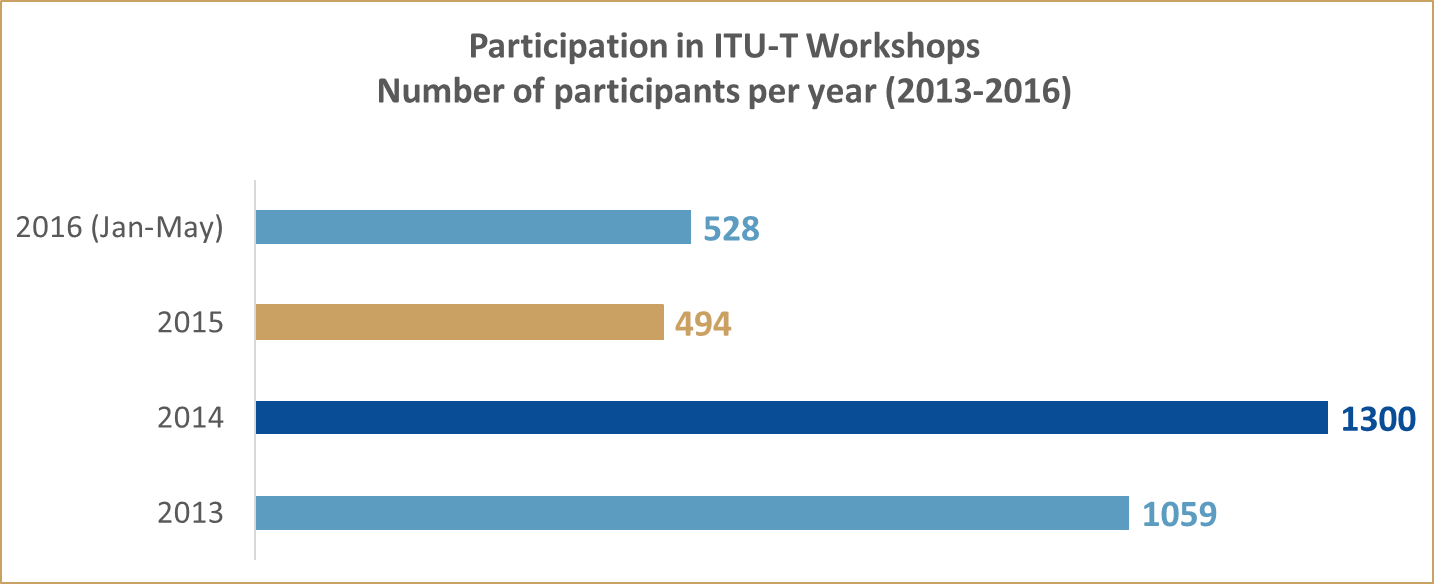


Figure 2: Participation in ITU-T Workshops

Targeted invitations to ITU-T workshops, forums and symposia are now sent to the standardization organizations of all the ITU Regions, to keep them informed about ITU-T activities of common interest, as well as to enhance the participation of national standards bodies in the work of ITU-T, in accordance with the implementation of the strategic goals of the Union for 2016-2019, namely objective T.5 “Extend and facilitate cooperation with international, regional and national standardization bodies”. In this regard, increased cooperation between TSB and the ITU Regional and Area Offices has proven valuable, particularly in facilitating cooperation with relevant standards bodies.

### 16.2.5 Studies on the role of innovation in bridging the standardization gap

One of the key recommendations of the ITU-T Focus Group on Bridging the Gap From Innovation to Standards (2012-2015) to TSAG was to establish an ICT Innovation Strategy Group that would carry out studies on the role of innovation in bridging the standardization gap. The terms of reference of the ICT Innovation Strategy Group identified several work items to assist in promoting global collaborative innovation and bridging the standardization gap.

## 16.3 BSG Programme 3: Human resources capacity building

### 16.3.1 BSG hands-on training sessions

The successful hands-on training sessions conducted by ITU-T SG3 since early 2014 have been extended to cover the activities of other study groups and their regional groups. BSG hands-on training sessions assist developing countries in developing their skills and capabilities for international standards-making. The sessions focus on the development of practical skills to maximize the effectiveness of developing countries' participation in the ITU-T standardization process, covering topics including strategies for participation in study groups, drafting contributions to meetings, presenting proposals, collaborative working methods and building consensus.

Eight hands-on training sessions were held between January and August 2016 for delegates of ITU-T SG2, SG9, SG11, SG12, SG13 and SG17. These sessions focused on five key aspects set out in the figure below.



Figure 3: Focus areas of BSG hands-on sessions

There have also been tailored on-site sessions organized in Tunisia and India. In total, 177 participants from 35 countries and 75 different organizations have benefited from these BSG hands-on training sessions.

### 16.3.2 Regional Groups

Regional Groups within ITU-T Study Groups have proven effective mechanisms to assist in bridging the standardization gap by stimulating effective participation in ITU-T Study Groups and increasing the number and quality of contributions from developing countries that could eventually lead to standards. ITU-T has 15 regional groups:

* Seven for Africa (Study Groups 2, 3, 5, 12, 11[[2]](#footnote-2), 13, and 17)
* Three for the Americas (Study Groups 2, 3 and 5)
* Three for the Arab States (Study Groups 2, 3 and 5)
* Two for Asia and the Pacific (Study Groups 3 and 5)
* Two for the Regional Commonwealth in the field of Communications / CIS region (RCC/CIS) (Study Groups 3 and 11[[3]](#footnote-3)).

Statistics on Regional Groups and meetings for 2013 to 2016 are set out in the figures below. From 2009 to 2012 there were 15 Regional Group meetings.

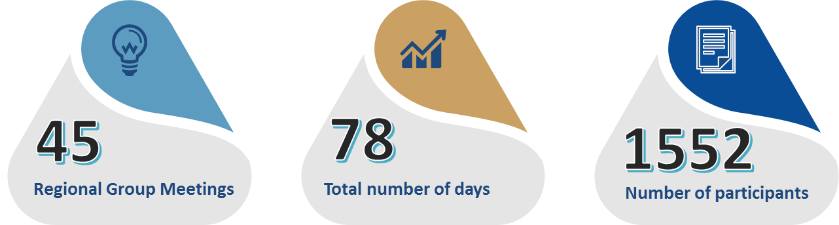


Figure 4: Study Group Regional Group meetings: Total number, duration and participation, 2013-2016

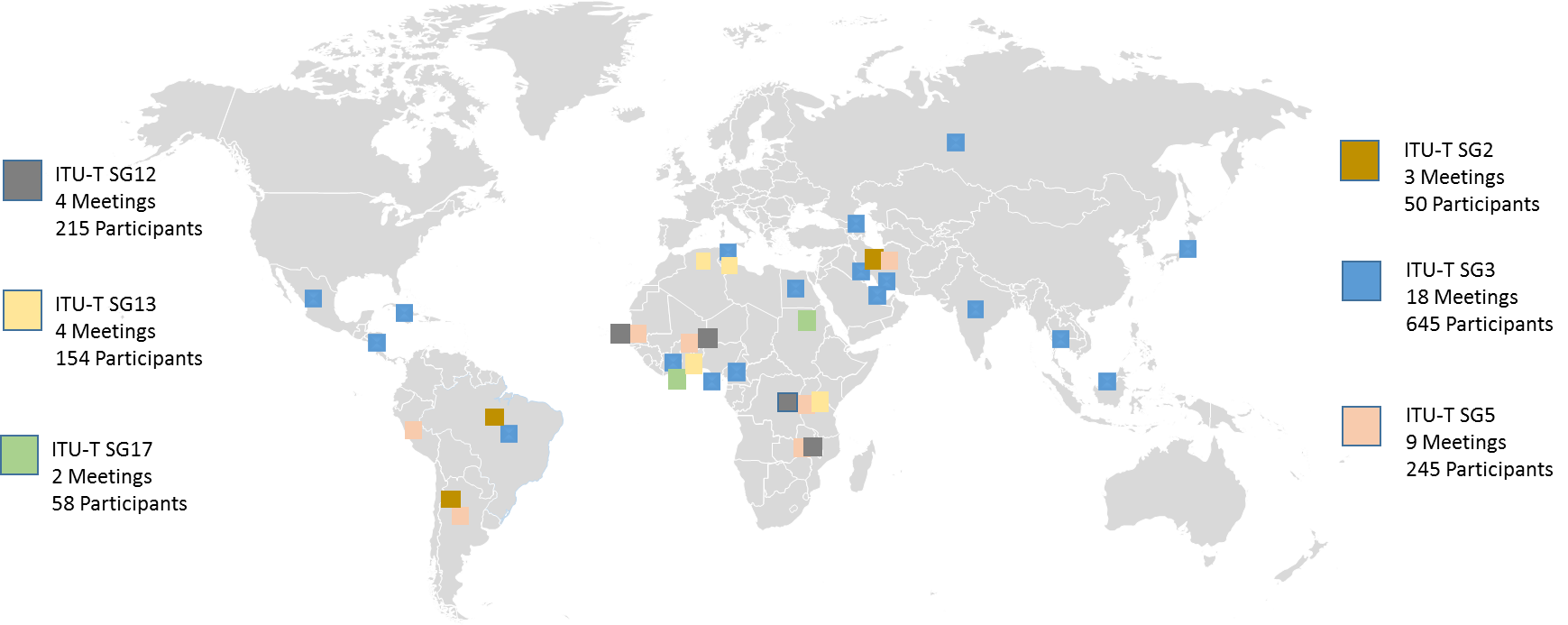


Figure 5: Study Group Regional Group Meetings: Location, number and participation, 2013-2016

### 16.3.3 Regional Standardization Forums

Overall, there were twelve Regional Standardization Forums (RSFs) held for developing countries or in developing countries during the 2013-2016 study period (see Figure 6). These forums included tutorials on ITU-T working methods as well as more technically-oriented events covering themes including human exposure to EMF, quality of service, smart water management, international mobile roaming, mobile financial services, digital identity and big data.

Meetings and Participants by Region (2013- 2016)

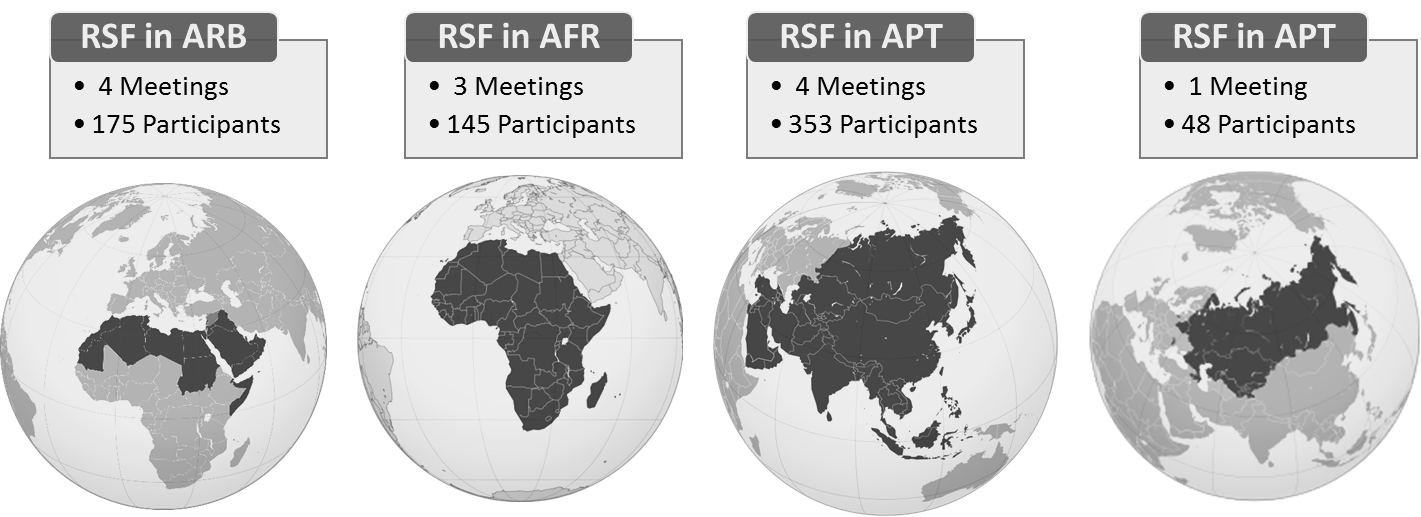


Figure 6: ITU-T Regional Standardization Forums for BSG

### 16.3.4 Fellowships

The figure below shows the fellowships awarded during the study period with a breakdown by region and gender. 444 fellowships were awarded to developing and low-income countries over the 2013-2016 study period.

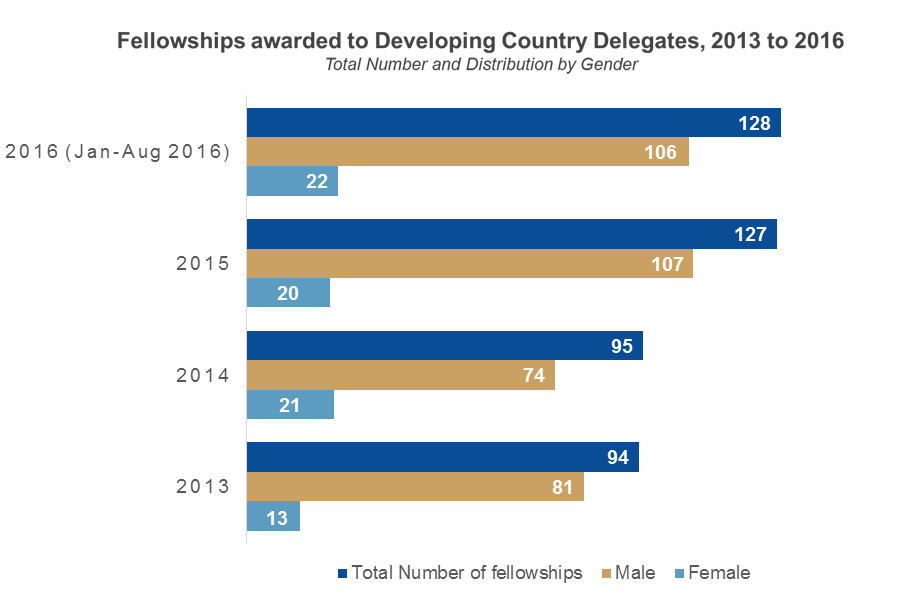


Figure 7: Fellowships awarded during the 2013-2016 study period

### 16.3.5 Participation of developing countries in management teams

Figure 8 shows a comparison of the number of Vice-Chairmen and Chairmen from developing countries in the 2013-2016 and 2009-2012 study periods.

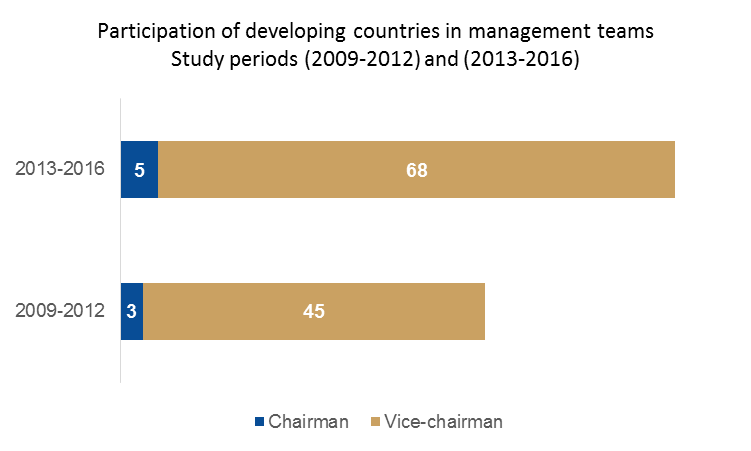


Figure 8: Participation of developing countries in management teams

## 16.4 BSG Programme 4: Fundraising for Bridging the Standardization Gap

The following Member States and Sector Members have made contributions to the BSG Fund: Canada, ETRI, MSIP-TTA Rep. of Korea, Cisco, Microsoft and Nokia Siemens Networks.

# 17 Membership

## 17.1 Evolution of ITU-T membership

The ITU-T membership trend has continued to increase over the current study period, confirming the positive trend that began in 2011. The total number of ITU-T members (Sector Members, Associates and Academia) increased from 458 to 531 between January 2013 and August 2016, representing a 16 per cent increase. See Table 1 and Figure 9.

The implementation since 2011 of a proactive membership strategy and service has supported this growth. The establishment of a new participation category for Academia by PP-10 also contributed to attracting new members. As of August 2016, 124 Academia had joined ITU, accounting for 24 per cent of the total number of ITU-T members. The efforts deployed by ITU staff and management to recruit universities and research institutions combined with the support of Member States to promote the Academia category were pivotal to this success. PP-14 granted Academia participation in ITU's three sectors for a single annual fee.

Conversely, the number of ITU-T Sector Members has slightly declined over the current study period, with 10 fewer Sector Members in August 2016, compared to January 2013. This is partly due to the suspension since 2015 of the procedure allowing regional and international organizations to join ITU-T with exemption of fees, pending the ongoing revision of the criteria for exemptions by Council.

The number of ITU-T Associates has remained stable over the same period, with Study Group 15 on Transport, Access and Home and Study Group 2 on Operational Aspects attracting most of ITU-T new Associates. Both Study Group 15 and 2 accounted for over 70 per cent of the total number of ITU-T Associates in August 2016.

Table 1: Evolution of ITU-T membership from 31 December 2006 to 31 August 2016

|  | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sector Members | 344 | 314 | 309 | 294 | 273 | 271 | 278 | 284 | 275 | 272 | 268 |
| Associates | 112 | 116 | 134 | 128 | 125 | 136 | 144 | 139 | 138 | 142 | 139 |
| Academia | ‑ | ‑ | ‑ | ‑ | ‑ | 25 | 36 | 45 | 67 | 109 | 124 |
| TOTAL | 456 | 430 | 443 | 422 | 398 | 432 | 458 | 468 | 480 | 523 | 531 |

NOTE – The Academia category was created in 2011.

Figure 9: Evolution of ITU-T membership from 31 December 2006 to 31 August 2016

## 17.2 European operator target list

TSB has launched a project to increase the participation of European operators (both Members and non-Members) in ITU-T SGs, FGs, JCAs and Workshops. This project targets specific EU operators, on a one-by-one basis, linked to identified subject-matter interest and upcoming meetings. In order to achieve this, a database of close to 1000 European operator contacts (CIOs, CTOs, CISOs, etc.) has been mapped to relevant ITU-T Study Groups and activities. These contacts are being systematically approached in coordination with the study group secretariats each time a new meeting or workshop approaches. Work is also being done to include them in ITU's CRM (Customer Relationship Management) system and invite them to become subscribers to the new ITU newsletter.

## 17.3 Academia

ITU-T is carrying out various activities to encourage and facilitate the participation of academia in the work of the Sector, as well as to benefit from their technical and intellectual expertise. An assessment of ITU Academia members' involvement in ITU-T activities shows that more than 30 universities actively participate in ITU-T events and contribute to ITU-T Study Groups.

### 17.3.1 Kaleidoscope academic conferences

Held since 2008, [Kaleidoscope events](http://www.itu.int/en/ITU-T/academia/kaleidoscope/Pages/default.aspx) are peer-reviewed academic conferences that increase dialogue between academics and ICT standardization experts. The aim of the conference is to identify emerging trends in ICT research and their associated implications for international standardization. Kaleidoscope is organized by ITU-T with the technical co-sponsorship of IEEE Communications Society.

[Kaleidoscope 2013: *Building Sustainable Communities*](http://www.itu.int/en/ITU-T/academia/kaleidoscope/2013/Pages/default.aspx), hosted by Kyoto University, Japan, brought together some of the best academic minds from around the world to present their research on innovative technologies that tackle the challenge of the co-evolution of technology and sustainable communities.

[Kaleidoscope 2014: *Living in a converged world – impossible without standards?*](http://www.itu.int/en/ITU-T/academia/kaleidoscope/2014/Pages/default.aspx), hosted by the Bonch-Bruevich Saint-Petersburg State University of Telecommunications, Russia, explored the growing role of ICT in other social and economic sectors and the resulting challenges for international standardization.

[Kaleidoscope 2015: *Trust in the Information Society*](http://www.itu.int/en/ITU-T/academia/kaleidoscope/2015/Pages/default.aspx), hosted by Universitat Autònoma de Barcelona, Spain, analyzed means of building information infrastructures deserving our trust. The event highlighted ideas and research to help ensure that the Information Society grows in inclusivity and sustainability thanks to trusted foundations.

[Kaleidoscope 2016: *ICTs for a Sustainable World*](http://www.itu.int/en/ITU-T/academia/kaleidoscope/2016/Pages/default.aspx) will be held 14-16 November 2016 co-located with [ITU Telecom World](http://telecomworld.itu.int/) in Bangkok, Thailand. The conference will highlight research into ICT developments capable of supporting the broad spectrum of innovation required to achieve the UN Sustainable Development Goals (SDGs), emphasizing the role of international ICT standards in providing the platform for this innovation to achieve its aims on a global scale.

### 17.3.2 ITU-Academia consultation meetings

Following the first [Academia Consultation meeting](http://www.itu.int/ITU-T/uni/meetings.html) coordinated by TSB in 2007 (which led to the creation of the Kaleidoscope series of academic conferences), a second consultation meeting, organized by the ITU General Secretariat in collaboration with TSB, took place in conjunction with Kaleidoscope 2015 and highlighted the importance of strengthening the collaboration of ITU's three sectors in their engagement with academia. A third event will take place on 13 November 2016, preceding Kaleidoscope 2016, in particular to solicit feedback on the planned establishment of an ITU scholarly, professional, peer-reviewed and freely available online Journal. TSB is the lead for this Journal, supported by collaboration with ITU's Radiocommunication Bureau and Development Bureau and the ITU General Secretariat.

This consultation meeting will be followed by an Academic Roundtable on 17 November 2016 organized by ITU under the umbrella of the World Standards Cooperation (WSC) to discuss the role of Academia in the standards-development process (see more on academia and WSC in section 17.3.4).

### 17.3.3 TSB Director's Ad Hoc Group on Education about Standardization

Organizations developing standards have taken up the challenge of promoting education about standardization to familiarize graduates, business leaders and policymakers with standards, their importance and development processes. The [TSB Director's Ad Hoc Group on Education about Standardization (AHG-SE)](http://www.itu.int/en/ITU-T/academia/Pages/stdsedu/default.aspx) was established during TSAG in July 2012, based on the proposal of an ITU-T Academia member.

The first meeting was held by the Aalborg University in Aalborg, Denmark, 8-9 October 2013, in conjunction with the Joint ITU-GISFI-DS-CTIF Standards Education Workshop. The objective was to strengthen collaboration among ITU-T standardization experts, representatives of academia and other standards-developing organizations.

The second meeting was hosted by Kyoto University in Kyoto, Japan, 25 April 2013, and organized in conjunction with the [Joint ITU-IEICE-CTIF-GISFI Workshop on Education about Standardization](http://www.itu.int/en/ITU-T/academia/kaleidoscope/2013/Pages/Joint-ITU-IEICE-CTIF-GISFI-Worshop-on-Education-about-Standardization.aspx), an ITU Kaleidoscope 2013 side event. As mentioned in the meeting's [final report](http://www.itu.int/en/ITU-T/academia/Documents/stdsedu/2nd%20Meeting-20130425-Japan/012_AHG_SE_Final_Report.docx), various areas of action were identified. The AHG-SE work progressed by correspondence, an [action list](http://www.itu.int/en/ITU-T/academia/Documents/stdsedu/3rd%20Meeting-20140602-St.Petersburg/014_AHG_SE_Action_plan_13-05-14.docx) was updated and action leaders were identified.

### 17.3.4 World Standards Cooperation and Academia

IEC, ISO and IEC organize World Standards Cooperation (WSC) Academic events, which aim at discussing the role of academia in the standards-development process.

WSC Academic Days took place in France (2013), Canada (2014) and Korea (2015), in conjunction with the annual International Cooperation for Education about Standardization (ICES) conferences. The next event was held in Frankfurt, Germany, on 12 October 2016.

The first WSC Academic Roundtable (Washington DC, USA, 2013) was organized by ISO to explore the role of standardization in strategy, innovation and entrepreneurship. The second roundtable, organized by IEC, took place in Seattle, USA, in 2015.

The third edition, [*Engaging academia in standardization for a sustainable future*](http://www.itu.int/en/ITU-T/extcoop/Pages/wsc-academia-16.aspx), organized by ITU-T in Bangkok on 17 November 2016, will bring together university professors, students, standards leaders and representatives of industry and government, to debate the following topics:

* Collaboration among academia, industry, and global standards organizations to develop international standards for a sustainable future
* Gender dimension in international standardization
* Internet of Things (IoT) to accelerate sustainable development

## 17.4 Mainstreaming accessibility in ICTs

IEC, ISO and ITU have developed a ["Guide for addressing accessibility in standards" (ITU-T H-Series Supplement 17 | ISO/IEC Guide 71)](http://www.itu.int/itu-t/recommendations/rec.aspx?rec=12358) as well as a joint policy statement on "Standardization and accessibility" ([accessibility.worldstandardscooperation.org](http://accessibility.worldstandardscooperation.org)).

The guide adds to two other pioneering ITU documents for accessibility and standards, the [Telecommunications accessibility guidelines for older persons and persons with disabilities](http://www.itu.int/rec/T-REC-F.790-200701-I/en) and the [Telecommunications Accessibility Checklist](http://www.itu.int/pub/T-TUT-FSTP-2006-TACL/en).

In addition to ITU-T H.702 (see section 4.4), ITU members have completed the ITU-T F.791 on accessibility terminology.

ITU-T H.702 provides accessibility profiles for IPTV systems, and ITU members have launched new work to specify the requirements for the conformance testing of accessible IPTV terminals implemented according to ITU-T H.702.

Technical Paper ITU-T FSTP-UMAA on use cases for assisting people with disabilities using mobile applications was approved in early June 2016 ([TD 565/Plen](http://www.itu.int/md/meetingdoc.asp?lang=en&parent=T13-SG16-160523-TD-PLEN-0565)).

***ITU-T is a strong advocate of “Universal Design”*** *and has developed standardization guidelines to produce solutions that are inherently accessible to persons with and without disabilities.*

### 17.4.1 Accessible ITU-T meetings

ITU-T provides services such as sign-language interpretation and captioning, and financial support in some cases, to engage persons with disabilities in the ITU-T standardization process.

A pair of ITU-T technical papers provide guidelines on organizing accessible meetings (ITU-T FSTP-AM) and on how to ensure online remote participation in meetings s accessible to persons with disabilities (ITU-T FSTP-ACC-REMPART). The latter complements the new A-Series Supplement 4 on the organization of remote participation in meetings, agreed by TSAG.

### 17.4.2 IPTV Accessibility Challenge in partnership with the [IPC](http://www.paralympic.org/)

Themed "Better Quality of Life with Global Standards: an Accessible World for All", [ITU's 3rd IPTV Application Challenge](http://www.itu.int/en/ITU-T/challenges/iptv/201406/Pages/default.aspx) focusing on accessibility was launched jointly with the [International Paralympic Committee (IPC)](http://www.paralympic.org/). The Challenge aimed at raising awareness of the importance of multimedia and multimodal audiovisual accessibility for everyone, especially persons with a variety of levels and types of disability. The Challenge promoted innovative ideas that could be further developed towards deployment in systems built in conformance with ITU-T's international IPTV standards.

The award for "Best App – Individual/SME" was presented to two winners:

Laboratory of Advanced Web Systems from Brazil for the application, "Listening TV: a different perspective about watching TV", based on ITU-T H.761. The app adds a set of interactive audio descriptions to IPTV video contents, helping blind persons to access such contents.

Günter Heinrich Herweg Filho, a software analyst from Brazil, for the application, "A+", based on ITU-T H.761. The educational IPTV application aims to facilitate an initial screening to detect possible learning disabilities in children.

The award for "Best-App – Corporate/Public Sector" was presented to ASTEM Co., Ltd., Japan, for the application, "Listen with your eyes TV", based on ITU-T H.762. The app helps deaf or hard-of-hearing persons to access IPTV video or audio contents, by multiplexing remotely-provided captioning text. The app also follows ITU-T H.702 "Accessibility profiles for IPTV systems".

### 17.4.3 Joint Coordination Activity on Accessibility and Human Factors

The role of the [Joint Coordination Activity on Accessibility and Human Factors (JCA-AHF)](http://www.itu.int/en/ITU-T/jca/ahf/Pages/default.aspx) was enhanced at WTSA-12. The JCA-AHF is mandated to reinforce cooperation within ITU, as well as with other UN agencies and activities, with the aim of increasing standardization experts' awareness of the importance of accessibility to ICTs and the need to mainstream the consideration of accessibility in international standardization efforts.

All JCA-AHF meetings take place with TSB-provided teleconference facilities, a tool for remote sharing of documents (Adobe Connect), sign-language interpretation and real-time captioning on request.

A series of blogs related to standards, accessibility and ICTs has been published on the [ITU-T portal on Accessibility](http://www.itu.int/en/ITU-T/accessibility/Pages/default.aspx) that also provides an overview of activities, a calendar and some links to studies, tools and resources relevant to ITU's areas of action in the area of accessibility to ICTs.

## 17.5 Gender

TSB continues its efforts to include a gender perspective in all of its activities and programmes under the umbrella of the ITU Gender Task Force. ITU Member States and Sector Members are encouraged to support the active involvement of women experts in standardization groups and activities.

In 2014, a training course on leadership skills was delivered to all women in the professional staff category. Further, TSB took the lead in implementing the web-based training, "I know Gender", in fulfilment of the ITU Gender and Mainstreaming Policy (GEM) and the United Nations System-wide Action Plan (UN-SWAP). The training was carried out successfully, completed by 98% of TSB staff.

Currently, 56 per cent of all TSB staff are women. The number of women in the professional category has more than quadrupled over the last 10 years, taking the proportion of women in the professional category to 41 per cent. Diversity of staff, gender equality and the empowerment of women continue to be among TSB's priorities.

The establishment of the Women in Standardization Expert Group (WISE) was agreed by the February 2016 meeting of TSAG, with the goal of supporting ITU-T's efforts to encourage the active participation of women in standardization work.

# 18 Publications

Over 50,000 pages of ITU-T Recommendations and Supplements were published in the reporting period, as well as Technical Papers, Technical Reports, Operational Bulletins and Focus Group deliverables.

Figure 10 illustrates the number of texts produced since 2000 (as of 20 September 2016). At the time of writing, 51 ITU-T Recommendations were in the process of being approved under the Alternative Approval Process (AAP), making 2016 the year that produced the most ITU-T standards over the period shown in the figure below.

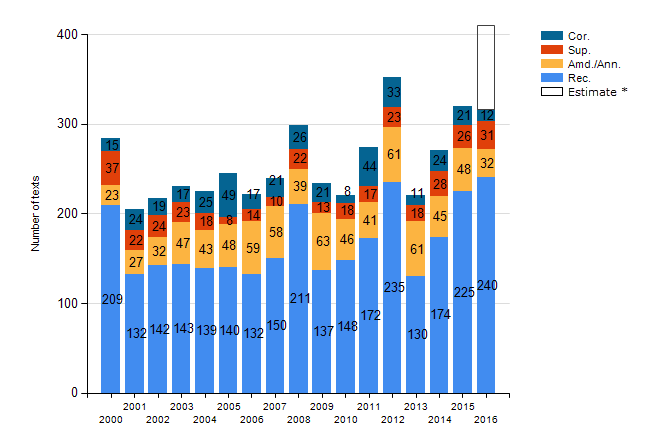


Figure 10: Number of Recommendations, amendments, corrigenda and Supplements approved between 2000/01/01 and 2016/09/20

The DVD "ITU-T Recommendations and selected Handbooks" continues to be produced on a quarterly basis. It represents a tool of great value to standards developers and implementers as a consolidated archive of the over 4,000 ITU-T Recommendations in force. The DVD incorporates advanced search tools, including detailed search-by-content capabilities. Search parameters can be defined by keywords, timeframe and Study Group, among others, with searches applicable to the title or the full text of the standard. "Tool-tips" offer real-time guidance to the DVD's functionality, assisting first-time users and ensuring the accessibility of the DVD to persons with disabilities.

# 19 Media and promotion

## 19.1 Communications on ITU standardization

[ITU press releases](http://www.itu.int/en/mediacentre/Pages/default.aspx) distribute news on ITU work of particular interest to media. Press releases are distributed with supplemental notes to technical editors in certain cases, a return to past practice valued by media outlets covering standardization.

[ITU-wide newslog](http://newslog.itu.int/) pages are well visited and often spur media attention. The ITU blog (called "[itu4u](http://itu4u.wordpress.com/)") was introduced in 2012 to carry bylined 'opinion' pieces and many of the most successful pieces of content on this platform were developed by TSB.

The consistent output of ITU-T news content, coupled with a coordinated social media strategy led by the ITU General Secretariat, continues to see news of ITU-T's work feature in a variety of mainstream publications. A [scoop page](http://www.scoop.it/t/itu-t-in-the-news) highlights a selection of the news coverage of ITU-T.

Communications on ITU standardization that have received the highest levels of worldwide coverage in the 2013-2016 study period were on subjects including:

* The ITU-T H.265 "HEVC" video codec
* G.fast broadband access, the implementation of which is the subject of sustained media attention
* The work of ITU-T Study Group 20 on IoT and smart cities
* The work of the ITU-T Focus Group on IMT-2020 (5G)
* NG-PON2 40-Gigabit-capable passive optical networks
* XGS-PON 10-Gigabit-capable symmetric passive optical networks
* OTN Beyond 100G, the 5th edition of Recommendation ITU-T G.709/Y.1331 "Interfaces for the Optical Transport Network"

Communications on ITU-T activities in fields such as IPR, e-health, intelligent transport systems, and aviation applications of cloud computing have also received significant media attention.

A new video clip "ITU Standardization – the technical foundations of the information society" was released on 24 May 2016 and has since received more than 1600 views. The video was sponsored by NTT and KT (see <http://www.itu.int/en/ITU-T/wtsa16>).

Video interviews with ITU-T Study Group Chairmen are found on 'SG at a Glance' webpages, which also host a range of video interviews on specific technical areas; and the numbers of views of these videos indicate that they have been appreciated by ITU-T's audience. An [interview conducted on G.fast](https://www.youtube.com/watch?v=bXg_vRaFBpg) has garnered close to 3.5 thousand views.

## 19.2 ITU 150th anniversary

The year 2015 marked a major milestone in the history of ITU. The celebrations of the 150th anniversary took the theme, "ICTs as Drivers of Innovation". Events led by ITU-T under the banner of the 150th anniversary:

* The ITU-UNECE Symposium on Future Networked Car within the Geneva International Motor Show, 5 March 2015.
* The ITU Workshop on "Future Trust and Knowledge Infrastructure, Phase 1" at ITU Headquarters in Geneva, 24 April 2015.
* The joint ITU-D/ITU-T "ITU International Mobile Roaming Dialogue" at ITU Headquarters in Geneva, 18 September 2015.
* ITU Kaleidoscope 2015: Trust in the Information Society hosted by Universitat Autònoma de Barcelona, Spain, 9-11 December 2015.

## 19.3 CCITT/ITU-T 60th anniversary

***2016 marks 60 years since the 1956 establishment of the International Telegraph and Telephone Consultative Committee (CCITT), the precursor to ITU-T, established in 1992****.*

*The* [*60th anniversary of CCITT/ITU-T*](http://www.itu.int/en/ITU-T/60/Pages/default.aspx) *celebrates the many experts that contribute their time and expertise to the development of the ITU standards that bring cohesion to the unceasing innovation of the ICT community.*

To celebrate the CCITT/ITU-T 60th Anniversary, a series of talks will be held during the WTSA-16 Plenary sessions on Wednesday, 26 October. The evening of 26 October will also host a Gala reception kindly sponsored by UAE (Gold), South Korea (Silver) and Rohde & Schwarz (Bronze).

Talks on Digital Financial Services

Globally, more than 2 billion adults do not have a formal bank account. Low levels of financial inclusion represent a barrier to socio-economic development. Mobile money could be a game-changer for people of limited income and an enabler for financial inclusion in developing countries. The recent growth of Digital Financial Services has allowed millions of people previously excluded from the formal financial system to perform financial transactions relatively cheaply, securely and reliably.

Policy reform and the development of international standards will be important in facilitating the adoption of interoperable Digital Financial Services. [Web page](http://www.itu.int/en/ITU-T/60/Pages/Talks-DFS.aspx).

Talks on Artificial Intelligence

The future will see large parts of our lives influenced by AI technology. Machines can execute repetitive tasks with complete precision, and with recent advances in artificial intelligence (AI), machines are gaining the ability to learn, improve and make calculated decisions in ways that will enable them to perform tasks undertaken by journalists, teachers, doctors and other professions previously thought to rely on human experience and ingenuity. AI will also come to support emerging applications in the IoT space, with billions of devices, things and objects gaining the ability to learn from patterns observed in their environment and communicate these learnings to a larger ecosystem of intelligent devices.

The development and adoption of relevant international standards will help us to realize the benefits of AI advances on a global scale. [Web page](http://www.itu.int/en/ITU-T/60/Pages/Talks-AI.aspx).

# 20 Services and tools

Electronic working methods offer crucial support to members engaged in ITU standardization work. The ITU secretariat continues to develop new applications and services to maintain and expand ITU's advanced electronic working environment.

## 20.1 New ITU-T website design

A new website design developed under the ITU Web Site Visual Redesign Project has seen the redesign of core elements of the ITU website. The new website adheres to modern best practices for corporate websites, contributing to the clear presentation of ITU's values and objectives and improved user experience.

## 20.2 ITU-T Databases

Among the numerous databases which are continuously enhanced to serve ITU-T delegates and secretariat staff are:

* [ITU-T Recommendations](http://www.itu.int/itu-t/recommendations)
* [International Numbering Resources](http://www.itu.int/ITU-T/inr/index.html)
* [ITU Product Conformity Database](http://www.itu.int/net/itu-t/cdb/ConformityDB.aspx)
* [ITU-T Patents and Software Copyrights](http://www.itu.int/ipr/)
* [ITU-T Formal descriptions and Object identifiers](http://www.itu.int/ITU-T/formal-language/index.html)
* [ITU-T Test Signals](http://www.itu.int/net/itu-t/sigdb/menu.htm)
* [ITU-T Work Programme](http://www.itu.int/ITU-T/workprog)
* [ITU-T Liaison Statements](http://www.itu.int/net/itu-t/ls/)
* [ITU-T Terms & Definitions](http://www.itu.int/ITU-R/go/terminology-database)

Unique and persistent identifiers based on the DOA are now available for items registered in the following ITU-T databases: ITU-T Recommendations; ITU-T Conformity Statements; ITU-T Patents and Software Copyrights; ITU-T Formal descriptions and Object identifiers; ITU-T Test Signals; and ITU-T Liaison Statements. These persistent identifiers will enable new features such as digital signature-based data integrity checks, role-based information management, data privacy and other advanced information management capabilities.

In order to help the ITU-T community to follow up with the latest services and tool enhancements, a new service announcements platform is now available at <http://tsbtech.itu.int/>

## 20.3 Document Management System for Rapporteur Groups

The ITU IS Department together with TSB have developed a system for managing documents of ITU-T Rapporteur Group Meetings (RGM) in a well-structured and secured environment. This new system, which is based on MS SharePoint, was used extensively at the [SG13 co-located Rapporteur group meetings](https://extranet.itu.int/meetings/ITU-T/T13-SG13RGM/12068-160418/SitePages/Welcome.aspx) in April 2016 and the [Interim Rapporteur group meetings for SG20](https://extranet.itu.int/meetings/ITU-T/T13-SG20RGM/13307-160502/SitePages/Welcome.aspx) in May 2016. With a total of 571 documents submitted (258 documents for SG20, and 313 documents for SG13) over a combined period of 22 meeting days, the system underwent an exhaustive stress test under real-world conditions.

The new ITU-T RGM system is now available for any Rapporteur Group wishing to utilise and take advantage of its improved capabilities. The current and past RGM meetings may be accessed at <https://extranet.itu.int/meetings/ITU-T/> and contains a comprehensive support and FAQs page offering RGM tips and best practices is available to users, a detailed online user guide for the RGM System complete with videos, as well as a feedback form for the new RGM system.

The RGM system is part of several services available in the ITU-T SharePoint collaboration sites. Most of the collaboration sites are restricted to ITU-T Members and can be accessed using a TIES account. Some collaboration sites which are open to non-members can be accessed using ITU Guest accounts. The ITU-T SharePoint collaboration home site can be accessed here:  
<https://extranet.itu.int/ITU-T/>

## 20.4 New ITU-T Electronic Registration and Subscription Service

Since the launch of the ITU-T Electronic Registration and Subscription Service in 2009, ITU-T participants have provided very important feedbacks on different issues and suggestions for improvements and other enhancements. To address these issues and to further improve the current tools that cover self-registration to mailing lists, access to FTP areas, etc., a new project, Improving Working Method V2 (IWM v2) was launched and successfully implemented in March 2013. The result is the new ITU-T Electronic Registration and Subscription Service web interface which is available at: <http://www.itu.int/en/ITU-T/ewm/Pages/services.aspx>.

## 20.5 International Numbering Resources (INRs)

The [INR database](http://www.itu.int/net/itu-t/inrdb/index.aspx) has undergone a major revamp, including the presentation of a more intuitive user interface. The database includes numbers and codes allocated in accordance with:

* ITU-T E.164 "The international public telecommunication numbering plan"
* ITU-T E.118 "The international telecommunication charge card"
* ITU-T E.212 "The international identification plan for public networks and subscriptions"
* ITU-T E.218 "Management of the allocation of terrestrial trunk radio Mobile Country Codes"
* ITU-T Q.708 "Assignment procedures for international signalling point codes"

Notifications of national numbering/identification plan update and assignment or reclamation of national numbering/identification resources were received and published in the [ITU Operational Bulletin](http://www.itu.int/pub/T-SP-OB). The ITU Operational Bulletin is published in the six official languages twice a month.

ITU members called on TSB to 'streamline' the process to report the misuse of INRs to make it as automatic as possible. The reporting mechanism has been redesigned to allow for a more user-friendly interface (available [here](http://www.itu.int/en/ITU-T/inr/Pages/misuse.aspx)).

## 20.6 ITU-T Study Groups SharePoint collaboration sites

A new online collaborative platform has been developed to further improve the electronic working methods of ITU-T Study Groups. Based on SharePoint, the collaboration site allows members to conduct online discussions and work on documents in a secure and shared environment. Several categories for online discussions based on the current structures of the different ITU-T Study Groups have been created and are now available for use. In addition, basic social media functionalities are also available to encourage lively and productive discussions between the members.

The SharePoint collaboration sites are being utilized actively in the work of ITU-T Focus Groups and some Focus Groups are now storing their documents exclusively in SharePoint document libraries. The advanced features and tools available in SharePoint make it easier for participants to access and work more efficiently on their documents. Some of the Focus Groups Collaboration sites currently available are:

* FG AC - Focus Group on Aviation Applications of Cloud Computing for Flight Data Monitoring (<https://extranet.itu.int/ITU-T/focusgroups/imt-2020>)
* FG DFS - ITU-T Focus Group Digital Financial Services (<https://extranet.itu.int/ITU-T/focusgroups/fgdfs>)
* FG IMT-2020 - Focus Group on IMT-2020 (<https://extranet.itu.int/ITU-T/focusgroups/imt-2020>)

## 20.7 TSB Sharepoint Services Support site

A site dedicated to providing support to the users of SharePoint collaboration sites is available at: <https://extranet.itu.int/ITU-T/support/>. The support site contains a knowledge base of FAQs and user guides on the various SharePoint services available to members.

## 20.8 Meeting Documents Sync Application

This application allows meeting participants to synchronize documents of the current meeting of an ITU-T Study Group from the ITU server to their local drive. A new version has been developed and now allows selective download of documents, such as Contributions and TDs according to Working Parties. The new version also provides the option to sync documents from past meetings.

## 20.9 Electronic meetings

Since January 2014, TSB has been providing Adobe Connect as the remote participation tool for all official ITU-T meetings held at ITU Headquarters in Geneva. Users' TIES accounts grant access to sessions that require login details. Having two possibilities in terms of permissions to access sessions – TIES-secured, or open to guests – adds greater flexibility and security when organizing sessions and simplifies the login procedure for all participants. GoToMeeting is preferred as the tool to facilitate ad-hoc electronic meetings of working groups such as Rapporteur Groups. Statistics on e-meetings have been compiled as from 2014 and are indicated below.

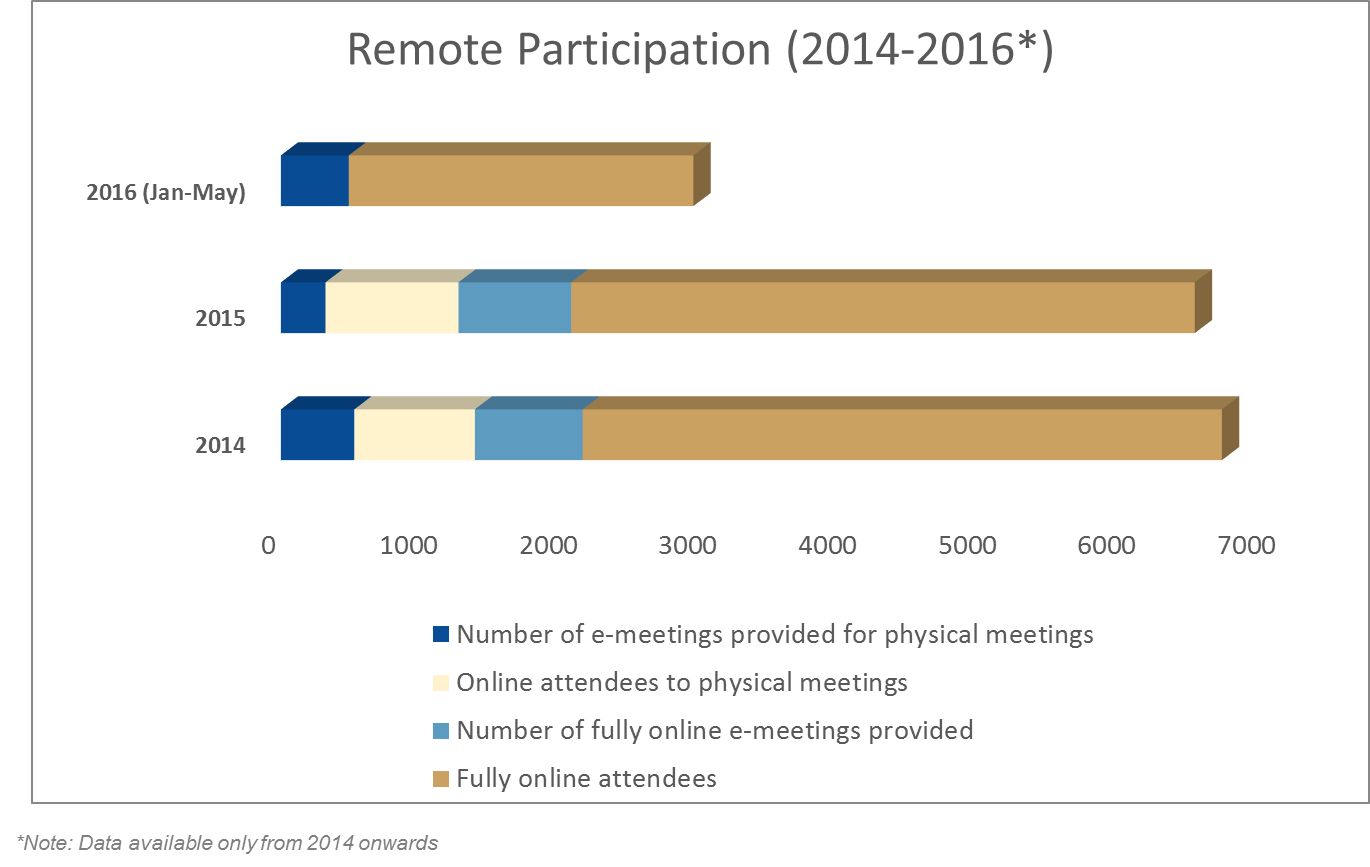


Figure 11: Remote participation and e-meetings

## 20.10 Online interim Rapporteur group and electronic meetings

Access to information about Interim, Rapporteur meetings and e-Meetings of ITU-T Study Groups and TSAG is enhanced since January 2014, making it easier for delegates to find and participate in the most relevant ITU-T activities:

* Browse meetings of all groups simultaneously in the [ITU events calendar](http://www.itu.int/events/upcomingevents.asp?lang=en)
* View a specific study group's [Interim Meetings](http://www.itu.int/net/ITU-T/lists/rgmeetings.aspx?Group=15) (by following the link on the SG homepage under Other Meetings)
* Access detailed meeting information for a selected [event](http://www.itu.int/net/ITU-T/lists/rgmdetails.aspx?id=552&Group=15)
* Download a meeting notification letter to support participation
* Full search capacity from the [past events](http://www.itu.int/net/itu-t/lists/rgmeetings-past.aspx?Group=15) search page
* Export the list of meetings into an MS Word file

## 20.11 Online form for new work item submission

An online version of [ITU-T A.1 (11/2012)](http://www.itu.int/rec/T-REC-A.1-201211-I) Annex A justification form for proposal of new work items aiming at becoming Recommendations, was made available for ITU-T Study Groups in May 2014 (e.g., <https://www.itu.int/ITU-T/workprog/secured/wp_new_item_in.aspx?sg=15>).

## 20.12 Use in the ITU-T of the languages of the Union on an equal footing

The Standardization Committee for Vocabulary (SCV), comprising of experts in the official languages, serves as focal points to ITU-T Study Groups in terminology-related matters and has provided consultation on terms and definitions to be adopted in ITU-T Recommendations. The meetings of SCV have since September taken place jointly with meetings of ITU-R's CCV (Coordination Committee for Vocabulary). TSB continues to collect all new terms and definitions, which are proposed by the ITU-T Study Groups, and enters them in the online ITU Terms and Definitions database.

As requested by Resolution 67 (Rev. Dubai, 2012) of WTSA, TSB continues to translate all Recommendations approved under the traditional approval process (TAP) as well as all TSAG reports in all the languages of the Union.  Similarly, the circulars that announce the approval of a Recommendation via the alternate approval procedure (AAP) will include an indication of whether it will be translated once the mechanism for selecting the candidate AAP Recommendations has been established by TSAG and if the funds are available in the budget.

Additionally, TSB continues to look for ways to translate AAP Recommendations at translation rates that would allow for the translation of more Recommendations while guaranteeing quality. TSB is now pursuing a new project with the involvement of recognized institutions specialized in the field of telecommunications that would be able to provide high quality translations into the language of their own linguistic group.

# 21 ITU-T's activities in the implementation of WSIS and the Sustainable Development Goals

ITU-T has undertaken a mapping of its activities to the UN Sustainable Development Goals (SDGs), an action highlighting the ITU-T activities most relevant to the SDGs and proposing actions for ITU-T to expand its contribution to the pursuit of the SDGs. This mapping of ITU-T work to the SDGs will support the WSIS process in its promotion of efforts to leverage ICTs for sustainable development (see the [WSIS-SDG Matrix](https://www.itu.int/net4/wsis/sdg/) linking WSIS Action Lines with the SDGs), highlighting areas where these efforts will receive support from the international standards developed by ITU-T. This mapping was presented to the February 2016 meeting of TSAG ([TSAG TD419](http://www.itu.int/md/T13-TSAG-160201-TD-GEN-0419/en)) and led to the development of a mapping tool to map all ITU-wide objectives and outputs to SDG goals and targets.

ITU-T's work contributes to the implementation of ITU mandates of the World Summit on the Information Society (WSIS), and in particular to Action Lines C2 (Information and communication infrastructure), C5 (Building confidence and security in the use of ICTs) and C7 (e-Environment).

WSIS Forum 2013 was held 13-17 May 2013 in Geneva. ITU-T played a leading collaborating role in the preparation of WSIS+10 visioning interactive session, WSIS Action Line C2 Facilitation Meeting and thematic workshops on Infrastructure Broadband Backbone Connectivity, Climate Change, ICT innovation, and Accessibility.

ITU-T also participated actively in the ITU WSIS +10 review process.

In 2014, ITU-T participated in the WSIS+10 High-Level Event held 10-13 June 2014 which produced two important outcome documents: a "WSIS+10 Statement on Implementation of WSIS Outcomes"; and a "WSIS+10 Vision for WSIS Beyond 2015".

In 2015, ITU-T led or participated in the organization of workshops during WSIS Forum 2015 in Geneva, 25-29 May 2015, on the following subjects: Trust; Digital Financial Services; Accessibility; e-Waste Management and Gender; and IoT and Smart Sustainable Cities.

In 2016, ITU-T led or participated in the organization of workshops during WSIS Forum 2016 in Geneva, 2-6 May 2016, on the following subjects: Trust; Accessibility; Safe listening; Cybersecurity; Sustainable e-Waste Management; and the role of IoT and Smart Sustainable Cities in the pursuit of the UN Sustainable Development Goals.

# 22 ITU-T Review Committee

The ITU-T Review Committee (RevCom) was established to undertake a review of ITU's strategy, structure and working methods to assist related studies in TSAG. RevCom met six times in Geneva (June 2013, January 2014, June 2014, June 2015, January 2016 and July 2016) and once in Tunis, Tunisia, in February 2015. Two e-meetings were organized on [9 October 2014](http://ifa.itu.int/t/2013/revcom/exchange/rg-restruct/1410-GVA/) and [22 April 2015](http://ifa.itu.int/t/2013/revcom/exchange/rg-restruct/1504-GVA).

Several statistics-reporting tools were developed by TSB at the request of RevCom to facilitate the monitoring of Study Group activities. In reviewing the effectiveness and efficiency of the current ITU-T structure and groups (study groups, focus groups, joint coordination activities, global standards initiatives, etc.), RevCom identified Focus Groups as a key tool in ITU-T to stimulate new standardization work in the various Study Groups.

As such, RevCom recommended to TSAG that ITU-T develop guidelines on how to fast-track the transfer of Focus Group output into Recommendations developed by Study Groups. RevCom also called for ITU members to explore the establishment of a strategic coordination function focused on the dialogue among the leadership of ITU-T working groups (e.g., study group and focus group chairmen) on the identification and initiation of new work topics of particular strategic importance to industry and government.

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1. <http://itu.int/en/wtisd> [↑](#footnote-ref-1)
2. ITU-T SG11 Regional Group for Africa was established in July 2016 and will initiate activity in 2017. [↑](#footnote-ref-2)
3. ITU-T SG11 Regional Group for RCC was established in July 2016 and will initiate activity in 2017. [↑](#footnote-ref-3)