|  |  |  |
| --- | --- | --- |
| ITU logo | INTERNATIONAL TELECOMMUNICATION UNION**TELECOMMUNICATIONSTANDARDIZATION SECTOR**STUDY PERIOD 2017-2020 | **TD 138** |
| **TSAG** |
| **Original: English** |
| **Question(s):** | N/A | Geneva, 26 February – 2 March 2018 |
| **TD** |
| **Source:** | Director, TSB |
| **Title:** | Report of activities in ITU-T (from April 2017 to January 2018) |
| **Purpose:** | Information |
| **Contact:** | TSB TSAG  | E-mail: tsbtsag@itu.int |

|  |  |
| --- | --- |
| **Keywords:** | Standardization; Study Groups; activity report; key results |
| **Abstract:** | This report highlights the key results achieved in ITU-T standardization from April 2017 to January 2018, as well as measures taken by TSB to enhance the ITU-T standardization platform. |

CONTENTS

Page

[Executive Summary 6](#_Toc505855699)

[Annex – Full Report of activities in ITU-T (from April 2017 to January 2018) 8](#_Toc505855700)

[1 Transport and access networks 8](#_Toc505855701)

[1.1 G.fast and DSL: Breathing new life into existing copper infrastructure 8](#_Toc505855702)

[1.2 Ultra-high-speed access including NG-PON2 8](#_Toc505855703)

[1.3 Optical fibre 8](#_Toc505855704)

[1.4 Ultra-high-speed optical core network: OTN beyond 100G 9](#_Toc505855705)

[1.5 Optical transmission systems 9](#_Toc505855706)

[1.6 Transport network control aspects 9](#_Toc505855707)

[1.7 Ethernet over transport networks 9](#_Toc505855708)

[1.8 MPLS over transport networks 9](#_Toc505855709)

[1.9 Timing and synchronization 9](#_Toc505855710)

[1.10 Cable 9](#_Toc505855711)

[2 Smart 5G networks and networking solutions 9](#_Toc505855712)

[2.1 Synchronized mobile backhaul networks 9](#_Toc505855713)

[2.2 Smart ubiquitous networks, next-generation networks evolution, and future networks 9](#_Toc505855714)

[2.3 IMT-2020/5G networks 10](#_Toc505855715)

[2.4 Home networking 10](#_Toc505855716)

[2.5 Smart Grid 11](#_Toc505855717)

[2.6 Software-defined networking 11](#_Toc505855718)

[2.7 Cloud computing 11](#_Toc505855719)

[2.8 Big Data 11](#_Toc505855720)

[2.9 Network Management 11](#_Toc505855721)

[3 Media networking/broadcasting solutions 11](#_Toc505855722)

[3.1 Video and image coding 11](#_Toc505855723)

[3.2 Intelligent, interoperable visual surveillance systems 11](#_Toc505855724)

[3.3 Smart television systems 11](#_Toc505855725)

[3.4 IPTV and digital signage 12](#_Toc505855726)

[3.5 ITU IPTV IPv6 global testbed 12](#_Toc505855727)

[3.6 Immersive live experience 12](#_Toc505855728)

[3.7 Standards to assess quality of adaptive-bitrate video streaming 12](#_Toc505855729)

[3.8 New services and applications 12](#_Toc505855730)

[4 Hyperconnected smart world 12](#_Toc505855731)

[4.1 Internet of Things and Smart City 12](#_Toc505855732)

[4.2 Smart sustainable cities global initiative 13](#_Toc505855733)

[4.3 Cities trialling ITU key performance indicators for smart sustainable cities 13](#_Toc505855734)

[4.4 Connected vehicles, automated driving and intelligent transport systems 14](#_Toc505855735)

[4.5 Connected health: e-Health 14](#_Toc505855736)

[5 Security and trust 15](#_Toc505855737)

[5.1 New security standards 15](#_Toc505855738)

[5.2 Trust 17](#_Toc505855739)

[6 Environment and emergency communications 17](#_Toc505855740)

[6.1 Green ICT standards 17](#_Toc505855741)

[6.2 Electromagnetic fields 18](#_Toc505855742)

[6.3 SMART\* submarine cables systems 18](#_Toc505855743)

[6.4 Emergency communications & disaster relief 18](#_Toc505855744)

[7 Tariff and accounting principles and international telecommunication/ICT economic and policy issues 18](#_Toc505855745)

[7.1 Economic impact of IXP, Universal service, NGN, Mobile Roaming and SMPOTT and Valuation of spectrum 18](#_Toc505855746)

[8 Quality of service and experience 18](#_Toc505855747)

[9 Conformity, interoperability and testing 19](#_Toc505855748)

[9.1 Conformance Assessment Steering Committee (CASC) 19](#_Toc505855749)

[9.2 ICT Product Conformity Database 20](#_Toc505855750)

[9.3 SIP-IMS conformity assessment and interconnection testing 20](#_Toc505855751)

[9.4 Internet-related performance measurements 21](#_Toc505855752)

[9.5 IPTV testing events 21](#_Toc505855753)

[9.6 ITU-T studies on interconnection/interoperability of VoLTE/ViLTE services 21](#_Toc505855754)

[9.7 Testing performance of mobile phones with vehicle-mounted hands-free terminals 22](#_Toc505855755)

[9.8 Testing Internet of things 22](#_Toc505855756)

[10 Mainstreaming accessibility in ICTs 22](#_Toc505855757)

[10.1 Accessible ITU-T meetings 23](#_Toc505855758)

[10.2 Joint Coordination Activity on Accessibility and Human Factors (JCA-AHF) 23](#_Toc505855759)

[11 Intellectual property rights 23](#_Toc505855760)

[11.1 TSB Director's Ad Hoc Group on Intellectual Property Rights 23](#_Toc505855761)

[12 Combating counterfeit and stolen ICT devices 23](#_Toc505855762)

[13 ITU-T Focus Groups: Exploring new directions in ITU standardization 24](#_Toc505855763)

[13.1 Data Processing and Management to support IoT and Smart Cities & Communities 24](#_Toc505855764)

[13.2 Digital currency including digital fiat currency 24](#_Toc505855765)

[13.3 Application of Distributed Ledger Technology 24](#_Toc505855766)

[13.4 Machine learning in 5G systems 24](#_Toc505855767)

[14 Collaboration in standardization 25](#_Toc505855768)

[14.1 Coordination and cooperation among ITU Sectors 25](#_Toc505855769)

[14.2 General assistance and cooperation 25](#_Toc505855770)

[14.3 MoU and cooperation agreements 26](#_Toc505855771)

[14.4 Cooperation with national and regional standardization organizations 27](#_Toc505855772)

[15 Bridging the standardization gap 28](#_Toc505855773)

[15.1 BSG hands-on training sessions 28](#_Toc505855774)

[15.2 Regional Groups 28](#_Toc505855775)

[15.3 Standardization Forums 29](#_Toc505855776)

[15.4 National Standardization Secretariats 29](#_Toc505855777)

[15.5 e-Learning courses 29](#_Toc505855778)

[15.6 Study Group Mentoring Programme 30](#_Toc505855779)

[15.7 Technical Papers 30](#_Toc505855780)

[15.8 Fellowships 30](#_Toc505855781)

[15.9 BSG Programme 4: Fundraising for Bridging the Standardization Gap 32](#_Toc505855782)

[16 Membership 32](#_Toc505855783)

[16.1 Evolution of ITU-T membership 32](#_Toc505855784)

[16.2 Targeted outreach to network operators 33](#_Toc505855785)

[16.3 Gender 33](#_Toc505855786)

[17 Academia 34](#_Toc505855787)

[18 Publications 35](#_Toc505855788)

[19 Media and promotion 35](#_Toc505855789)

[20 Services and tools 36](#_Toc505855790)

[20.1 Noteworthy ITU-T Web Areas 36](#_Toc505855791)

[20.2 ITU-T MyWorkspace 36](#_Toc505855792)

[20.3 ITU Search engine 37](#_Toc505855793)

[20.4 ITU-T services & tools announcements 37](#_Toc505855794)

[20.5 Document Management System for Rapporteur Groups 37](#_Toc505855795)

[20.6 International Numbering Resources (INRs) 38](#_Toc505855796)

[20.7 ITU-T Study Groups SharePoint collaboration sites 39](#_Toc505855797)

[20.8 Meeting Documents Sync Application 39](#_Toc505855798)

[20.9 Electronic meetings 40](#_Toc505855799)

[20.10 Use in the ITU-T of the languages of the Union on an equal footing 40](#_Toc505855800)

[20.11 Workshops and symposia 41](#_Toc505855801)

[21 Implementation of WTSA-16 Resolutions 42](#_Toc505855802)

[22 ITU-T's activities in the implementation of WSIS and the Sustainable Development Goals 43](#_Toc505855803)

[23 Implementation of ITU-T A-series Recommendations 43](#_Toc505855804)

[23.1 Implementation of trial authorized by TSAG (July 2016 meeting) 43](#_Toc505855805)

[24 Stale work items 44](#_Toc505855806)

[Appendix I – List of approved Recommendations and other approved texts 45](#_Toc505855807)

# Executive Summary

*Achievements in ITU standardization*

ITU approved more than 270 new and revised ITU-T Recommendations from April 2017 to January 2018. Appendix I lists and summarizes the content of these ITU-T Recommendations and related texts.

ITU-T provides leadership in the standardization of broadband access and home networks and infrastructures for ultra-high-speed transport. High priority has been assigned to ITU-T standardization work on the wireline elements of IMT-2020 (5G) systems. Primetime Emmy Award winning ITU video compression standards continue to dominate the global marketplace.

ITU-T continues to increase the capabilities of broadband access technologies such as 40G Fibre to the Home (NG-PON2), 10G Symmetric Fibre to the Home (XGS-PON). G.fast is capable of delivering 2 Gbit/s over traditional telephone wires, and MGfast is a new standardization project aiming to achieve 5-10 Gbit/s over telephone wires by 2020. ITU standardization for the Optical Transport Network is driving optical transport to rates beyond 100 Gbit/s, meeting industry demand for increased capacity in metro and long-haul transport networks.

ITU-T has approved a first suite of standards on IMT-2020 (5G) based on the deliverables of the former ITU-T Focus Group on network aspects of IMT-2020. The standards cover terminology, network management and orchestration, network softwarization, and fixed-mobile convergence. ITU-T Study Groups 5, 12, 13, 15 are 17 are all engaged in standardization activity to support 5G/IMT-2020.

ITU, ISO and IEC received a Primetime Emmy Award in October 2017 in honour of “High Efficiency Video Coding” (HEVC, published as ITU H.265 | ISO/IEC 23008-2), the video compression standard that has emerged as the primary coding format for Ultra-High Definition TV. This is the second Primetime Emmy Award to recognize this video coding collaboration, following the 2008 award for HEVC’s predecessor, ITU-T H.264 | MPEG-4 AVC. A new collaboration has been formalized after an exploratory phase: the Joint Video Experts Group aims to deliver a new standard by 2020 with significant performance gains over HEVC.

ITU work to build confidence and security in the use of ICTs continues to expand. ITU-T Study Group 17 has established two new work streams to coordinate a growing volume of standardization work on security aspects of distributed ledger technologies such as blockchain and connected car communications. The new ITU-T X.1058 | ISO/IEC 29151 provides a valuable point of reference to government and industry in their protection of personal data. The new ITU-T X.1373 specifies secure software update capabilities for intelligent transport systems.

A new ITU-T Focus Group on ‘Machine learning for future networks including 5G’ is establishing a basis for ITU standardization to assist machine learning in bringing more automation and intelligence to ICT network design and management. The group is active alongside three other ITU-T Focus Groups, studying: ‘Data processing and management to support IoT and smart cities and communities’; ‘Application of distributed ledger technology’; and ‘Digital currency including digital fiat currency’.

The ‘Financial Inclusion Global Initiative’ is a three-year programme of collective action led by ITU, the World Bank Group and the Committee on Payments and Market Infrastructures, with support from the Bill & Melinda Gates Foundation. The initiative is designed to advance research in digital finance and accelerate digital financial inclusion in developing countries. This work is guided in large part by the 85 policy recommendations issued by the ITU-T Focus Group on Digital Financial Services.

The ‘United for Smart Sustainable Cities’ (U4SSC) initiative advocates for public policy to ensure that ICT standards play a definitive role in smart cities. The collaboration encouraged by U4SSC has led over 50 cities to join a pilot project implementing the Key Performance Indicators for Smart Sustainable Cities developed by ITU and the United Nations Economic Commission for Europe (UNECE). New ITU case studies offer an evaluation of the progress achieved by Dubai and Singapore in meeting the objectives of their smart city strategies, evaluations undertaken using the ITU-UNECE Key Performance Indicators.

*ITU standardization platform*

ITU-T achieved a net increase of 14 new memberships in 2017, including 9 new Sector Memberships and 21 new Associate Memberships. New ITU-T Sector Memberships taken up by companies in the automobile and insurance industries, as well as emerging market segments in IoT and M2M, reflect the growing importance of ITU-T support for vertical markets such as healthcare, transport, energy and financial services.

Over 10 800 pages of ITU-T Recommendations and Supplements were published between May 2017 and January 2018. See section 19. The ITU product "ITU-T Recommendations and selected Handbooks" continues to be distributed on a quarterly basis. Because of space limitations of the double-layer DVD format, the product has been distributed on a USB key starting with the March 2017 edition.

ITU workshops help increase ITU-T’s visibility, disseminate accomplished results, encourage participation in ITU-T, attract new members, and build collaboration with other organizations. 35 ITU-T workshops were held in 2017, seven focused on bridging the standardization gap and seven co-orgnaized with other organizations.

Communications on ITU-T standardization feature among the most popular ITU content each year. TSB maintains a consistent output of original ITU-T news content, coupled with a coordinated social media strategy led by the ITU General Secretariat. In 2017, levels of worldwide media coverage were highest for the Primetime Emmy Award recognizing High Efficiency Video Coding and the AI for Good Global Summit.

[MyWorkspace](https://www.itu.int/net4/ITU-T/myworkspace/) is a new personalized webpage for TIES users that provides easy access to the information and services most valued by ITU-T delegates. The [search engine](https://www.itu.int/net4/ITU-T/search/Landing) returns results from the full collections of ITU documents, publications and web pages. ITU-T Study Groups’ SharePoint collaboration sites continue to be enhanced. A new service announcements news channel, <http://tsbtech.itu.int/>, provides regular updates on new services and tool enhancements available to ITU-T delegates.

TSB continues to translate Recommendations approved under the traditional approval process (TAP), as well as all TSAG reports in all the languages of the Union. In 2017, TSB translated 60 AAP Recommendations in the reporting period, in accordance with requests previously received from the ITU-T Study Groups and linguistic groups, and within the allocated translation budget.

Diversity of staff, gender equality and the empowerment of women continue to be among TSB's priorities. 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. 48 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. Women hold 39 per cent of TSB’s professional posts and 67 per cent of the posts at P5 level.

# Annex – Full Report of activities in ITU-T (from April 2017 to January 2018)

# 1 Transport and access networks

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

MGfast is a new ITU-T Q4/15 standardization project that aimes to achieve 5-10 Gbit/s broadband over traditional telephone wiring by 2020.

G.fast is an ITU broadband standard capable of delivering access speeds up to 2 Gbit/s over copper wiring and coaxial cable. It answers service providers’ need to complement fibre-to-the-home (FTTH) technologies in scenarios where G.fast proves the more cost-efficient strategy.

ADTRAN, Arris, Calix, Huawei, Metanoia, Nokia and Technicolor are among the first vendors to have completed the [G.fast certification programme](https://www.broadband-forum.org/implementation/interop-certification/test-certification-program) run by the Broadband Forum and the University of New Hampshire InterOperability Laboratory.

The certification programme is making an essential contribution to industry confidence in G.fast. The G.fast solutions that have achieved chipset interoperability have undergone thousands of tests to gain the prized G.fast certification.

See relevant [press release](http://news.itu.int/meet-itu-experts-aiming-achieve-10-gbit-s-broadband-traditional-telephone-wiring/).

**Approved Recommendations: see Appendix I.1.1.**

## 1.2 Ultra-high-speed access including 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.

NG-PON2 40G Fibre to the Home is a major milestone in access networking as the first series of standards to provide broadband 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.

**Approved Recommendation: see Appendix I.2.2.**

## 1.3 Optical fibre

ITU-T L.110 “Optical fibre cables for direct surface application” defines the shape of low-cost, terabit-capable optical cable that can be deployed on the ground’s surface with minimal expense and environmental impact. ITU-T L.110 was developed within the framework of Recommendation [ITU-T L.1700](http://www.itu.int/itu-t/recommendations/rec.aspx?rec=12885), a standard prviding “requirements and framework for low-cost sustainable telecommunications infrastructure for rural communications in developing countries”. L.1700 builds on established technologies to identify the founding principles for low-cost, sustainable broadband backhaul infrastructure. See relevant [press release](http://newslog.itu.int/archives/1579).

ITU-T L.404 specifies the design of a “field-mountable single-mode fibre connector**”**, building on a design originally intended to support quick repairs and temporary connections. The time-tested connector has existed for decades but has found new relevance in the past ten years as a result of its value to the installation of FTTH connections. Customers will see ITU-T L.404 in action at the wall outlet of their FTTH connection. ITU-T L.404 enables these connections to be made fast and with great flexibility, meeting technicians’ needs in a wide variety of installation scenarios. See relevant [press release](http://news.itu.int/wall-outlet-connector-ftth-installation/).

**Approved Recommendations: see Appendix I.1.3.**

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

**Approved Recommendations: see Appendix I.1.4.**

## 1.5 Optical transmission systems

**Approved Recommendations: see Appendix I.1.5.**

## 1.6 Transport network control aspects

**Approved Recommendations: see Appendix I.1.6.**

## 1.7 Ethernet over transport networks

**Approved Recommendations: see Appendix I.1.7.**

## 1.8 MPLS over transport networks

**Approved Recommendations: see Appendix I.1.8**

## 1.9 Timing and synchronization

**Approved Recommendations: see Appendix I.1.9.**

## 1.10 Cable

**Approved Recommendations: see Appendix I.1.10.**

# 2 Smart 5G networks and networking solutions

## 2.1 Synchronized mobile backhaul networks

Timing and synchronization is crucial to the efficient operation of advanced mobile-wireless technologies. ITU-T Q13/15 is developing standards on synchronization in the ITU-T G.8200-series Recommendations.

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

ITU-T Y.2322 “The functional architecture of VCNMO (Virtualized Control Network entities Management and Orchestrator) in NGN evolution” was approved (see annex for details).

[ITU Y.2241 supports customized e-learning in future networks](http://handle.itu.int/11.1002/1000/13348), detailing a web service framework to support ‘ubiquitous self-directed learning’. It supports adaptive learning methodologies attentive to the behaviour of the learner, providing for e-learning service features such as self-guided reading, participation in study groups, internships, electronic dialogues and reflective writing activities. See relevant [press release](http://news.itu.int/new-itu-standard-to-support-customized-e-learning-in-future-networks/).

**Approved Recommendations: see Appendix I.2.2.**

## 2.3 IMT-2020/5G networks

ITU Y.3101 “Requirements of the IMT-2020 network” describes the features of 5G networks necessary to ensure efficient 5G deployment and high network flexibility. ITU Y.3150 “High-level technical characteristics of network softwarization for IMT-2020” describes the value of slicing in both horizontal and vertical, application-specific environments.

ITU Y.3130 “Requirements of IMT-2020 fixed-mobile convergence” calls for unified user identity, unified charging, service continuity, guaranteed support for high quality of service, control plane convergence and smart management of user data.

ITU standardization work on the wireline elements of 5G systems continues to accelerate.

[ITU-T Study Group 15 (Transport, access and home)](https://www.itu.int/en/ITU-T/about/groups/Pages/sg15.aspx) is developing a technical report on 5G requirements associated with backbone optical transport networks. [ITU-T Study Group 11 (Protocols and test specifications)](https://www.itu.int/en/ITU-T/about/groups/Pages/sg11.aspx) is studying the 5G control plane, relevant protocols and related testing methodologies. [ITU-T Study Group 5 (Environment and circular economy)](https://www.itu.int/en/ITU-T/about/groups/Pages/sg05.aspx) has assigned priority to its emerging study of the environmental requirements of 5G systems.

[ITU-T Study Group 13 (Future networks)](https://www.itu.int/en/ITU-T/about/groups/Pages/sg13.aspx) continues to support the shift to software-driven network management and orchestration. The group is progressing draft 5G standards addressing subjects including network architectures, network capability exposure, network slicing, network orchestration, network management-control, and frameworks to ensure high quality of service.

5G wireline standards developed by ITU-T Study Group 13 and approved in 2017 include:

[ITU Y.3101 “Requirements of the IMT-2020 network”](https://www.itu.int/rec/T-REC-Y.3101/en) describes the features of 5G networks necessary to ensure efficient 5G deployment and high network flexibility. ITU Y.3150 “High-level technical characteristics of network softwarization for IMT-2020” describes the value of slicing in both horizontal and vertical, application-specific environments.

[ITU Y.3130 “Requirements of IMT-2020 fixed-mobile convergence”](https://www.itu.int/rec/T-REC-Y.3130-201801-P/en) calls for unified user identity, unified charging, service continuity, guaranteed support for high quality of service, control plane convergence and smart management of user data.

[ITU Y.3071 “Data Aware Networking (Information Centric Networking) – Requirements and Capabilities”](http://www.itu.int/rec/T-REC-Y.3071-201703-I/en) will support ultra-low latency 5G communications by enabling proactive in-network data caching and limiting redundant traffic in core networks.

[ITU Y.3100 “Terms and definitions for IMT-2020 network”](https://www.itu.int/ITU-T/recommendations/rec.aspx?rec=13349&lang=en) provides a foundational set of terminology to be applied universally across 5G-related standardization work.

[ITU Y.3111 “IMT-2020 network management and orchestration framework”](http://handle.itu.int/11.1002/1000/13351-en) establishes a framework and related principles for the design of 5G networks.

[ITU Y.3310 “IMT-2020 network management and orchestration requirements”](http://handle.itu.int/11.1002/1000/13350-en) describes the capabilities required to support emerging 5G services and applications.

[Supplement 44 to the ITU Y.3100 series “Standardization and open source activities related to network softwarization of IMT-2020”](https://www.itu.int/ITU-T/recommendations/rec.aspx?rec=13353) summarizes open-source and standardization initiatives relevant to ITU’s development of standards for network softwarization.

See relevant [press release](http://news.itu.int/5g-update-new-itu-standards-network-softwarization-fixed-mobile-convergence/).

**Approved Recommendations: see Appendix I.2.3.**

## 2.4 Home networking

**Approved Recommendations: see Appendix I.2.4.**

## 2.5 Smart Grid

**Approved Recommendations: see Appendix I.2.5.**

## 2.6 Software-defined networking

**Approved Recommendations: see Appendix I.2.6.**

## 2.7 Cloud computing

A new ITU-T standard Y.3516 “Cloud computing - Functional architecture of inter-cloud computing” was approved in 2017.

The **Cloud Computing Roadmap** (under development) 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.

**Approved Recommendations: see Appendix I.2.7.**

## 2.8 Big Data

The new ITU-T standards Y.3601 “Big data - framework and requirements for data exchange” (currently in AAP LC comments resolution process) and Y.3650 “Framework of big data driven networking” were developed to a mature state (see Annex for more details).

**Approved Recommendations: see Appendix I.2.8.**

## 2.9 Network Management

**Approved Recommendations: see Appendix I.2.9.**

# 3 Media networking/broadcasting solutions

## 3.1 Video and image coding

The prestige of the collaborative video coding work of ITU, ISO and IEC was recognized with a Primetime Emmy Award in October 2017 in honour of “High Efficiency Video Coding” (HEVC, published as ITU H.265 | ISO/IEC 23008-2), the video compression standard that has emerged as the primary coding format for Ultra-High Definition TV. This is the second Primetime Emmy Award to recognize this video coding collaboration, following the 2008 award for HEVC’s predecessor, ITU-T H.264 | MPEG-4 AVC.

The fifth edition of the HEVC was completed in October 2017. A new collaboration has been formalized after an exploratory phase: the Joint Video Experts Group aims to deliver a new standard by 2020 with significant performance gains over HEVC.

Approved Recommendations: see Appendix I.4.1.

## 3.2 Intelligent, interoperable visual surveillance systems

The work on visual surveillance progressed with the approval of new Recommendation ITU-T H.626.2 that defines an architecture for cloud storage in visual surveillance systems.

**Approved Recommendation: see Appendix I.3.2**

## 3.3 Smart television systems

**Approved Recommendation: see Appendix I.3.3.**

## 3.4 IPTV and digital signage

Work on IPTV and digital signage progressed with Recommendations with a profile for HTML in IPTV systems; with specifications for interworking between IPTV terminals for continuous and seamless content consumption independently of the terminal device type, the access network type and the users' location; and specification of metadata structures and data elements for interoperable digital signage systems.

**Approved Recommendations: see Appendix I.3.4.**

## 3.5 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. At the ITU-T SG16 meeting in Macau, China, October 2017, experts started working on draft ITU-T Technical Paper [HSTP.IPTV-Guide.2](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14423), “IPTV service parameters for new IPTV service providers”, in order to help new implementers of ITU-T’s IPTV standards to decide several technical parameters, by providing guidelines and examples of good practice gained through I3GT project conducted in different environments, regions or countries.

## 3.6 Immersive live experience

ITU members have progressed 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. In addition to updated and new work items, the [3rd ILE Mini Workshop](https://www.itu.int/en/ITU-T/studygroups/2017-2020/16/Pages/ws/201710_ILE.aspx) was held in Macau, 24 October 2017, during the SG16 meeting.

## 3.7 Standards to assess quality of adaptive-bitrate video streaming

ITU-T SG12 is extending its video quality assessment standards to provide support for ‘4K’ UHD video encoded using ITU-T H.264, ITU-T H.265, and VP9. Work was also initiated to assess the initial loading delay of videos on user experience.

## 3.8 New services and applications

Natural language processing: Work was completed on ITU-T F.746.5 (ex H.LLS-FW) that defines a Framework for language learning system based on speech and natural language processing.

Information-centric networks (ICNs): Complementing the approval of new ITU-T F.746.6 (ex F.NRICNReqs) "Requirements for a name resolution service in information-centric networks", a mini workshop on future content delivery networks was organized in Macau, 17 October 2017, in parallel with the SG16 meeting.

**Approved Recommendations: see Appendix I.3.8.**

# 4 Hyperconnected smart world

## 4.1 Internet of Things and Smart City

Internet of Things (IoT) technologies are automating and adding intelligence to business operations in every industry sector, driving innovation in fields spanning from energy and water management to transportation, healthcare, manufacturing and agriculture.

ITU-T continues to advance IoT standardization work in the fields of definition, overview.

The [IoT and Smart Cities and Communities Standards Roadmap](https://www.itu.int/net4/itu-t/roadmap#?topic=0&workgroup=1&searchValue=&page=1&sort=Revelance) 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.The 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).

ITU-T SG20 is building close collaboration with oneM2M. Following the creation of 24 new work items based on oneM2M specifications, 14 new draft ITU-T Recommendations have since gained consent; one has been determined; and one has been approved.

ITU-T SG20 leads ITU’s contribution to the IEC- ISO-ITU Working team on Smart City Terminology established in July 2017.

IEC, ISO and ITU organize the annual World Smart City Forum ([Singapore, 13 July 2016](http://www.worldsmartcity.org/) and [Barcelona, 15 November 2017](http://www.cvent.com/events/world-smart-cities-forum-2017/event-summary-4b48256f68c240a39c4576ce295121ac.aspx)).

**Approved Recommendation: see Appendix I.4.1**

## 4.2 Smart sustainable cities global initiative

The [United for Smart Sustainable Cities (U4SSC)](https://www.itu.int/en/ITU-T/ssc/united/Pages/default.aspx) is a UN initiative coordinated by ITU and UNECE and supported by 14 other UN Agencies and Programmes: CBD, ECLAC, FAO, UNESCO, UNDP, UNECA, UN-Women, UN Environment, UNEP-FI, UNFCCC, UN-Habitat, UNIDO, UNU-EGOV and WMO.

U4SSC advocates for public policy to ensure that ICT standards play a definitive role in smart cities.

The U4SSC has developed the following deliverables:

* [Flipbook on "Connecting cities and communities with the SDGs"](https://www.itu.int/en/publications/Documents/tsb/2017-U4SSC-Deliverable-Connecting-Cities/index.html)
* [Flipbook on "Enhancing innovation and participation in smart sustainable cities"](https://www.itu.int/en/publications/Documents/tsb/2017-U4SSC-Enhancing-innovation/index.html)
* [Flipbook on "Implementing SDG11 by connecting sustainability policies and urban planning practices through ICTs".](https://www.itu.int/en/publications/Documents/tsb/2017-U4SSC-Implementing-sustainable-devt/index.html)

U4SSC is currently working on the following deliverables: Guidelines on tools and mechanisms to finance SSC projects; Guidelines on strategies for circular cities; City science application framework; Guiding principles for artificial intelligence in cities and Blockchain 4 cities.

A [Global Portal on IoT, Smart Cities & Communities](http://www.itu.int/en/ITU-T/ssc/Pages/default.aspx) provides references to external resources on these issues.

## 4.3 Cities trialling ITU key performance indicators for smart sustainable cities

The collaboration encouraged by U4SSC has led over 50 cities to join a pilot project implementing the Key Performance Indicators for Smart Sustainable Cities developed by ITU and UNECE.

New ITU case studies offer an evaluation of the progress achieved by Dubai and Singapore in meeting the objectives of their smart city strategies, evaluations undertaken using the ITU-UNECE Key Performance Indicators.

* “[Implementing ITU-T International Standards to Shape Smart Sustainable Cities: The Case of Singapore](https://www.itu.int/en/publications/Documents/tsb/2017-Implementing-ITU-T-International-Standards-to-Shape-Smart-Sustainable-Cities-The-Case-of-Singapore/index.html#p=1)”
* “[Implementing ITU-T International Standards to Shape Smart Sustainable Cities: The Case of Dubai](https://www.itu.int/en/publications/Documents/tsb/2016-DubaiCase/index.html#p=1)”

U4SSC has developed a ['Collection methodology for the Key Performance Indicators for Smart Sustainable Cities'](https://www.itu.int/en/publications/Documents/tsb/2017-U4SSC-Collection-Methodology/index.html) to guide cities in their collection of core data and information necessary to the assessment of their progress in becoming smart sustainable cities.

The collection methodology developed by U4SSC complements the three sets of Key Performance Indicators for Smart Sustainable Cities developed by ITU and UNECE. Two sets of indicators provide a framework to measure and report progress relevant to the ICT aspects of a smart city, in terms of the [use of ICTs](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=12661) and the [impact of ICTs on sustainability](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=12662). The third assists cities' efforts to measure their [progress towards the achievement of the United Nations' Sustainable Development Goals](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=12884).

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

ITU-T SG17 has established a new work stream to coordinate the development of security standards for intelligent transport systems (ITS).

Question 13/17 will standardize identification and authentication schemes for ITS services and applications, building on ITU-T Study Group 17’s expertise in Identity Management. In view of identified threats to user privacy, Question 13/17 will develop privacy protection and management schemes within the framework of ITU’s standardization work on the protection of ‘personally identifiable information’.

An ITU standard for secure over-the-air software updates for connected cars was approved in March 2017, and a new ITU standard is under development to provide security guidelines for ‘V2X’ communications such as vehicle-to-vehicle and vehicle-to-infrastructure communications.

ITU continues to see key results emerging from its collaboration with the [UNECE Transport Division](http://www.unece.org/wp29.html), the body responsible for global vehicle regulations. The new global regulation on vehicle emergency calls, ‘Automatic Emergency Call Systems’, makes reference to an ITU voice-quality performance standard.

The annual [ITU-UNECE Symposium on the Future Networked Car](https://www.itu.int/en/fnc/2018/Pages/default.aspx) (FNC-2018) will take place on 8 March 2018 at the Geneva International Motor Show. It brings together key players in the ICT and automotive industries to present their latest intelligent-transport innovations. See relevant [press release](http://news.itu.int/8-march-symposium-future-networked-car-within-geneva-motor-show/). The draft programme is available [here](https://www.itu.int/en/fnc/2018/Pages/programme.aspx).

Helping different actors in the ecosystem to understand one another is one of the objectives of the [Collaboration on ITS Communication Standards (CITS)](https://www.itu.int/en/ITU-T/extcoop/cits/Pages/default.aspx), which works to identify where different standards bodies are best placed to contribute to the achievement of common goals in ITS standardization. The next meeting is planned at ITU on 9 March 2018, back-to-back with FNC-2018.

The [UN Task Force on Cybersecurity and Over-the-Air Issues](https://wiki.unece.org/pages/viewpage.action?pageId=40829521), which reports to UNECE WP.29, has assessed ITS security threats and started to develop 18 mitigations, an effort Nakao sees as a valuable reference point for the work of ITU-T Study Group 17.

ITU’s collaboration with UNECE WP.29 has flourished in other areas, most notably in the area of vehicle emergency calls. The new global regulation on vehicle emergency calls, ‘Automatic Emergency Call Systems’, will reference an ITU-T voice-quality performance standard ([ITU-T P.1140](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=13177)). See relevant [press release](http://newslog.itu.int/archives/1613).

ITU also co-organized with TIA on 5-6 December 2017 in Arlington, USA a [Workshop on "Autonomous Transportation”](http://www.tiaonline.org/autonomous-transportation) as well as a meeting of the Collaboration on ITS Communication Standards.

**Approved Recommendations: see Appendix I.4.4.**

## 4.5 Connected health: e-Health

ITU continued the work on personal connected health devices with the transposition of the next edition of the Continua Design Guidelines (CDG), contributed to ITU by the Personal Connected Health Alliance, for a total of eight Recommendations. The CDG have been adopted in various countries following the adoption of the CDG as ITU-T Recommendations, inter alia Norway, Denmark and Sweden; other European countries are looking into following the same path.

In order to meet market expectations, and in particular adoption in Norway, a technical paper was approved with a "specification for trial implementation" of a new observation upload technology called FHIR (read as /*fire*/) being prototyped by HL7 and in high demand by implementers. It is expected that this Technical Paper will become a Recommendation shortly after the final version of FHIR is published by HL7. Two Technical Papers introducing the Continua Design Guidelines were reviewed and offer readers an overview of the protocol stack as well as of the data exchange (upload) mechanisms within the CDG.

A new Recommendation on *Requirements on a communication platform for multimedia brain information* aims at facilitating the exchange of brain data for clinical and research purposes.

**Approved Recommendations: See Appendix I.4.5.**

# 5 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-T Study Group 17 this year established two new work streams to coordinate a growing volume of standardization work on security aspects of distributed ledger technologies such as blockchain and connected car communications. See relevant [press release](http://news.itu.int/international-standard-curb-theft-personal/). In addition, ITU security standardization work continues on topics including:

* Cybersecurity
* Telecommunication security management
* Security architectures and frameworks
* Mobile security
* Web security
* Countering spam
* Protection of Personally Identifiable Information

ITU-T SG17 plans to organize an [ITU workshop on 5G Security](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/20180319/Pages/default.aspx) on 19 March 2018, prior to the next SG17 meeting on 20-29 March 2018 in Geneva, Switzerland.

## 5.1 New security standards

[ITU-T X.1058 | ISO/IEC 29151 “Code of Practice for the Protection of Personally Identifiable Information”](https://www.itu.int/rec/T-REC-X.1058-201703-I/en) establishes the objectives of data-protection controls, specifies the controls required and provides guidelines for their implementation. It shows how arrangements of these controls can meet the requirements identified by organizations’ risk and impact assessments relevant to the protection of personal data. The standard builds on ISO/IEC 27002 – code of practice for information security controls – with guidelines specific to personal data protection. An Annex integral to Recommendation ITU-T X.1058 provides an extended set of controls for personal data beyond the standard’s augmented provisions of ISO/IEC 27002.

[ITU-T X.1080.0 “Access control for telebiometrics data protection”](https://www.itu.int/itu-t/recommendations/rec.aspx?id=13193) is a specification for how to protect telebiometrics information against unauthorized access. It does so by taking a service-oriented view, where only information necessary for a particular purpose is provided, i.e., access is given not only on a right-to-know basis, but also on a need-to-know basis. The heart of this Recommendation is an attribute specification included in an attribute certificate or public-key certificate that specifies in details what privileges a particular entity has for one or more service types.

[ITU-T X.1040 “Security reference architecture for lifecycle management of e-commerce business data”](https://www.itu.int/rec/T-REC-X.1040-201710-I/en) analyzes the main features and typical threats faced by e commerce service ecosystems, and provides a security reference architecture for lifecycle management of e-commerce business data.

[Supplement 30 to ITU-T X.805 “Security guidelines for mobile virtual network operators”](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=13410&lang=en) analyses the main features of MVNOs and the typical security threats that they face. Security is very important to MVNOs and most MVNOs share similar security concerns. Based on the structure of MVNOs, this Supplement provides a security framework for MVNOs, including security objectives and security requirements.

[ITU-T X.1053 “Code of practice for information security controls based on ITU-T X.1051 for small and medium-sized telecommunication organizations”](https://www.itu.int/rec/T-REC-X.1053-201711-I) establishes guidelines and general principles for initiating, implementing, maintaining, and improving information security controls in small and medium-sized telecommunication organizations (SMTOs) with an implementation baseline of information security controls for SMTOs to ensure the confidentiality, integrity and availability of telecommunication facilities and services and information handled, processed or stored by the facilities and services.

[ITU-T X.1362 “Simple encryption procedure for Internet of things (IoT) environments”](https://www.itu.int/rec/T-REC-X.1362-201703-I/en) solves this issue with specification on an encryption with associated mask data (EAMD) for the Internet of things (IoT) devices and how it provides a set of security services for traffic using it.To ensure data confidentiality and integrity protection, one of the most basic countermeasures is the application of data encryption/authentication algorithms. The problem to apply data encryption/authentication algorithm in IoT scenario is that this real-time processing requirement could not be met.

[ITU-T X.1373 “Secure software update capability for intelligent transportation system communication devices”](https://www.itu.int/rec/T-REC-X.1373-201703-I/en) specifies secure software update procedures between software-update-server and vehicles with appropriate security controls. This Recommendation can be practically utilized by car manufactures and ITS-related industries as a set of standard capabilities for best practices.

[ITU-T X.1213 “Security capability requirements for countering smartphone-based botnets”](https://www.itu.int/rec/T-REC-X.1213-201709-I/en) analyzes the background and potential security threats of smartphone-based botnets and provides security capability requirements. The potential threat of smartphone-based botnets is increasing very quickly in some regions, showing potential to become a serious global issue. Compared with PCs and servers, smartphones have less processing power, storage space and battery life. However, the adversarial influence of smartphone-based botnets could have greater repercussions on users for the following reasons: 1) smartphones often store very important personally identifiable information (PII) and 2) if attacks on smartphones or on the operator's infrastructure occur, user experience may degrade significantly due to the prevalence of, and user dependence on, smartphones.

[ITU-T X.1550 “Access control models for incident exchange networks”](https://www.itu.int/rec/T-REC-X.1550-201703-I/en) introduces existing approaches for implementing access control policies for incident exchange networks. This Recommendation introduces a variety of well-established access control models, sharing models as well as criteria for evaluating incident exchange network performance. Standards-based solutions are considered to facilitate implementation of different access control models within different cybersecurity information sharing models and under diverse trust environments.

[ITU-T X.1248 “Technical requirements for countering instant messaging spam”](https://www.itu.int/rec/T-REC-X.1248-201709-I) identifies characteristics of spam over instant messaging (SPIM) and specifies technical requirements for countering it. As instant messaging (IM) increases in popularity, the proliferation of SPIM becomes an increasingly serious problem. The characteristics of IM, such as being Internet protocol (IP)-based with widespread usage that is free of charge, potentially allows SPIM to spread widely and uncontrollably. If SPIM problems are not carefully addressed, they can have negative impacts on the utilization of the IM service itself.

[Supplement 29 to ITU-T X.1242 “Guidelines on countermeasures against short message service (SMS) phishing and smishing attacks”](https://www.itu.int/ITU-T/recommendations/rec.aspx?rec=13409&lang=en) provides a universal guideline about security technology against SMS phishing incident and method, and specification of report contents. Short message service (SMS) phishing is a fraudulent technique through mobile phones by causing phishing frauds with smartphones, acquiring personal information on the smartphones, or by enabling small amounts of money to be approved and paid while the account holder is not aware of the approval.

[ITU-T X.1145 “Security framework and requirements for open capabilities of telecommunication services”](https://www.itu.int/rec/T-REC-X.1145-201705-I/en) focuses on an analysis of the security requirements of open capabilities of telecommunication services and provides a security framework. As the core asset for operators, capabilities of telecommunication services should be opened in a secure way and be fully protected, as both operators' business security and users' information security are implicated. Without a comprehensive security mechanism, an unsecure/spiteful application/service from a third party service provider using the capabilities of telecommunication services may harm the operators' transmission network, business system and even users' personally identifiable information (PII). Consequently, in order to offer secure telecommunication service capabilities to cooperative service providers, the security requirements for open capabilities of telecommunication services need to be analysed exhaustively and an overall security framework needs to be established.

[ITU-T X.1146 “Secure protection guidelines for value-added services provided by telecommunication operators”](https://www.itu.int/rec/T-REC-X.1146-201710-I) analyzes typical service scenarios, security threats and attack methods, and provides technical measures to counter threats and attacks. Value-added services including Mobile Office Automation, e-Reading, e-Commerce, etc often involve sensitive operations or critical dada, which could be the target of the malicious attackers. Malicious users may utilize the service vulnerabilities to get benefits or do harm to the service and other users.

**These and further approved Recommendations: see Appendix I.5.1.**

## 5.2 Trust

A new ITU-T Recommendation Y.3053 “Framework of trustworthy networking with trust-centric network domains” was approved in January 2018 (see Annex for details).

**Approved Recommendations: see Appendix I.5.2.**

# 6 Environment and emergency communications

## 6.1 Green ICT standards

ITU-T SG5 has launched a new project on ***Setting Environmental Requirements for 5G***, developing a series of technical reports and international standards on 5G electromagnetic compatibility (EMC); electromagnetic fields (EMF); energy feeding and efficiency; and resistibility.

ITU-T SG5 has agreed four new Supplements to ITU standards looking at four key dimensions of 5G’s relationship with our environment: energy efficiency (K. Suppl. 8), resistibility to electromagnetic disturbances (K. Suppl. 9), EMC (K. Suppl. 10), and the responsible management of human exposure to EMF (L. Suppl. 36). These four dimensions of 5G environmental sustainability will remain the focus of ITU-T SG5’s new standardization project on ‘5G environmental requirements’, a project to benefit from the close collaboration of ITU and ETSI.

18 new standards developed by ITU-T SG5 have been approved.

The standards include energy efficiency metrics for network infrastructure as well as expert guidance on EMC requirements, the management of EMF, e-waste management and the protection of ICT systems from forces of nature.

A new standard will support the shift to more resource-efficient ICT value chains by helping network operators and their suppliers to operate in line with the key principles of ‘circular economy’.

Two new standards address risk assessments relevant to ICT sector’s adaptation to climate change and the role played by ICTs in assisting climate change adaptation in the fisheries sector.

See relevant [press release](http://news.itu.int/itu-environment-expert-group-takes-aim-5g-energy-efficiency/).

**Approved Recommendations: see Appendix I.6.1.**

## 6.2 Electromagnetic fields

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.

**Approved Recommendations: see Appendix I.6.2.**

## 6.3 SMART\* submarine cables systems

The [ITU/WMO/UNESCO-IOC Joint Task Force on SMART[[1]](#footnote-1) 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.

Information on this Task Force including publications and workshop information is available at its webpage: <http://www.itu.int/en/ITU-T/climatechange/task-force-sc/Pages/default.aspx>.

## 6.4 Emergency communications & disaster relief

**Approved Recommendation: see Appendix I.6.4.**

# 7 Tariff and accounting principles and international telecommunication/ICT economic and policy issues

## 7.1 Economic impact of IXP, Universal service, NGN, Mobile Roaming and SMPOTT and Valuation of spectrum

ITU-T SG3 agreed on two Technical Papers on the [Economic impact of OTTs](https://www.itu.int/pub/publications.aspx?lang=en&parent=T-TUT-ECOPO-2017) and the [Methodologies for valuation of spectrum](https://www.itu.int/pub/publications.aspx?lang=en&parent=T-TUT-ECOPO-2017-2).

# 8 Quality of service and experience

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.

The second meeting of SG12 in this study period ([summary](https://www.itu.int/en/ITU-T/studygroups/2017-2020/12/Pages/1709-summary.aspx)) reached consent on 10 draft Recommendations, agreement of two Supplements and creation of 12 new work items, including five of those work items related to WTSA-16 Resolution 95 on *ITU-T initiatives to raise awareness on best practices and policies related to service quality*. Addressing the same Resolution, SG12 adopted a questionnaire on service quality regulatory frameworks for dissemination by TSB (see [TSB Circular 62](https://www.itu.int/md/T17-TSB-CIR-0062/en)). SG12 initiated studies on the effect of so-called SIM-boxing on QoS and QoE (related to WTSA‑16 Resolution 29) and on QoS and QoE aspects of digital financial services (related to WTSA‑16 Resolution 89).

The meeting completed work on conversational speech quality analysis (now Recommendation ITU‑T P.804) and gaming quality of experience (ITU-T G.1032). The vocabulary for performance and quality of service (ITU-T P.10 / G.100) was also revised.

SG12 released the [ITU-T Software Tool Library (Recommendation ITU-T G.191) on GitHub](https://github.com/openitu/STL), enabling the wider community to use, improve and contribute to the code. SG12 also approved working methods enabling it to collaborate with ETSI TC STQ WG MOBILE in selected areas of interest, e.g., update and maintenance of the ETSI TS 102 250 series and Recommendation ITU-T E.804; QoS and QoE aspects of digital financial services.

SG12 delegates contributed to the development of a QoS Regulation Manual and the QoS Training Programme, in close collaboration with the BDT.

The Quality of Service Development Group, operating under SG12, organized two workshops in the reporting timeframe:

The [**ITU Workshop on Performance, QoS and QoE for Multimedia Services**](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/qos/201707/Pages/default.aspx), Johannesburg, South Africa, 24-25 July 2017 discussed **KPIs and methods for measuring and evaluating the QoS/QoE in LTE and LTE-Advanced networks, QoS/QoE regulatory and policy aspects, network performance and QoS requirements for 5G networks, and ITU-T activities on QoS/QoE.**

**The** [ITU Workshop on Telecommunications Service Quality](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/qos/201711/Pages/default.aspx)**, Rio de Janeiro, Brazil, 27‑29 November 2017 offered a platform to discuss current trends in telecommunications service quality, including regulatory frameworks, customer behavior and strategies for ensuring quality of service and quality of experience, for all stakeholders involved. Both events attracted more than 100 participants, including representatives of organizations interested in ITU-T Sector Membership / SG12 Associate Membership.**

**Approved Recommendations: see Appendix I.8.**

# 9 Conformity, interoperability and testing

The [ITU Conformity and Interoperability (C&I) programme](http://www.itu.int/en/ITU-T/C-I/Pages/default.aspx) is of particular value to developing countries in their efforts to increase conformance with ITU standards and benefit from improved interoperability.

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-16'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").

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 ITU-T Study Groups consider 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. One workshop on C&I and two test events were organized since April 2017.

More information about ITU C&I Programme is available on its web page [www.itu.int/go/citest](http://www.itu.int/go/citest).

## 9.1 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-T SG11 in 2015. 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.

The fifth meeting of CASC took place in November 2017.

ITU-T CASC continue collaboration with existing conformity assessment systems and schemes such as IEC and ILAC, including participation in a new Task Force “ITU requirements” which was set up by IECEE Certification Management Committee (CMC). ITU-T CASC is currently developing guidelines to detail collaboration mechanisms with IECEE. The next meeting will take place during next SG11 meeting in July 2018. 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).

## 9.2 ICT Product Conformity Database

The “[ICT product conformity database](http://www.itu.int/net/itu-t/cdb/ConformityDB.aspx)” enables industry to publicize the conformance of ICT products and services to ITU-T Recommendations, assisting users in their efforts to select standards-compliant products. Four categories of products and services have been submitted to the database:

**e-Health** solutions complying with the specifications of ITU-T H.810 “Interoperability design guidelines for personal health systems”, a transposition of the Continua Design Guidelines. The testing procedures are specified in the ITU-T H.820-H.850 sub-series of Recommendations. Updated conformance testing specs matching the 4th edition of H.810 are expected to be ready in early 2019.

**Mobile phones** compatible with Bluetooth-enabled vehicle hands-free terminals. This compatibility is 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. The best hands-free performers are also highlighted on a [web page](https://www.itu.int/en/ITU-T/C-I/Pages/HFT-mobile-tests/HFT_testing.aspx).

**Ethernet** products complying with ITU-T G.8011/Y.1307 “Ethernet Services Characteristics”. This standard as well as the corresponding tests are based on the work of MEF (formerly called Metro Ethernet Forum).

**Accessible IPTV** products are the most recent addition to the the database. Products meet the requirements of [ITU-T H.721](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=12458) “IPTV terminal devices: Basic Model” and [ITU-T H.702](http://www.itu.int/itu-t/recommendations/rec.aspx?rec=H.702) “Accessibility profiles for IPTV systems”, tested to [HSTP-CONF H721](http://www.itu.int/pub/T-TUT-IPTV-2015-H721) and [HSTP-CONF-H702](http://www.itu.int/pub/T-TUT-IPTV-2017-H702). Conformance tests were performed by Keio University at an ITU-T C&I test event in May 2017.

## 9.3 SIP-IMS conformity assessment and interconnection testing

ITU-T SG11 finalized the first set of Recommendations (58) which specify requirements and relevant test specifications for basic call and some supplementary services for SIP-IMS. More details are available on [SIP-IMS web page](https://www.itu.int/en/ITU-T/C-I/Pages/SIP/IMS.aspx).

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.

ITU-T SG11 revised Recommendation ITU-T Q.3940 dealing with interconnection testing between network operators at the IMS 'Ic' interface and NGN NNI/SIP-I.

In addition, following approval of the framework of interconnection of VoLTE-based networks, ITU-T SG11 approved new Recommendation ITU-T Q.3953 “VoLTE/ViLTE interconnection testing for interworking and roaming scenarios”.

**Approved Recommendations: see Appendix I.9.3**

## 9.4 Internet-related performance measurements

In 2016, ITU-T SG11 approved a new Recommendation ITU-T Q.3960 *“Framework of Internet related performance measurements”* which is the first of a series of ITU-T Recommendations on Internet measurements. This Recommendation 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 the customer's connection to the Internet.

Currently, ITU-T SG11 jointly with ETSI TC INT is developing draft Recommendation ITU-T Q.3961 *“Testing methodologies of Internet related performance measurements including e2e bit rate within the fixed and mobile operator's networks”.* For the time being, following the discussion at the last SG11 meeting (November 2017), SG11 decided to put draft Recommendation ITU-T Q.3961 on hold up to the moment when the relevant standard appears in other standardization bodies. The related liaison statement was sent to TSAG.

## 9.5 IPTV testing events

A series of [ITU test events on IPTV](http://www.itu.int/en/ITU-T/C-I/interop/Pages/IPTV2017May.aspx) has been organized to offer a continuous platform to test products based on both existing and developing ITU-T IPTV standards, to meet rapidly growing market needs and to improve the ITU-T standards and test specifications on IPTV.

Accessible IPTV products are the most recent addition to the ITU Product Conformity Database (see section 10.2). These products meet the requirements of [ITU-T H.721](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=12458) “IPTV terminal devices: Basic Model” and [ITU-T H.702](http://www.itu.int/itu-t/recommendations/rec.aspx?rec=H.702) “Accessibility profiles for IPTV systems”, tested to [HSTP-CONF H721](http://www.itu.int/pub/T-TUT-IPTV-2015-H721) and [HSTP-CONF-H702](http://www.itu.int/pub/T-TUT-IPTV-2017-H702). Conformance tests were performed by Keio University at an ITU-T C&I test event in May 2017.

ITU-T SG16 is encouraging IPTV testing with a project to accelerate conformity assessment against Recommendation ITU-T H.700 series, as listed on this on the C&I portal [webpage](http://www.itu.int/go/pilot-projects) .

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

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.

This work 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.

The standard is built 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.

January 2018 saw the approval a framework and related testing procedures for VoLTE interconnection:

* ITU-T Q.3640: Framework of interconnection of VoLTE/ViLTE-based networks;
* ITU-T Q.3953: VoLTE/ViLTE interconnection testing for interworking and roaming scenarios.

Work items under development in ITU-T SG11 for VoLTE:

* Q.VoLTE-SAO-req *“Requirements for signalling network analyses and optimization in VoLTE”*;
* Q.suppl.Multi\_Device\_ETS “Signalling requirements for VoLTE-based network and GSMUMTS network supporting Multi-device emergency telecommunications service”;
* Q.suppl.VoLTE\_ETS\_Interconnection *“Signalling requirements for interconnection between VoLTE-based network and other networks supporting emergency telecommunications service (ETS)”*;
* Q.VoLTE\_INT\_TEST *“VoLTE/ViLTE interconnection testing for interworking and roaming scenarios including relevant QoS/QoE testing”*.

Following the results of the VoLTE discussion and discussion related to SIP-IMS testing requirements, SG11 has started a new work item ITU-T Q.DEN\_IMS "Signalling architecture of distributed ENUM networking for IMS", work also related to the implementation of VoLTE interconnection.

## 9.7 Testing performance of mobile phones with vehicle-mounted hands-free terminals

ITU, on the regular basis, conducts the test events and roundtables which aim are to address issues related to performance of mobile phones with vehicle-mounted hands-free terminals. Since 2014, ITU organized 4 test events and 1 roundtable.

Information about the [fourth ITU test event](https://www.itu.int/en/ITU-T/C-I/Pages/HFT-mobile-tests/test_event_4.aspx), which took place in Busan (Korea) during ITU Telecom World in September 2017, is available at its [web page](https://www.itu.int/en/ITU-T/C-I/Pages/HFT-mobile-tests/test_event_4.aspx).

## 9.8 Testing Internet of things

SG11 approved Recommendation ITU-T Q.3952 which defines the architecture and facilities of model network for IoT testing.

Currently, SG11 is working on three work items dealing with IoT testing, as follows:

* Q.39\_FW\_Test\_ID\_IoT “The framework of testing of identification systems used in IoT”;
* Q.FW\_IoT/Test “Framework for IoT Testing”;
* Q.Het\_IoT\_Gateway\_Test “The structure of the testing of heterogeneous Internet of Things gateways in a laboratory environment”.

SG20 reached consent on Recommendations:

ITU-T Y.4500.15 “oneM2M- Testing framework” provides a methodology for development of conformance and interoperability test strategies, test systems and the resulting test specifications for oneM2M standards.

ITU-T Y.4500.13 “oneM2M - Interoperability Testing” specifies Interoperability Test Descriptions for the oneM2M primitives.

**Approved Recommendation: see Appendix I.9.8.**

# 10 Mainstreaming accessibility in ICTs

Work advanced in SG16 on telecommunication relay services and the text is planned for Consent at the WP2/16 Plenary planned on 16 February 2018. Following discussions started at the IRG-AVA, the SG16 accessibility experts supported the idea for stronger collaboration with ISO/IEC JTC1 SC35 "User Interfaces" and plans on participating in a joint information session planned for the week of 12-16 February 2018; further, three of the work items created at this meeting refer to specifications developed by SC35 on audio descriptions and text description of audio materials that will be reviewed in detail for possible publication as twin texts. A draft in SG20 is planned for Consent in December 2018 that provides use cases and requirements of accessibility of IoT devices and systems to persons with disabilities.

## 10.1 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.

## 10.2 Joint Coordination Activity on Accessibility and Human Factors (JCA-AHF)

The [Joint Coordination Activity on Accessibility and Human Factors (JCA-AHF)](http://www.itu.int/en/ITU-T/jca/ahf/Pages/default.aspx) is mandated to reinforce cooperation within ITU, other UN agencies and activities, ISO, IEC, regional and national SDOs, industry groups, academia, disability organizations and telecommunication user groups for persons with disabilities, 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.

The group assists ITU-T study groups in the identification of standardization opportunities and solutions related to accessibility; for example, the initial discussions on cyber-vulnerability of persons with disabilities and specific needs led to a work item in Q26/16, [F.CVR-PWN](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14346).

A liaison with IEC Systems Committee on Active Assisted Living (SyC-AAL) is reinforced through JCA-AHF and SG16, to share information on accessibility and e-health standards work.

JCA-AHF meetings take place at least twice a year with accessibility experts including persons with disabilities, each with TSB-provided teleconference facilities, a tool for remote sharing of documents (Adobe Connect), sign-language interpretation and real-time captioning on request.

ITU organized a workshop together with G3ict on [Inclusive ICTs for Disaster and Emergency Preparedness for Persons with Disabilities and those with specific needs](http://www.itu.int/net4/wsis/forum/2017/Agenda/Session/229#intro), 12 June 2017, during WSIS Forum. The workshop highlighted the urgent needs of ICT accessibility in emergency situations, to save the lives of those persons (two to four times more likely to get injured or die in case of a disaster), which can be improved by implementing ICT accessibility standards including ITU-T’s.

# 11 Intellectual property rights

## 11.1 TSB Director's Ad Hoc Group 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).

# 12 Combating counterfeit and stolen ICT devices

ITU-T SG11 is working on the following work items related to combating counterfeiting and stolen ICT devices:

* ITU-T Q.FW\_CSM "Framework for combating the use of Stolen Mobile ICT Devices"
* ITU-T Q.FW\_CCF “Framework for solution to combat counterfeit ICT Devices”
* TR-BP\_CF “Technical Report - Guidelines on Best Practice and Solutions for Combating Counterfeit ICT devices”
* [TR-Uni\_Id (ex TR-Sub\_Una)](https://www.itu.int/ITU-T/workprog/wp_item.aspx?isn=13826) “Technical Report on use of anti-counterfeiting technical solutions relying on unique and persistent mobile device identifiers”.

# 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 Data Processing and Management to support IoT and Smart Cities & Communities

The [ITU-T Focus Group on Data Processing and Management to support IoT and Smart Cities & Communities](https://www.itu.int/en/ITU-T/focusgroups/dpm/Pages/default.aspx), established by ITU-T SG20,will propose standardization approaches to the security, privacy and interoperability of datasets and data-management systems in the IoT and smart city domains. See relevant [press release](https://www.itu.int/en/mediacentre/Pages/2017-PR13.aspx).

FG-DPM has had two meetings in Geneva in July 2017 and October 2017. The next meeting of FG-DPM is scheduled for 20-23 February in Brussels, Belgium, back-to-back with a related workshop hosted by European Commission on 19 February 2018.

## 13.2 Digital currency including digital fiat currency

The [ITU-T Focus Group on Digital Currency including Digital Fiat Currency](https://www.itu.int/en/ITU-T/focusgroups/dfc/Pages/default.aspx), established by TSAG, is investigating the emerging questions of how best to standardize and regulate the interoperability and security aspects of digital fiat currency. See [relevant press release](http://newslog.itu.int/archives/1545).

The Focus Group will work in close cooperation with ITU-T Study Groups as well as other bodies in the field of digital currency, such as [ISO/TC68/SC2](https://www.iso.org/committee/49670.html), [ISO/TC68/SC8](https://www.iso.org/committee/6534796.html) and [ISO/TC307](https://www.iso.org/committee/6266604.html).

The first meeting of the Focus Group was held in Beijing, China, 12-13 October 2017. The next meeting will be in July 2018.

## 13.3 Application of Distributed Ledger Technology

The [ITU-T Focus Group](https://www.itu.int/en/ITU-T/focusgroups/dlt/Pages/default.aspx) on Application of Distributed Ledger Technology is identifying compelling use cases of Distributed Ledger Technology (DLT) to propose standardization directions capable of supporting these use cases in achieving global scale. See relevant [press release](http://news.itu.int/distributed-ledger-technology-itu-focus-group-propose-standards-roadmap/).

Distributed ledger technologies such as blockchain are fast moving into the ITU standardization work programme. ITU-T Study Group 17 has established a new work stream ([Question 14/17](https://www.itu.int/en/ITU-T/studygroups/2017-2020/17/Pages/q14.aspx)) to coordinate work on [seven work-in-progress draft ITU standards](https://www.itu.int/ITU-T/workprog/wp_search.aspx?sg=17&q=14) on DLT security. The topic is alos under study in ITU-T Study Groups 13, 16, 17 and 20.

The Focus Group works in close cooperation with ITU-T Study Groups as well as other bodies investigating DLT standardization demands, such as [ISO/TC307](https://www.iso.org/committee/6266604.html).

The first meeting of the Focus Group was held in Geneva, 17-19 October 2017. The second meeting takes place in Bern, Switzerland, 5-7 February, hosted by Swisscom.

## 13.4 Machine learning in 5G systems

The ITU Focus Group on Machine Learning for Future Networks including 5G, established by ITU-T SG13, will establish a basis for ITU standardization to assist machine learning in bringing more automation and intelligence to ICT network design and management. See relevant [press release](https://news.itu.int/itu-launches-new-focus-group-study-machine-learning-5g-systems/).

An analysis of emerging use cases will inform the Focus Group’s development of technical specifications to meet the requirements of such use cases with respect to network architectures, interfaces, protocols, algorithms and data formats.

The first meeting of the Focus Group was held in Geneva, 29 January to 2 February 2018. The second meeting of the Focus Group is scheduled for 24-27 April 2018 in Xi’an, China.

# 14 Collaboration in standardization

## 14.1 Coordination and cooperation among ITU Sectors

Collaboration with ITU-R and with ITU-D is a standing agenda point of TSAG, where TSAG examines existing methods and approaches to collaboration and/or cooperation with other sectors, with the view to encouraging ITU-T to work more collaboratively and/or cooperatively in a reciprocal manner, and review is performed on a regular basis based on information received. TSAG, established and maintains a close relationship with the RAG and TDAG in order to develop synergies with the objective of strengthening coordination and cooperation among the three ITU Sectors on matters of mutual interest. Three inter-Sector Rapporteur groups (IRGs) were created to work on items of interests to various ITU-T and ITU-R study groups.

* IRG-AVA: Intersector Rapporteur Group Audiovisual Media Accessibility, amongst ITU-T SG9, ITU-T SG16 and ITU-R SG6.
* IRG-AVQA: Intersector Rapporteur Group Audiovisual Quality Assessment, amongst ITU-T SG12 and ITU-R SG6.
* IRG-IBB: Intersector Rapporteur Group Integrated Broadcast-Broadband, between ITU-T SG9, ITU-T SG16 and ITU-R WP 6B.

The inter-Sector coordination team (ISCT) on issues of mutual interest is composed by representatives of all three advisory groups, and works to identify subjects common to the tree Sector. It also seeks to identify the necessary mechanisms to strengthen the cooperation and joint activity among the three Sectors, with particular emphasis on the interests of developing countries. In addition, the ITU Inter-Sectoral Coordination Task Force (ISC-TF) is coordinating activities among the tree Bureaux.

## 14.2 General assistance and cooperation

ITU continues to provide leadership in building cooperation among the many interests served by ICT standardization.

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

**ITU 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.

**ITU’s Bridging the Standardization Gap (BSG) programme** improves the capacity of developing countries to participate in the development and implementation of international ICT standards.

**ITU’s conformity and interoperability (C&I) programme** is of particular value to developing countries in their efforts to increase conformance with ITU standards.

**Chief Technology Officer meetings**: [CTO and CxO 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 **AI for Good Global Summit** identifies practical applications of AI with the potential to accelerate progress towards the United Nations’ Sustainable Development Goals. The summit encourages inclusive global dialogue to formulate strategies to ensure trusted, safe and inclusive development of AI technologies and equitable access to their benefits.

**e-Health**: ITU-T continues its longstanding collaboration with bodies active in the healthcare field, supporting the development of medical-grade e-health devices. Participating organizations include UN bodies, standards bodies, academic and research institutes, and industry associations.

**Safe listening of music players:** 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.

**Aviation applications of cloud computing for flight-data monitoring**: 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.

**Intelligent transport systems (ITS)**: The [Collaboration on ITS Communication Standards](http://www.itu.int/en/ITU-T/extcoop/cits/Pages/default.aspx) is a body responsible for the coordination of technical standardization work to encourage the offer of interoperable ITS products.

**Smart Sustainable Cities**: The [United for Smart Sustainable Cities (U4SSC)](http://www.itu.int/en/ITU-T/ssc/united/Pages/default.aspx) initiative, supported by 17 UN bodies, advocates for public policy to ensure that ICTs – and ICT standards in particular – play a definitive role in the transition to smart cities.

**ITU/WMO/UNESCO-IOC Joint Task Force on SMART Cable Systems:** The task force is leading an ambitious new project to equip submarine communications cables with climate and hazard-monitoring sensors.

**Pilot project implementing the ITU-UNECE Key Performance Indicators for Smart Sustainable Cities:** The project includes cities such as Wuxi, Manizales, Dubai, Singapore, Santiago de Chile, Montevideo and Rimini. ITU has published case studies evaluating Dubai and Singapore’s progress in meeting their smart city objectives, evaluations undertaken using the ITU-UNECE Key Performance Indicators.

**ICT, environment and climate change**: ITU-T maintains cooperation with bodies active in environmental sustainability. Participating organizations include UN bodies, standards bodies, regional organizations, academic and research institutes, and industry associations.

## 14.3 MoU and cooperation agreements

**IEC, ISO and ITU** cooperate in standardization to the degree that 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).

**Global Standards Collaboration** **(GSC)** assists regional and international SDOs in coordinating their contributions to fields of mutual interest. Topics discussed at GSC meetings from 2015 to 2017 include IoT, 5G, critical communications and public safety, security and privacy, SMEs, Artificial Intelligence and smart cities. ITU hosts the [repository](http://www.itu.int/en/ITU-T/gsc/Pages/meetings.aspx) of GSC-documents from past meetings. See [GSC website](http://www.itu.int/en/ITU-T/gsc/Pages/default.aspx).

**ITU and ETSI** reaffirmed their MoU in 2016. ETSI and ITU continue to enjoy successful collaboration in areas including ICT energy efficiency and methodologies to assess ICTs’ environmental impacts and standardization for C&I testing.

**ITU and the NGMN Alliance** cooperate in support ofthe development of next-generation mobile broadband technologies.

**Financial Inclusion Global Initiative** **(FIGI)** is a three-year programme of collective action led by ITU, the World Bank Group and the Committee on Payments and Market Infrastructures, with support from the Bill & Melinda Gates Foundation. The initiative is designed to advance research in digital finance and accelerate digital financial inclusion in developing countries.

**ITU and CEN-CENELEC** cooperate within a high-level, non-exclusive framework in areas including IoT and smart sustainable cities, trust, privacy by design, cybersecurity, mobility and Intelligent Transportation System (ITS) communication.

**United for Smart Sustainable Cities (U4SSC) initiative**, supported by 17 UN bodies, advocates for public policy to ensure that ICTs – and ICT standards in particular – play a definitive role in the transition to smart cities.

**Collaboration on ITS Communication Standards** is a globally recognized forum for the creation of an internationally accepted, globally harmonized set of ITS communication standards.

**ITU and Association for Information Systems (AIS) –** a non-profit professional association of individuals and organizations - cooperate on technical challenges to bring greater certainty, confidence and predictability to interactions within the Information Society.

**ITU and Georgia Tech Applied Research Corporation (GTARC) –** a non-profit supporting organization of the Georgia Tech Research Institute – cooperate in raising awareness of the importance of IoT standardization. See relevant [press release](http://newslog.itu.int/archives/1182).

**ITU and MEF** cooperate on standards for emerging connectivity services – designed to be agile, assured, and orchestrated – in addition to standardized CE 2.0 (Carrier Ethernet) services. See relevant [press release](http://www.itu.int/net/pressoffice/press_releases/2015/41.aspx).

**ITU and XPRIZE** co-organized the AI for Good Global Summit to accelerate the development of scalable Artificial Intelligence (AI) solutions to address humanity’s greatest challenges. See relevant [press release](https://itu4u.wordpress.com/2016/09/06/itu-partners-with-ibm-watsons-xprize-to-promote-ai-innovation/).

**ITU and Arab Information and Communication Technology Organization (AICTO)** are cooperating to lend further impetus to the development of ITU-T’s ‘Bridging the Standardization Gap’ programme in the Arab Region. See relevant [press release](http://news.itu.int/bsg-arab-region/).

## 14.4 Cooperation with national and regional standardization organizations

Implementating ITU-T Objective T.5 of the Strategic Plan of the Union – Extend and facilitate cooperation with international, regional and national standardization bodies” – ITU-T/TSB has become more visible to national and regional standards organizations, building on good collaboration with ITU Regional and Area Offices.

Proactive outreach has increased ITU-T interaction with regional standards bodies including CEN-CENELEC, Pan American Standards Commission (COPANT), Pacific Area Standards Congress (PASC) and the African Organization for Standardizations (ARSO).

ITU-T/TSB has encouraged the participation of national and regional standardization bodies in ITU workshops and standardization activities, including:

* Joint IEEE 802 and ITU-T Study Group 15 workshop “Building Tomorrow’s Networks”
* ITU Workshop on Security Aspects of Blockchain
* FG IMT-2020 workshop and demo day: Technology Enablers for 5G
* ITU-T Focus Group on Machine Learning for Future Networks including 5G
* ITU-T Focus Group on Application of Distributed Ledger Technology
* Financial Inclusion Global Initiative, the policy recommendations of the ITU-T Focus Group on Digital Financial Services
* Joint Task Force Workshop on SMART Cable Applications.

# 15 Bridging the standardization gap

ITU’s Bridging the Standardization Gap (BSG) programme improves the capacity of developing countries to participate in the development and implementation of international ICT standards.

WTSA-16 agreed 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.

## 15.1 BSG hands-on training sessions

ITU-T has introduced the new ‘BSG Hands-On Study Group effectiveness training’ under Resolution 44 (WTSA-12). The training focuses 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.



Figure 1 – Key Statistics on hands-on capacity-building training sessions

## 15.2 Regional Groups

Regional Groups within ITU-T Study Groups have proven effective mechanisms to coordinate regional contributions to ITU and increase the number and quality of technical contributions from developing countries. ITU-T has 23 regional groups:

* Eight for Africa (Study Groups 2, 3, 5, 11, 12, 13, 17 and 20)
* Four for the Americas (Study Groups 2, 3, 5 and 20)
* Five for the Arab States (Study Groups 2, 3, 5, 17 and 20)
* Two for Asia and the Pacific (Study Groups 3 and 5)
* One for Eastern Europe, Central Asia and Transcaucasia (Study Group 20)
* One for Europe and the Mediterranean Basin (Study Group 3)
* Two for the Regional Commonwealth in the field of Communications / CIS region (RCC/CIS) (Study Groups 3 and 11).

Participation in Regional Group meetings continues to increase, with more than 520 delegates in participating in 2018, compared to just over 300 in 2016.

****In 2018, ITU celebrates 50 years of the existence of ITU-T Regional Groups. The first four Regional Groups under ITU-T SG3 were established in 1968 by the 4th Plenary Assembly of CCITT.

## 15.3 Standardization Forums

Regional Standardization Forums provide tutorials on ITU-T working methods as well as more technically-oriented themes such as human exposure to EMF, quality of service, smart water management, international mobile roaming, mobile financial services, digital identity, big data, and security and trust.



Figure 2 – ITU-T Regional Standardization Forums for BSG 2013-2016

The following forums were held in 2017:

* [ITU Regional Standardization Forum - Americas Region](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/bsg/201703/Pages/default.aspx) (focused on SG2 and SG3 topics), Port of Spain, Trinidad and Tobago, 6 March 2017
* [ITU Regional Standardization Forum - Asia and Pacific Region](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/bsg/201710/Pages/default.aspx) (focused on SG3 topics), Seoul, Korea (Rep. of), 24 October 2017
* [ITU Regional Standardization Forum - Arab Region](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/bsg/112017/Pages/default.aspx) (focused on SG20 topics), Riyadh, Saudi Arabia, 19 November 2017
* [ITU Interregional Standardization Forum - Arab and African Region](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/bsg/201712/Pages/default.aspx) (focused on SG17 topics), Muscat, Oman, 11-12 December 2017.

## 15.4 National Standardization Secretariats

ITU-T is the process of updating the ["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) first.published in 2014.

Training in establishing an NSS was offered at the ITU Regional Standardization Forum for the Asia-Pacific Region in Jakarta, Indonesia, 27-28 October 2017.

TSB supported NSS development in Zambia in 2015 and will launch new projects in 2018 to support NSS development in Malaysia, India and Mongolia.

## 15.5 e-Learning courses

Two e-learning courses are offered under the BSG programme:

* **Recommendation ITU-T A.1: Working Methods of ITU-T study groups.** This course is hosted on the ITU Academy 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. The course has 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. After going through the course, participants need to take a final assessment online which upon scoring at least 80%, they can obtain a certificate of achievement.

* **Introduction to Next Generation Networks (NGN).** The course provides an introduction to Next Generation Networks (NGN) and a better understanding of the drivers to migrate to NGN and possible influences on regulatory considerations, which are caused by technology innovation, especially impacts to the telecommunication regulatory frameworks.

## 15.6 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.

## 15.7 Technical Papers

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

## 15.8 Fellowships

The table below shows the fellowships awarded during the period from March 2017 until January 2018. 298 fellowships were requested and 155 fellowships were awarded. Of the 155 fellowships awarded, 119 fellowships were used and 36 were cancelled.

| **Meeting** | **Fellows** | **Total** |
| --- | --- | --- |
| **Female** | **Male** |
| ITU-T Study Group 3 RG-LAC meeting*Port of Spain, Trinidad and Tobago 6 – 10 March 2017* | 1 | 3 | 4 |
| ITU-T Study Group 20 Meeting*Dubai, UAE 13 -23 March 2017* | 1 | 2 + 1 cancelled | 4 fellowships awarded3 participants |
| ITU-T Study Group 17 Meeting*Geneva 22-30 March 2017* | 1 cancelled | 5 | 6 fellowships awarded5 participants |
| ITU-T Study Group 2 Meeting*Geneva 29 March – 4 April 2017* | 1 | 4 | 5 |
| ITU-T Study Groups 11 RG-AFR and13 RG-AFR meetings*Cairo, Egypt 5-6 April 2017* | 2 | 7 + 2 cancelled | 11 fellowships awarded9 participants |
| ITU-T Study Group 3 Meeting*Geneva 5-13 April 2017* | 6 | 7 + 1 cancelled | 14 fellowships awarded13 participants |
| TSAG Meeting*Geneva 1-4 May 2017* | 2 | 5 + 1 cancelled | 8 fellowships awarded7 participants |
| ITU-T Study Group 5 Meeting*Geneva 15-25 May 2017* | 2 | 1 + 2 cancelled | 5 fellowships awarded3 participants  |
| C&I Training for AFR*Tunis, Tunisia 22-26 May 2017* | 0 | 3 + 4 cancelled | 7 fellowships awarded3 participants |
| ITU-T Study Group 9 Meeting*Hangzhou, China 24-31 May 2017* | 0 | 3 + 2 cancelled | 5 fellowships awarded3 participants |
| ITU-T Study Groups 11RG-RCC and 20RG-EECAT *Saint-Petersburg, Russia 19-20 June 2017* | 1 | 2 | 3 |
| ITU-T Study Group 15 Meeting*Geneva 19-30 June 2017* | 0 | 2 + 2 cancelled | 4 fellowships awarded2 participants |
| ITU-T Study Group 12 RG-AFR, *Johannesburg, South Africa 24-28 July 2017* | 3 + 1 cancelled | 8 + 2 cancelled | 14 fellowships awarded11 participants |
| ITU-T Study Group 17 Meeting*Geneva 29 August-6 September 2017* | 0 + 1 cancelled | 2 + 2 cancelled | 5 fellowships awarded2 participants |
| ITU-T Study Group 20 Meeting*Geneva 4-15 September 2017* | 1 | 3 | 4 |
| ITU-T Study Group 12 Meeting*Geneva 19-28 September 2017* | 1 | 4 + 1 cancelled | 6 fellowships awarded5 participants |
| ITU-T Study Group 16 Meeting*Macau, China 16-27 October 2017* | 0 | 3 + 2 cancelled | 5 fellowships awarded3 participants |
| ITU-T Study Group 3 RG-AO*Seoul, Korea, 24-27 October 2017* | 2 | 4 | 6 |
| ITU-T Study Group 13 Meeting*Geneva 6-17 November 2017* | 1 | 4 | 5 |
| ITU-T Study Group 11 Meeting*Geneva 8-17 November 2017* | 0 | 6 + 1 cancelled | 7 fellowships awarded6 participants |
| ITU-T Study Group 5 Meeting*Sophia-Antipolis, France 13-22 November 2017* | 4 | 2 + 1 cancelled | 7 fellowships awarded6 participants  |
| ITU-T Study Groups 3 RG-ARB and 20 RG-ARB*Riyadh, Saudi Arabia, 21-22 November 2017* | 1 + 1 cancelled | 0 + 2 cancelled | 4 fellowships awarded1 participant |
| ITU-T Study Group 2 Meeting*Geneva 27 Nov. – 1 Dec. 2017* | 0 + 1 cancelled | 5 | 6 fellowships awarded5 participants |
| ITU-T Study Group 17 RG-ARB*Muscat, Oman 10 December 2017* | 1 + 3 cancelled | 0 + 2 cancelled | 6 fellowships awarded1 participant |
| ITU-T Study Group 9 Meeting*Geneva 22-30 January 2018* | 0 | 4 | 4 |

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

The Ministry of Science and ICT (MSIT) of the Republic of Korea made a contribution to the BSG Fund during the reporting period. TSB is encouraging other voluntary contributions to the BSG Fund.

# 16 Membership

## 16.1 Evolution of ITU-T membership

**ITU-T achieved a net increase of 14 new memberships in 2017**, including 9 new Sector Members and 21 new Associates.

ITU-T work to support vertical markets has attracted new Sector Members from the automotive and insurance industries, as well as emerging markets segments in IoT and M2M.

Targeted membership outreach and campaigns – executed in collaboration by TSB Membership, Communications and Study Groups divisions – are showing great promise in attracting and recruiting new ITU-T members.

ITU-T SG5, SG16 and SG20 have begun to implement a pilot project to engage SMEs in the work of ITU. Five SMEs have been approved by their relevant administrations to participate in ITU-T meetings as part of the pilot project, with a further seven applications currently pending approval.

New Sector Members since January 2017:
Hyundai, SOMPO Holdings, eCurrency, Bahamas Telecommunications Company, Econet Telecom Lesotho, Symantec Corporation, MaxLinear, World’s Global Telecom, RTFM LLP, Nepal Telecommunications Authority

New Associates since January 2017:
MTN (SG2), Legos (SG2), TinkLabs (SG2), Twilio Inc. (SG2), MulteFire Alliance (SG2), SIGOS (SG3), Pentair (ERICO brand) (SG5), CommProve Technologies SpA (SG12), P3 Communications GmbH (SG12), Planet Network International (PNI)  (SG12), Opale Systems (SG12), InfoVista SAS (SG12), SM Optics s.r.l. (SG15), Hisilicon Technologies Co. Ltd. (SG15), Botswana Fibre Networks (SG15), Guangdong DAPU Telecom Technology Co. Ltd. (SG15), Wangsu Science & Technology Co. Ltd. (SG16), Canon Inc. (SG16), Polycom Inc. (SG16), ISARA Corporation (SG17), Sigfox (SG20), Botswana Fibre Networks (SG15).

Total ITU-T Sector Members, Associates and Academia (2006-present):

Table 1: Evolution of ITU-T membership from 31 December 2006 to 31 January 2018

|  | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sector Members | 344 | 314 | 309 | 294 | 273 | 271 | 278 | 284 | 274 | 267 | 255 | 259 | 260 |
| Associates | 112 | 116 | 134 | 128 | 125 | 136 | 144 | 139 | 134 | 134 | 131 | 141 | 142 |
| Academia | ‑ | ‑ | ‑ | ‑ | ‑ | 25 | 36 | 45 | 86 | 109 | 107 | 126 | 134 |
| TOTAL  | 456 | 430 | 443 | 422 | 398 | 432 | 458 | 468 | 494 | 510 | 493 | 526 | 536 |



NOTE – The Academia category was created in 2011.

Figure 3 – Evolution of ITU-T membership from 31 December 2006 to 31 January 2018

## 16.2 Targeted outreach to network operators

Proactive TSB outreach aims to increae the participation of network operators (both ITU-T Members and non-Members) in ITU-T SGs, FGs, JCAs and Workshops. Targeted outreach linked to identified subject-matter interest and upcoming meetings engages decision-makers such as CIOs, CTOs and CISOs. A database of close to 1000 operator contacts has been mapped to relevant ITU-T study groups and activities. This outreach has attracted speakers and participants to ITU-T event on SS7, DFS, Blockchain and ITS. It has also motivated a representative of Swisscom to Chair the ITU-T Focus Group on Application of Distributed Ledger Technology and a representative of Hyundai to take up the position of Associate Rapporteur for the new Q13/17 “Security aspects of Intelligent Transport Systems”.

## 16.3 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.

WTSA-16 reaffirmed ITU-T [Resolution 55](#Resolution_55) to promote gender equality in ITU-T. ITU Member States and Sector Members are encouraged to support the active involvement of women experts in standardization groups and activities.

48 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. 39 per cent of professional posts are held by women, and women hold 67 per cent of posts at P5 level. Diversity of staff, gender equality and the empowerment of women continue to be among TSB's priorities.

# 17 Academia

### 17.1 ITU Kaleidoscope academic conferences

The ITU Kaleidoscope series of peer-reviewed academic conferences – technically co-sponsored by IEEE Communications Society – calls for original research on ICT innovation and related demands on international standardization.

[Kaleidoscope 2017 “Challenges for a data-driven society”](http://www.itu.int/en/ITU-T/academia/kaleidoscope/2017/Pages/default.aspx) was hosted by the Nanjing University of Posts and Telecommunications (NUPT), Nanjing, China, 27-29 November 2017.2017 attracted nearly 300 participants from 26 countries to share research on advances in data science able to drive sustainable development. See relevant [press release](http://news.itu.int/yonsei-university-e-health-research-claims-1st-prize-kaleidoscope-2017/#.Wip_KztrxGE).

The 10th edition of Kaleidoscope, [Kaleidosope 2018: Machine Learning for a 5G future](http://www.itu.int/en/ITU-T/academia/kaleidoscope/Pages/default.aspx), will be hosted by the Universidad Tecnológica Nacional, Santa Fé de la Vera Cruz, Argentina, 26-28 November 2018.

Authors of outstanding Kaleidoscope 2018 papers will be invited to contribute to the work of the [ITU-T Focus Group on Machine Learning for Future Networks including 5G](https://www.itu.int/en/ITU-T/focusgroups/ml5g/Pages/default.aspx).

### 17.2 ITU Journal: *ICT Discoveries*

The new [ITU Journal: *ICT Discoveries*](https://www.itu.int/en/journal/001/Pages/default.aspx) was launched on 25 September 2017 in Busan, Republic of Korea, in conjunction with ITU Telecom World.

The ITU Journal, led by ITU-T, publishes original research on telecommunication/ICT technical developments and their policy and regulatory, economic, social and legal dimensions. The Journal aims to build bridges between disciplines, connect theory with application, and stimulate international dialogue.

Renowned ICT researchers take part in an Editorial Board as [Editor-in-Chief](https://www.itu.int/en/journal/001/Pages/bios.aspx#Song), [Associate Editors-in-Chief](https://www.itu.int/en/journal/001/Pages/bios.aspx#Associates) and [Outreach Chairman](https://www.itu.int/en/journal/001/Pages/bios.aspx#Ibaraki).

The first special issue of the Journal – “[The impact of Artificial Intelligence (AI) on communication networks and services](http://www.itu.int/en/journal/001/Pages/cfp.aspx)” – explores the contributions of AI to the performance and efficiency of communications networks. The first special issue includes 15 papers selected by an Editorial Board of [Guest Editors](https://www.itu.int/en/journal/001/Pages/bios.aspx#Guests) and [Reviewers](https://www.itu.int/en/journal/001/Pages/reviewers.aspx).

The 2nd special issue will focus on “Data for Good”. The Call for Papers will be issued shortly.

### 17.3 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 China (2011), Indonesia (2012), France (2013), Canada (2014), Korea (2015), and Germany (2016), in conjunction with the annual International Cooperation for Education about Standardization (ICES) conferences.

The [ICES conference and WSC Academic Day 2017](http://www.standards-education.org/) took place in Chicago, USA, 10-11 August 2017. 50 international experts shared their views on “The value of standards and education about standardization”.

The ICES conference and WSC Academic Day 2018 will take place in Jakarta, Indonesia, 3-5 July 2018. The theme of the ICES conference will be “Strengthening Industry and Engineering, Science, and Management Education”. The WSC Academic Day 2018 will aim at reviewing the potential of Internet-based technologies to improve teaching, training and education about standardization.

# 18 Publications

Over 10 800 pages of ITU-T Recommendations and Supplements were published between May 2017 and January 2018. Figure 4 illustrates the number of Recommendations (including Supplements) published per year in the 2013 to 2017 period.

The ITU product "ITU-T Recommendations and selected Handbooks" continues to be distributed on a quarterly basis as a USB key. This product represents a tool of great value to standards developers and implementers as a consolidated archive of the over 4000 ITU-T standards in force. The USB key 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.



Figure 4 – Number of Recommendations, amendments and Supplements
published per year since 2013

# 19 Media and promotion

Communications on ITU standardization feature among the most popular ITU content each year. TSB maintains a consistent output of original ITU-T news content, coupled with a coordinated social media strategy led by the ITU General Secretariat. ITU-T news is now published on the new [ITU News platform](http://news.itu.int/). A selection of news coverage of ITU-T can be found on a [scoop page](https://www.scoop.it/t/itu-t-in-the-news/).

High-priority ITU-T news topics include:

* Transport and access; video coding; and performance, QoS and QoE are of great interest to ITU-T’s audience. The success of related ITU-T news can be attributed to ITU’s leadership and credibility in these fields.
* 5G, Trust, IoT and Smart Cities are effective ‘headline’ topics, helping ITU-T news to highlight how ITU standards support ICT users.
* ‘Emerging trends’ such as AI, ITS, Blockchain and DFS are also proving very popular with ITU-T’s audience.

The [AI for Good Global Summit](https://www.itu.int/en/ITU-T/AI/Pages/201706-default.aspx) in June 2017 captured imaginations worldwide. 45 journalists attendede the summit for media houses including BBC, Reuters, Euronews and WIRED. The global, multilingual coverage reached over 100 million people. The event achieved record-breaking social media coverage, most notably with the Facebook Live Sophia segment being viewed over 3.5 million times.

Video is gaining a larger share of communications on ITU standardization.

* Communications on ITU workshops are supported by event wrap-up videos. See, for example, video playlists for workshops on [network aspects of IMT-2020](https://www.youtube.com/watch?v=04W1YI0ZxCs&list=PLpoIPNlF8P2NPFldoAGvSmBijxXSaL5ei); [Digital Financial Services](https://www.youtube.com/watch?v=5_jK8NKQBnU&list=PLpoIPNlF8P2NMDChEpow1n0ks9O63DXkg); [Future Networked Car](https://www.youtube.com/watch?v=zly1rf3cY64&list=PLpoIPNlF8P2MVL0biDS1wPgDEFxJ0Hq93).
* Videos expressly designed for social media are a new addition to ITU-T expert interviews and event wrap-up videos. See, for example, ‘motion slideshow’ videos on [Artificial Intelligence](https://www.facebook.com/ITU/videos/1240008842750586/) and [Intelligent Transport Systems](https://www.facebook.com/ITU/videos/1271884246229712/).
* An animated video offering an introduction to ITU-T’s work was released in May 2016, sponsored by NTT and KT (see <http://www.itu.int/en/ITU-T/wtsa16>).
* Video interviews with the Chairmen of ITU-T Study Groups are found on ['SG at a Glance' webpages](http://www.itu.int/en/ITU-T/studygroups/2017-2020/Pages/default.aspx), which also host a range of video interviews on specific technical areas.

# 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 Noteworthy ITU-T Web Areas

To serve ITU-T delegates and secretariat staff, the following working databases are available:

* [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)

## 20.2 ITU-T MyWorkspace

TSB created [MyWorkspace](https://www.itu.int/net4/ITU-T/myworkspace/), a personalized webpage for TIES users that provides easy access to the information and services most valued by ITU-T delegates, including:

* Meeting documents;
* Mailing list subscriptions;
* Calendar of current and future events;
* Advanced search features (including TIES-protected content, and keyword-based resources);
* Personalized profile and links; and more.

A trial version of these features has been under review for some months, and the platform remains under continuous development – further enhancements will be released in the coming months based on your feedback (tsbitdev@itu.int).

TSB presented these tools to ITU-T SG11 and SG13 delegates in November 2017. Respective slides are available [here](https://www.itu.int/en/ITU-T/studygroups/2017-2020/Documents/MyWorkspace_Nov2017.pptxhttps%3A/www.itu.int/en/ITU-T/studygroups/2017-2020/Documents/MyWorkspace_Nov2017.pptx).

A quick access to [MyWorkspace](https://www.itu.int/net4/ITU-T/myworkspace/) is available from the [ITU-T homepage](http://www.itu.int/itu-t) top banner: 

## 20.3 ITU Search engine

To ease access to ITU resources, TSB developed the [search engine](https://www.itu.int/net4/ITU-T/search/Landing) which has been constantly enriched with the full collections of ITU documents, publications and web pages. That search engine is available from the [ITU website](http://www.itu.int) banner:



## 20.4 ITU-T services & tools announcements

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/>.

## 20.5 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 system which is based on MS SharePoint is now being used extensively by majority of the ITU-T Study Groups notably Study Groups 2, 3, 9, 13, 15, 16 and TSAG. Preparations are underway for ITU-T SG11 to start using the system for their Rapporteur Group meetings from March 2017.

The RGM system is continuously being improved following invaluable feedback from Rapporteurs. It is available for any Rapporteur group wishing to utilise it and take advantage of these improved capabilities such as:

* Improved RGM Document Sync Tool.
* New RGM Document Sync Tool for Mac.
* Automatic and real-time mirroring of documents in the IFA.
* Automatic generation and update of documents lists.
* Archiving of documents after the meeting.
* Setting of deadlines with a procedure for managing late submissions.
* Distinct permission levels on RGM sites and documents.

The current and past RGM meetings may be accessed here: <http://itu.int/go/itu-t/rgm>

A comprehensive support and FAQs page offering RGM tips and best practices is available for users at: <http://itu.int/go/itu-t/rgm-support>

A very detailed online user guide for the RGM System complete with videos is available at: <http://itu.int/go/itu-t/rgm-guide>

The RGM system is part of several services available in the ITU-T SharePoint collaboration sites and is restricted to ITU-T Members and may be accessed using an ITU User (TIES) account.

## 20.6 International Numbering Resources (INRs)

ITU assigns about two-dozen types of International Numbering Resources (INRs), either directly or indirectly.

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. Some 20 annexes on the lists of codes and the database includes numbers and codes allocated in accordance with the following recommendations are maintained:

* 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"

[Recommendation ITU-T E.156 “Guidelines for ITU-T action on reported misuse of E.164 number resources”](http://www.itu.int/rec/T-REC-E.156-200605-I) is under revision to include new cases of misuse and to investigate more efficient means of combating misuse.

Council 2017 approved the new fee structure for UIFN (Universal International Freephone Number) and IIN (Issuer Identifier Number) by approving new Decision 600 ([C17/133](https://www.itu.int/md/S17-CL-C-0133/en)) and 601 ([C17/134](https://www.itu.int/md/S17-CL-C-0134/en)). The improved systems went live on 16 January 2018 and 23 UIFN requests have been processed following the new fee structure approved in Council Decision 600 via the improved systems. While it was found that information of 53 RoAs who are also UIFN Service Providers and 430 assignees of IINs are still incomplete or out of the date. National Administrations/regulators are invited to provide focal point for providing or investigating up-to-date contacts for UIFN service providers (RoAs) and the assignees of IINs.

TSB initiated the process to notify 166 service providers of UIFNs and 787 assignees of IIN, see [CWG-FHR 8/18](https://www.itu.int/md/S18-CLCWGFHRM8-C-0018). Over 3000 e-mails were sent out to assignees, to regulators, and to answer queries. Due to lack of responses from relevant agencies, including national regulators, up-to-date email addresses are still not available for several assignees. The situation is as follows:

* UIFN: 11 entities with no email address (6 of them with 0 UIFNs) and no updated contacts for the 42 entities with bounced e-mail messages (11 of them with 0 UIFNs).
* IIN: 288 entities with no email address and no updated contacts for the 142 entities with bounced e-mail messages.

Improvements to relevant ITU Billing system and UIFN system have been undergoing. The first user acceptance test was completed.

Revisions were proposed to Recommendation ITU-T E.169.1 “Application of Recommendation E.164 numbering plan for universal international freephone numbers for international freephone service” and ITU-T E.118 “The international telecommunication charge card” to reflect Council Decision 600 and 601. The draft revised ITU-T E.169.1 and E.118 were discussed in ITU-T SG2 meeting of 27 November to 1 December 2017, but could not be agreed for determination. It was noted that whilst E.118 IINs were administered by member states and could not be reclaimed without their decision, reclaiming the resource in absence of payment can be considered for UIFNs as the resources are under the responsibility of TSB.

A new WTSA-16 Resolution 91 on “Enhancing access to an electronic repository of information on numbering plans published by the ITU Telecommunication Standardization Sector” was approved by WTSA-16. It instructs ITU-T SG2 to study this matter on the basis of contributions received and information from TSB and to organize the necessary work in order to determine the requirements for electronic access to a repository of numbering resources reserved, assigned or allocated to each operator/service provider (to the extent available) within every country, including presentation of E.164 national numbering plans on the basis of Recommendation ITU T E.129, and international numbering resources assigned by the Director of TSB. On the request of ITU-T SG2, TSB has provided and presented the information on implementation of WTSA-16 Resolution 91 to the SG2 meeting of 29 March - 7 April 2017 ([SG2-TD143](https://www.itu.int/md/T17-SG02-170329-TD-GEN-0143/en)) and the SG2 meeting of 27 November - 1 December 2017 ([SG2-TD233-R1](https://www.itu.int/md/T17-SG02-171127-TD-GEN-0233)). A prototype of the new NNPs repository is available at: <https://www.itu.int/net4/itu-t/nnp>. Pursuant to the relevant ITU T Recommendations, Member States are invited to make available information on the presentation of their national numbering plans and amendments thereto in a timely manner, so as to ensure that the electronic repository remains up to date.

## 20.7 ITU-T Study Groups SharePoint collaboration sites

The ITU-T SharePoint Collaboration sites have been developed to further improve the electronic working methods of ITU-T Study Groups, Focus Groups and other groups. The collaboration sites allow participants to conduct online discussions, work on projects, make meeting plans or schedules, manage and store documents in a secure and shared environment.

The ITU-T SharePoint collaboration home site may be accessed here: <https://extranet.itu.int/sites/ITU-T/>.

Some notable ITU-T Collaboration sites currently available are:

* ITU-T Study Groups (Study Period 2017-2020) (<https://extranet.itu.int/sites/itu-t/studygroups/2017-2020>)
* United for Smart Sustainable Cities (U4SSC) (<https://extranet.itu.int/sites/itu-t/initiatives/U4SSC/>)
* Security, Infrastructure and Trust Working Group (SIT WG) (<https://extranet.itu.int/sites/itu-t/initiatives/sitwg/>)
* FG DPM - ITU-T Focus Group on Data Processing and Management to support IoT and Smart Cities & Communities (<https://extranet.itu.int/sites/itu-t/focusgroups/dpm/>)
* FG DFC - ITU-T Focus Group on Digital Currency including digital fiat currency (<https://extranet.itu.int/sites/itu-t/focusgroups/dfc/>)
* FG DLT - ITU-T Focus Group on Application of Distributed Ledger Technology (<https://extranet.itu.int/sites/itu-t/focusgroups/fgdlt/>)
* FG ML5G - ITU-T Focus Group on Machine Learning for Future Networks including 5G (<https://extranet.itu.int/sites/itu-t/focusgroups/ML5G/>)

A support site which contains a knowledge base of FAQs and user guides on the various SharePoint services is also available at: <https://extranet.itu.int/ITU-T/support/>.

Most of the collaboration sites are restricted to ITU-T Members and may be accessed using an ITU User (TIES) account. Some collaboration sites are open to non-members and may be accessed using non-member ITU User accounts.

## 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. The application is constantly enhanced and updated following feedback and suggestions from users. An improved Windows version and a new Mac version of the sync application for Rapporteur Group Meeting (RGM) documents are also now available.

## 20.9 Electronic meetings

TSB continues to improve electronic meeting facilities for the members. TSB now provides GoToMeeting and Adobe Connect as remote participation tools for e-meetings. TSB uses Adobe Connect as the official remote participation tool to complement physical meetings that are held in ITU HQ in Geneva. GoToMeeting is still used for physical, fully online (virtual) and any on-demand ad-hoc meetings. Statistics on e-meetings for the last three years are indicated below.

**Figure 5 – Remote participation and e-meetings**

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

The Standardization Committee for Vocabulary (SCV), which is composed by ITU-T experts in all the official languages, serves as focal point to ITU-T Study Groups in terminology-related matters, has provided consultation on terms and definitions to be adopted in ITU-T Recommendations in accordance with WTSA Resolution 67 (Hammamet, 2016). The Committee met three times in 2017, and will meet next in June 2018. All meetings have been held jointly with the ITU-R Coordination Committee for Vocabulary (CCV).

TSB continues to collect all new terms and definitions proposed by ITU-T Study Groups, and enters them in the online ITU Terms and Definitions database.

As requested by WTSA Resolution 67, 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.

In 2017 TSB also translated 60 AAP Recommendations, in accordance with requests previously received from the ITU-T Study Groups and linguistic groups. Of these, 41 Recommendations were translated using regular budget, and 19 using extra budgetary resources provided by the General Secretariat out of the savings.

## 20.11 Workshops and symposia

ITU workshops help to increase ITU-T’s visibility, disseminate accomplished results, encourage participation in ITU-T, attract new members, and enhance collaboration with other organizations.

35 ITU-T workshops were organized in 2017, seven focused on bridging the standardization gap, and seven co-organized with other organizations.

Notable workshops in the reporting period include:

The [“AI for Good Global Summit”](https://www.itu.int/en/ITU-T/AI/Pages/201706-default.aspx) in June 2017 – organized by ITU and the XPRIZE Foundation, in partnership with 20 UN agencies – launched inclusive global dialogue to ensure that AI benefits humanity. The AI for Good Global Summit captured imaginations worldwide. The event positioned ITU as a thought leader in the field of AI. ITU signaled that it intends to take the lead on AI in the UN system while concurrently demonstrating its commitment to collaboration. The second [“AI for Good Global Summit – Accelerating progress towards the SDGs”](https://www.itu.int/en/ITU-T/AI/Pages/default.aspx) is scheduled for 15-17 May 2017 in Geneva, Switzerland.

The first edition of the [Smart ABC programme](https://telecomworld.itu.int/2017-telecomworld-event/smart-abc/) was held as part of ITU Telecom World in Busan, Republic of Korea, 25-28 September 2017. Smart ABC is a comprehensive programme of exhibition, discussion, knowledge sharing, and networking among experts and leaders in the field of AI, Fintech, and Smart Cities.

An [ITU workshop on *“*The Future of Cable TV](http://itu.int/go/SG9-FCTV)*”* on 25 and 26 January 2018 in Geneva was jointly organized by TSB and BDT within the context of the European Regional Initiative approved by WTDC-17 on "Broadband Infrastructure, Broadcasting and Spectrum Management". The collaboration among the two ITU Sectors proofed to be effective and the workshop was an opportunity to discuss also cable TV related regional and international standardization. The workshop was attended by 85 participants from 30 countries covering a large spectrum of stakeholders.

An [ITU workshop on TV and content delivery over Integrated Broadband Cable Networks](http://www.itu.int/en/ITU-T/Workshops-and-Seminars/201705/Pages/default.aspx) in Hangzhou, China, 26 May 2017, explored the latest innovations in the field of Integrated Broadband Cable Networks, networks delivering TV and broadband services over coaxial and hybrid fibre-coaxial cable.

The [5th SG13 Regional Workshop for Africa on "ITU-T Standardization Work on Future Networks: Towards a Better Future for Africa"](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/standardization/20170402/Pages/default.aspx) in Cairo, Egypt, 2-3 April 2017, gave an overview of ITU-T SG13 standardization work in areas of current high interest, such as IMT 2020 network aspects, Trust in ICT Infrastructures and Services, SDN, cloud computing and Big Data.

Network softwarization and slicing took centre stage at a [5G workshop and demo day](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/201707/Pages/default.aspx) held in Geneva, 11 July 2017, in conjunction with a meeting of ITU-T SG13. The workshop brought together standards bodies, industry associations, operators, manufacturers, and academic and research institutes to discuss the networking innovations necessary to achieve the 5G vision.

An [ITU Workshop on "Control plane of IMT-2020 and emerging networks. Current issues and the way forward"](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/201711/Pages/default.aspx) in Geneva, 15 November 2017, highlighted the importance of developing protocols for the control plane of IMT-2020 and emerging networks dedicated to different scenarios, using SDN, NFV and network slicing as the fundamental supporting technologies.

A [Joint IEEE 802 and ITU-T SG15 workshop “Building Tomorrow’s Networks”](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/20180127/Pages/default.aspx) in Geneva, 27 January 2018 – held in conjunction with back-to-back meetings of IEEE 802.1, IEEE 802.2 and ITU-T SG15 – shared information on work of common interest in optical interfaces, passive optical network (PON), mobile fronthaul, 5G mobile transport, management and YANG modeling.

The 7th [International IoT Week](http://iot-week.eu/) in Geneva, 6-9 June 2017, brought together thought leaders from government, industry and academia to interrogate the challenges and opportunities emerging with the rise of IoT. Over 200 sessions and activities assessed the latest developments in IoT, in fields including IoT and Big Data, IoT in developing countries, e-health, smart transportation, clean energy, wearable technologies and smart agriculture. IoT Week concluded with the “[Internet of Things Declaration to Achieve the Sustainable Development Goals](http://iot-week.eu/internet-of-things-declaration-to-achieve-the-sustainable-development-goals/)”. IoT Week was co-located with the [Global IoT Summit](http://www.globaliotsummit.org/), an event exploring scientific publications on IoT research. See relevant [press release](http://newslog.itu.int/archives/1537).

An [ITU Regional Workshop for CIS countries on "Internet of Things (IoT) and future networks"](https://www.itu.int/en/ITU-D/Regional-Presence/CIS/Pages/EVENTS/2017/06_Saint_Petersburg/06_Saint_Petersburg.aspx), organized in St. Petersburg, Russia, on 19-20 June 2017, shared experiences in the field of the Internet of Things development and considered international standardization of the Internet of Things (IoT), perspectives of implementing IoT technologies in telecom networks in the CIS region, future telecom networks development in the region, and international standardization of the technologies of the future networks and its applications.

The [ITU Workshop on Security Aspects of Intelligent Transport Systems](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/201708/Pages/default.aspx) in Geneva, 28 August 2017, discussed the security requirements of all actors in the value chain underlying intelligent transport systems (ITS), encouraging an ecosystem view of the ITS security challenge. The event analyzed a variety of high-profile ITS security breaches, using these case studies to demonstrate a ream of security vulnerabilities in the ITS environment.

An [ITU/IMDA Workshop on How Communications will Change Vehicles and Transport](https://www.itu.int/en/ITU-T/extcoop/cits/Pages/201707.aspx) was held in Singapore on 6 July 2017. The workshop sessions discussed, inter alia, connectivity options for connected vehicles and automated driving; cybersecurity for automotive communications; how connected vehicles (and ICTs more generally) are transforming the insurance sector; and the role to be played by artificial intelligence and machine learning in future transport systems. The workshop was followed on 7 July 2017 by a meeting of the Collaboration on ITS Communication Standards ([CITS](https://www.itu.int/en/ITU-T/extcoop/cits/Pages/default.aspx)).

A [workshop on the environmental requirements of 5G systems](http://www.etsi.org/news-events/events/1217-towards-setting-environmental-requirements-for-5g) co-organized by ITU and ETSI in Sophia Antipolis, 23 November, in conjunction with a meeting of ITU-T SG5, 13-22 November 2017, identified the energy efficiency of 5G systems and electromagnetic compatibility (EMC) requirements to ensure interference-free 5G operation as high-priority fields of standardization to be address by ITU-T SG5.

An [ITU Workshop on “5G, EMF & Health”](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/20171205/Pages/default.aspx) in Warsaw, Poland, 5 Decemeber 2017, provided an overview of the EMF, 5G and health issues to policymakers and other stakeholders with a special focus on Poland and identified a variety of actions for the consideration of ITU-T SG5.

The [7th ITU Green Standards Week (GSW-17)](http://newslog.itu.int/archives/1493) in Manizales, Colombia, 3-5 April 2017, hosted by the Municipality of Manizales and Colombia's Ministry of Information and Communication Technologies, concluded with the adoption of the [Manizales Manifesto](http://www.itu.int/en/ITU-T/Workshops-and-Seminars/gsw/201704/Documents/Manifesto-Manizales-05-04-2017-Eng-Final.pdf), expressing the shared commitment of the event's over 850 participants to the development of resource-efficient "Circular Economies" and Smart Sustainable Cities. The event explored the role to be played by ICTs in the pursuit of the United Nations' [New Urban Agenda](http://www.un.org/sustainabledevelopment/blog/2016/10/newurbanagenda/) and [Sustainable Development Goals](http://www.itu.int/en/sustainable-world/Pages/default.aspx).

The [ITU-T SG11 regional workshop for Africa on “Counterfeit ICT Devices, Conformance and Interoperability Testing Challenges in Africa”](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/20170405/Pages/default.aspx) in Cairo, Egypt, 5 April 2017, discussed the current situation on combating counterfeiting, new trends and mechanisms in ICT counterfeiting, tampering and/or duplication of unique device identifiers and the implementation of C&I regimes in the region. The second such workshop will take place in Tunis, Tunisia on 23 April 2018, followed by the second meeting of the ITU-T SG11 Regional Group for Africa (SG11RG-AFR) at the same venue, 23-25 April 2018.

# 21 Implementation of WTSA-16 Resolutions

WTSA-16 Resolution 22 instructs the TSB Director to provide to each TSAG meeting a report on the implementation of WTSA resolutions and actions to be undertaken pursuant to their operative paragraphs. The WTSA-16 Action Plan ([TSAG TD 025](https://www.itu.int/md/meetingdoc.asp?lang=en&parent=T17-TSAG-170501-TD-GEN-0025)) assigns action items to the operational provisions in the Resolutions and also reports information on the progress of the implementation of those action items.

The WTSA-16 Resolutions are freely available at <http://www.itu.int/pub/T-RES>; and the ITU-T Recommendation A-Series are available at <http://www.itu.int/ITU-T/recommendations/index.aspx?ser=A>.

# 22 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).

# 23 Implementation of ITU-T A-series Recommendations

WTSA-16 Resolution 22 instructs the TSB Director to report to TSAG on the experience in the implementation of the A-series Recommendations for consideration by the ITU‑T membership.

Regarding the liaison template in Rec. ITU-T A.1, TSB noticed that the "For Comment" field of liaison statements should be discontinued in Rec. ITU-T A.1 as was agreed by TSAG 2016; however, those changes were missed to be brought to WTSA-16. Hence, there is a need to correct A.1 accordingly.

Concerning the two Focus Groups (DFS and IMT-2020) that concluded end of 2016, positive experiences were made in the implementation of Rec. ITU-T A.7, in particular with the streamlined transfer of deliverables from the Focus Groups to the parent study groups as per Rec. ITU-T A.7 Appendix I, which was found very useful.

## 23.1 Implementation of trial authorized by TSAG (July 2016 meeting)

In implementing the decision of the TSAG July 2016 meeting (C.108/TSAG) SG13 set up in February 2017 an ad-hoc group on guidance for drafting technical Recommendations led by Mr Wu Tong (China Telecom) and Mr Marco Carugi (NEC, Japan). This ad-hoc is elaborating some directions how to draft the technical Recommendations in ITU-T. The first meeting of the group gathered the interest in elaboration of the other types of documents, such as “Schema” (e.g. UML, ASN.1 and XML schema for information modelling) and “APIs” related documents.

To date the group had a number of live and e-meetings and came up with the initial draft of the “Guidelines and Methodologies for Developing Technical Recommendations”. Guidelines intend to introduce the development of methodologies based on the successful experience of cloud computing, big data and NGN(e) related Recommendations. Guidelines attempt to cover the kinds of questions which are likely to arise in the preparation of an ITU-T technical Recommendation and provides, through application of its own rules, an illustration using the normal order of the elements for drafting a technical Recommendation.

The plan is to deliver the results of this activity by the first SG13 meeting in 2018 (July). TSAG members are welcome to join the ad-hoc meetings.

# 24 Stale work items

WTSA-16 Resolution 22 instructs the TSB Director to provide information about any work item that has not given rise to any contribution in the time interval of the previous two study group meetings through his or her report about study group activity.

The following stale work items are identified:

SG5 reviewed all its work item including its stale work items at its meeting in November 2017. At the end of the meeting the appropriate actions were taken.

No stale work item in SG13.

SG15 reviewed its work items at its meeting in June 2017. At the end of the meeting, there was no stale items. In addition, SG15 identified three potential stale work items, which would be stale if no action are taken by the end of its subsequent meeting in January/February 2018 (so called “yellow alarm”).

Other study group potentially having some stale work item will want to adapt to the new reporting modality first before being able to report on stale items.

# Appendix I – List of approved Recommendations and other approved texts

Note – Corrigenda are not listed here.

**I.1.1 G.fast and DSL: Breathing new life into existing copper infrastructure**

**ITU-T G.993.2 (2015) Amd.3 “Very high speed digital subscriber line transceivers 2 (VDSL2) - Annex D: Long Reach VDSL2” (under approval)** defines the Long Reach operation for VDSL2 without vectoring.

**ITU-T G.993.5 (2015) Amd.2 “Self- FEXT cancellation (vectoring) for use with VDSL2 transceivers - Annex A: Mitigating strong FEXT”** defines a method for mitigating strong FEXT.

**ITU-T G.994.1 (2012) Amd.8 “Handshake procedures for digital subscriber line transceivers: Amendment 8”** includes:

- New handshake carrier set (F43) for the support of G.9701 over coaxial cable.

- Add codepoints for the support of Annex X of [ITU-T G.9701]

- Add codepoints for profiles 106c and 212c of [ITU-T G.9701].

**ITU-T G.994.1 (2012) Amd.9 “Handshake procedures for digital subscriber line transceivers”** includes:

- Codepoint for the support of G.993.5 Annex A (Mitigating Strong FEXT)

- Codepoints for the support of G.993.5 Annex B (Vectored Long Reach VDSL) and G.993.2 Annex D (Unvectored Long Reach VDSL).

**ITU-T G.996.2 (2009) Amd.5 “Single-ended line testing for digital subscriber lines (DSL) - Amendment 5”** contains the draft new amendment to G.996.2 on SELT in G.fast environment.

**ITU-T G.997.1 (2012) Amd.7 “Physical layer management for digital subscriber line transceivers”** includes:

- Management parameters for the support of G.993.5 Annex B (Vectored Long Reach VDSL) and G.993.2 Annex D (Unvectored Long Reach VDSL)

- Management parameters for the support of G.993.5 Annex A (Mitigating strong FEXT)

- Add missing parameter INM\_INPEQ\_FORMAT for the support of INM in G.993.2.

**ITU-T G.997.2 (2015) Amd.3 “Physical layer management for G.fast transceivers: Amendment 3**” includes:

- A new annex for the management of Remote Power Feeding (RPF).

- A new annex for the management of NT software upgrades.

- A new annex for the management of Annex X and Annex T of [ITU-T G.9701].

- Update managed objects to support new profiles 212a, 106c and 212c.

**ITU-T G.997.2 (2015) Amd.4 “Physical layer management for G.fast transceivers: Amendment 4”** includes:

- Update to the Annex A: Physical layer management for Reverse Power Feeding (RPF) of Remote Access Equipment

- Additional managed objects for support of impulse noise monitoring of G.9701.

- Additional managed objects for support of ANDEFTR of G.9701

- Additional managed objects for support of RMCR of G.9701.

**ITU-T G.9700 (2014) Amd.2 “Fast access to subscriber terminals (G.fast) - Power spectral density specification (2014) Amendment 2”** aligns the text of clause 6.5 on notching of specific frequency bands with ITU-T G.9701 (2014) and its latest amendments, completes the specification of 212 MHz profiles, adds Annex X “Adaptation to the coax medium” in support of Annex X “ Operation without multi-line coordination intended for a crosstalk free environment” that has been specified in amendment 3 to ITU-T G.9701, and updates the table of International amateur radio frequencies in Appendix I.

**ITU-T G.9701 (2014) Amd.3 “Fast access to subscriber terminals (G.fast) - Physical layer specification: Amendment 3”** supports the following new functionality: full specification of the 212 MHz profile, Annex X – Operation without multi-line coordination intended for a crosstalk free environment (e.g., coax medium) including dynamic time assignment (DTA), Annex T – higher layer control aspects of DTA, and Annex S – software download to NTs.

**ITU-T G.9701 (2014) Amd.4 “Fast Access to Subscriber Terminals (G.fast) – Physical layer specification”** supports the following new functionality: Impulse noise monitoring (INM) and robust management channel recovery (RMCR).

**I.1.2 Ultra-high-speed access including NG-PON2**

**ITU-T G.987.2 Amd.1 “10-Gigabit-capable passive optical networks (XG-PON): Physical media dependent (PMD) layer specification - Amendment 1”** continues the maintenance and evolution of Physical media dependent (PMD) layer specifications for XG-PON as defined in Recommendation ITU-T G.987.2 (2016-02).

**ITU-T G.988 (revised) “ONU management and control interface (OMCI) specification”** specifies the optical network unit (ONU) management and control interface (OMCI) for optical access networks. This Recommendation specifies the managed entities of a protocol-independent management information base (MIB) that models the exchange of information between an optical line termination (OLT) and an optical network unit (ONU). In addition, it covers the ONU management and control channel, protocol and detailed messages.

**ITU-T G.989.2 (2014) Amd.2 “40-Gigabit-capable passive optical networks (NG PON2): Physical media dependent (PMD) layer specification: Amendment 2”** continues the maintenance and evolution of Physical media dependent (PMD) layer specification as defined in Recommendation ITU-T G.989.2 (2014).

**ITU-T G.9807.1 (2016) Amd.1 “10-Gigabit-capable symmetric passive optical network (XGS-PON)”** contains necessary additional details and clarifications for the Recommendation, and provides regular specification maintenance.

**ITU-T G.9807.2 “10 Gigabit-capable symmetrical passive optical networks (XG(S) PON): Reach extension”** outlines the architecture and interface parameters for 10 Gigabit-capable symmetrical passive optical network (XG(S)-PON) systems with extended reach using a physical layer reach extension device, such as a regenerator or optical amplifier in the fibre link between the optical line termination (OLT) and optical network unit (ONU). Wavelength converting, continuous mode, 1:N and combination type reach extenders are also described. The maximum reach is up to 60 km with loss budgets of in excess of 28.5 dB being achievable in both spans.

**ITU-T G.Suppl.51 (revised) “Passive optical network protection considerations”** collects this information, and guided by input from operators, distils it into use cases and methods that are recommended for adding redundancy and increasing the reliability of PON networks.

**I.1.3 Optical fibres**

**ITU-T G.650.3 (revised) “Test methods for installed single-mode optical fibre cable links”** outlines the tests normally carried out on installed single-mode optical fibre cable links. It includes a collection of references to the main measurement methods and gives an indication of which are most suitable for installed cable links, depending on the required inspection level. Optical fibre cable links are comprised of multiple cable sections, splices and other connections. This term is more completely defined in this Recommendation. This Recommendation uses a tiered approach. The first level indicates measurements that are normally carried out to commission new optical fibre cable links. The second level indicates measurements that may be carried out to satisfy service level agreements (for example, when a dark fibre contract is signed) or to verify attributes of older links that may be used at higher bit rates or over extended wavelength ranges. This version of Recommendation ITU-T G.650.3 newly introduces the Appendix IV to provide information of splice loss measurement based on quasi-bidirectional technique. The method for differentiating splice loss and macrobending loss in installed links, which was issued as Amendment 1 for Recommendation G.650.3 in 2011, is also included as Appendix III.

**ITU-T L.110 “Optical fibre cables for direct surface application”** describes characteristics, construction and test methods of optical fibre cables for direct surface application. First, in order that an optical fibre demonstrates sufficient performance, characteristics that a cable should have are described. Then, the method of examining whether the cable has the required characteristic is described.

**ITU-T L.206 “Requirements for passive optical nodes: Outdoor optical cross-connect cabinets”** refers to outdoor optical cross-connect cabinets deployed as passive optical nodes in outdoor environments. It deals with the cabinet housing, internal fibre management system, cable attachment and termination system, and specifies the mechanical and environmental characteristics as well.

**ITU-T L.404 “Field mountable single-mode optical fibre connectors”** describes the main features of field mountable single-mode optical fibre connectors, defines requirements for their optical, mechanical and environmental characteristics and lists the main test methods. Further, this Recommendation gives a general description of the basic principles of operation and of technologies of fabrication of field mountable single-mode optical fibre connectors.

**I.1.4 Ultra-high-speed optical core network: OTN beyond 100G**

**ITU-T G.798 (revised) “Characteristics of optical transport network hierarchy equipment functional blocks”** specifies both the components and the methodology that should be used in order to specify the optical transport network (OTN) functionality of network elements; it does not specify individual optical transport network equipment. Edition 6.0 of this Recommendation includes the text of Amendments 1, 2 and 3, as well as Corrigendum 1 to Edition 5.0 of this Recommendation, addition of Beyond 100 Gbit/s OTU and ODU functions and optical layer terminology updates. Edition 6.0 furthermore deleted the ODU virtual concatenation functions and the ODUkP to ATM adaptation function and removed the processing of the TCM ACT and FTFL overhead bytes.

**I.1.5 Optical transmission systems**

**ITU-T G.873.1 (revised) “Optical transport network (OTN): Linear protection”** defines the automatic protection switching (APS) protocol and protection switching operation for the linear protection schemes for the optical transport network at the optical data unit k (ODUk) level. Protection schemes considered in this Recommendation are:

– ODUk subnetwork connection protection with inherent monitoring (1+1, 1:n);

– ODUk subnetwork connection protection with non-intrusive monitoring (1+1);

– ODUk subnetwork connection protection with sublayer monitoring (1+1, 1:n).

– ODUk compound link subnetwork connection group protection with inherent monitoring (1+1, 1:1).

In addition, client-related protection architectures are described.

**ITU-T G.873.3 “OTN protection switching - Shared Mesh Protection”** defines the protocol and protection switching operation for shared mesh protection for the OTN at the ODU layer.

**ITU-T G.Suppl.58 “Optical transport network (OTN) module framer interfaces (MFIs)”** describes several interoperable component-to-component multilane interfaces (across different vendors) to connect an optical module (with or without digital signal processor (DSP)) to a framer device in a vendor's equipment supporting 40G, 100G or beyond 100G optical transport network (OTN) interfaces. Only the structure of the 11G, 28G or 56G physical lanes of the different OTN module framer interface (MFI) examples is provided in this Supplement. For their electrical characteristics, the OIF-CEI IA specifications can be used. This Supplement relates to Recommendation ITU-T G.709/Y.1331.

**I.1.6 Transport network control aspects**

**ITU-T G.7714.1/Y.1705.1 (revised) “Protocol for automatic discovery in transport networks”** describes the methods, procedures and transport plane mechanisms for discovering layer adjacency according to the requirements of Recommendation ITU T G.7714/Y.1705. Layer adjacency discovery describes the process of discovering link connection end-point relationships and verifying their connectivity. Two alternative methods are described: one using a test set in the client layer, the other using in-band overhead in the server layer. Additional actions that may be required for obtaining physical media adjacency discovery, transport entity capability exchange, etc., will be addressed in future Recommendations.

**ITU-T G.874 (revised) “Management aspects of optical transport network elements”** addresses management aspects of optical transport network elements containing transport functions of one or more of the layer networks of the optical transport network. The management of the optical layer networks is separable from that of its client layer networks so that the same means of management can be used regardless of the client. The management functions for fault management, configuration management and performance monitoring are specified.

**ITU-T G.874.1 (revised) “Optical transport network (OTN): Protocol-neutral management information model for the network element view”** provides a protocol-neutral management information model for managing network elements in the optical transport network (OTN). The 2016 revision of this Recommendation has incorporated Amendment 1 and Amendment 2, and in additional the following updates: change the UML modeling tool from RSA to open source Papyrus tool, update the G.874.1 information model to align with the G.7711 v2.0 Core information model, drop subclassing the TP classes from M.3160, and support the additional management requirements in Recommendation ITU-T G.874.

**I.1.7 Ethernet over transport networks**

**ITU-T G.8051/Y.1345 (2015) Amd.1 “Management aspects of the Ethernet Transport (ET) capable network element”** provides:

* Addition of fFOP –PM and fFOP-TO for ETH\_C\_MI in clause 7
* Deletion of the description related to ODUkP-X-L/MT\_A in clause 7, 8 and 10, due to the deletion LCAS-capable ODUk to ETH Adaptation function in G.8021
* Update the text in clause 8.3 “Protection switching”
* Update RAPS (G.8032) related MIs for ETH-C in Table8-4
* Addition the definitions for Traffic condition and shaping functions in clause 3
* Update some reference in clause 2

**I.1.8 MPLS over transport networks**

**ITU-T G.8112/Y.1371 (2015) Amd.1 “Interfaces for the MPLS transport profile layer network: Amendment 1”** avoids redefining terms defined in Recommendations ITU-T G.8001/Y.1354 and G.8101/Y.1355 by referencing these Recommendations.

**ITU-T G.8113.2/Y.1372.2 (2015) Amd.1 “Operations, administration and maintenance mechanisms for MPLS-TP networks using the tools defined for MPLS - Amendment 1”** adds material related to client signal fail handling.

**ITU-T G.8121/Y.1318 (2016) Amd.1 “Characteristics of MPLS-TP equipment functional blocks: Amendment 1”** deletes the LCAS-capable ODUk to MPLS-TP Adaptation function (clause 11.2.2).

**ITU-T G.8132/Y.1383 “MPLS-TP Shared Ring Protection”** provides an architecture and mechanisms for shared ring protection for MPLS transport profile (MPLS-TP) networks. It describes the MPLS-TP Shared Ring Protection (MSRP) mechanisms and the Ring Protection Switch (RPS) protocol. The mechanisms defined herein protect point-to-point MPLS-TP label switched paths (LSPs) against failures at the MPLS-TP section layer.

**ITU-T G.8151/Y.1374 (revised) “Management aspects of the MPLS-TP network element”** addresses management aspects of the MPLS Transport Profile (MPLS-TP) capable network element containing transport functions of one or more of the layer networks of the MPLS-TP network. The management of the MPLS-TP layer networks is separable from that of its client layer networks so that the same means of management can be used regardless of the client. The management functions for fault management, configuration management, performance monitoring, and security management are specified. The 2011 Revision of this Recommendation aligns with the MPLS-TP architecture and requirements jointly developed by IETF and ITU-T and provides the specification for managing MPLS-TP NEs that support the OAM protocol neutral equipment functionality as defined in Recommendation ITU-T G.8121/Y.1381.

**I.1.9 Synchronization and timing**

**ITU-T G.781 (revised) “Synchronization layer functions”** defines the atomic functions that are part of the two synchronization layers, the synchronization distribution (SD) layer and the network synchronization (NS) layer. It also defines some atomic functions, part of the transport layer, which are related to synchronization. These functions describe the synchronization of SDH, Ethernet, and OTN NEs and how these NEs are involved in Network Synchronization. The specifications in this Recommendation are the superset of functionality of three regional standards bodies. Care should be taken when selecting from this Recommendation. Not every atomic function defined in this Recommendation is required for every application. Different subsets of atomic functions may be assembled in different ways according to the combination rules given in Recommendations ITU-T G.783, ITU-T G.705, ITU-T G.8021, ITU-T G.8121, and ITU-T G.798 to provide a variety of different capabilities. Network operators and equipment suppliers may choose which functions must be implemented for each application.

**ITU-T G.811.1 “Timing characteristics of enhanced primary reference clocks”** outlines the requirements for enhanced primary reference clocks (ePRCs) suitable for frequency synchronization. These requirements apply under the normal environmental conditions specified for the equipment.

**ITU-T G.8263/Y.1363 (revised) “Timing characteristics of packet-based equipment clocks”** outlines requirements for timing devices used in synchronizing network equipment that operates in the interworking function (IWF) and other network elements as defined in Recommendation ITU-T G.8261/Y.1361. This Recommendation defines the requirements for packet-based equipment clocks.

**ITU-T G.8264/Y.1364 (revised) “Distribution of timing information through packet networks”** outlines aspects of distribution of timing information through packet networks and initially focuses on Ethernet networks. A number of methods may be used to transfer frequency which may be physical-layer based or protocol-layer based. This Recommendation provides information on architectural aspects of timing flows in Ethernet networks which will form the basis for future work related to time and phase transfer. This Recommendation specifies the synchronization status message (SSM) protocol and formats for use with synchronous Ethernet. Adherence to the SSM formats specified in this Recommendation is required in order to ensure interoperability between synchronous Ethernet equipment involved in frequency transfer.

**ITU-T G.8271.1/Y.1366.1 (2013) (revised) “Network limits for time synchronization in Packet networks (under approval)** specifies the maximum network limits of phase and time error that shall not be exceeded. It specifies the minimum equipment tolerance to phase and time error that shall be provided at the boundary of packet networks at phase and time synchronization interfaces. It also outlines the minimum requirements for the synchronization function of network elements. This Recommendation addresses the case of time and phase distribution across a network with packet-based method with full timing support to the protocol level from the network.

**ITU-T G.8271/Y.1366 (2016) Amd.1 “Time and phase synchronization aspects of telecommunications networks: Amendment 1”** provides the following updates:

* + Updated Title and Scope
	+ Updated Conventions clause
	+ Updated Table 1 and addition of Table 2, describing applications for high-accuracy time synchronization
	+ Revised notes in clause 7 and 7.1
	+ Revised clause 8, updating reference point descriptions
	+ Correction to the definition of the FCS field in the serial communication channel
	+ Replacement of Table A.7 with a new version and associated notes
	+ Revision to Tables II.1 and II.2 of Appendix II
	+ Correction to Appendix V.

**ITU-T G.8271.1/Y.1366.1 (revised) “Network limits for time synchronization in packet networks”** specifies the maximum network limits of phase and time error that shall not be exceeded. It specifies the minimum equipment tolerance to phase and time error that shall be provided at the boundary of packet networks at phase and time synchronization interfaces. It also outlines the minimum requirements for the synchronization function of network elements. This Recommendation addresses the case of time and phase distribution across a network with packet-based method with full timing support to the protocol level from the network.

**ITU-T G.8271.2/Y.1366.2 “Network limits for time synchronization in packet networks with partial timing support from the network”** specifies the maximum network limits of phase and time error that shall not be exceeded. It specifies the minimum equipment tolerance to phase and time error that shall be provided at the boundary of these packet networks at phase and time synchronization interfaces. It also outlines the minimum requirements for the synchronization function of network elements. This Recommendation addresses the case of time and phase distribution across a network with packet-based method with partial timing support to the protocol level from the network.

**ITU-T G.8272.1/Y.1367.1 (2016) Amd.1 “Timing characteristics of enhanced primary reference time clocks - Amendment 1”** adds a reference, changes a bullet in Clause 6.1, and replaces Annex A.

**ITU-T G.8273.2/Y.1368.2 (2017) Amd.1 “Timing characteristics of telecom boundary clocks and telecom time slave clocks - Amendment 1”** adds a paragraph in the Scope, adds a note in Clause 7.1, replaces text in clause 7.3.1, clause 7.4, Annex A, Clause C.2.3.1, Clause C.2.4, Appendix I, Appendix II, and Appendix III. It also adds Appendix VI.

**ITU-T G.8273.3/Y.1368.3 “Timing characteristics of telecom transparent clocks”** defines the minimum requirements for transparent clocks. These requirements apply under the normal environmental conditions specified for the equipment. This Recommendation includes clock accuracy, noise generation, noise tolerance, noise transfer, and transient response for Telecom Transparent Clocks.

**ITU-T G.8275/Y.1369 (revised) “Architecture and requirements for packet-based time and phase distribution”** describes the architecture and requirements for packet based time and phase distribution in telecom networks. The architecture described is mainly applicable to the use of IEEE 1588. Details necessary to utilize IEEE 1588 in a manner consistent with the architecture are defined in other Recommendations.

**ITU-T G.8275.1/Y.1369.1 (2016) Amd.1 “Precision time protocol telecom profile for phase/time synchronization with full timing support from the network – Amendment 1”.**

**ITU-T G.8275.2/Y.1369.2 (2016) Amd.1 “Precision time protocol telecom profile for phase/time synchronization with partial timing support from the network – Amendment 1”** provides the following updates:

− Added G.8271 to references

− Addition of a new definition: Special Port (3.2)

− Clarification on the use of logMessageInterval in Delay\_Resp messages (6.2.8)

− Clarification on the behaviour of the T-BC Announce message contents when the T-BC has a parent clock.

− Incremented the minor revision number of the profileVersion (Annex A)

− Correction to the handling of the alternateMasterFlag

− Added informative text on the handling of the synchronizationUncertain flag (Annex E)

− Added monitoring of a PTP MASTER port by a PTP PASSIVE port (Annex G)

− Updates to Announce message fields of currentUtcOffset and synchronizationUncertain when using PTP clock states (Appendix V)

− Update of Appendix VII

− Added informative use cases for the use of the priority2 attribute (Appendix X)

− Added considerations on native access equipment (Appendix XI)

− Added monitoring alternate master time information provided by a peer PTP port (Appendix XII).

**I.1.10 Cable**

**ITU-T J.1020 “Service model and architecture of downloadable mobile multi-CA/DRM solutions for delivering CA/DRM client software to secondary device”** provides the reference service model, the architecture, and the service operation protocols which are needed for multi-CA/DRM service based on downloadable scheme. The downloadable scheme in this [draft new] Recommendation means downloading CA/DRM client software images from the multichannel video programming distributor (MVPD) or broadcaster to a secondary device such as smart phone, tablet, and laptop PC that are connected to a primary customer premises equipment (CPE) such as a set-top box. Service providers can change CA/DRM solutions for the secondary device from one to the other using on-line methods as well as operate multiple CA/DRM solutions at the same time.

**ITU-T J.1106 “Requirement for Radio over IP transmission system”** describes functional requirements for radio over IP (RoIP) transmission systems. The purpose of RoIP system is to transmit data over cable service interface specifications (DOCSIS) based up stream (US) RF signal of cable modem (CM) to cable modem termination system (CMTS) through IP transmission in optic-based cable TV network. ITU-T J.1106 provides a cost-effective solution to adapt the HFC-based cable TV network devices into optic-based cable TV network devices.

**I.2.2 Smart ubiquitous networks, next-generation networks evolution, and future networks**

**ITU-T I.570 (revised) “Public/private ISDN interworking”** is focusing on the aspect of private networks connect to public ISDN with ISUP and presented public/private ISDN interworking reference configuration, scenario, interworking requirement, etc.

**ITU T Q.1912.5 (revised) “Interworking between Session Initiation Protocol (SIP) and Bearer Independent Call Control protocol or ISDN User Part”** defines the signalling interworking between the Bearer Independent Call Control (BICC) or ISDN User Part (ISUP) protocols and SIP in order to support services that can be commonly supported by BICC or ISUP and SIP-based network domains. It includes assured early dialogue, end-to-end support for ISDN user equipment, support of number portability and support interworking of supplementary services.

**ITU-T Q.3640 “Framework of interconnection of VoLTE/ViLTE-based networks”** specifies the high-level framework of interconnection of LTE-based networks for providing interoperable voice and video services.

**ITU-T Q.3714 “Signalling requirements of SDN-based access networks with media independent management capabilities”** provides signalling architecture, signalling requirements, and signalling protocol procedures for SDN-based access networks with media independent management (MIM) capabilities. It defines signalling architecture models of the SDN-based access networks with MIM capabilities. The signalling architecture models are described for loosely and tightly coupled integrations between SDN and MIM control frameworks. Signalling requirements and protocol procedures for resource management and seamless handover are described for each signalling architecture model.

**ITU-T Q.3715 “Signalling requirements for dynamic bandwidth adjustment on demand on broadband network gateway implemented by software defined networking technologies”** describes the architecture and signalling requirements for dynamic bandwidth adjustment on demand on broadband network gateway implemented by software defined networking technologies. The objective is to enhance the intelligent control of broadband networks, provide open southbound interfaces to network devices, support extensible capability for open northbound interfaces to service platform, and then build flexible, intelligent, secure next-generation broadband network and service system.

**ITU-T Q.3716 “Signalling Requirements for Mapping between Physical and Virtual Networks”** specifies signalling requirement for mapping between SDN based physical underlay networks and virtual overlay networks, by architecturally adding dedicated functional components and the corresponding interfaces in the SDN framework.

**ITU-T Q.3740 “Signalling requirements for SDN and NFV based Central Office services”** specifies the signalling requirements of Si interface between Software-Defined Networking (SDN) controller and Network Function Virtualization Orchestration (NFVO) for SDN and Network Function Virtualization (NFV) based central office services.

**ITU-T Y.2241 “Service framework to support web objects based ubiquitous self-directed learning”** provides a framework to support a web objects based ubiquitous self-directed learning (uSDL) service including overview, content object model, functional capabilities, security and trust considerations of web objects based uSDL.

**ITU-T Y.2255 “Voice and Video Call Continuity over LTE, Wi-Fi and 2G/3G”** specifies the voice and video call continuity (VCC) over LTE, Wi-Fi and 2G/3G. The scenarios and relevant requirements are specified, as well as the solutions for access transfer between each of the access types, handover policy, terminating access domain selection (T-ADS), evolved packet data gateway (ePDG) selection and other call continuity related solutions.

**ITU-T Y.2322 “The functional architecture of VCNMO (Virtualized Control Network entities Management and Orchestrator) in NGN evolution”** focuses on the functions, functional entities and reference points of VCNMO (Virtualized Control Network entities Management and Orchestrator) and its subcomponents in the architecture of VCN. This Recommendation defines the functional architecture of VCNMO and specifies the related reference points of VCNMO, which includes orchestrator, VCNM and VIM of VCN. The architecture design of this recommendation will fulfill the requirements proposed by ITU-T Y.2320. The high level description of functions and reference points related to orchestrator, VCNM and VIM in this recommendation are consistent with the functions and reference points standardized in ITU-T Y.2321.

**ITU-T Y.2618 “M interface in Public packet Telecommunication Data Network (PTDN)”** defines the reference point M interface in the Public packet Telecommunication Data Network (PTDN), specifies common PTDN management functions and protocols and defines specific PTDN management functions related to VPN and multicast service. In Annex, management information model about VPN and multicast service management is given using management interface specification methodology defined in ITU-T M.3020.

**ITU-T Y.2774 “Functional requirements of deep packet inspection for future networks” (under approval)** specifies the functional requirements of deep packet inspection for future networks (i.e., software defined network, network function virtualization etc.). The scope of this Recommendation includes general requirements of deep packet inspection for future networks, DPI functional requirements for SDN, DPI functional requirements for NFV, DPI functional requirements for service function chain and DPI as a service, DPI functional requirements for network virtualization and DPI functional requirements for evolving mobile network.

**I.2.3 IMT-2020/5G networks**

**ITU-T Y.3100 “Terms and definitions for IMT-2020 network”** describes essential terms and their definitions for IMT-2020 network to provide a general common understanding for ITU-T IMT-2020 related standard documents. It can be used as a guideline for the further development of IMT-2020 related documents. The terms defined in this Recommendation will constitute a reference for other ITU-T IMT-2020 related standard documents.

**ITU-T Y.3101 “Requirements of the IMT-2020 network”** describes requirements of the IMT-2020 network. The Recommendation first provides general principles of the IMT-2020 network, then the requirements for overall non-radio aspects of the IMT-2020 network are specified from both service point of view and network operation point of view.

**ITU-T Y.3110 “IMT-2020 Network Management and Orchestration Requirements”** describes requirements for network management and orchestration of IMT-2020. It describes high-level and functional requirements. The functional requirements consist of two levels: a) lifecycle management for all slices and b) instance management pertinent to each slice.

**ITU-T Y.3111 “IMT-2020 Network Management and Orchestration Framework”** provides network management and orchestration architecture and functional components for design, deployment, and operation to implement IMT-2020 network covering fixed and mobile networks.’

**ITU-T Y.3130 “Requirements of IMT-2020 fixed mobile convergence”** specifies service related requirements as unified user identity, unified charging, service continuity and guaranteed quality of service support, and network capability requirements as control plane convergence, user data management, capability exposure and cloud based infrastructure, to support fixed mobile convergence in IMT-2020 network.

**ITU-T Y.3150 “High level technical characteristics of network softwarization for IMT-2020”** describes how network softwarization and network slicing contribute to IMT-2020 systems. It explores network slicing from two viewpoints: vertical and horizontal aspects. The Recommendation further describes network slicing for mobile fronthaul/backhaul, introduction to advanced data-plane programmability, and capability exposure. These technical characteristic descriptions are expected to lead to their detailed study.

**ITU-T K.Suppl.8 to K.-series of Recommendations “Resistibility analysis of 5G systems”** analyses 5G system resistibility requirements for lightning and power fault events. The electrical threats posed by lightning and power fault events are discussed and the appropriate resistibility tests identified. Installation practice can have a big influence on the reliability of service and the equipment. Earthing, location and craftmanship are discussed.

**ITU-T K.Suppl.9 to K.-series of Recommendations “5G technology and human exposure to RF EMF”:** The deployment of 5G will see the evolution and expansion of existing 4G networks and the introduction of new radio access networks in the millimetre wave bands. Because of the use of much higher frequency ranges the number of base stations will substantially increase. These networks will include a range of installations including more small cell deployments and advanced antenna technologies. Massive MIMO antennas will allow to use very narrow beams that will follow the user with impact for the surrounding exposure level different than this from current systems. The number of wireless devices will dramatically increase. New technology allows for use more efficient systems that require lower level of the signals for communication.

**ITU-T K.Suppl.10 to K.-series of Recommendations “Analysis of EMC aspects and definition of requirements for 5G systems”** provides guidance on the EMC compliance assessment considerations for 5G systems. Given the 5G Radio Access Network (RAN) technical standards are still being finalised, the first version of this Supplement focuses on possible emission and immunity requirements for 5G systems. This Supplement will be revised, if needed, to address the more specific EMC requirements when technical standards of 5G systems will be published.

**ITU-T L.Suppl.36 to ITU-T L.1310 “Study on methods and metrics to evaluate energy efficiency for future 5G systems”** analyses the energy efficiency issues for future 5G systems. 5G systems are the object of standardization in 3GPP and ITU and is planned to be available from 2018 in various countries. The focus of this Supplement is on methods and metrics to measure energy efficiency in 5G systems, with consideration of the degree of stability of the systems known so far and the experience of the legacy systems as well as related measurement procedures for evaluating future standardization evolutions.

**I.2.4 Home networking**

**ITU-T G.9961 (2015) Amd.3 “Unified high-speed wireline-based home networking transceivers – Data link layer specification: Amendment 3”** **(under approval).**

**ITU-T G.9978 “Secure admission in G.hn network” (under approval)** specifies the different secure admission methods for a node to enter a G.hn domain, including MAC authorization-based pairing, push button pairing and passphrase-based secure admission.

**ITU-T G.9973 (revised) “Protocol for identifying home network topology”** specifies the configuration management protocol. This protocol is used to manage devices in the IP home network for the purpose of showing users the Layer 2 home network topology. Recommendation ITU-T G.9973 also enables fault management with utilizing device information which the local agent of the device manages. They are described in TTC JJ-300.00.

**I.2.5 Smart Grid**

**ITU-T G.9901 (revised) "Narrowband orthogonal frequency division multiplexing power line communication transceivers - Power spectral density specification"** specifies the transmitted output voltage in the band 9-535 kHz, the control parameters that determine spectral content, power spectral density (PSD) mask requirements, a set of tools to support the reduction of the transmit PSD, the means to measure this PSD for transmission over power line wiring, as well as the allowable total transmit power into a specified termination impedance.
It also complements the system architecture, physical layer (PHY) and data link layer (DLL) specifications in Recommendations ITU T G.9902 (G.hnem), ITU-T G.9903 (G3-PLC), and ITU-T G.9904 (PRIME).

**ITU-T G.9903 (revised) “Narrowband orthogonal frequency division multiplexing power line communication transceivers for G3-PLC networks”** contains the physical layer (PHY) and data link layer (DLL) specification for the G3 PLC narrowband orthogonal frequency division multiplexing (OFDM) power line communication transceivers, for communications via alternating current and direct current electric power lines over frequencies below 500 kHz. The control parameters that determine spectral content, power spectral density (PSD) mask requirements, and the set of tools and procedures to support the measurement and reduction of the transmit PSD can be found in Recommendation ITU-T G.9901. This Recommendation adds several corrections of and improvements to the PHY, the DLL, and the routing parts of the specification. It also integrates Amendment 1 to Recommendation ITU-T G.9903 (2014), adding support for coexistence with other narrowband PLC technologies via the preamble-based coexistence mechanism specified in clause 10 of IEEE 1901.2.

**I.2.6 Software-defined networking**

**I.2.7 Cloud computing**

**ITU-T H.626.2 “Architecture for cloud storage in visual surveillance”** defines a cloud storage architecture in visual surveillance. Cloud storage enables the service users to have ubiquitous, convenient and on-demand network access to a shared pool of the configurable storage resources, which can be rapidly provisioned and released with the minimal management effort. Cloud storage can realize flexible and reliable data storage for large-scale visual surveillance, and its components are modularized and allocated dynamically based on the real usage. This Recommendation describes the architecture, entities, reference points and service control flow for cloud storage in visual surveillance.

**ITU-T Q.3914 “Set of parameters of cloud computing for monitoring”** gives functional reference architecture of cloud computing according to Y.3500. This Recommendation provides a set of parameters that indicate the status and event of a cloud computing system, including resource layer, service layer and access layer.

**ITU-T Q.4041.1 “Cloud computing infrastructure capabilities interoperability testing – part 1: Interoperability testing between CSC and CSP”** specifies the cloud computing infrastructure capabilities type interoperability testing between CSC and CSP, including interoperability testing of computing service, storage service, network service and related management functions based on the functional requirements specified in [ITU-T Y.3513]. The test cases of cloud computing infrastructure capabilities type interoperability testing between CSC and CSP have also been introduced.

**ITU-T Y.3514 “Cloud computing - Trusted inter-cloud computing framework and requirements”** specifies a framework of trusted inter-cloud computing and relevant use cases. It provides general requirements for trusted inter-cloud and specific ones related to governance, management, resiliency and security and confidentiality of trusted inter-cloud.

**ITU-T Y.3515 “Cloud computing - Functional architecture of Network as a Service”** provides Network as a Service (NaaS) functional architecture by specifying functionalities and functional components as well as reference points for the operation support system (OSS). This Recommendation also describes the mapping between functionalities and functional requirements of NaaS, relationship between the NaaS functional architecture and software-defined networking (SDN), and illustrated usage of SDN and network functions virtualisation (NFV) in support of the NaaS functional architecture.

**ITU-T Y.3516 “Cloud computing - Functional architecture of inter-cloud computing”** specifies inter-cloud computing functional architecture, including functions and functional components, based on the inter-cloud computing framework specified in ITU-T Y.3511. The Recommendation builds upon the functional view of the cloud computing reference architecture ITU-T Y.3502 and makes extensions to functional components with inter-cloud functions. This Recommendation also describes the mapping between functions and functional requirements of inter-cloud computing and examples of inter-cloud related reference points.

**ITU-T Supplement 46 to ITU-T Y.3500-series “Requirements and Challenges Regarding Provision and Consumption of Cloud Computing Services in Developing Countries”** applies to Recommendations ITU-T Y.3500-series. Cloud computing has the potential to alleviate some of the socio-economic challenges being faced in developing countries such as lack of resilient electrical power, lack of Information and Communications Technology (ICT) infrastructure and can also improve service delivery to mention but a few. Emanating from a survey conducted on cloud computing status in developing countries, this supplement highlights the requirements and challenges of cloud computing provision and consumption in developing countries with regards but not limited to standards implementation, data connectivity and infrastructure deployment.

**I.2.8 Big data**

**ITU-T Y.3601 “Big data - framework and requirements for data exchange” (under approval)** provides framework to exchange big data. Big data exchange has multiple processes consist of data import and data export within big data ecosystem. Big data exchange is used for exchanging data of multiple types and multiple formats from data source to data target. In this Recommendation, direct and intermediary exchange patters are introduced for big data exchange. Also, for big data exchange, the extended activities of big data ecosystem are provided. Functional requirements are derived from use cases.

**ITU-T Y.3650 “Framework of big data driven networking”** specifies framework of big data driven networking. The scope of this recommendation includes the model architecture of big data driven networking (bDDN), the high-level capabilities of bDDN, the interface capabilities among different planes and layers.

**ITU-T Y.4114 “Specific requirements and capabilities of the IoT for Big Data”** specifies requirements and capabilities of the IoT for Big Data. This Recommendation complements the developments on common requirements of the IoT [ITU-T Y.2066] and functional framework of the IoT [ITU-T Y.2068] in terms of the specific requirements and capabilities that the IoT is expected to support in order to address the challenges related to Big Data. Also, it constitutes a basis for further standardization work (e.g. functional entities, APIs and protocols) concerning Big Data in the IoT.

**I.2.9 Network Management**

**ITU-T M.1400 (04/2015) Amd.1 “Designations for interconnections among operators' networks - Draft Amendment 1: Addition of new function codes for optical networks beyond 100 Gb/s”** adds new function codes for optical networks beyond 100 Gb/s The 2016 edition of Recommendation ITU-T G.709 has introduced support for optical transport networks with rates beyond 100 Gb/s. This draft amendment augments clause 29 of Recommendation ITU-T M.1400 with new function codes for the corresponding Optical Data Units and Optical Transport Units. It also corrects a few editorial inconsistencies.

**ITU-T M.3020 (revised) “Management interface specification methodology”** describes the management interface specification methodology (MISM), and the process to derive interface specifications based on user requirements, analysis and design (RAD). Guidelines are given on RAD using unified modelling language (UML) notation; however, other interface specification techniques are not precluded. The guidelines for using UML are described at a high level in this ITU-T Recommendation.

**ITU-T M.3071 “Cloud-based network management functional architecture”** introduces a new network management functional architecture with the cloud computing technology. In this Recommendation, the background and basic concept of cloud-based network management are provided. This Recommendation also provides the cloud-based network management functional architecture, including the basic components of the cloud-based network management functional architecture, their functionalities and the relationship between the components.

**I.3.1 Video and image coding**

**Version 5 of ITU-T H.265 “High Efficiency Video Coding”** **(revised)**, which was awarded a Primetime Emmy Award in October 2017, includes the addition of new Monochrome 10 and Main 10 Still Picture profiles, updating of colour space aspects, miscellaneous minor corrections and clarifications, and additional Supplemental Enhancement Information messages for content colour volume, equirectangular and cubemap omnidirectional 360° projections, region-wise packing, sphere rotation, omnidirectional viewport, regional nesting, and motion-constrained tile sets extraction information sets and associated nesting.

This Recommendation was developed jointly with ISO/IEC JTC 1/SC 29/WG 11 (MPEG) and Rec. ITU-T H.265 is maintained as technically aligned twin text with ISO/IEC 23008-2. The technical changes in this edition were developed in a joint collaborative team with MPEG in technical alignment with Amendments 1, 2 and 3 of the third edition (2017) of ISO/IEC 23008-2.

**I.3.1 Video and image coding**

**ITU-T H.222.0 (2017) Amd.1 “Information technology - Generic coding of moving pictures and associated audio information: Systems: Ultra-low latency and 4k and higher resolution support for transport of JPEG 2000 video”** fixes interoperability issues in the transport of JPEG 2000 Part 1 (Rec. ITU-T T.800 | ISO/IEC 15444-1) by removing references to ISO/IEC 15444-1 Annex M and updating the definition of the elementary stream header to make it self-contained in ISO/IEC 13818-1 Annex S. It further adds support for JPEG 2000 Ultra-Low Latency (ULL) encoding and transport of professional video, audio and data over Internet Protocol networks, by specifying the use of horizontal, independent JPEG 2000 stripes. Finally, it supports higher resolutions (4K or higher) of JPEG 2000 video images by adding a new block mode. This new mode allows implementers to divide a given frame into blocks.

**ITU-T H.265 | ISO/IEC 23008-2**, which was awarded a Primetime Emmy Award in October 2017, had its 5th version completed at this meeting. It adds two new profiles (Monochrome 10 and Main 10 Still Picture), updates colour space aspects, and defines additional Supplemental Enhancement Information (SEI) messages (content colour volume, equirectangular and cubemap omnidirectional 360° projections, region-wise packing, sphere rotation, omnidirectional viewport, regional nesting, and motion-constrained tile sets extraction information sets and associated nesting).

Another accomplishment was new Supplement 18 to the H-Series of Recommendations (ex HSTP.HDR.WCG) that reviews approaches for processing and coding of high definition range/ wide colour gamut (HDR/WCG) video content. This is technically aligned with TR 23008-15. H.Sup18 complements the material provided in Supplement 15 to the ITU-T H-series  Technical Report ISO/IEC 23008-14) on conversion and coding practices for HDR/WCG Y′CbCr 4:2:0 video with PQ transfer characteristics.

**I.3.2 Intelligent, interoperable visual surveillance systems**

**ITU-T H.626.2 “Architecture for cloud storage in visual surveillance”** defines a cloud storage architecture in visual surveillance. Cloud storage enables the service users to have ubiquitous, convenient and on-demand network access to a shared pool of the configurable storage resources, which can be rapidly provisioned and released with the minimal management effort. Cloud storage can realize flexible and reliable data storage for large-scale visual surveillance, and its components are modularized and allocated dynamically based on the real usage. This Recommendation describes the architecture, entities, reference points and service control flow for cloud storage in visual surveillance.

**I.3.3 Smart television systems**

**ITU-T Y.Suppl.43 “ITU-T Y.1900-series – Deployment models of N-screen services”** describes three kinds of deployment model of N-screen services when user devices use the different protocols, metadata and stream formats to enable a user to view same media content on multiple user devices which the translation and adjustment of content formats is necessary when the formats used in each user device are different. The service requirements are also specified when the deployment model is applied for the support of N-screen services.

**I.3.4 IPTV and digital signage**

**ITU-T H.724 “IPTV Terminal Device: Interworking-enabled model of multiple devices”** describes the functional components and features that enable interworking between the IPTV terminal devices defined in ITU-T Recommendations H.721, H.722 and H.723. The service supported by the capability of interworking will provide users a continuous and seamless consumption experience independently of the terminal device type, the access network type and the users' location. This Recommendation does not only concern with the interworking within the local home network, but also the interworking while terminal devices are distributed in the public network. Therefore, this Recommendation also specifies some new functional requirements related to the local and distributed scenarios.

In comparison with the other IPTV terminal device models defined in ITU-T Recommendations before, the interworking-enabled terminal device model in this Recommendation focuses on specifying the capability and functions of IPTV terminal device that enable the service or content consumption over multiple IPTV terminal devices. The capabilities and functions include interworking modes, functional roles, application framework, APIs, and the interfaces. In addition, Appendices I and II describe the use cases and scenarios for interworking modes and synchronization issues.

Although this is one of the IPTV terminal device series of Recommendations, this Recommendation does not intend to specify the technical requirements for a single IPTV terminal device, but to specify the relationship among those IPTV terminal devices by considering the different interworking scenarios. With the specification in this Recommendation, it is beneficial for the IPTV service provider and application developers to expand their IPTV services or applications to provide better user experience.

**ITU-T H.763.3 “HTML for IPTV services”** describes hypertext markup language to provide interoperability and harmonization among IPTV multimedia application frameworks. HTML has increasingly been used to create multimedia contents and many declarative application platforms based on HTML have been used to provide various kinds of multimedia services in accordance with different purpose in different areas. However, depending on its purpose, targeted contents and services, or environments, each declarative application platform has different implementation scope of HTML elements.

To avoid different appearances and interactivities depending on specific implementations of HTML, a minimal set of HTML elements to be supported by any IPTV terminal needs to be specified for enhancing the interoperability of IPTV services among different terminals.

Therefore, we define Elements of IPTV-HTML (Basic profile), Attributes associated with each element in IPTV-HTML (Basic profile), and DOM interfaces in IPTV-HTML (Basic profile). This document can be used for developing IPTV based application services.

**ITU-T H.782 “Digital signage: Metadata”** specifies the data elements and structures of the metadata for digital signage services. The metadata describes information for contents, terminal devices, play logs, playlist schedule, screen layout, etc. The metadata is handled by a digital signage server, a digital signage client, a content delivery server, and a content delivery client. It also specifies general information flows to describe how the metadata are used in the digital signage services.

**I.3.8 New services and applications**

**ITU-T F.746.5 “Framework for language learning system based on speech/NLP technology”** defines a framework for language learning system based on speech/NLP technology. Speech interface and natural language processing (NLP) technology are the advanced technology which makes a computer understand what a person says and also exchanges information in smooth conversation between a computer and a person. Speech interface and natural language processing technologies are expected to be combined with other technologies in many application areas including language learning system. NLP technology is used for understanding a user’s speech in dialogue practices in various language learning situations. More advanced dialog-based speech interface technology is also applied to foreign language learning system which simulates one-on-one conversation training. This Recommendation describes functional requirements and detailed functions for framework for language learning system based on speech/NLP technology. It provides a framework for language learning system that will serve as a reference framework for language learning systems to be developed and used as low cost tools in many educational situations.

**ITU-T F.746.6 “Requirements for a name resolution service in information-centric networks”** describes the requirements for a flexible name resolution service and the capabilities of the name resolution service in information-centric networks (ICN). This name resolution service can flexibly support name resolution for any particular ICN instance and facilitate interoperation between different ICN instances with their own namespaces.

**ITU-T G.722.2 Annex C (revised) “Wideband coding of speech at around 16 kbit/s using Adaptive Multi-Rate Wideband (AMR-WB): Fixed-point C-code”** specifies the bit-exact ANSI C-code implementation of the AMR-WB algorithm specified in Recommendation ITU-T G.722.2, its Annexes A and B, and its Appendix I (non-normative). This revision to Annex C incorporates several Change Requests (CRs) approved by 3GPP since the last revision of this Annex approved in November 2008. This annex includes an electronic attachment containing the C-code of the G.722.2 AMR-WB speech transcoder. The C-code has been updated to harmonise with the AMR-WB coder in 3GPP specification TS 26.173 V14.0.0 (2017-03).

**ITU-T G.722.2 Annex D (G.722.2 Annex D) (revised) “Wideband coding of speech at around 16 kbit/s using Adaptive Multi-Rate Wideband (AMR-WB): Digital test sequences”** specifies version 14.0.0 of the bit-exact test sequences for the verification of the implementation of G.722.2 AMR-WB codec, voice activity detection, comfort noise generation and source controlled rate operation. This revision to Annex D incorporates several Change Requests (CRs) approved by 3GPP since the last revision of this Annex approved in July 2003. The test sequences specified in this annex were also adopted by 3GPP in 3GPP specification TS 26.174 V14.0.0 (2017-03).

**ITU-T H.248.77 (revised) “Gateway control protocol: Secure real-time transport protocol (SRTP) package and procedures”** contains an updated package that allows for the usage of DTLS-SRTP key management scheme that exchanges the peers' certificates via the signalling path and then establishes a DTLS connection on the bearer path.

**ITU-T X.609.3 “Managed P2P communications: Multimedia streaming signalling requirements”** specifies signalling requirements for distributed multimedia streaming over managed P2P architecture. This Recommendation lists up requirements on all reference points that are defined in Recommendation ITU-T X.609 for providing multimedia streaming services. This Recommendation also describes high-level procedures for multimedia streaming services over managed P2P architecture, and roles of managed P2P components.

**ITU-T X.609.4 “Managed P2P communications: Multimedia streaming peer protocol”** specifies peer protocol for distributed multimedia streaming services over managed P2P architecture that defined in ITU-T X.609. It satisfies the signaling requirements that specified in ITU-T X.609.3. This Recommendation also specifies protocol messages among peers, behaviors, and the types of peer relationship.

**ITU-T X.609.5 “Managed P2P communications: Multimedia streaming overlay management protocol”** specifies the overlay network management protocol for multimedia streaming service over managed P2P communications. The purpose of multimedia streaming overlay management protocol (MSOMP) is to manage overlay network including establishment, modification, and termination. In addition, MSOMP also supports querying status of overlay network. MSOMP runs on the interface among entities of managed P2P communications. For managing overlay network, this Recommendation defines protocol operations and signalling messages for each operation.

**ITU-T X.760 “The measurement framework for the statistical indicators of website traffic”** describes the measurement framework for the statistical indicators of website traffic. This Recommendation defines three key statistical indicators (KSIs) including eight sub-indicators of website traffic and describes the measurement framework including measurement environment and measurement procedure for KSIs of website traffic. This Recommendation is aimed at providing network operators with a means to benchmark websites for scaling and optimizing network infrastructures.

**I.4.1 Internet of Things and Smart City**

**ITU-T Y.4101/Y.2067 (revised) “Common requirements and capabilities of a gateway for Internet of Things applications”** provides the common requirements and capabilities of a gateway for Internet of things (IoT) applications. The provided common requirements and capabilities are intended to be generally applicable in gateway application scenarios.

**ITU-T Y.4114 “Specific requirements and capabilities of the IoT for Big Data”** specifies requirements and capabilities of the IoT for Big Data. This Recommendation complements the developments on common requirements of the IoT [ITU-T Y.2066] and functional framework of the IoT [ITU-T Y.2068] in terms of the specific requirements and capabilities that the IoT is expected to support in order to address the challenges related to Big Data. Also, it constitutes a basis for further standardization work (e.g. functional entities, APIs and protocols) concerning Big Data in the IoT.

**ITU-T Y.4115 “Reference architecture for IoT device capabilities exposure”** clarifies the concept of the IoT device capability exposure (DCE), identifies its general characteristics and common requirements and provides relevant reference architecture and common procedures.

**ITU-T Y.4116 “Requirements of transportation safety service including use cases and service scenarios”** describes requirements for providing transportation safety services. The use cases and related service scenarios which are used to extract requirements for various IoT services and applications are also described in this Recommendation.

**ITU-T Y.4117 “Requirements and capabilities of Internet of Things for support of wearable devices and related services”** describes characteristics, specific requirements and capabilities of the IoT for support of wearable devices and related services.
From an IoT requirement perspective, the wearable device related services (WDS) are classified in this Recommendation in four main classes: wearable device related multimedia services (WDMS), wearable device related health management services (WDHS), wearable device related sport services (WDSS) and wearable device related assistant services (WDAS). Wearable devices (WDs) can be categorized according to their usage (WDS class).
Specific requirements and capabilities of the IoT to support the different WDs and WDS are provided. Furthermore, information concerning relevant use cases for WDs and WDS is provided in appendix.

**ITU-T Y.4118 “Internet of Things requirements and technical capabilities for support of accounting and charging” (under approval)** provides accounting and charging requirements for IoT as well as an IoT accounting and charging technical capability framework, in order to assist in the standardization of accounting and charging technical mechanisms for IoT and to facilitate the development of the IoT market. The Recommendation focuses on the network layer capabilities and service support and application support layer capabilities, as well as business use cases applied to IoT. The use cases, requirements and technical capability framework provided in this Recommendation are from a technical point view.

**ITU-T Y.4119 “Requirements and capability framework for IoT-based automotive emergency response system”** **(under approval)** provides an overview of an IoT-based automotive emergency response system (AERS), identifies requirements of the AERS for aftermarket devices, and provides a capability framework of the AERS.

**ITU-T Y.4456 “Requirements and Functional Architecture for Smart Parking Lot in Smart City**” **(under approval)** specifies requirements and functional architecture for Smart Parking Lot.

**ITU-T Y.4200 “Requirements for interoperability of smart city platforms**” **(under approval)** defines the requirements for interoperability of a smart city platform (SCP) and reference points in order to ensure the correct functioning of the city services.
The SCP offers services to a smart city. Interoperability between SCPs allows the increase in the number of services and their quality. It enables the provision of better services to citizens, and at the same time ensures maximum efficiency, scalability and simple integration.
By permitting interoperability with other platforms, the SCP will also encourage local economic development through innovation and competition.

**ITU-T Y.4201 “High-level requirements and reference framework of smart city platform” (under approval)** presents the high-level requirements and reference framework of smart city platform (SCP). The SCP is a fundamental platform supporting all the services and applications of a smart city, with the objective to improve quality of life, provide urban operation and services for the benefit of the citizens while ensuring city sustainability. These high-level requirements include comprehensive and updated repositories of city information, infrastructure life-cycle management, inter-system communication, security support, maintenance support, controls of processer, decision making support, real-time dissemination of public information, resiliency, and interoperability. This Recommendation benefits the plan, design, construction, deployment, operation and maintenance of smart cities and communities.

**ITU-T Y.4455 “Reference architecture for IoT network service capability exposure”** introduces IoT network capability exposure (IoT NCE). The IoT NCE is a functional entity in network domain, and facilitates the Internet of things (IoT) applications and services to make full use of capabilities of their underlying networks. The IoT NCE can optimize user experience, improve network efficiency and expose network capability in order to optimize IoT applications and services.
This Recommendation clarifies the concept of the IoT NCE, identifies its general characteristics and common requirements, and provides the reference architecture and relevant capabilities for the IoT NCE. Additionally, it provides several use cases and common procedures to illustrate the concept and the architecture of the IoT NCE.

**ITU-T Y.4500.1 “oneM2M- Functional Architecture”** harmonizes and specifies the end-to-end oneM2M functional architecture in the M2M Service Layer.

**ITU-T Y.4500.4 “oneM2M- Service Layer Core Protocol Specification“ (under approval)** specifies the communication protocol(s) for oneM2M compliant Systems, M2M Applications, and/or other M2M systems. The present document also specifies the common data formats, interfaces and message sequences to support reference points(s) defined by oneM2M.

**ITU-T Y.4500.5 “oneM2M- Management enablement (OMA)” (under approval)** specifies the usage of OMA DM and OMA LwM2M resources and the corresponding message flows including normal cases as well as error cases to fulfil the oneM2M management requirements.

**ITU-T Y.4500.6 “oneM2M Management enablement (BBF)” (under approval)** specifies the usage of the BBF TR-069 protocol and the corresponding message flows including normal cases as well as error cases to fulfil the oneM2M management requirements.

• Protocol mapping between the oneM2M service layer and BBF TR-069 protocol. The Mca reference point, ms interface and la interface are possibly involved in this protocol mapping.

• Mapping between the oneM2M management related resources and the TR-069 protocol RPCs and TR-181i2 data model.

Specification of new TR-181 data model elements to fulfil oneM2M specific management requirements that cannot be currently translated.

**ITU-T Y.4500.8 “oneM2M- CoAP Protocol Binding“ (under approval)** covers the protocol specific part of communication protocol used by oneM2M compliant systems as 'CoAP binding'.

**ITU-T Y.4500.9 “oneM2M- HTTP Protocol Binding” (under approval)** specifies the protocol specific part of communication protocol used by oneM2M compliant systems as RESTful HTTP binding. The scope of the present document is (not limited to as shown below):

• Binding oneM2M Protocol primitive types to HTTP method.

• Binding oneM2M response status codes (successful/unsuccessful) to HTTP response codes.

• Binding oneM2M RESTful resources to HTTP resources.

**ITU-T Y.4500.10 “oneM2M- MQTT Protocol Binding”** **(under approval)** specifies the binding of Mca and Mcc primitives (message flows), defined in the Service Layer Core Protocol, onto the MQTT transport protocol.

**ITU-T Y.4500.11 "oneM2M- Common Terminology”** **(under approval)** contains a collection of specialist technical terms, definitions and abbreviations referenced within the oneM2M specifications.

**ITU-T Y.4500.12 “oneM2M Base Ontology”** **(under approval)** contains provides normative and informative specifications for the oneM2M Base Ontology and its instantiation into oneM2M resources.

**ITU-T Y.4500.13 “oneM2M- Interoperability Testing”** **(under approval)** specifies Interoperability Test Descriptions for the oneM2M primitives.

**ITU-T Y.4500.14 “oneM2M- LwM2M Interworking”** **(under approval)** specifies the interworking capabilities of the M2M Service Layer between ASN/IN/MN CSEs and LWM2M Endpoints.

**ITU-T Y.4500.15 “oneM2M- Testing framework“ (under approval)** provides methodology for development of conformance and interoperability test strategies, test systems and the resulting test specifications for oneM2M standards.

**ITU-T Y.4500.20 “oneM2M- WebSocket Protocol Binding”** **(under approval)** specifies the binding of Mca and Mcc primitives onto the WebSocket binding. It specifies:

* Procedures and message formats for operating and closing of WebSocket connections.
* How request and response primitives are mapped into the payload of the WebSocket protocol.

**ITU-T Y.4500.22 “oneM2M- Field Device Configuration“ (under approval)** specifies the architectural options, resources and procedures needed to provision and maintain devices in the Field Domain in order to establish M2M Service Layer operation.

**ITU-T Y.4500.23 “oneM2M-Home Appliances Information Model and Mapping”** **(under approval)** describes the oneM2M defined information model for home appliances, including the description of how it is mapped with other information models from external organizations. It also explains the ontology for the home domain information model.

**ITU-T Y.4805 “Identifier service requirements for the interoperability of Smart City applications”** specifies a set of requirements for identifier services in smart city. The set of requirements may serve as the guidelines for developing new identifier services for smart city. It will include security features for service integrity, data confidentiality. The Recommendation will define a full list of security requirements for the identifier service.

**ITU-T Y.4806 “Security capabilities supporting safety of the Internet of Things”** provides a classification of the security issues for the Internet of Things and examines how the security threats may affect safety, in order to determine which security capabilities specified in Recommendation ITU-T Y.4401/Y.2068 support safe execution of the Internet of Things. The Appendixes of this Recommendation consider how the joint analysis of threats and security capabilities mentioned herein may be used to establish security requirements for the different applications of the Internet of Things.

**ITU-T Y Suppl.45 to ITU-T Y.4000 series “An overview of smart cities and communities and the role of information and communication technologies”** provides an overview of roles of Information and Communication Technologies (ICTs) in Smart Sustainable Cities (SSC) primarily based on ITU-T Recommendations. A SSC aims to improve quality of life, efficiency of urban operation and services, and competitiveness, ensuring that needs of present and future generations with respect to economic, social, environmental as well as cultural aspects of cities and communities are met.

**I.4.5 Connected vehicles, automated driving and intelligent transport systems**

**ITU-T H.550 “Architecture and functional entities of Vehicle Gateway Platforms”** specifies architecture, functional architecture framework and functional entities for vehicle gateway platform. Some signalling flows of VGP are also described in Appendix I. A series of Recommendations for Vehicle Gateway Platforms is under the responsibility of ITU- T SG16. This Recommendation is a part of that series and gives the architecture, functional architecture framework and functional entities of VGP.

**ITU-T H.560 “Communications interface between external applications and a Vehicle Gateway Platform”** specifies functional requirements for vehicle gateway platform services, services functionalities and management, including Vehicle Gateway Platform (VGP), application, and communication network requirements. A series of Recommendations for VGP is under the responsibility of ITU-T SG16. This Recommendation is a part of that series and gives the description of VGP services and the communication interface with applications running over external devices.

**I.4.5 Connected health: e-Health**

**ITU-T H.810 (V4) (revised) “Interoperability design guidelines for personal connected health systems: Introduction”** on the Continua Design Guidelines (CDG) defines a framework of underlying standards and criteria required to ensure the interoperability of devices and data used for personal connected health. It also contains design guidelines (DGs) that further clarify the underlying standards or specifications by reducing options or by adding a missing feature to improve interoperability.

**ITU-T H.811 (revised) “Interoperability design guidelines for personal health systems: Personal health devices interface”** specifies the personal health devices interface (PHD-IF).

**ITU-T H.812 (revised) “Interoperability design guidelines for personal health systems: Services interface: Common certified capability class”** contains an overview of the Services interface (Services-IF), common design guidelines for all Services-IF Certified Capability Classes (CCC) and the design guidelines for Consent Enabled Personal Health Gateway (PHG) and Services CCCs.

**ITU-T H.812.1 (revised) “Interoperability design guidelines for personal health systems: Services interface: Observation upload certified capability class”** defines the additional design guidelines for the Observation Upload Certified Capability Class (CCC), whose function is to transfer an observation measurement from a medical device to a services application over the services interface (Services-IF).

**ITU-T H.812.2 (revised) “Interoperability design guidelines for personal health systems: Services interface: Questionnaires”** defines design guidelines for the certified capability class (CCC) Questionnaire, the function of which is to enable the interoperable exchange of PROMs (also known as Questionnaires) across the Services-IF of the Continua end-to-end architecture.

**ITU-T H.812.3 (revised) “Interoperability design guidelines for personal health systems: Services interface: Capability exchange certified capability class”** defines the additional design guidelines for the Capability Exchange-enabled PHG and health and fitness services certified capability class (CCC). The purpose of the Capability Exchange is to reduce the amount of information that must be pre-configured on a device in order to obtain plug and play interoperability. Specifically, Capability Exchange enables application hosting devices, such as a personal health gateway (PHG) to know what types of messages it can send to the health and fitness services, by identifying its Continua CCCs. Likewise, Capability Exchange provides a mechanism for the PHG to inform the health and fitness services of its capabilities. This enables the health and fitness services to tailor its communication with the PHG. Capability Exchange is mandatory for all health and fitness services while it is optional for PHGs.

**ITU-T H.812.4 (revised) “Interoperability design guidelines for personal health systems: Services interface: Authenticated persistent session capability”** defines the additional design guidelines for the Authenticated Persistent Session (APS), whose function is to provide a secure, long-lived, persistent bidirectional data channel between the health and fitness services application and a PHG application, suitable for sending unsolicited commands to the PHG or to devices connected via the PHG.

**ITU-T H.813 (revised) “Interoperability design guidelines for personal health systems: Healthcare information system (HIS) interface”** specifies the interface between Services health devices and healthcare information system (HIS) health devices.

**ITU-T H.821 (revised) “Conformance of ITU-T H.810 personal health devices: Health record network (HRN) interface”** is a transposition of Continua Health Alliance Test Tool DG2016, Test Suite Structure & Test Purposes, HIS Interface (Version 1.5, 2016-09-20), that was developed by the Personal Connected Health Alliance. A number of versions of this specification existed before transposition. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.830.1 (revised) “Conformance of ITU-T H.810 personal health devices: WAN interface Part 1: Web services interoperability: Sender”** is a transposition of Continua Test Tool DG2013, Test Suite Structure & Test Purposes, Services Interface; Part 1: Web Services Interoperability. HFS Sender (Version 1.5, 2016‑09‑20), that was developed by the Personal Connected Health Alliance. A number of versions of this specification existed before transposition. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.830.2 (revised) “Conformance of ITU-T H.810 personal health devices: WAN interface Part 2: Web services interoperability: Receiver”** is a transposition of Personal Connected Health Alliance Test Tool DG2013, Test Suite Structure & Test Purposes, Services Interface; Part 2: Web Services Interoperability. HFS Receiver (Version 1.4, 2016-09-20), that was developed by the Personal Connected Health Alliance. A number of versions of this specification existed before transposition. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.830.3 (revised) “Conformance of ITU-T H.810 personal health devices: WAN interface Part 3: SOAP/ATNA: Sender”** is a transposition of Continua Health Alliance Test Tool DG2013, Test Suite Structure & Test Purposes, Services Interface; Part 3: SOAP/ATNA. HFS Sender (Version 1.7, 2016-09-20), that was developed by the Personal Connected Health Alliance. A number of versions of this specification existed before transposition. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.830.4 (revised) “Conformance of ITU-T H.810 personal health devices: WAN interface Part 4: SOAP/ATNA: Receiver”** is the transposition of Continua Health Alliance Test Tool DG2013, Test Suite Structure & Test Purposes, Services Interface; Part 4: SOAP/ATNA. HFS Receiver (Version 1.6, 2016-09-20), that was developed by the Personal Connected Health Alliance. A number of versions of this specification existed before transposition. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.830.5 (revised) “Conformance of ITU-T H.810 personal health devices: WAN interface Part 5: PCD-01 HL7 messages: Sender”** is the transposition of Continua Health Alliance Test Tool DG2016, Test Suite Structure & Test Purposes, Services Interface; Part 5: PCD-01 HL 7 Messages. HFS Sender (Version 1.7, 2016-09-20), that was developed by the Continua Health Alliance. A number of versions of this specification existed before transposition. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.830.6 (revised) “Conformance of ITU-T H.810 personal health devices: WAN interface Part 6: PCD-01 HL7 messages: Receiver”** is a transposition of Continua Health Alliance Test Tool DG2016, Test Suite Structure & Test Purposes, Services Interface; Part 6: PCD-01 HL7 Messages. HFS Receiver (Version 1.7, 2016-09-20), that was developed by the Continua Health Alliance. A number of versions of this specification existed before transposition. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.830.7 (revised) “Conformance of ITU-T H.810 personal health devices: WAN interface Part 7: Consent management: Sender”** is a transposition of Continua Health Alliance Test Tool DG2016, Test Suite Structure & Test Purposes, Services Interface; Part 7: Consent Management. HFS Sender (Version 1.4, 2016-09-20), that was developed by the Personal Connected Health Alliance. A number of versions of this specification existed before transposition. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.830.8 (revised) “Conformance of ITU-T H.810 personal health devices: WAN interface Part 8: Consent management: Receiver”** is a transposition of Personal Connected Health Alliance Test Tool DG2016, Test Suite Structure & Test Purposes, Services Interface; Part 8: Consent Management. HFS Receiver (Version 1.3, 2016-09-20), that was developed by the Personal Connected Health Alliance. A number of versions of this specification existed before transposition. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.830.9 (revised) “Conformance of ITU-T H.810 personal health devices: WAN interface Part 9: hData observation upload: Sender”** provides a test suite structure (TSS) and the test purposes (TPs) for the Services interface (consent management; sender) based on the requirements defined in Recommendation ITU‑T H.810 (2016). The objective of this test specification is to provide a high probability of air interface interoperability between different devices. This Recommendation is a transposition of Continua Test Tool DG2016, Test Suite Structure (TSS) & Test Procedures, Services Interface; Part 9: hData observation upload: HFS Sender (Version 1.1, 2016‑09‑20).

**ITU-T H.830.10 (revised) “Conformance of ITU-T H.810 personal health devices: WAN interface Part 10: hData observation upload: Receiver”** provides a test suite structure and the test purposes (TSS & TPs) for the Services interface (consent management; receiver) based on the requirements defined in Recommendation ITU-T H.810 (2016). The objective of this test specification is to provide a high probability of air interface interoperability between different devices. This Recommendation is a transposition of Continua Test Tool DG2016, Test Suite Structure & Test Procedures, Services interface; Part 10: hData observation upload: HFS Receiver (Version 1.1, 2016‑09-20). This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.830.11 (revised) “Conformance of ITU-T H.810 personal health devices: WAN interface Part 11: Questionnaires: Sender”** provides a test suite structure and the test purposes (TSS & TP) for the Services interface (consent management; sender) based on the requirements defined in Recommendation ITU‑T H.810 (2016). The objective of this test specification is to provide a high probability of air interface interoperability between different devices. This Recommendation is a transposition of Continua Test Tool DG2016, Test Suite Structure & Test Procedures, Services Interface; Part 11: Questionnaires: HFS Sender (Version 1.1, 2016-09-20). This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.830.12 (revised) “Conformance of ITU-T H.810 personal health devices: WAN interface Part 12: Questionnaires: Receiver”** provides a test suite structure and the test purposes (TSS & TP) for the Services interface (consent management; receiver) based on the requirements defined in Recommendation ITU‑T H.810 (2016). The objective of this test specification is to provide a high probability of air interface interoperability between different devices. This Recommendation is the transposition of Continua Test Tool DG2016, Test Suite Structure & Test Procedures, Services Interface; Part 12: Questionnaires: HFS Receiver (Version 1.1, 2016-09-20). This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.840 (revised) “Conformance of ITU-T H.810 personal health devices: PAN/LAN/TAN: USB host”** is a transposition of Continua Test Tool DG2016, Test Suite Structure & Test Purposes, Personal Health Devices interface: USB Host (Version 1.3, 2016-09-20), that was developed by the Personal Connected Health Alliance. A number of versions of this specification existed before transposition. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.841 (revised) “Conformance of ITU-T H.810 personal health devices: PAN/LAN/TAN interface Part 1: Optimized exchange protocol: Agent”** is a transposition of Continua Test Tool DG2016, Test Suite Structure & Test Purposes, Personal Health Devices Interface; Part 1: Optimized Exchange Protocol. Personal Health Device (Version 1.10, 2016-09-20), that was developed by the Personal Connected Health Alliance. A number of versions of this specification existed before transposition. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.842 (revised) “Conformance of ITU-T H.810 personal health devices: PAN/LAN/TAN interface Part 2: Optimized exchange protocol: Manager”** is a transposition of Continua Test Tool DG2016, Test Suite Structure & Test Purposes, Personal Health Devices Interface; Part 2: Optimized Exchange Protocol: Personal Health Gateway (Version 1.7, 2016-09-20), that was developed by the Personal Connected Health Alliance. A number of versions of this specification existed before transposition. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.843 (revised) “Conformance of ITU-T H.810 personal health devices: PAN/LAN/TAN interface Part 3: Continua Design Guidelines: Agent”** is a transposition of Continua Test Tool DG2016, Test Suite Structure & Test Purposes, Personal Health Devices Interface; Part 3: Continua Design Guidelines. Personal Health Device (Version 1.10, 2016‑09-20), that was developed by the Personal Connected Health Alliance. A number of versions of this specification existed before transposition. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.844 (revised) “Conformance of ITU-T H.810 personal health devices: PAN/LAN/TAN interface Part 5D: Blood pressure monitor: Agent”** is a transposition of Continua Test Tool DG2016, Test Suite Structure & Test Purposes, Personal Health Devices Interface; Part 4: Continua Design Guidelines. Manager (Version 1.8, 2016-09-20), that was developed by the Personal Connected Health Alliance. A number of versions of this specification existed before transposition. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.845.1 (revised) “Conformance of ITU-T H.810 personal health devices: PAN/LAN/TAN interface Part 5A: Weighing scales: Agent”** is a transposition of Continua Test Tool DG2016, Test Suite Structure & Test Purposes, Personal Health Devices Interface; Part 5A: Device Specializations. Personal Health Device (Weighing Scale) (Version 1.6, 2016-09-20), that was developed by the Personal Connected Health Alliance. A number of versions of this specification existed before transposition. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.845.2 (revised) “Conformance of ITU-T H.810 personal health devices: PAN/LAN/TAN interface Part 5B: Glucose meter: Agent”** is a transposition of Continua Test Tool DG2016, Test Suite Structure & Test Purposes, Personal Health Devices Interface; Part 5B: Device Specializations. Personal Health Device (Glucose Meter) (Version 1.6, 2016-09-20), that was developed by the Personal Connected Health Alliance. A number of versions of this specification existed before transposition. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.845.3 (revised) “Conformance of ITU-T H.810 personal health devices: PAN/LAN/TAN interface Part 5C: Pulse oximeter: Agent”** is a transposition of Continua Test Tool DG2016, Test Suite Structure & Test Purposes, Personal Health Devices Interface; Part 5C: Device Specializations. Personal Health Device (Pulse Oximeter) (Version 1.7, 2016-09-20), that was developed by the Personal Connected Health Alliance. A number of versions of this specification existed before transposition. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.845.4 (revised) “Conformance of ITU-T H.810 personal health devices: PAN/LAN/TAN interface Part 5D: Blood pressure monitor: Agent”** is a transposition of Continua Test Tool DG2016, Test Suite Structure & Test Purposes, Personal Health Devices Interface; Part 5D: Device Specializations. Personal Health Device (Blood Pressure Monitor) (Version 1.7, 2016-09-20), that was developed by the Personal Connected Health Alliance. A number of versions of this specification existed before transposition. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.845.5 (revised) “Conformance of ITU-T H.810 personal health devices: PAN/LAN/TAN interface Part 5E: Thermometer: Agent”** is a transposition of Continua Test Tool DG2016, Test Suite Structure & Test Purposes, Personal Health Devices Interface; Part 5E: Device Specializations. Agent (Thermometer) (Version 1.6, 2016-09-20), that was developed by the Personal Connected Health Alliance. A number of versions of this specification existed before transposition. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.845.6 (revised) “Conformance of ITU-T H.810 personal health devices: PAN/LAN/TAN interface Part 5F: Cardiovascular fitness and activity monitor: Agent”** is a transposition of Continua Test Tool DG2016, Test Suite Structure & Test Purposes, Personal Health Devices Interface; Part 5F: Device Specializations. Personal Health Device (Cardiovascular) (Version 1.6, 2016-09-20), that was developed by the Personal Connected Health Alliance. A number of versions of this specification existed before transposition. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.845.7 (revised) “Conformance of ITU-T H.810 personal health devices: PAN/LAN/TAN interface Part 5G: Strength fitness equipment: Agent”** is a transposition of Continua Test Tool DG2016, Test Suite Structure & Test Purposes, Personal Health Devices Interface; Part 5G: Device Specializations. Personal Health Device (Strength) (Version 1.6, 2016-09-20), that was developed by the Personal Connected Health Alliance. A number of versions of this specification existed before transposition. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A

**ITU-T H.845.8 (revised) “Conformance of ITU-T H.810 personal health devices: PAN/LAN/TAN interface Part 5H: Independent living activity hub: Agent”** is a transposition of Continua Test Tool DG2016, Test Suite Structure & Test Purposes, Personal Health Devices Interface; Part 5H: Device Specializations. Personal Health Device (Activity Hub) (Version 1.7, 2016-09-20), that was developed by the Personal Connected Health Alliance. A number of versions of this specification existed before transposition. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.845.9 (revised) “Conformance of ITU-T H.810 personal health devices: PAN/LAN/TAN interface Part 5I: Medication adherence monitor: Agent”** is a transposition of Continua Test Tool DG2016, Test Suite Structure & Test Purposes, Personal Health Devices Interface; Part 5I: Device Specializations. Personal Health Device (Adherence Monitor) (Version 1.6, 2016-09-20), that was developed by the Personal Connected Health Alliance. A number of versions of this specification existed before transposition. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.845.10 “Conformance of ITU-T H.810 personal health system: Personal Health Devices interface Part 5I: Insulin Pump”** provides a test suite structure and the test purposes for the insulin pump agent in the Personal Health Devices interface of the ITU-T H.810 architecture [ITU-T H.810]. The objective of this test specification is to provide a high probability of air interface interoperability between different devices. This Recommendation is a transposition of Continua Test Tool DG2016, Continua Test Tool DG2016, Test Suite Structure & Test Purposes, Personal Health Devices Interface, Part 5J: Device specializations, Personal health device – Insulin Pump (IP), Version 1.0 (2016-09-20).

**ITU-T H.845.11 (revised) “Conformance of ITU-T H.810 personal health devices: PAN/LAN/TAN interface Part 5K: Peak expiratory flow monitor: Agent”** is a transposition of Continua Test Tool DG2016, Test Suite Structure & Test Purposes, Personal Health Devices Interface; Part 5K: Device Specializations. Personal Health Device (Peak expiratory flow monitor) (Version 1.6, 2016-09-20), that was developed by the Personal Connected Health Alliance. A number of versions of this specification existed before transposition. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.845.12 (revised) “Conformance of ITU-T H.810 personal health devices: PAN/LAN/TAN interface Part 5L: Body composition analyser: Agent”** is a transposition of Continua Test Tool DG2016, Test Suite Structure & Test Purposes, Personal Health Devices Interface; Part 5L: Device Specializations. Personal Health Device (Body Composition Analyser) (Version 1.3, 2016-09-20), that was developed by the Personal Connected Health Alliance. A number of versions of this specification existed before transposition. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.845.13 (revised) “Conformance of ITU-T H.810 personal health devices: PAN/LAN/TAN interface Part 5M: Basic electrocardiograph: Agent”** is a transposition of Continua Test Tool DG2016, Test Suite Structure & Test Purposes, Personal Health Devices Interface; Part 5M: Device Specializations. Personal Health Device (Basic Electrocardiograph) (Version 1.4, 2016-09-20), that was developed by the Personal Connected Health Alliance. A number of versions of this specification existed before transposition. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.845.14 (revised) “Conformance of ITU-T H.810 personal health devices: PAN/LAN/TAN interface Part 5N: International normalized ratio: Agent”** is a transposition of Continua Test Tool DG2016, Test Suite Structure & Test Purposes, Personal Health Devices Interface; Part 5N: Device Specializations. Personal Health Device (International Normalized Ratio -INR-) (Version 1.3, 2016-09-20), that was developed by the Personal Connected Health Alliance. Versions of this specification existed before transposition and are indicated in Table 1. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.845.15 (revised) “Conformance of ITU-T H.810 personal health devices: PAN/LAN/TAN interface Part 5O: Sleep apnoea breathing therapy equipment: Agent”** provides a test suite structure and the test purposes for the Personal Health Devices interface (Sleep apnoea breathing therapy equipment: Personal Health Device (PHD)) based on the requirements defined in Recommendation ITU-T H.810 (2016). The objective of this test specification is to provide a high probability of air interface interoperability between different devices. This Recommendation is a transposition of Continua Test Tool DG2016, Test Suite Structure & Test Procedures, Personal Health Devices Interface; Part 5O: Device Specializations. Personal Health Device (Sleep Apnoea Breathing Therapy Equipment (Version 1.1 2016-09-20)).

**ITU-T H.845.16 “Conformance of ITU-T H.810 personal health system: Personal Health Devices interface Part 5P: Continuous glucose monitor”** provides a test suite structure and the test purposes for the continuous glucose monitor in the Personal Health Devices interface of the ITU-T H.810 architecture [ITU-T H.810]. The objective of this test specification is to provide a high probability of air interface interoperability between different devices. This Recommendation is a transposition of Continua Test Tool DG2016, Continua Test Tool DG2016, Test Suite Structure & Test Purposes, Personal Health Devices Interface, Part 5P: Device Specializations. Personal Health Device, Continuous Glucose Monitor (CGM), Version 1.0 (2016-09-20). This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.846 (revised) “Conformance of ITU-T H.810 personal health system: Personal Health Devices interface Part 6: Device specializations: Personal Health Gateway”** is a transposition of Continua Test Tool DG2016, Test Suite Structure & Test Purposes, Personal Health Devices Interface; Part 6: Device Specializations. Personal Health Gateway (Version 1.9, 2016-09-20), that was developed by the Personal Connected Health Alliance. A number of versions of this specification existed before transposition. The objective of this test specification is to provide a high probability of air interface interoperability between different devices. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.847 (revised) “Conformance of ITU-T H.810 personal health devices: PAN/LAN/TAN interface Part 7: Bluetooth low energy (BLE): Agent”** is a transposition of Continua Test Tool DG2016, Test Suite Structure & Test Purposes, Personal Health Devices Interface; Part 5G: Device Specializations. Personal Health Device (Strength) (Version 1.6, 2016-09-20), that was developed by the Personal Connected Health Alliance. A number of versions of this specification existed before transposition.

**ITU-T H.848 (revised) “Conformance of ITU-T H.810 personal health devices: PAN/LAN/TAN interface Part 8: Bluetooth low energy (BLE): Manager”** is a transposition of Continua Health Alliance Test Tool DG2016, Test Suite Structure & Test Purposes, Personal Health Devices Interface; Part 8: Continua Design Guidelines. Personal Health Gateway BLE (Version 1.4, 2016-09-20), that was developed by the Personal Connected Health Alliance. A number of versions of this specification existed before transposition.

**ITU-T H.849 (revised) “Conformance of ITU-T H.810 personal health devices: PAN/LAN/TAN interface Part 9: Transcoding for Bluetooth low energy (BLE): Agent”** is a transposition of Continua Health Alliance Test Tool DG2016, Test Suite Structure & Test Purposes, Personal Health Devices Interface; Part 9: PHD Transcoding Whitepaper. Personal Health Device BLE (Version 1.6,2016-09-20), that was developed by the Personal Connected Health Alliance. A number of versions of this specification existed before transposition. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.850 (revised) “Conformance of ITU-T H.810 personal health devices: PAN/LAN/TAN interface Part 10: Transcoding for Bluetooth low energy (BLE): Manager”** is a transposition of Continua Test Tool DG2016, Test Suite Structure & Test Purposes, Personal Health Devices Interface; Part 10: PHD Transcoding Whitepaper. Personal Health Gateway (Version 1.6, 2016-09-20), that was developed by the Personal Connected Health Alliance. A number of versions of this specification existed before transposition. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.861.0 “Requirements on communication platform for multimedia brain information”** describes a conceptual ecosystem intended to exchange brain data based on the communication platform requirements and definitions. Starting from a background of the brain data exchange in the context of e-health, a functional framework model for multimedia brain information platform (MBI-PF) is outlined. This model is then developed into a set of communication platform which enable not only experts but also non-experts to utilize brain data for monitoring and maintaining health status of brain.

**Technical Report HSTP-H810 “Introduction to the ITU-T H.810 Continua Design Guidelines”** provides a high level overview of the Continua Design Guidelines, an introduction to each of the standards and specifications that were chosen by its members to be part of the design guidelines, and the rationale behind their selection. The reader is invited to read the Continua Design Guidelines itself for a comprehensive understanding.

**Technical Report HSTP-H810-XCHF “Fundamentals of data exchange within ITU-T H.810 Continua Design Guideline architecture”** provides a basic description of the data that is being exchanged between sensors, gateways, and end services and the value-add the Continua Design Guidelines (CDG) provide beyond the referenced standards to make implementations truly interoperable.

**Technical Paper ITU-T HSTP-H812-FHIR "Interoperability design guidelines for personal connected health systems: Services interface: FHIR observation upload for trial implementation"** contains a specification *for trial implementation* of the FHIR observation upload using the FHIR technique. This specification is issued at this stage as a technical paper, instead of as a Recommendation, as it is intended for trial implementation while the underlying protocol implementation completes final evaluation in HL7 (expected by early 2018). The release for trial implementation allows early adopters to start developing and testing their products using FHIR already now, in anticipation of the final issuance of the Recommendation, expected as H.812.5 in July 2018.

**I.5.2 New security standards**

**ITU-T H.248.77 (revised) “Gateway control protocol: Secure real-time transport protocol (SRTP) package and procedures” (under approval)** contains an updated package that allows for the usage of DTLS-SRTP key management scheme that exchanges the peers' certificates via the signalling path and then establishes a DTLS connection on the bearer path.

**ITU-T X.1040 “Security reference architecture for lifecycle management of e-commerce business data”** analyses the main features and typical threats faced by e commerce service ecosystems, and provides a security reference architecture for lifecycle management of e-commerce business data.

**ITU-T X.1053 “Code of practice for information security controls based on ITU-T X.1051 for small and medium-sized telecommunication organizations”** establishes guidelines and general principles for initiating, implementing, maintaining, and improving information security controls in small and medium-sized telecommunication organizations (SMTOs) based on ITU-T X.1051. This Recommendation also provides an implementation baseline of information security controls for SMTOs to ensure the confidentiality, integrity and availability of telecommunication facilities and services and information handled, processed or stored by the facilities and services.

The objectives of this Recommendation are to provide practical guidance suited for SMTOs on commonly accepted goals of information security specifically suited for these organizations.

As a result of implementing this Recommendation, SMTOs, both within and between jurisdictions, will:

1. be able to ensure the confidentiality, integrity and availability of the specific SMTO facilities and services and the information handled, processed or stored within the facilities and services;
2. have adopted secure collaborative processes and controls ensuring the lowering of risks in the delivery of telecommunication services;
3. be able to deliver information security in an effective and efficient manner;
4. have adopted a consistent holistic approach to information security; and
5. be able to improve the security culture of organizations, raise staff awareness and increase public trust.

**ITU-T X.1080.0 “Access control for telebiometrics data protection”** provides specifications on how to protect telebiometrics information against unauthorized access. A service-oriented view is taken, where only information necessary for a particular purpose is provided, i.e., access is given not only on a right-to-know basis, but also on a need-to-know basis.

The core of this Recommendation is an attribute specification included in an attribute certificate or public-key certificate that specifies in detail what privileges a particular entity has for one or more service types.

Security is provided by using a profile of the cryptographic message syntax (CMS). The CMS profile provides authentication, integrity and, when required, confidentiality (encryption).

This profile is intended to provide security support for telebiometrics specifications in general. The profile assumes, and is dependent upon, the correct deployment of a public-key infrastructure (PKI).

This Recommendation is also dependent on the deployment of a privilege management infrastructure (PMI).

**ITU-T X.1127 “Functional security requirements and architecture for mobile phone anti-theft measures”** focuses on the functional security requirements and functional architecture for smartphone anti-theft mechanisms based on the general requirements described by the GSMA. Smartphones are rapidly proliferating and have become a nearly indispensable part of daily life. Unfortunately, many smartphone users have had their phones stolen. A smartphone anti-theft measure, i.e., a kill switch tool, for use in the event it is lost or stolen, should provide the capability to:

* remotely delete the authorized user's data that is on the smartphone;
* render the smartphone inoperable to an unauthorized user;
* prevent reactivation without the authorized user's permission to the extent technologically feasible; and
* reverse the inoperability if the smartphone is recovered by the authorized user, and restore user data on the smartphone to the extent feasible.

**ITU-T X.1145 “Security framework and requirements for open capabilities of telecommunication services”** focuses on an analysis of the security requirements of open capabilities of telecommunication services and provides a security framework.

**ITU-T X.1146 “Secure protection guidelines of for value-added services provided by telecommunication for operators”** provides secure protection guidelines for value-added services provided by telecommunication operators. In addition to analysing typical service scenarios, security threats and attack methods, this Recommendation provides technical measures to counter threats and attacks. This will help the operators to assure the security of the value-added service, and will also protect the users’ benefits.

**ITU-T X.1213 “Security capability requirements for countering smartphone-based botnets”** analyses the background and potential security threats of smartphone-based botnets, and provides security capability requirements. Along with the rapid development of mobile Internet devices and the widespread use of smartphones, surveys from worldwide organizations show that botnets, formerly targeting mostly personal computer (PC)-based networks, are now being replicated very quickly on smartphones. Currently, countries and regions with differing conditions and ecosystems have varying levels of constraints on the propagation of smartphone-based botnets. Analytical reports from various security companies and investigative organizations show noticeably different statistical data on the severity of the propagation of smartphone-based botnets. The potential threat of smartphone-based botnets is increasing very quickly in some regions and could possibly spread worldwide and turn from a regional issue into a serious global issue. Compared with PCs and servers, smartphones have less processing power, storage space and battery life. However, the adversarial influence of smartphone-based botnets could have greater repercussions on users for the following reasons: 1) smartphones often store very important personally identifiable information (PII) and 2) if attacks on smartphones or on the operator's infrastructure occur, user experience may degrade significantly due to the prevalence of, and user dependence on, smartphones.

**ITU-T X.1214 (revised) “Security assessment techniques in telecommunication/ICT networks”** **(under approval)** describes global security assessment methodology and best practices for developers, manufacturers, operators and individual security experts of the telecommunication domain. Both the traditional circuit-switched networks and the packet-based networks are exposed to different threats and attacks - from external as well as internal sources - that target the various parts of the telecommunications/ICT network. This Recommendation covers the following:

- Detection of vulnerabilities in telecommunications/ICT network

- Methodology of security assessment in telecommunications/ICT network.

**ITU-T X.1248 “Technical requirements for countering instant messaging spam”** identifies characteristics of spam over instant messaging (SPIM) and specifies technical requirements for countering it. As instant messaging (IM) increases in popularity, the proliferation of SPIM becomes an increasingly serious problem. The characteristics of IM, such as being Internet protocol (IP)-based with widespread usage that is free of charge, potentially allows SPIM to spread widely and uncontrollably. If SPIM problems are not carefully addressed, they can have negative impacts on the utilization of the IM service itself.

**ITU-T X.1331 “Security guidelines for home area network (HAN) devices in smart grid systems”** **(under approval)** will provide threat analysis of the HAN in the smart grids, security requirements, and security functions. Since the role and functions of each HAN device are different, the security requirements and security functions by devices are provided.

**ITU-T X.1541 (revised) “Incident object description exchange format version 2”** describes the information model for the incident object description exchange format (IODEF) version 2 and provides an associated data model specified with XML schema. The IODEF specifies a data model representation for sharing commonly exchanged information about computer security or other incident types. This is achieved by listing the relevant clauses of IETF RFC 7970 and showing whether they are normative or informative.

**ITU-T X.1603 “Data security requirements for the monitoring service of cloud computing” (under approval)** analyses data security requirements for the monitoring service of cloud computing which include monitoring data scope requirements, monitoring data lifecycle, security requirements of monitoring data acquisition and security requirements of monitoring data storage. Monitoring data scope requirements include the necessary monitoring scope that cloud service providers (CSPs) should provide to maintain the cloud security and the biggest monitoring scope of CSPs. Monitoring data lifecycle includes data creation, data store, data use, data migrate, data present, data destroy and data backup. Monitoring acquisition determines the security requirements of the acquisition techniques of monitoring service. Monitoring data storage determines the security requirements for CSPs to store the monitoring data.

**ITU-T X.Suppl.29 “Guidelines on countermeasures against short message service (SMS) phishing and smishing attack”** provides universal guidelines on short message service (SMS) phishing which is a fraudulent technique through mobile phones by causing phishing frauds with smartphones, acquiring personal information on the smartphones, or by enabling small amounts of money to be approved and paid while the account holder is not aware of the approval. The purpose of this Supplement is to universalize the guideline for countermeasures against SMS phishing incident by defining a security guideline about security technology against SMS phishing incident and method, and specification of report contents.

**ITU-T X.Suppl.30 “Security guidelines for mobile virtual network operators”** provides security guidelines for mobile virtual network operators (MVNOs). Security is very important to MVNOs and most MVNOs have a lot of security similarities. This Supplement analyses the main features of MVNOs and the typical security threats that they face. Based on the structure of MVNOs, this Supplement provides a security framework for MVNOs, including security objectives and security requirements.

**I.5.2 Trust**

**ITU-T Y.3053 “Framework of trustworthy networking with trust-centric network domains”** introduces a framework of trustworthy networking with trust-centric network domains. It describes a trustworthy networking conceptual model that includes features of identification, trust evaluation and trustworthy communication. For a solution of trustworthy networking, the extension of the conceptual model into a concept of trust-centric network domains should be done. With the described concept, this Recommendation specifies high-level and functional requirements, a functional architecture, and scalability of trustworthy networking with trust-centric network domains.

**ITU-T Y.3514 “Cloud computing - Trusted inter-cloud computing framework and requirements”** specifies a framework of trusted inter-cloud computing and relevant use cases. It provides general requirements for trusted inter-cloud and specific ones related to governance, management, resiliency and security and confidentiality of trusted inter-cloud.

**I.6.1 Green ICT standards**

**ITU-T L.1020 “Circular Economy: Guide for Operators and Suppliers on approaches to migrate towards circular ICT goods and networks”**suggests approaches of circular economy (CE) for information and communication technology (ICT) goods and networks. It focuses particularly on the next steps in improving circularity in the operators′ supply chain. The Recommendation provides a guide on how operators could work with their supply chain to improve CE aspects for ICT goods and networks but it does not provide metrics. The objective of the guide is to provide options to improve circularity and to enable operators and their suppliers to create business models for the promotion of circular networks for an optimum solution that uses all the loops of circularity - from sharing to recycling.

**ITU-T L.1021 “Extended producer responsibility - Guidelines for sustainable e-waste management”** (under approval) offers a description of the extended producer responsibility (EPR) system in dealing with e-waste. It expands on the different existing forms of EPR globally, not only in theoretical terms, but also with a practical view on their feasibility, challenges and pre-requisites. It presents the definition of the EPR system, in addition to the roles and responsibilities of the different stakeholders, the different types of EPR as well as how and why they could be used in certain contexts and not in others. The funding mechanism behind every mode and the organizational structure expected to be in place are also presented. The Recommendation concludes with many best practices from the international arena including developed, developing and emerging economies, as well as the challenges faced in some cases.

**ITU-T L.1331 “Assessment of mobile network energy efficiency”** aims to provide a better understanding of the energy efficiency of mobile networks. The focus is on the metrics and methods of assessing energy efficiency in operational networks. This Recommendation explains how to extrapolate the measurements made on partial networks to the level of the total network. Such a simplified approach is proposed as an approximate way of making energy efficiency evaluations at the level of network elements and cannot therefore be considered sufficient for the whole network operation including, for example, transport.

**ITU-T L.1332 “Total network infrastructure energy efficiency metrics”** contains the basic definition of energy efficiency metrics and measurement methods required to evaluate the energy efficiency of a total network, including the energy consumption for:

* all telecommunication (TLC)/information and communications technology (ICT) equipment in the network;
* all facilities equipment (e.g., cooling systems, site monitoring systems, fire protection and lighting systems
* energy losses in DC power station or AC UPS and in the power distribution
* maintenance activities and site-visit energy used for transportation (e.g., by car);
* diesel generators used for emergency purposes.

**ITU-T L.1310 (revised) “Energy efficiency metrics and measurement methods for telecommunication equipment”** contains the definition of energy efficiency metrics test procedures, methodologies and measurement profiles required to assess the energy efficiency of telecommunication equipment. Energy efficiency metrics and measurement methods are defined for telecommunication network equipment and small networking equipment. These metrics allow for the comparison of equipment within the same class, e.g., equipment using the same technologies.

**ITU-T L.1315 “Standardization terms and trends in energy efficiency”** contains high level definition of energy efficiency, energy management requirement to increase the energy efficiency of ICT goods/networks/services.

**ITU-T L.1206 “Impact on ICT equipment architecture of multiple AC, -48VDC or up to 400 VDC power inputs”** discusses multiple power interfaces to ICT equipment operated by standardized -48V direct current, alternating current source and direct current source up to 400 V in line with the interfaces, operational voltage and characteristics detailed within ITU-T Recommendation and ETSI relevant standards. It also includes some details on the power architecture within the ICT equipment between the ICT power interface and the ICT end load.

**ITU-T L.1220 “Innovative energy storage technology for stationary use - Part 1: Overview of energy storage”** introduce an open series of documents for different families of technologies (batteries systems, super-capacitors systems, …) that will be enriched progressively when new technologies appear with a possible significant impact.

**ITU-T L.1331 “Assessment of mobile network energy efficiency”** provide a better understanding of the energy efficiency of mobile networks. The focus is on the metrics and methods of assessing energy efficiency in operational networks and explains how to extrapolate the measurements made on partial networks to the level of the total network.

**ITU-T L.1505 “Information and communication technology and adaptation of the fisheries sector to the effects of climate change”** includes a review of the effects of climate change on fisheries and fishing communities. Recommendation ITU-T L.1505 recognizes the need for adaptation and for the use and dissemination of relevant innovative techniques. It explores adaptation plans and the potential role of information and communication technologies (ICTs) in supporting the adaptation of the fisheries sector to cope with the effects of climate change.

**ITU-T L.1506 “Framework of climate change risk assessment for telecommunication and electrical facilities”** describes the framework of assessing climate change risk for telecommunication and electrical facilities. The framework consists of risk assessment methodology and considerations for applying the defined methodology. The methodology defined in this Recommendation provides a climate change risk assessment that integrates multiple climate change risk factors into a single metric and shows the assessment result from the overall perspective.

**ITU-T Technical Report LSTR.5GEE “Study on methods and metrics to evaluate energy efficiency for future 5G systems”** analyses the energy efficiency issues for the future 5G systems, object of standardization in 3GPP and ITU and foreseen to be available from 2018 in various countries. The focus is about methods and metrics to measure energy efficiency in 5G systems, considering the degree of stability of the systems known so far and the experience of the legacy systems and the related measurement procedures evaluating future standardization evolutions.

**I.6.2 Electromagnetic fields**

**ITU-T K.20 (revised) “Resistibility of telecommunication equipment installed in a telecommunication centre to overvoltages and overcurrents”** specifies resistibility requirements and test procedures for telecommunication equipment that is attached to or installed within a telecommunication centre. Overvoltages and overcurrents covered by this Recommendation include surges due to lightning on or near the line plant, short term induction from adjacent a.c. power lines or railway systems, earth potential rise due to power faults, direct contact between telecommunication lines and power lines and electrostatic discharges. The sources for overvoltages in internal lines, between equipment/racks, are mainly inductive coupling caused by lightning currents being conducted in nearby lightning strokes or lightning currents being conducted in nearby conductors.

**ITU-T K.21 (revised) “Resistibility of telecommunication equipment installed in customer premises to overvoltages and overcurrents”** specifies resistibility requirements and test procedures for telecommunication equipment that is attached to or installed within a customer's premises. Overvoltages or overcurrents covered by this Recommendation include surges due to lightning on or near the line plant, short-term induction from adjacent alternating current (a.c.) power lines or railway systems, earth potential rise due to power faults, direct contact between telecommunication lines and power lines, and electrostatic discharges. The sources for overvoltages in internal lines are mainly inductive coupling caused by lightning currents being conducted in nearby lightning strikes or lightning currents being conducted by nearby conductors.

**ITU-T K.35 (revised) “Bonding configurations and earthing at remote electronic sites”** proposes bonding configurations, earthing, and the type of power distribution for equipment located at remote electronic sites are proposed, which are intended to promote harmony of installation and equipment configurations while providing for personnel safety and electromagnetic compatibility.

**ITU-T K.40 (revised) “Protection against LEMP in telecommunications centres”** proposesguidelines for the design of an effective protective system for a telecom structure against LEMP. The concept of lightning protection zones is introduced as a framework where the specific protective measures are merged: earthing, bonding, cable routing, shielding, coordinated SPD system and isolating interfaces. Information about simulating the LEMP effects and a shopping-list for the protective measures in existing and new buildings are also given.

**ITU-T K.44 (revised) “Resistibility tests for telecommunication equipment exposed to overvoltages and overcurrents – Basic Recommendation”** seeks to establish fundamental test methods and criteria for the resistibility of telecommunication equipment to overvoltages and overcurrents. Overvoltages or overcurrents covered by this Recommendation include surges due to lightning on or near the line plant, short-term induction of alternating voltages from adjacent electric power lines or electrified railway systems, earth potential rise due to power faults, and direct contacts between telecommunication lines and power lines.

**ITU-T K.45 (revised) “Resistibility of telecommunication equipment installed in the access and trunk networks to overvoltages and overcurrents”** specifies resistibility requirements and test procedures for telecommunication equipment installed between telecommunication centres and between a telecommunication centre and the customer's premises. Overvoltages or overcurrents covered by this Recommendation include surges due to lightning on or near the line plant, short-term induction from adjacent a.c. power lines or railway systems, earth potential rise due to power faults, direct contact between telecommunication lines and power lines and electrostatic discharges.

**ITU-T K.50 (revised) “Safe limits for operating voltages and currents in telecommunication systems powered over the network”** provides guidance on voltages and currents that may safely be used to power telecommunication systems that are part of the network of telecommunications service providers.

**ITU-T K.52 (revised) “Guidance on complying with limits for human exposure to electromagnetic fields”** aims to help with compliance of telecommunication installations and mobile handsets or other radiating devices used against the head with safety limits for human exposure to electromagnetic fields (EMFs). It presents general guidance, a calculation method and an installation assessment procedure. The assessment procedure for telecommunication installations, based on safety limits provided by the International Commission on Non-Ionizing Radiation Protection (ICNIRP), helps users determine the likelihood of installation compliance based on accessibility criteria, antenna properties and emitter power. The IEC Standard for the compliance measurement of mobile handsets is recommended.

**ITU T K.61 (revised) “Guidance on measurement and numerical prediction of electromagnetic fields for compliance with human exposure limits for telecommunication installations”** defines tools, methods and procedures that can be used to achieve a compliance assessment and provides indications on the need to perform an exposure assessment for a telecommunication installation such as a base station. Recommendation ITU-K.100 provides indications on the process for putting a telecommunication installation such as a base station into service.

**ITU-T K.70 (revised) “Mitigation techniques to limit human exposure to EMFs in the vicinity of radiocommunication stations**” defines techniques which may be used by telecommunication operators to evaluate the cumulative (total) exposure ratio in the vicinity of transmitting antennas and to identify the main source of radiation. It offers guidance on mitigation methods which allow reduction of radiation level in order to comply with exposure limits. It also provides guidance on procedures necessary in the environment (on site) in which, in most cases, there is a simultaneous exposure to multiple frequencies from many different sources. Radiating sources may belong to many operators and may represent different radiocommunication services (e.g., cellular systems, trunking systems, broadcasting, radio relays, wireless access, etc.).

**ITU-T K.91 (revised) “Guidance for assessment, evaluation and monitoring of human exposure to radio frequency electromagnetic fields”** gives guidance on how to assess and monitor human exposure to radio frequency (RF) electromagnetic fields (EMF) in areas with surrounding radiocommunication installations based on existing exposure and compliance standards in the frequency range of 9 kHz to 300 GHz. This includes procedures of evaluating exposure and how to show compliance with exposure limits with reference to existing standards. Recommendation ITU-T K.91 is oriented to the examination of the area accessible to people in the real environment of currently operated services with many different sources of RF EMF, but also gives references to standards and Recommendations related to EMF compliance of products. This Recommendation includes an electronic attachment containing an uncertainty calculator and the Watt Guard modules.

**ITU-T K.99 (revised) “Surge protective component application guide - Gas discharge tubes”** describes the construction, characteristics, ratings and application examples of gas discharge tubes (GDTs) intended for the protection of exchange and outdoor equipment, subscriber or customer equipment and telecommunication lines from surges.

**ITU-T K.100 (revised) “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 the general public electromagnetic fields (EMFs) exposure limits when a new base station (BS) is put into service, taking into account effects of the environment and other relevant radio frequency sources present in its surrounding.

**ITU-T K.125 “Dangerous effects and protective measures against electromagnetic disturbances when internet data centre is co-sited with high-voltage substation”** specifies the calculating methods for dangerous effects, tolerable limits of dangerous effects, tolerable limits of electromagnetic effects from high-voltage substation, distance requirement and protection methods, protective measures, as well as requirements of power frequency magnetic field immunity of server when an internet data centre is co-sited with a high-voltage substation.

**ITU-T K.126 “Surge protective component application guide – High frequency signal isolation transformers”** discusses isolation transformer parameters and how they influence the equipment common-mode and differential-mode surge performance.

**ITU-T K.127 “Immunity requirements for telecommunication equipment in close proximity use of wireless devices”** specifies the immunity requirements for equipment used in the telecom facilities where wireless LAN devices are used in close proximity. This Recommendation is established in order to avoid malfunctions of the equipment from RF signals of devices. And this Recommendation contains requirements including test levels, test signal, test procedures and test facilities.

**ITU-T K.128 “Surge protective component application guide - metal oxide varistor (MOV) components”** describes metal oxide varistor (MOV) construction, non-linearity modelling, impedance properties, equivalent circuit, element temperature distribution, time factors, degradation and failure modes, operation states and application examples. These surge protective components (SPCs), intended for the protection of exchange and outdoor equipment, subscriber or customer equipment and telecommunication lines from surges.

**ITU-T K.129 “Characteristics and ratings of silicon PN junction voltage clamping components used for the protection of telecommunications installations”** defines the basic electrical parameters to be met by silicon PN junction voltage clamping components used for the protection of telecommunications equipment or lines from surges. Examples of equipment include those located either within a telecommunication centre [b-ITU-T K.20], customer premises [b-ITU-T K.21], in access or in trunk networks [b-ITU-T K.45]. It is intended that this Recommendation be used for the harmonization of existing or future specifications issued by PN diode surge protective component manufacturers, telecommunication equipment manufacturers, administrations or network operators.

**ITU-T K.130 “Neutron irradiation test methods for telecommunications equipment”** describes soft error test methods for the telecommunication equipment that composes carrier telecommunications networks. The objective of soft error tests of the telecommunication equipment using an accelerator-driven neutron source is described first. The overview of the soft error tests and operating principles of an accelerator-driven neutron source are introduced next. The requirements of the accelerator-driven neutron sources and test sites are specified. The test conditions including test setup, operational conditions and error monitoring and test procedures for the telecommunication equipment are specified. Notes for determining specific, detailed test methods, such as the neutron flux to be used for irradiation and conditions for counting as failures in estimation of the reliability are also described.

**ITU-T K.131 “Design methodologies for telecommunication systems applying soft error measures”** describes the principles and design methods for soft error measures for the equipment that composes carrier telecommunications networks. It also describes basic configurations of telecommunication equipment, definitions and methods to determine reliability requirements, and procedures for the design of equipment from the perspective of mitigation of failures caused by soft errors. Also included are the methods to determine the areas, e.g., circuit blocks or circuit packs, requiring soft error measures in telecommunication equipment in order to conform to the reliability requirements. The main design issues to be considered for soft error measures are described as well as the actual design methods for the application of measures against soft errors and their effects. Finally, the reliability evaluation methods using theoretical calculations and tests of actual equipment are described to confirm the effect of the applied measures and conformity to the reliability requirements.

**ITU-T K.132 “EMC requirements of electromagnetic disturbances from lighting equipment located in telecommunication facilities”** specifies limits and measurement methods of electromagnetic disturbances from lighting equipment, which are intended to be installed in telecommunication facilities. The requirements in this Recommendation are based on the CISPR 15 and CISPR 32 for continuous electromagnetic disturbances. Furthermore, this Recommendation specifies the limit of transient conducted current and measurement methods.

**ITU-T K.133 “Electromagnetic (EM) environment of body worn equipment in the 2.4 GHz and 13.56MHz industrial, scientific and medical band“** specifies electromagnetic characterization of the radiated and conducted environment for the body worn electronic devices.

**ITU-T K.Suppl.7 to ITU-T K.44 “Supplement on AC supply configurations”** defines the AC supply configurations known as; IT, TT, TN-C, TN-C-S and TN-S. Distribution wiring practices used for these AC supply configurations are specified. Circuit examples of six AC distribution systems and their wiring practices are given.

**ITU-T K.Suppl.8 to K.-series of Recommendations “Resistibility analysis of 5G systems”** analyses 5G system resistibility requirements for lightning and power fault events. The electrical threats posed by lightning and power fault events are discussed and the appropriate resistibility tests identified. Installation practice can have a big influence on the reliability of service and the equipment. Earthing, location and craftmanship are discussed.

**ITU-T K.Suppl.9 to K.-series of Recommendations “5G technology and human exposure to RF EMF”:** The deployment of 5G will see the evolution and expansion of existing 4G networks and the introduction of new radio access networks in the millimetre wave bands. Because of the use of much higher frequency ranges the number of base stations will substantially increase. These networks will include a range of installations including more small cell deployments and advanced antenna technologies. Massive MIMO antennas will allow to use very narrow beams that will follow the user with impact for the surrounding exposure level different than this from current systems. The number of wireless devices will dramatically increase. New technology allows for use more efficient systems that require lower level of the signals for communication.

**ITU-T K.Suppl.10 to K.-series of Recommendations “Analysis of EMC aspects and definition of requirements for 5G systems”** provides guidance on the EMC compliance assessment considerations for 5G systems. Given the 5G Radio Access Network (RAN) technical standards are still being finalised, the first version of this Supplement focuses on possible emission and immunity requirements for 5G systems. This Supplement will be revised, if needed, to address the more specific EMC requirements when technical standards of 5G systems will be published.

**ITU-T K.Suppl.11 “Soft error measures of FPGA”** describes soft error mitigation for FPGA is described. FPGA is the mainstream of recent LSI and many of them are used in equipment for communication as main device. First, trend of soft error rate along with miniaturization of manufacturing process rules for semiconductor is described, and mitigation techniques such as material, physical layout, and design tool that FPGA venders provide to users are outlined. Next, design methodology of communication equipment, which considers reliability specification by using those mitigation measures, is discussed. Finally, recent trend for mitigation measures for FPGA is explained.

**I.6.4 Emergency communication & disaster relief**

**ITU-T L.sup.35 to L-300series “Framework of disaster management for network resilience and recovery”** provides a framework of disaster management for improving network resilience and recovery (NRR) by reviewing high-level objectives of NRR against disasters, identifying several approaches (i.e., redundancy, congestion control, repair, substitute, and robustness) that meet the objectives, and clarifying the approaches with regard to the effective time frame (i.e., phase) for disaster recovery. Based on the identified approaches with effective disaster recovery phases, information about relevant technologies, including already available ones and emerging ones, is also provided.

**I.8 Quality of service and experience, and network performance**

**ITU-T E.831 “Customer experience management index for popular services in operators' network to score service quality that customer experience in terms of key network performance parameters” (under approval)** highlights the need for scoring mechanism for services, which customers interact in a high volume, in order to understand overall service quality in a holistic point of view.

**ITU-T G.1032 “Influence Factors on Gaming Quality of Experience”** presents a list of factors, which may influence the Quality of Experience of cloud gaming and online gaming. The factors are grouped into user, system, and context factors. They should be taken into account when planning and implementing online gaming services, and when evaluating their Quality of Experience with subjective methods or instrumental quality prediction models.

**ITU-T Supplement 61 to ITU-T G.1020 series of Recommendations “IP aware QoS management”** documents a packet oriented (IP-centric) QoS management model. This model is applicable to a wireless Access Point (e.g. WiFi AP, eNode B, Node B), referred to as "IP aware Access Point". In the supplement a possible cross-layer design for this model in LTE/EPC networks is described. Some implementation challenges are highlighted, together with possible solutions implying only minor modifications in the eNode B. Performance of this proposal compared to various implementations of the 3GPP QoS model is evaluated using the ns-3 simulator in realistic scenarios.

**ITU-T P.10/G.100 (revised) “Vocabulary for performance, quality of service and quality of experience”** contains terms and definitions associated with network performance, quality of service and quality of experience.

**ITU-T P.804 “Subjective Diagnostic Test Method for Conversational Speech Quality Analysis”** describes a subjective methodology for assessing and diagnosing the quality of transmitted speech in a telephone conversation. In addition to a score for the overall conversation quality, the methodology yields overall quality scores for three perceivable phases in a telephone conversation (listening phase, speaking phase, and interaction phase) as well as scores for their corresponding seven perceptual dimensions. Four of the perceptual dimension scores represent degradation associated with the listening phase, two are associated with the speaking phase, and one is associated with the interaction phase. Each of the perceptual dimension scores are based on ratings of the amount of degradation present in one system condition. The method is designed to be used with naïve subjects. The dimension scores can be used to provide diagnostic information on the causes of system degradations. The method is meant as a complement to standard conversation tests.

**ITU-T P.1203 (revised) “Parametric bitstream-based quality assessment of progressive download and adaptive audiovisual streaming services over reliable transport”** provides the introductory document for a set of documents that describe model algorithms for monitoring the integral media session quality for TCP-type video streaming. The models comprise modules for short-term audio- and video-quality estimation. The per-one-second outputs of these short-term modules are integrated into estimates of audiovisual quality and, together with information about initial loading delay and media playout stalling events, further integrated into the final model output, the estimate of integral quality. The respective ITU-T work item has formerly been referred to as P.NATS (Parametric non-intrusive assessment of TCP-based multimedia streaming quality).

**ITU-T P.1203.1 (revised) “Parametric bitstream-based quality assessment of progressive download and adaptive audiovisual streaming services over reliable transport - video quality estimation module”** specifies the short-term video representation quality estimation modules for ITU-T P.1203 (Pv module). The ITU-T P.1203 series of Recommendations specifies modules for a set of model algorithms for monitoring the integral media session quality for transport control protocol (TCP) type video streaming. The models comprise modules for short-term video-quality (described in this part of the Recommendation family) and audio-quality estimation. The per-one-second outputs of these short-term modules are integrated into estimates of audio-visual quality and together with information about initial loading delay and media playout stalling events, they are further integrated into the final model output, to provide an estimate of integral quality. The respective ITU-T work item has formerly been referred to as “Parametric non-intrusive assessment of TCP-based multimedia streaming quality”, or “P.NATS”. The ITU T P.1203.1 part of ITU-T P.1203 provides details for the modules for bitstream-based, short-term video quality estimation.

Four different modes can be used for the Pv module specified in this Recommendation. These modes – referred to as mode 0 to 3 – use input information of differing complexity and amount and represent four model algorithms each with a different level of complexity. The Pv modules comprise components reflecting the effects due to video compression, up-scaling of content and the effect due to low frame rates. The four different modes use the same overall model architecture and individual coefficients and all have the same components for up-scaling and framerate. The only Pv module component that differs between modes is the Pv module component related to video compression.’

**ITU-T P.1203.2 (revised) “Parametric bitstream-based quality assessment of progressive download and adaptive audiovisual streaming services over reliable transport - audio quality estimation module”** specifies the short-term audio quality estimation module for Recommendation ITU T P.1203. The ITU-T P.1203 series of ITU-T Recommendations specifies modules for a set of model algorithms for monitoring the integral media session quality for transport control protocol (TCP) type video streaming. The models comprise modules for short-term video-quality and audio-quality estimation (the latter specified in this Recommendation). The per-one-second outputs of these short-term modules are integrated into estimates of audio-visual quality and together with information about initial loading delay and media playout stalling events, they are further integrated into the final model output, the estimate of integral quality. The respective ITU-T work item has formerly been referred to as “Parametric non-intrusive assessment of TCP-based multimedia streaming quality” or “P.NATS”. The Recommendation ITU-T P.1203.2 part of Recommendation ITU-T P.1203 provides details for the module for bitstream-based, short-term audio quality estimation.

Only one audio module is recommended for all four modes 0 to 3 of the Recommendation ITU-T P.1203 model series, corresponding to mode 0. The model is identical to the audio coding quality estimation component of the user datagram protocol (UDP) streaming related prediction model described in Recommendation ITU-T P.1201.

**ITU-T P.1203.3 (revised) “Parametric bitstream-based quality assessment of progressive download and adaptive audiovisual streaming services over reliable transport - quality integration module”** specifies the quality integration module for Recommendation ITU T P.1203. The ITU-T P.1203 series of ITU-T Recommendations specify modules for monitoring the audio, video and audiovisual quality of video services such as adaptive bitrate video streaming. The respective ITU T work item has formerly been referred to as P.NATS (parametric non-intrusive assessment of TCP-based multimedia streaming quality). The ITU-T P.1203.3 part of Recommendation ITU-T P.1203 can be applied to the monitoring of performance and quality of experience (QoE) of video services such as adaptive bitrate video streaming. Besides stream-based input information, the P.1203.3 quality integration module takes the per-one-second video- and audio-quality scores calculated according to P.1203.1 and P.1203.2, respectively, as input.

Only one quality integration module is recommended for all four modes 0 to 3 of the Recommendation ITU-T P.1203 model series, unique across all modes.

This Recommendation includes an electronic attachment containing the full 20 trees described in clause 8.4.

**ITU-T P.1301 (revised) “Subjective quality evaluation of audio and audiovisual multiparty telemeetings”** concerns subjective quality assessment of telemeeting systems that provide multiparty communication between distant locations, using audio-only, video-only, audiovisual, text-based or graphical means as communication modes. The term multiparty refers to more than two meeting participants who can be located at two or more locations.

Evaluation of those systems can focus on audio-only, video-only or audiovisual quality aspects and non-interactive or conversational quality can be assessed.

This recommendation gives an overview of relevant aspects that need to be considered for subjective quality evaluation of multiparty telemeetings and provides guidance to recommendations describing the details of applicable methods and procedures. Aspects in this recommendation are also applicable to two-party telemeetings.

**ITU-T Supplement 26 (revised) to ITU-T P-series Recommendations “Scenarios for the subjective evaluation of audio and audiovisual multiparty telemeetings quality“** concerns subjective quality assessment of telemeeting systems that provide audio-only or audio-visual communication for multiple parties. The term multiple parties refers to more than two meeting participants who can be located at two or more than two locations. Evaluation of those systems can focus on audio-only, video-only or audio-visual quality aspects and non-interactive or conversational quality can be assessed. This supplement provides example test scenarios that can be used to conduct conversation tests for multiparty audio-only telemeetings.

**I.9 Conformity, interoperability and testing**

**I.9.3 SIP-IMS conformity assessment and interconnection testing**

**ITU-T Q.3940 (revised) “NGN/IMS interconnection tests between network operators at the IMS 'Ic' interface and NGN NNI/SIP-I”** describes a series of tests that could be performed as part of the interconnection process before live traffic is present.

**ITU-T Q.3953 “VoLTE/ViLTE interconnection testing for interworking and roaming scenarios”** aims to verify the various interconnections and ensure that interoperability, interworking and roaming will respect national and international requirements and the SLA agreed between operators.

**ITU-T Q.4016 (revised) “Testing specification of call establishment procedures based on SIP/SDP and ITU-T H.248 for a real-time fax over IP service”** contains the testing specification of call establishment procedures based on session initiation protocol (SIP)/session description protocol (SDP) and ITU-T H.248 for a real-time fax over IP service. The listed test requirements in this Recommendation have to be interpreted as "minimal requirements" for fax support between SIP-enabled devices for real-time fax over IP.

**I.9.8 Testing Internet of things**

**ITU-T Q.3952 “The architecture and facilities of Model network for IoT testing”** describes the architecture and facilities of Model Network for IoT testing.

**ITU-T Y.4500.13 “oneM2M - Interoperability Testing”** (under approval) specifies Interoperability Test Descriptions for the oneM2M primitives.

**ITU-T Y.4500.15 “oneM2M - Testing framework”** (under approval) provides a methodology for development of conformance and interoperability test strategies, test systems and the resulting test specifications for oneM2M standards.

**I.30 Formal Languages and Identification**

**ITU-T X.697 “Information technology – ASN.1 encoding rules: Specification of JavaScript Object Notation Encoding Rules (JER)”** specifies a set of JavaScript Object Notation Encoding Rules (JER) that may be used to derive a transfer syntax for values of types defined in Rec. ITU-T X.680 | ISO/IEC 8824-1, Rec. ITU-T X.681 | ISO/IEC 8824-2, Rec. ITU-T X.682 | ISO/IEC 8824-3, Rec. ITU-T X.683 | ISO/IEC 8824-4. It is implicit in the specification of these encoding rules that they are also to be used for decoding.

**ITU-T X.Suppl.31 “Supplement on guidelines for using object identifiers for the Internet of things”** provides guidelines on how to use object identifiers (OIDs) to identify objects in the Internet of things (IoT). It includes guidelines on how to structure OIDs, how to implement resolution systems and how to establish management procedures based on existing ITU-T Recommendations and International Standards.

**ITU-T Z.161 (revised) “Testing and Test Control Notation version 3: TTCN-3 core language”** defines TTCN-3 (Testing and Test Control Notation 3) intended for specification of test suites that are independent of platforms, test methods, protocol layers and protocols.

**ITU-T Z.161.1 (revised) “Testing and Test Control Notation version 3: TTCN-3 language extensions: Support of interfaces with continuous signals”** defines the "continuous signal support" package of TTCN 3.

**ITU-T Z.161.2 (revised) “Testing and Test Control Notation version 3: TTCN-3 language extensions: Configuration and deployment support”** defines the configuration and deployment support package of TTCN-3.

**ITU-T Z.161.3 (revised) “Testing and Test Control Notation version 3: TTCN-3 language extensions: Advanced parameterization”** defines the advanced parameterization package of TTCN-3.

**ITU-T Z.161.4 (revised) Testing and Test Control Notation version 3: TTCN-3 language extensions: Behaviour types”** defines the behaviour types package of TTCN‑3.

**ITU-T Z.161.6 “Testing and Test Control Notation version 3: TTCN-3 language extensions: Advanced matching”** defines the support of advance matching of TTCN-3. TTCN-3 can be used for the specification of all types of reactive system tests over a variety of communication ports. Typical areas of application are protocol testing (including mobile and Internet protocols), service testing (including supplementary services), module testing, testing of OMG CORBA based platforms, APIs, etc. TTCN-3 is not restricted to conformance testing and can be used for many other kinds of testing including interoperability, robustness, regression, system and integration testing. The specification of test suites for physical layer protocols is outside the scope of the present document. TTCN-3 packages are intended to define additional TTCN-3 concepts, which are not mandatory as concepts in the TTCN-3 core language, but which are optional as part of a package which is suited for dedicated applications and/or usages of TTCN-3. While the design of TTCN-3 package has taken into account the consistency of a combined usage of the core language with a number of packages, the concrete usages of and guidelines for this package in combination with other packages is outside the scope of the present document.

**ITU-T Z.164 (revised) “Testing and Test Control Notation version 3: TTCN-3 operational semantics”** defines the operational semantics of TTCN-3 (Testing and Test Control Notation 3).

**ITU-T Z.165 (revised) “Testing and Test Control Notation version 3: TTCN-3 runtime interface (TRI)”** provides the specification of the runtime interface for TTCN-3 (Testing and Test Control Notation 3) test system implementations.

**ITU-T Z.166 (revised) “Testing and Test Control Notation version 3: TTCN-3 control interface (TCI)”** specifies the control interfaces for TTCN-3 test system implementations, and provides a standardized adaptation for management, test component handling and encoding/decoding of a test system to a particular test platform.

**ITU-T Z.167 (revised) “Testing and Test Control Notation version 3: Using ASN.1 with TTCN-3”** defines a normative way of using ASN.1 as defined in Recommendations ITU-T X.680, ITU-T X.681, ITU-T X.682 and ITU-T X.683 with TTCN-3.

**ITU-T Z.168 (revised) “Testing and Test Control Notation version 3: The IDL to TTCN-3 mapping”** defines the mapping rules for Common Object Request Broker Architecture (CORBA) Interface Definition Language (IDL) to TTCN-3 (as defined in Recommendation ITU-T Z.161) to enable testing of CORBA-based systems.

**ITU-T Z.169 (revised) “Testing and Test Control Notation version 3: Using XML schema with TTCN-3”** defines the mapping rules for W3C Schema to TTCN-3 to enable testing of XML-based systems, interfaces and protocols.

**ITU-T Z.170 (revised) “Testing and Test Control Notation version 3: TTCN-3 documentation comment specification”** defines a documentation of TTCN-3 source code using special documentation comments. The source code documentation can then be produced automatically from the TTCN-3 core language, e.g., in the form of hypertext web pages.

**ITU-T Z.171 “Testing and Test Control Notation version 3: Using JSON with TTCN-3”** specifies the rules to define schemas for JSON data structures in TTCN 3, to enable testing of JSON-based systems, interfaces and protocols, and the conversion rules between TTCN-3 and JSON to enable exchanging TTCN 3 data in JSON format between different systems.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

1. Science Monitoring and Reliable Telecommunications [↑](#footnote-ref-1)