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| **Abstract:** | This report summarizes progress achieved ITU-T standardization from September to December 2019, as well as measures taken by TSB to enhance the ITU-T standardization platform. |

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# Executive Summary

*Selection of achievements in ITU-T standardization*

ITU approved more than 130 new and revised ITU-T Recommendations from September to December 2019. Appendix I lists these ITU-T Recommendations and related texts and summarizes their contents.

**JPEG wins an Emmy:** The engineering team responsible for the first edition of the JPEG image compression standard (ITU T.80-series) has been [honoured with an Emmy Award](https://news.itu.int/how-jpeg-gained-emmy-fame/) for its outstanding contribution to image coding.

**IMT-2020/5G:** New ITU standards for 5G networking address network slice orchestration and management ([ITU-T Y.3153](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14132)) and fixed-mobile convergence, in relation to mobility management ([ITU-T Y.3132](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14130)) and capability exposure ([ITU-T Y.3133](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14131)).

**Passive optical network (PON):** A new ITU standard serves as a guide to the development to higher speed PON systems, identifying sets of applications that can be addressed by a particular system and defining the requirements for each of those systems ([ITU-T G.9804.1](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14024)).

**Video coding:** Version 7 of High Efficiency Video Coding (HEVC, published as [ITU-T H.265](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14107) | ISO/IEC 23008-2) has been released. The Versatile Video Coding project, developing the successor of HEVC, is on course for completion by mid-2020.

**Regulatory frameworks for quality of service/experience (QoS/QoE:** A new ITU standard provides guidance to regulators aiming to establish national or regional regulatory frameworks to monitor and measure QoS and QoE ([ITU-T E.805](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=13949)).

**Digital financial services:** New ITU standards introduce QoS and QoE aspects of digital financial services ([ITU-T G.1033](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14065)) and a methodology to test the QoE of digital financial services ([ITU-T P.1502](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14160)).

**IP performance measurement:** A revision of the ITU standard on IP service performance ([ITU-T Y.1540](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=13933)) reflects changes in the design of IP services and the protocols employed by end-users. The latest edition of the standard defines IP-layer capacity parameters in ways that cater to performance assessment, and provides requirements for methods of measurement of IP-layer capacity.

**Quantum information technology:** New ITU standards describe the networking concepts to underpin quantum key distribution, a means of enabling secure encryption and authentication ([ITU-T Y.3800](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=13990)), and the architecture of a quantum noise random number generator ([ITU-T X.1702](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14095)).

**Energy efficiency:** New ITU standards aim to support sustainable power feeding solutions for 5G networks ([ITU-T L.1210](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14079)), energy-efficient datacentres capitalizing on big data and AI ([ITU-T L.1305](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14080)) and smart energy management for telecom base stations ([ITU-T L.1380](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14082)).

**Environment and circular economy:** New ITU standards provide definitions and concepts relevant to material efficiency in the ICT sector, in line with the concept of circular economy ([ITU-T L.1022](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=13962)), and a methodology to assess the positive impacts of ICTs on the environmental efficiency of other industry sectors ([ITU-T L.1451](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14083)).

**Smart cities and communities:** New ITU standards address IoT-based smart residential communities ([ITU-T Y.4556](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=13863)) and put forward a maturity model for smart sustainable cities to enable the examination of a city’s progress towards smart city objectives ([ITU-T Y.4904](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=13864)).

**Distributed ledger technology:** New ITU standards address the requirements of blockchain in next-generation network evolution ([ITU-T Y.2342](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14128)) and the security requirements of blockchain, both in terms of blockchain’s security capabilities and security threats to blockchain ([ITU-T X.1401](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14092)).

**Content delivery and edge computing:** New ITU standards provide requirements for content delivery networks enabled by mobile edge computing ([ITU-T F.743.10](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14103)) and mobile edge computing enabled by civilian unmanned aerial vehicles ([ITU-T F.749.11](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14104)).

**Security:** New ITU standards address security aspects of network virtualization ([ITU-T X.1044](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14042)), risk management for assets that are globally accessible in IP-based networks ([ITU-T X.1059](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14045)) and advertising spam [(ITU-T X.1232](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14085)).

**Premium cable networks:** A new ITU standard provides the framework for a premium cable network platform to support industry in offering advanced multimedia services ([ITU-T J.1600](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=13977)). It is the first of a new series of ITU standards on AI-assisted cable networks.

***Supporting collaboration***

The [second ITU-T SG Leadership Assembly](https://www.itu.int/en/ITU-T/studygroups/2017-2020/Pages/sgla.aspx) was held in Budapest, Hungary, 9-10 September 2019, in conjunction with ITU Telecom World. It brought together more than 50 experts holding leadership positions in TSAG, SGs and FGs to discuss technical matters of growing strategic relevance to ITU standardization, and to identify opportunities for collaboration.

The [FIGI Security Clinic](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/201912/Pages/default.aspx) in Geneva, 4-5 December 2019, presented the latest findings of the ITU-led [FIGI Working Group on “Security, Infrastructure and Trust”](https://www.itu.int/en/ITU-T/extcoop/figisymposium/Pages/FIGISITWG.aspx). In focus were new FIGI reports on topics including the mitigation of security vulnerabilities in Signalling System 7, digital identity and strong authentication, and security assurance frameworks to increase security across the value chain. The [Financial Inclusion Global Initiative (FIGI)](https://www.itu.int/en/ITU-T/extcoop/figisymposium/Pages/default.aspx) – designed to advance research in digital finance and accelerate digital financial inclusion in developing countries – is led by ITU, the World Bank Group and the Committee on Payments and Market Infrastructures, with support from the Bill & Melinda Gates Foundation.

More than 100 cities worldwide are measuring their progress using ‘Key Performance Indicators for Smart Sustainable Cities’ based on ITU standards, indicators promoted by the [“United for Smart Sustainable Cities (U4SSC) initiative”](https://www.itu.int/en/ITU-T/ssc/united/Pages/default.aspx). New U4SSC reports include a [“City Science Application Framework”](https://www.itu.int/en/publications/Documents/tsb/2019-U4SSC-City-Science-Application-Framework/index.html) and eight associated [case studies](https://www.itu.int/en/ITU-T/ssc/united/Pages/city-science-case-studies.aspx), as well as ‘city snapshots’ of [Ålesund, Norway](https://www.itu.int/en/ITU-T/ssc/united/Documents/U4SSC-Snapshots/City_Snapshot_Alesund_Norway.pdf); [Bizerte, Tunisia](https://www.itu.int/en/ITU-T/ssc/united/Documents/U4SSC-Snapshots/City_Snapshot_Bizerte_Tunisia.pdf); [Moscow, Russia](https://www.itu.int/en/ITU-T/ssc/united/Documents/U4SSC-Snapshots/City_Snapshot_Moscow_Russia.pdf); [Riyadh, Saudi Arabia](https://www.itu.int/en/ITU-T/ssc/united/Documents/U4SSC-Snapshots/City_Snapshot_Riyadh_Saudi-Arabia.pdf); and [Pully, Switzerland](https://www.itu.int/en/ITU-T/ssc/united/Documents/U4SSC-Snapshots/City_Snapshot_Pully_Switzerland.pdf). U4SSC has also launched the [U4SSC implementation programme](https://www.itu.int/en/ITU-T/ssc/united/Pages/U4SSC-IP.aspx), which supports the implementation of the Key Performance Indicators as well as related projects and the building of partnerships.

Themed “Connecting Smart Sustainable Cities with the Sustainable Development Goals”, the [9th Green Standards Week (GSW-19)](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/gsw/201910/Pages/default.aspx) was held in Valencia, Spain, 1-4 October 2019, organized by ITU together with 37 partners and hosted by the city of Valencia. GSW-19 concluded with the adoption of a [Call to Action](https://news.itu.int/itu-green-standards-week-adopts-call-to-action-smart-sustainable-cities/) to accelerate the transition to Smart Sustainable Cities.

[ITU Kaleidoscope 2019: “ICT for Health: Networks, standards and innovation](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2019/Pages/default.aspx)”, the 11th edition of the Kaleidoscope conference, was organized by ITU in collaboration with WHO and held in Atlanta, U.S., 4-6 December 2019, hosted by ITU Academia member the Georgia Institute of Technology. [Kaleidoscope’s winning paper](https://news.itu.int/authentication-solution-for-people-with-disabilities-wins-1st-prize-at-kaleidoscope-2019/) proposes to extend the password-authenticated key exchange protocols – the weak ‘shared secret’ model of authentication, often dependent on usernames and passwords – with other authentication factors, such as biometrics. The proposal aims to enable secure access to digital health services, especially for people with disabilities relying on assistive devices.

November 2019 saw the publication of a new special issue of the ITU Journal on [“Propagation modelling for advanced future radio systems – Challenges for a congested radio spectrum”](https://www.itu.int/en/journal/2019/001/Pages/default.aspx). The next special issue of the ITU Journal will address [“The future of video and immersive media”](https://www.itu.int/en/journal/2020/001/Pages/default.aspx). ITU has also signed a co-publishing agreement with Tsinghua University Press Ltd. in support of a new joint publication, under the framework of the ITU Journal: *ICT Discoveries*, to be launched in the first quarter of 2020.

ITU and the Gulf Cooperation Council Standardization Organization signed a [Cooperation Agreement](https://www.itu.int/en/ITU-T/extcoop/Documents/mou/GSO-ITU.pdf) in September 2019, establishing a high-level, non-exclusive framework for cooperation. The agreement forms part of TSB support for the achievement of Objective T.5 of the Strategic Plan of the Union, "Extend and facilitate cooperation with international, regional and national standardization bodies".

ITU and ITU Academia member Zhejiang University signed a [Memorandum of Understanding](https://news.itu.int/advancing-research-in-emerging-technologies-itu-and-zhejiang-university/) in September 2019, outlining potential collaboration in global, regional and national events – as well as research collaboration in radiocommunication, standardization, telecommunication and ICT development activities.

ITU standardization platform

ITU-T membership maintained strong growth in 2019. During this period, 20 Sector Members and 34 Associates joined ITU-T, amounting to a total of 54 new members. Overall, ITU-T achieved a net increase of 38 members in 2019 (not including Academia). In addition, 23 new Academia members joined ITU, leading to a net increase of 8 Academia memberships. New ITU-T members include companies specializing in energy and utilities, shipping and logistics, mobile payments, over-the-top applications, automotive, IoT/M2M connectivity, visible light communication, distributed ledger technologies, quantum information technology, cybersecurity, AI, and quality of service and experience.

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. The database includes products for e-health, mobile phones compatible with vehicle hands-free terminals, Ethernet, IPTV, and mobile number portability.

Diversity of staff, gender equality and the empowerment of women continue to be among TSB's priorities. TSB has endorsed the “Gender Responsive Standards” initiative by UNECE which aims to improve gender balance in standards development and ensure that the content and impacts of standards are gender responsive.

ITU-T SGs 5, 11, 16 and 20 have implemented a pilot project to increase the engagement of SMEs in the work of ITU. The participation of 16 SMEs in ITU-T has been approved by their relevant administrations as part of the pilot project. A number of SMEs currently participating in this pilot project have expressed a strong interest in applying for Associate status under the reduced fee structure contained in PP Resolution 209 (Dubai, 2018), which will come into effect on 31 January 2020.

TSB supports the achievement of Objective T.5 of the Strategic Plan of the Union, "Extend and facilitate cooperation with international, regional and national standardization bodies", by facilitating an ITU-T presence in activities arranged by other standards bodies, with a view to promoting other standards bodies' engagement with ITU-T workings groups, workshops and related ITU-T collaboration initiatives.

Version 3 of [MyWorkspace](https://www.itu.int/net4/ITU-T/myworkspace/) includes new features based on the feedback from its initial users. 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 SGs' 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.

Over 6,000 pages of ITU-T Recommendations and Supplements were published between September and mid-December 2019. Main versions of Recommendations and Supplements are being published in reflowable ePub format (i.e., the document can adapt its presentation to the output device) in addition to the usual PDF format. The ITU product "ITU-T Recommendations and selected Handbooks" continues to be distributed on a quarterly basis as a USB key.

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. TSB translated 22 AAP Recommendations between January and November 2019, in accordance with requests previously received from the ITU-T SGs and linguistic groups, and within the allocated translation budget.

ITU workshops and symposia discuss emerging trends in standardization, increase the visibility of ITU-T work, enhance ITU-T collaboration with other bodies, attract and recruit new ITU-T members, and encourage peer-learning relevant to the development and implementation of international standards. More than 20 ITU workshops and symposia were organized from September to December 2019.

# Annex – Full Report of activities in ITU-T (from September 2019 to December 2019)

# 1 Selection of achievements in ITU-T standardization

Executive summaries for the various ITU-T SG meetings can be found on the homepages of [ITU-T SGs](https://www.itu.int/en/ITU-T/studygroups/Pages/default.aspx).

ITU approved more than 130 new and revised ITU-T Recommendations from 1 September 2019 to 16 December 2019. Appendix I lists these ITU-T Recommendations and related texts and summarizes their contents. A selection of ITU standards approved from September to December 2019 is provided below.

**IMT-2020/5G:** New ITU standards for 5G networking address network slice orchestration and management ([ITU-T Y.3153](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14132)) and fixed-mobile convergence, in relation to mobility management ([ITU-T Y.3132](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14130)) and capability exposure ([ITU-T Y.3133](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14131)).

**Passive optical network (PON):** A new ITU standard serves as a guide to the development to higher speed PON systems, identifying sets of applications that can be addressed by a particular system and defining the requirements for each of those systems ([ITU-T G.9804.1](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14024)).

**Video coding:** Version 7 of High Efficiency Video Coding (HEVC, published as [ITU-T H.265](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14107) | ISO/IEC 23008-2) has been released. The Versatile Video Coding project, developing the successor of HEVC, is on course for completion by mid-2020.

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**Digital financial services:** New ITU standards introduce QoS and QoE aspects of digital financial services ([ITU-T G.1033](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14065)) and a methodology to test the QoE of digital financial services ([ITU-T P.1502](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14160)).

**IP performance measurement:** A revision of the ITU standard on IP service performance ([ITU-T Y.1540](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=13933)) reflects changes in the design of IP services and the protocols employed by end-users. The latest edition of the standard defines IP-layer capacity parameters in ways that cater to performance assessment, and provides requirements for methods of measurement of IP-layer capacity.

**Quantum information technology:** New ITU standards describe the networking concepts to underpin quantum key distribution, a means of enabling secure encryption and authentication ([ITU-T Y.3800](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=13990)), and the architecture of a quantum noise random number generator ([ITU-T X.1702](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14095)).

**Energy efficiency:** New ITU standards aim to support sustainable power feeding solutions for 5G networks ([ITU-T L.1210](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14079)), energy-efficient datacentres capitalizing on big data and AI ([ITU-T L.1305](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14080)) and smart energy management for telecom base stations ([ITU-T L.1380](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14082)).

**Environment and circular economy:** New ITU standards provide definitions and concepts relevant to material efficiency in the ICT sector, in line with the concept of circular economy ([ITU-T L.1022](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=13962)), and a methodology to assess the positive impacts of ICTs on the environmental efficiency of other industry sectors ([ITU-T L.1451](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14083)).

**Smart cities and communities:** New ITU standards address IoT-based smart residential communities ([ITU-T Y.4556](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=13863)) and put forward a maturity model for smart sustainable cities to enable the examination of a city’s progress towards smart city objectives ([ITU-T Y.4904](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=13864)).

**Distributed ledger technology:** New ITU standards address the requirements of blockchain in next-generation network evolution ([ITU-T Y.2342](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14128)) and the security requirements of blockchain, both in terms of blockchain’s security capabilities and security threats to blockchain ([ITU-T X.1401](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14092)).

**Content delivery and edge computing:** New ITU standards provide requirements for content delivery networks enabled by mobile edge computing ([ITU-T F.743.10](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14103)) and mobile edge computing enabled by civilian unmanned aerial vehicles ([ITU-T F.749.11](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14104)).

**Security:** New ITU standards address security aspects of network virtualization ([ITU-T X.1044](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14042)), risk management for assets that are globally accessible in IP-based networks ([ITU-T X.1059](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14045)) and advertising spam [(ITU-T X.1232](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14085)).

**Premium cable networks:** A new ITU standard provides the framework for a premium cable network platform to support industry in offering advanced multimedia services ([ITU-T J.1600](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=13977)). It is the first of a new series of ITU standards on AI-assisted cable networks.

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

Active ITU-T Focus Groups (see section 5):

* [AI for Health](https://www.itu.int/en/ITU-T/focusgroups/ai4h/Pages/default.aspx)
* [Machine Learning for Future Networks including 5G](https://www.itu.int/en/ITU-T/focusgroups/ml5g/Pages/default.aspx)
* [Vehicular Multimedia](https://www.itu.int/en/ITU-T/focusgroups/vm/Pages/default.aspx)
* [Technologies for Network 2030](https://www.itu.int/en/ITU-T/focusgroups/net2030/Pages/default.aspx)
* [Environmental Efficiency for AI and other Emerging Technologies](https://www.itu.int/en/ITU-T/focusgroups/ai4ee/Pages/default.aspx)
* [AI for Autonomous and Assisted Driving](https://www.itu.int/en/ITU-T/focusgroups/ai4ad/Pages/default.aspx)
* [Quantum Information Technology for Networks](https://www.itu.int/en/ITU-T/focusgroups/qit4n/Pages/default.aspx)

# 2 Conformity, interoperability and testing

## 2.1 Conformity Assessment Steering Committee (CASC)

The main objective of ITU-T CASC is to set up criteria, rules and procedures to recognize Test Laboratories (TLs) with competence in ITU-T Recommendation(s) and register these TLs in a list of ITU-recognized TLs. This effort is supported by a guideline "Testing laboratories recognition procedure" agreed by ITU-T SG11 in 2015.

A meeting of ITU-T CASC on 18 October 2019 revised the existing guideline “ITU-T CASC procedure to appoint ITU-T technical expert”. The revision enables ITU-T CASC to appoint ITU-T technical experts nominated by ITU-T SGs without additional assessment by ITU-T CASC appointment teams, as was previously required. ITU-T CASC appointment teams will, however, continue to assess applications in cases where an individual applies to be appointed without the prior endorsement of an ITU-T SG. ITU-T CASC has appointed 11 technical experts active in ITU-T SG2, SG5 and SG16. The list of appointed experts can be found in the most recent [ITU-T CASC meeting report](https://www.itu.int/md/meetingdoc.asp?lang=en&parent=T17-SG11-191016-TD-GEN-1020).

The October 2019 meeting of ITU-T CASC also reviewed a request from ITU-T SG16 for ITU-T CASC to establish joint ITU/IEC certification schemes in areas including: safe listening devices/systems, visual surveillance systems and services, and accessibility features of IPTV systems.

In addition, at the request of IECEE Certification Management Committee Working Group 33 ‘ITU requirements’ (IECEE CMC WG33), a questionnaire formulated by IECEE CMC WG33 was distributed by ITU-T CASC to evaluate market need for a joint ITU/IEC TL recognition procedure and certification schemes for ITU-T Recommendations. The questionnaire collected views on the in-progress joint ITU/IEC work to establish a peer-assessment laboratory service (joint ITU/IEC TL recognition procedure) and joint conformity assessment programme (joint ITU/IEC certification schemes). All interested parties, including non-ITU members, were invited to complete the questionnaire (<https://www.research.net/r/SG11-ITU-IEC-TL>) by 16 January 2020. More details are available in [TSB Circular 208](https://www.itu.int/md/T17-TSB-CIR-0208/en).

The next meeting of ITU-T CASC will be held in Geneva, 6 March 2020. 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).

## 2.2 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. The database currently contains more than 500 entries. Five 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.
* **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.
* **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).
* **IPTV systems** compatible with ITU-T H.721 "IPTV terminal devices: Basic model" and ITU-T 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).
* **Mobile Number Portability (MNP)** systems compatible with ITU-T Q.Supplement 4 "Number portability – Capability set 1 requirements for service provider portability (All call query and Onward routing)", tested to ITU-T Q.3905.

# 3 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.

British Sign Language (BSL) and real-time captioning were provided for Q26/16 during the ITU-T SG16 meeting in October 2019, the [IRG-AVA](https://www.itu.int/en/irg/ava/Pages/default.aspx) meeting on 10 October 2019, and the [JCA-AHF](https://www.itu.int/en/ITU-T/jca/ahf/Pages/default.aspx) meeting on 11 October 2019.

TSB led the organization of a [webinar on e-accessibility for e-business](https://www.itu.int/en/ITU-T/ebusiness/Pages/mou/webinar-on-e-accessibility-for-e-business.aspx) on 21 October 2019 at the request of the Management Group of the Memorandum of Understanding on electronic business between IEC, ISO, ITU and UNECE. Real-time captioning was provided.

# 4 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). IPR AHG met at ITU headquarters in Geneva, 28 January 2019, and has continued meeting by conference call to address IPR issues related to A-Series Recommendations. All meeting reports can be found on the IPR AHG website at <https://itu.int/en/ITU-T/ipr/Pages/adhoc.aspx>.

# 5 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 SGs. 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. These groups are afforded great flexibility in their chosen deliverables and working methods.

## 5.1 Quantum Information Technologies for Networks

The [ITU-T Focus Group on Quantum Information Technology for Networks (FG-QIT4N)](https://www.itu.int/en/ITU-T/focusgroups/qit4n/Pages/default.aspx) **is studying the evolution of quantum information technologies in view of their foreseen applications in ICT networks. It is leading exploratory ‘pre-standardization’ studies to identify emerging standardization demands and anticipate demands to arise in future. Chief among its list of priorities is the analysis of high-potential use cases of quantum information technologies in ICT networks and the harmonization of associated terminology.**

## 5.2 Machine Learning for Future Networks including 5G

The [ITU-T Focus Group on Machine Learning for Future Networks including 5G (FG ML5G)](https://www.itu.int/en/ITU-T/focusgroups/ml5g/Pages/default.aspx) is proposing standardization strategies to assist machine learning in contributing to the efficiency of emerging 5G systems. The group is defining the requirements of machine learning as they relate to interfaces, protocols, algorithms, data formats and network architectures. One of the Focus Group's ambitions is to address the challenges surrounding the availability and quality of the data required to fuel machine learning algorithms.

[ITU-T Y.3172 “Architectural framework for machine learning in future networks including IMT-2020”](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=13894) and [Supplement 55 to the ITU-T Y.3170-series “Machine learning in future networks including IMT-2020: use cases”](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=14100) are based on the work of FG ML5G.

## 5.3 Technologies for Network 2030

The [ITU-T Focus Group on Technologies for Network 2030 (FG NET-2030)](https://www.itu.int/en/ITU-T/focusgroups/net2030/Pages/default.aspx) is examining how emerging technologies can enhance network capabilities to meet the demands of 5G systems and future innovations. The group is studying new media, services and architectures to identify communication needs and use cases for the year 2030 and beyond. In focus are applications including augmented and virtual reality and holograms, and the group aims also respond to increasing user demand for time-sensitive applications in fields such as telemedicine and industrial automation.

In October 2019, FG NET-2030 put forward its vision of [“New Services and Capabilities for Network 2030: Description, Technical Gap and Performance Target Analysis”](https://www.itu.int/pub/T-FG/publications.aspx?lang=en&parent=T-FG-NET2030-2019-SUB.G2).

## 5.4 AI for Health

The [ITU-T Focus Group on AI for Health (FG AI4H)](https://www.itu.int/en/ITU-T/focusgroups/ai4h), driven in close collaboration by ITU and WHO, is working towards the establishment of a framework and associated processes for the performance benchmarking of ‘AI for Health’ algorithms. The group is currently working on 18 topic areas ("use cases"), addressing health issues including breast cancer, neurodegenerative diseases, vision loss, skin lesions, cardiovascular diseases, and venomous snakebites.

A summary of the current status of the group’s work – “[WHO and ITU establish benchmarking process for AI in health](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(19)30762-7/fulltext?dgcid=raven_jbs_etoc_email)” – was published in The Lancet Digital Health, a highly reputed peer-reviewed weekly medical journal.

## 5.5 Vehicular Multimedia

The [ITU-T Focus Group on Vehicular Multimedia (FG VM](https://www.itu.int/en/ITU-T/focusgroups/vm/Pages/default.aspx)) is investigating where international standards could support the global adoption of new ‘infotainment’ systems incorporating services such as Augmented Reality navigation, video streaming, and automated in-vehicle climate control. FG VM has documented innovative use cases of vehicular multimedia and their underlying technical requirements: [“Use cases and requirements for the vehicular multimedia”](https://www.itu.int/en/ITU-T/focusgroups/vm/Documents/FGVM-01R1.pdf). In the second phase of its work, the group will study the architecture, interfaces and protocols of the vehicular multimedia network.

## 5.6 AI for Autonomous and Assisted driving

The [ITU-T Focus Group on AI for Autonomous and Assisted Driving (FG-AI4AD)](https://www.itu.int/en/ITU-T/focusgroups/ai4ad) is working towards the establishment of international standards to monitor and assess the performance of the AI ‘drivers’ in control of automated vehicles. The group aims to devise a ‘Driving Test’ for AI drivers. The proposed test could become the basis for an International Driving Permit for AI. The right to hold this permit would be assessed continuously, based on the AI driver’s behavioural performance on the road. The FG-AI4AD deliverables will focus on the behavioural evaluation of AI responsible for the dynamic driving task in accordance with the 1949 and 1968 United Nations Conventions on Road Traffic.

## 5.7 Environmental Efficiency for AI and other Emerging Technologies

The [ITU-T Focus Group on Environmental Efficiency for AI and other Emerging Technologies (FG AI4EE)](https://www.itu.int/en/ITU-T/focusgroups/ai4ee/Pages/default.aspx) is studying environmental efficiency in the age of AI, increasing automation, and smart manufacturing. The group’s work is also expected to support ITU’s ongoing studies of the environmental requirements of IMT-2020 (5G) systems. It will curate and analyze research into the relationship between emerging technologies and environmental efficiency. This analysis will conclude with the delivery of Technical Reports and specifications to benchmark best practices and describe pathways towards a standardized framework to assess environmental aspects of the adoption of emerging technologies.

# 6 Collaboration in standardization

## 6.1 ITU-T SG Leadership Assembly

The second ITU-T SG Leadership Assembly was held in Budapest, Hungary, 9-10 September 2019, in conjunction with ITU Telecom World. It brought together more than 50 experts holding leadership positions in TSAG, SGs and FGs to discuss technical matters of growing strategic relevance to ITU standardization, and to identify opportunities for collaboration.

Topics considered by the assembly included the standardization needs of AI-enabled multimedia systems for health and vehicles; 5G systems and their enablers; machine learning in ICT networks; numbering, naming, addressing and identification; and security, privacy and trust.

In anticipation of the ITU World Telecommunication Standardization Assembly 2020 (WTSA-20), participants reiterated the need to strengthen collaboration and cooperation across all ITU-T activities, and to share information and results more regularly and effectively. Participants also stressed the importance of the role played by TSAG and its rapporteur groups in assessing to what extent the needs of ITU-T are met by the current SG structure and existing mechanisms for internal and external collaboration.

Areas identified as in need of ITU-T leadership, and closer supporting collaboration within ITU-T, included:

* Use of AI and machine learning for networks and services;
* Network slicing (e.g., diversity of network slices, their management and operation, identification and security requirements);
* Network functions and capabilities at the boundary of the data plane, control plane and management plane (orchestration);
* A framework to benchmark AI algorithms with respect to their performance and robustness;
* Applications enabled by AI systems in health as well as autonomous and assisted driving;
* Numbering, naming, addressing and identification in fields including IoT, 5G and network slicing;
* Identity management, ENUM, caller ID spoofing, and the mitigation of other SS7 vulnerabilities;
* Security, privacy and trust for networks and network functions in the 5G era;
* Cybersecurity threat intelligence;
* Energy efficiency and climate change; and,
* Architecture considerations and methodologies, including orchestration of various functions.

The discussions of the five thematic sessions of the SG Leadership Assembly are summarized in Annex in more detail. The assembly’s agenda, presentation materials and list of participants can be found at <https://itu.int/en/ITU-T/studygroups/2017-2020/Pages/sgla.aspx>. See also the assembly’s summary record in [TSAG-TD578](https://www.itu.int/md/T17-TSAG-190923-TD-GEN-0578).

## 6.2 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 or cooperation with other sectors, with the view to encouraging ITU-T to work more collaboratively or cooperatively in a reciprocal manner, and review is performed on a regular basis based on information received.

TSAG maintains a close relationship with 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) work on items of interest to various ITU-T and ITU-R SGs.

* IRG-AVA: Intersector Rapporteur Group on Audiovisual Media Accessibility, among ITU-T SG9, ITU-T SG16 and ITU-R SG6.
* IRG-AVQA: Intersector Rapporteur Group on Audiovisual Quality Assessment, among ITU-T SG12 and ITU-R SG6. The next meeting is planned for March 2020, in conjunction with the Video Quality Expert Group (VQEG).
* IRG-IBB: Intersector Rapporteur Group on Integrated Broadcast-Broadband, among ITU-T SG9, ITU-T SG16 and ITU-R WP 6B.

The Inter-Sector Coordination Team (ISCT) is composed of representatives of all three advisory groups, working to identify subjects common interest to the three Sectors. It also seeks to identify the mechanisms necessary to strengthen cooperation and joint activities 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 three Bureaux.

A [series of events](https://www.itu.int/en/ITU-T/studygroups/2017-2020/09/Pages/workshops.aspx) on "The Future of TV", initiated by ITU-T SG9, are organized in collaboration by the three ITU Sectors and ITU Regional Offices. Two events in this series are planned for 2020:

* ITU Workshop on the Future of Television for Asia & Pacific**,** Tokyo, Japan, April 2020;
* ITU Workshop on the Future of Television for Africa, TheGambia, September/October 2020.

## 6.3 Coordination and cooperation with the Regions and the Regional Offices

With the goal of improving coordination and increasing the efficiency of the overall operations, events and activities of the Sector and the Bureau, at the initiative of the TSB Director, TSB organizes conference calls and face-to-face meetings on a regular basis with ITU’s Regional Offices.

This activity has led to significant improvements in the overall coordination of standardization operations, events and activities taking place in the Regions. It has contributed to greater awareness of ITU-T standardization activities in each Region.

TSB will continue to enhance cooperation with the ITU Regional Offices, as well as with relevant regional and other international organizations dealing with standards.

## 6.4 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. The World Standards Cooperation leads the celebration of World Standards Day, 14 October. The theme of World Standards Day 2019 was “Video standards create a global stage”.

**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).

The **Global Standards Collaboration** **(GSC)** assists regional and international SDOs in coordinating their contributions to fields of mutual interest. 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).

The **European Commission Multi-Stakeholder Platform on ICT Standardization** supports the coordination of the activities of the European Commission, European Standardization Organizations and ITU. ITU also contributes to the [EC Rolling Plan on ICT Standardization](https://joinup.ec.europa.eu/collection/rolling-plan-ict-standardisation/rolling-plan-2019).

**ITU is a strong advocate of "Universal Design"** and has 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 enhance conformity and interoperability of ICT products implementing ITU Recommendations or part thereof.

**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 [annual CTO meeting](https://news.itu.int/5g-dominates-debate-at-cto-meeting-in-budapest/) was held in Budapest, Hungary, 8 September 2019, in conjunction with ITU Telecom World. A [CxO meeting](https://news.itu.int/intelligence-security-cost-efficiency-industry-executives-highlight-priorities/) was held in Dubai, UAE, 11 December 2019, in conjunction with the Telecom Review Leaders’ Summit.

**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. ITU-T continues to collaborate with WHO, with notable recent initiatives on safe listening devices/systems and AI for health.

**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. CITS meetings are held back-to-back with ITU workshops on intelligent transport systems. CITS has established a [standards database](https://www.itu.int/net4/ITU-T/landscape#?topic=0.131&workgroup=1&searchValue=&page=1&sort=Revelance) to assist the harmonization of ITS standards. The database includes ITS standards developed by all relevant standards bodies.

**ITU/WMO/UNESCO-IOC Joint Task Force (JTF) on SMART Cable Systems:** The JTF is leading an ambitious project to equip submarine communications cables with scientific sensors (e.g., sea water temperature, pressure, water movement) that could be used for climate change monitoring and tsunami early warning (“SMART cables”). SMART cables are technically and financially feasible and expected to be field-proven via ongoing demonstrations and proposed pilot systems in The Americas, Antarctica, Asia and Europe. A detailed peer-reviewed article on the project can be found in the journal “Frontiers in Marine Science”: [“SMART Cables for Observing the Global Ocean: Science and Implementation”](https://www.frontiersin.org/articles/10.3389/fmars.2019.00424/full).

**ICT, environment and climate change**: ITU-T maintains cooperation with a wide range of bodies active in environmental sustainability, including UN bodies, standards bodies, regional organizations, academia, and industry associations. ITU is working together with nine other UN bodies to develop a report on “frontier technologies to protect the environment and tackle climate change”.

**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 16 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. More than 100 cities worldwide are measuring their progress using ‘Key Performance Indicators for Smart Sustainable Cities’ based on ITU standards, indicators promoted by U4SSC. New U4SSC reports include a [“City Science Application Framework”](https://www.itu.int/en/publications/Documents/tsb/2019-U4SSC-City-Science-Application-Framework/index.html) and eight associated [case studies](https://www.itu.int/en/ITU-T/ssc/united/Pages/city-science-case-studies.aspx), as well as ‘city snapshots’ of [Ålesund, Norway](https://www.itu.int/en/ITU-T/ssc/united/Documents/U4SSC-Snapshots/City_Snapshot_Alesund_Norway.pdf); [Bizerte, Tunisia](https://www.itu.int/en/ITU-T/ssc/united/Documents/U4SSC-Snapshots/City_Snapshot_Bizerte_Tunisia.pdf); [Moscow, Russia](https://www.itu.int/en/ITU-T/ssc/united/Documents/U4SSC-Snapshots/City_Snapshot_Moscow_Russia.pdf); [Riyadh, Saudi Arabia](https://www.itu.int/en/ITU-T/ssc/united/Documents/U4SSC-Snapshots/City_Snapshot_Riyadh_Saudi-Arabia.pdf) and [Pully, Switzerland](https://www.itu.int/en/ITU-T/ssc/united/Documents/U4SSC-Snapshots/City_Snapshot_Pully_Switzerland.pdf). U4SSC has also launched the [U4SSC implementation programme](https://www.itu.int/en/ITU-T/ssc/united/Pages/U4SSC-IP.aspx), which supports the implementation of the Key Performance Indicators as well as related projects and the building of partnerships.

**Green Standards Week**: Themed “Connecting Smart Sustainable Cities with the Sustainable Development Goals”, the [9th Green Standards Week (GSW-19)](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/gsw/201910/Pages/default.aspx) was held in Valencia, Spain, 1-4 October 2019, organized by ITU together with 37 partners and hosted by the city of Valencia. GSW-19 concluded with the adoption of a [Call to Action](https://news.itu.int/itu-green-standards-week-adopts-call-to-action-smart-sustainable-cities/) to accelerate the transition to Smart Sustainable Cities.

**ITU and ETSI** continue to enjoy successful collaboration in areas including multimedia QoE and IP capacity and latency parameters; ICT energy efficiency and methodologies to assess ICTs’ environmental impacts; standardization for C&I testing; and Test and Test Control Notation version 3.

The **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. The [FIGI Security Clinic](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/201912/Pages/default.aspx) in Geneva, 4-5 December 2019, presented the latest findings of the ITU-led [FIGI Working Group on “Security, Infrastructure and Trust”](https://www.itu.int/en/ITU-T/extcoop/figisymposium/Pages/FIGISITWG.aspx) . In focus were new FIGI reports on topics including the mitigation of security vulnerabilities in Signalling System 7, digital identity and strong authentication, and security assurance frameworks to increase security across the value chain. The working group’s reports have informed related work in ITU-T SG11, SG12 and SG17.

**ITU and ITU Academia member Zhejiang University** signed a [Memorandum of Understanding](https://news.itu.int/advancing-research-in-emerging-technologies-itu-and-zhejiang-university/) in September 2019, outlining potential collaboration in global, regional and national events – as well as research collaboration in radiocommunication, standardization, telecommunication and ICT development activities.

## 6.5 Cooperation with national and regional standardization organizations

TSB supports the achievement of Objective T.5 of the Strategic Plan of the Union, "Extend and facilitate cooperation with international, regional and national standardization bodies", by facilitating an ITU-T presence in activities arranged by other standards bodies, with a view to promoting other standards bodies' engagement with ITU-T workings groups, workshops and related ITU-T collaboration initiatives. TSB’s efforts in this regard have strengthened the exchange of information between ITU-T and national and regional standards, supporting closer cooperation and collaboration.

ITU and the Gulf Cooperation Council Standardization Organization (GSO)signed a [Cooperation Agreement](https://www.itu.int/en/ITU-T/extcoop/Documents/mou/GSO-ITU.pdf) in September 2019, establishing a high-level, non-exclusive framework for cooperation. The agreement supports the promotion of ITU standards, taking into account the requirements GSO member countries, to support long-term sustainable economic development.

The GSO cooperation agreement follows similar agreements with:

* The African Organization for Standardization (June 2019)
* The European Committee for Standardization and European Committee for Electrotechnical Standardization (March 2017)
* The European Telecommunications Standards Institute (July 2012; renewed May 2016)
* The Association of Radio Industries and Businesses, China Communications Standards Association, Telecommunications Technology Association and Telecommunication Technology Committee (July 2011).

For all Memoranda of Understanding and Cooperation Agreement, see relevant [web page](https://www.itu.int/en/ITU-T/extcoop/Pages/mou.aspx).

Other standardization bodies with which TSB is increasing engagement include the Pan American Standards Commission, the Pacific Area Standards Congress, and the South Asian Regional Standards Organization.

# 7 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 revamped BSG Programme is structured around five pillars, responding to WTSA Resolution 44. The five pillars of the BSG programme are: Engagement, know-how, community, awareness, and partnering:

1. **Engagement** is about facilitating participation in standards development. This includes fellowship and mentorship programmes and tools for remote participation.
2. **Know-how** covers the development of skills and capabilities for standards-making. This includes standards-making effectiveness sessions, video tutorials and e-learning courses.
3. **Community** focused on empowerment at regional and national levels. Regional Groups within ITU-T SGs are a prime example, ensuring that standards-making is inclusive of the needs of all regions.
4. **Awareness** covers information sharing, using ITU-T publications on a wide range of topics as well as Regional and Inter-Regional standardization forums.
5. **Partnering** is about mobilizing resources and fostering collaboration.

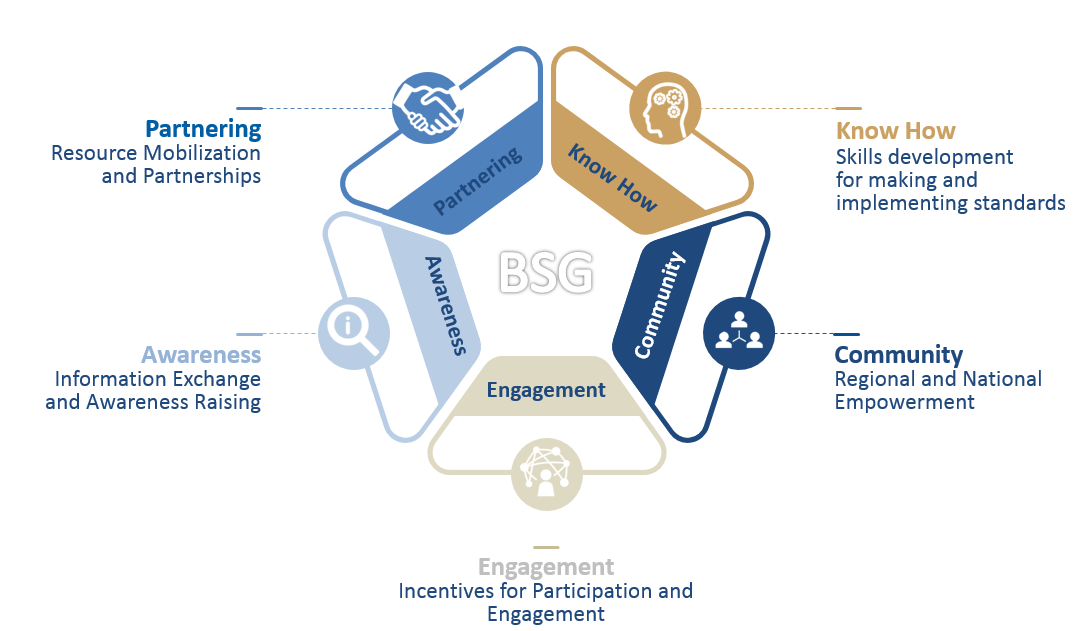


Figure 1 - Five pillars of the BSG Programme

## 7.1 BSG hands-on training sessions

ITU-T has introduced the new 'BSG Hands-On SG effectiveness training' in response to WTSA Resolution 44. 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 SGs, drafting contributions to meetings, presenting proposals, collaborative working methods and building consensus.

An inter-regional Arab-African hands-on training programme was held in Dubai, UAE, 20-21 October 2019, in conjunction an ITU Inter-Regional Standardization Forum discussing issues pertinent to the African and Arab regions’ participation in ITU-T SG2 and SG3 and meetings of the African and Arab Regional Groups within these two SGs. See also section 7.3.

**7.1.1 BSG training on services and tools**

TSB offered a full-day training session on the use of TSB services and tools in conjunction with the second African Telecommunications Union’s Regional Preparatory Meeting for WTSA-20 in Entebbe, Uganda, 7-11 October 2019.

TSB staff presented remotely from ITU Headquarters, introducing services and tools including remote participation, MyWorkspace and publications. The training session aimed to support more active and efficient participation in ITU-T work, particularly in view of the upcoming WTSA-20. The full programme of the training session can be found [here](http://atu-uat.org/7-11-oct-2019/). For more on TSB services and tools, see section 13.

## 7.2 Regional Groups

Regional Groups within ITU-T SGs have proven effective mechanisms to coordinate regional contributions to ITU and increase the number and quality of technical contributions from developing countries. Some 330 participants attended the nine Regional Group meetings held since August 2019:

* Four in Africa ( SGs 2, 5, 11 and 20)

1. SG2RG-AFR: Dubai, UAE, 23-24 October 2019: 25 participants.
2. SG5-RGAFR: Abuja, Nigeria, 29-30 August 2019: 81 participants.
3. SG11-RGAFR: Tunis, Tunisia, 30 September - 2 October 2019: 19 participants.
4. SG20-RGAFR: Abuja, Nigeria, 27-29 August 2019: 80 participants.

* One for the Americas (SG20)
  1. **SG20-RGLATAM: San Salvador, El Salvador, 11-12 September 2019: 30 participants.**
* Three for the Arab States (SGs 2, 3 and 20)

1. SG2-RGARB: Dubai, UAE, 23-24 October 2019: 25 participants.
2. SG3-RGARB: Dubai, UAE, 23-24 October 2019: 26 participants.
3. SG20-RGARB: Riyadh, Saudi Arabia, 7 October 2019: 11 participants.

* One for Asia and Oceania (SG3).

1. SG3-RGAO: Colombo, Sri Lanka, 2-4 October 2019: 31 participants.

## 7.3 Regional Standardization Forums

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

RSFs are being held in conjunction with meetings of Regional Groups to improve the alignment of RSF discussions and the priorities of ITU-T SGs. RSFs are also raising awareness of ITU standardization activities through the participation of key decision-makers (Prime Ministers, Ministers, Heads of Regulators, CEOs, etc.).

The [ITU Regional Standardization Forum (RSF) on “Addressing Competition Issues in ICT Economy”](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/bsg/201910/Pages/default.aspx) was held in Colombo, Sri Lanka, 1 October 2019.

The [ITU Inter-Regional Standardization Forum on “Operational issues on numbering, emergency service and OTTs”](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/bsg/20191022/Pages/default.aspx) was held in Dubai, UAE, 22 October 2019.

## 7.4 National Standardization Secretariats

ITU-T’s [new Guidelines for National Standardization Secretariats (NSS)](https://www.itu.int/en/ITU-T/gap/Documents/nss-rep-may.pdf) take into account the membership feedback on the Guidelines first published in 2014. The Guidelines set out a number of options for developing national procedures and processes to support effective participation in the ITU-T standards-development process. An NSS, as described by the Guidelines, is the full set of arrangements by which participation in and contributions to ITU-T are coordinated within a country.

An extensive set of functions that an NSS could perform are presented, enabling a country to select functions and organizational arrangements in a modular fashion, considering factors such as its ICT standardization policies; the number and type of organizations with an interest in ICT standardization in the country (e.g., number of service providers, equipment manufacturers, and academic and research institutes); and the level of participation in ITU-T SGs (e.g., whether as an initiator of work items, active contributor or observer in one or more ITU-T SGs).

## 7.5 e-Learning courses

One of the BSG measures adopted under WTSA Resolution 44 calls for the exploration of e-learning channels for training on ITU-T Recommendations. These training courses are available on the ITU Academy website at <http://academy.itu.int>.

The most recent addition to the ITU Academia platform trains developers of systems compliant with ITU-T F.921 “Audio-based indoor and outdoor network navigation system for persons with vision impairment”. The course was developed by Wayfindr, in collaboration with TSB and BDT.

## 7.6 SG Mentoring Programme

In 2011, a mentoring programme for ITU-T SGs 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 SGs and TSAG.

## 7.7 Technical Papers

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

## 7.8 Fellowships

The table below shows the fellowships awarded during the period from August to December 2019. 193 fellowships were requested and 105 fellowships were awarded. Of the 105 fellowships awarded, 85 fellowships were used and 20 were cancelled.

| Meeting | Fellows | | Total |
| --- | --- | --- | --- |
| Female | Male |
| ITU-T SG17, Geneva, 27 August – 5 September 2019 | 2 (1 cancelled) | 4 (1 cancelled) | 6 fellowships awarded, 4 participants |
| ITU-T SG5RG-AFR and SG20RG-AFR, Abuja, Nigeria, 27-30 August 2019 | 6 (2 cancelled) | 6 (3 cancelled) | 12 fellowships awarded, 7 participants |
| ITU-T SG5, Geneva, 16-20 September 2019 | 5 | 2 (1 cancelled) | 7 fellowships awarded, 6 participants |
| TSAG, Geneva, 23-27 September 2019 | 2 (1 cancelled) | 10 (1 cancelled) | 12 fellowships awarded, 10 participants |
| ITU-T SG11RG-AFR, Tunis, Tunisia, 30 September – 2 October 2019 | 0 | 4 | 4 fellowships awarded, 4 participants |
| ITU-T SG3RG-AO, Colombo, Sri Lanka, 2-4 October 2019 | 0 | 1 | 1 fellowship awarded, 1 participant |
| ITU-T SG16, Geneva, 7-17 October 2019 | 1 | 5 | 6 fellowships awarded, 6 participants |
| ITU-T SG13, Geneva, 14-25 October 2019 | 0 | 5 | 5 fellowships awarded, 5 participants |
| ITU-T SG11, Geneva, 16-25 October 2019 | 0 | 7 | 7 fellowships awarded, 7 participants |
| ITU-T SG2RG-ARB, SG2RG-AFR and SG3RG-ARB, Dubai, UAE, 23-24 October 2019 | 10 (1 cancelled) | 18 (7 cancelled) | 28 fellowships awarded, 20 participants |
| ITU-T SG20, Geneva, 25 November – 6 December 2019 | 1 | 4 | 5 fellowships awarded, 5 participants |
| ITU-T SG12, Geneva, 26 November – 5 December 2019 | 3 | 3 | 6 fellowships awarded, 6 participants |
| ITU-T SG2, Geneva, 4-13 December 2019 | 1 | 5 (2 cancelled) | 6 fellowships awarded, 4 participants |

## 7.9 Questionnaires for developing countries

Questionnaireson “Big Data Adoption in Developing Countries” and “Use of ITU-T Recommendations in developing countries” received 17 and 18 responses, respectively, by the 31 August 2019 submission deadline. The responses have formed a basis for the progression of associated Supplements under development in Q5/13 (Applying networks of future and innovation in developing countries).

# 8 Membership

## 8.1 Evolution of ITU-T membership

ITU-T membership maintained strong growth in 2019. During this period, 20 Sector Members and 34 Associates joined ITU-T, amounting to a total of 54 new members. Overall, ITU-T achieved a net increase of 38 members in 2019 (not including Academia). In addition, 23 new Academia members joined ITU, leading to a net increase of 8 Academia memberships.

New ITU-T members include companies specializing in energy and utilities, shipping and logistics, mobile payments, over-the-top applications, automotive, IoT/M2M connectivity, visible light communication, distributed ledger technologies, quantum information technology, cybersecurity, AI, and quality of service and experience.

Targeted membership outreach, campaigns and events – executed in collaboration with TSB’s Strategic Engagement Division and SGs Department – continue to show great promise in attracting and recruiting new ITU-T members. TSB continues to put an increased emphasis on tailored outreach to membership prospects while also enhancing the level of account management offered to ITU-T’s existing membership.

New Sector Members in 2019:

Bangladesh Communication Satellite Company Limited (BCSCL); Beijing Baidu Netcom Science Technology Co., Ltd.; CAS Quantum Network Co. Ltd.; QuantumCTek Co., Ltd.; Credit Pilot PLC; Volkswagen AG; Subah Infosolutions Ghana Limited; Reliance Jio Infocomm Limited; LG Uplus; Infinera Corporation; ITRI International Inc.; Plantronics, Inc.; XPRIZE Foundation Inc.; ADA Innovation Lab Limited; Hengtong Optic-electric Co., Ltd.; Jinan Institute of Quantum Technology; Atlantique Télécom Côte d'Ivoire; SomosGov Inc.; XPERI; Huawei Technologies Düsseldorf GmbH.

New Associates in 2019:

Maersk Line A/S (SG2); Vattenfall Vindkraft A/S (SG2); Clementvale Baltic OÜ (SG2); Bouygues Telecom (SG2); Athalos PRS-Telecom (SG2); Tele2 IoT (SG2); Phonegroup SA (SG2); Dense Air (SG2); Arkessa Limited (SG2); MNF Group Limited (SG2); Telit Wireless Solutions GmbH (SG2); MovieLabs (SG9); Synamedia (SG9); Afilias Ltd. (SG11); Advanced Telecommunications Research Institute International (SG11); OpenSignal Limited (SG12); Continental Automotive Systems Inc.(SG12); Hyundai Mobis Co., Ltd. (SG12); Dingli Corporation Ltd.(SG12); Ookla (SG12); CEZ Distribuce, a.s.(SG15); Signify/Philips, Lighting B.V.(SG15); u-blox AG (SG15); IBM (SG15); Tibit Communications (SG15); Xilinx Incorporation (SG15); OLEDCOMM (SG15); Mentor Graphics Corporation (SG15); VisionVera Information Technology Co. Ltd. (SG16); Fondation Botnar (SG16); Cambridge Quantum Computing (SG17); Capital City Service Limited (SG17); FORTINET Inc. (SG17); System Engineering Research Institute (SG20).

New Academia in 2019:

Universidad Nacional del Litoral; Concordia University; Mila - Institut Québécois d'Intelligence Artificielle; Hong Kong Applied Science and Technology Research Institute; Universidad Técnica del Norte; Institut Scientifique Européen; Université de Bordeaux; RWTH Aachen University; Ilmenau University of Technology; Centre for Development of Telematics; University of Tehran; Amirkabir University of Technology; Tarbiat Modares University; Tokyo Institute of Technology; Shinshu University; Arab States Research and Education Network; Nazarbayev University; Smart Quantum Communication ITRC (Korea University); Hamad Bin Khalifa University; The University of Dodoma; University of California Irvine School of Law; University of Surrey Institute for Communication Systems; University of Bristol.

**Total ITU-T Sector Members, Associates and Academia (31 December 2006 – 31 December 2019):**

The following table and figure illustrate the evolution of ITU-T membership from 31 December 2006 to 31 December 2019 (noting that the Academia membership category opened in 2011).

**Table 1: Evolution of ITU-T membership from 31 December 2006 to 31 December 2019**

|  | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sector Members | 344 | 314 | 309 | 294 | 273 | 271 | 278 | 284 | 274 | 267 | 254 | 256 | 257 | 268 |
| Associates | 112 | 116 | 134 | 128 | 125 | 136 | 144 | 139 | 134 | 134 | 130 | 139 | 157 | 184 |
| Academia | ‑ | - | ‑ | ‑ | ‑ | 25 | 36 | 45 | 86 | 109 | 107 | 125 | 155 | 163 |
| TOTAL | 456 | 430 | 443 | 422 | 398 | 432 | 458 | 468 | 494 | 510 | 491 | 520 | 569 | 615 |

NOTE – Some of the figures in the table above have been subject to retroactive changes

**Figure 3 – Evolution of ITU-T membership from 31 December 2006 to 31 December 2019**

NOTE – The Academia category was created in 2011.

## 8.2 Implementation of SME Pilot Project

ITU-T SGs 5, 11, 16 and 20 have implemented a pilot project to increase the engagement of SMEs in the work of ITU. The participation of 16 SMEs in ITU-T has been approved by their relevant administrations as part of the pilot project.

A number of SMEs currently participating in this pilot project have expressed a strong interest in applying for Associate status under the reduced fee structure contained in PP Resolution 209 (Dubai, 2018), which will come into effect on 31 January 2020.

Examples of work underway as a result of the SME pilot project include:

* In ITU-T SG5, WaveControl (Spain) led the development of ITU-T K.145 "Assessment and management of compliance with radio frequency electromagnetic field exposure limits for workers at radiocommunication sites and facilities" (11/19); and MJRD Assessment Inc. (Canada) is leading the development of the work item L.SP\_OB "A methodology for improving, assessing and scoring the sustainability performance of office buildings".
* In ITU-T SG11, Vaulto Technologies (Israel) contributed a Technical Report on SS7 vulnerabilities and associated mitigation measures for digital financial transactions, and continues to contribute to ITU-T SG11’s work to assist network operators and financial institutions in addressing SS7 security vulnerabilities.
* In ITU-T SG16, Wayfindr (UK) contributed the material that became ITU-T F.921 and FSTP-CONF-F921 on indoor and outdoor network navigation for persons with visual impairments.

# 9 Gender

In alignment with ITU-T Resolution 55 (Rev. Hammamet, 2016), TSB continues to undertake actions to improve gender equality in TSB and ITU-T. TSB has endorsed the “Gender Responsive Standards” initiative by UNECE which aims to improve gender balance in standards development and ensure that the content and impacts of standards are gender responsive. Diversity of staff, gender equality and the empowerment of women continue to be among TSB's priorities.

# 10 Academia

## 10.1 ITU Kaleidoscope academic conferences

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

The 11th edition of Kaleidoscope, [Kaleidoscope 2019: “ICT for Health: Networks, standards and innovation](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2019/Pages/default.aspx)”, organized by ITU in collaboration with WHO, was held in Atlanta, U.S., 4-6 December 2019, hosted by ITU Academia member the Georgia Institute of Technology. IEEE, IEEE ComSoc and The Lancet Digital Health were technical co-sponsors of Kaleidoscope 2019.

[Kaleidoscope’s winning paper](https://news.itu.int/authentication-solution-for-people-with-disabilities-wins-1st-prize-at-kaleidoscope-2019/) proposes to extend the password-authenticated key exchange protocols – the weak ‘shared secret’ model of authentication, often dependent on usernames and passwords – with other authentication factors, such as biometrics. The proposal aims to enable secure access to digital health services, especially for people with disabilities relying on assistive devices.

## 10.2 ITU Journal: *ICT Discoveries*

November 2019 saw the publication of a new special issue of the ITU Journal on "[Propagation modelling for advanced future radio systems – Challenges for a congested radio spectrum](https://www.itu.int/en/journal/2019/001/Pages/default.aspx)". The next special issue of the ITU Journal will address "[The future of video and immersive media](https://www.itu.int/en/journal/2020/001/Pages/default.aspx)".

November 2019 saw the publication of a new special issue of the ITU Journal on [“Propagation modelling for advanced future radio systems – Challenges for a congested radio spectrum”](https://www.itu.int/en/journal/2019/001/Pages/default.aspx). The next special issue of the ITU Journal will address [“The future of video and immersive media”](https://www.itu.int/en/journal/2020/001/Pages/default.aspx).

ITU has also signed a co-publishing agreement with Tsinghua University Press Ltd. in support of a new joint publication, under the framework of the ITU Journal: *ICT Discoveries*, to be launched in the first quarter of 2020.

## 10.3 World Standards Cooperation and Academia

IEC, ISO and ITU organize academic events under the banner of the World Standards Cooperation to discuss the role played by academia in the standards-development process. See relevant [web page](https://www.itu.int/en/ITU-T/academia/Pages/default.aspx).

WSC Academic Days took place in China (2011), Indonesia (2012), France (2013), Canada (2014), Korea (2015), Germany (2016), the U.S. (2017) and Indonesia (2018). These events are held in conjunction with the annual International Cooperation for Education about Standardization (ICES) conferences.

WSC Academic Day 2019 was held in Belgrade, Serbia, 11 October 2019, hosted by the University of Belgrade. The central theme of WSC Academic Day 2019 was the economic, social and environmental benefits of International Standards.

# 11 Publications

Over 6,000 pages of ITU-T Recommendations and Supplements were published between September and mid-December 2019. Figure 4 illustrates the number of Recommendations (including Supplements) published per year since 2016, noting that 2019 covers only until mid-December.

All major editions of ITU-T Recommendations are now also being converted to the reflowable ePub format, and are published for free download alongside the usual PDF format. The ePub format allows users to read the Recommendations on devices of different screen sizes, and also to apply functions such as bookmarks, notes and highlights.

As approved by TSAG, most corrigenda and amendments to ITU-T Recommendations are now integrated into the main edition. The changes introduced by the amendment or corrigendum are still shown in revision marks.

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 4,000 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, time frame and SG, 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 2016**

# 12 Media and promotion

TSB maintains a consistent output of original ITU-T news content, coupled with a coordinated social media strategy led by the ITU General Secretariat.

TSB produces the most communications of any sector and these communications feature among the most popular ITU content each year. ITU-T news is published on the new [ITU News platform](http://news.itu.int/), a mobile-optimized platform which supports the incorporation of multimedia and improves search-engine results and sharing. A new ['Standards' category of ITU News](https://news.itu.int/category/standards/) focuses on the work of ITU-R and ITU-T.

TSB communications are systematically distributed using a variety of social media channels including Twitter, Facebook, LinkedIn, Weibo and YouTube. Infographics, animations and video form part of coordinated packages of TSB communications.

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, DFS and quantum information technologies are also proving popular with ITU-T's audience.

# 13 Services and tools

Electronic working methods offer crucial support to members engaged in ITU-T standardization work. TSB continues to develop new applications and services to maintain and expand ITU-T's advanced electronic working environment.

## 13.1 ITU-T databases

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

* [ITU-T Work Programme](http://www.itu.int/ITU-T/workprog)
* [ITU-T A.4, A.5 and A.6 recognized organizations](https://www.itu.int/en/ITU-T/extcoop/Pages/sdo.aspx)
* [ITU-T AAP](https://www.itu.int/ITU-T/aap/AAPSearch.aspx) & [TAP](https://www.itu.int/net/ITU-T/lists/t-approval.aspx)
* [ITU-T Recommendations](http://www.itu.int/itu-t/recommendations)
* [ITU-T Liaison Statements](http://www.itu.int/net/itu-t/ls/)
* [ITU-T Patents and Software Copyrights](http://www.itu.int/ipr/)
* [ITU Product Conformity Database](http://www.itu.int/net/itu-t/cdb/ConformityDB.aspx)
* [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 Terms & Definitions](http://www.itu.int/ITU-R/go/terminology-database)
* [International Numbering Resources](http://www.itu.int/ITU-T/inr/index.html) (See section 13.6 for more details)
* [ITS Communication Standards database](https://www.itu.int/net4/ITU-T/landscape#?topic=0.131&workgroup=1&searchValue=&page=1&sort=Revelance) (from CITS)
* [ICT standards landscape](https://www.itu.int/en/ITU-T/studygroups/com17/ict/Pages/default.aspx) (from SG17).

## 13.2 ITU-T MyWorkspace

[MyWorkspace](https://www.itu.int/net4/ITU-T/myworkspace/) is a set of mobile-friendly tools and services to facilitate the work of ITU-T experts. MyWorkspace responds to WTSA Resolution 32 on strengthening electronic working methods. The first version was released in 2017 and has since welcomed 1,600 users. The site receives visits from an average of 500 users per month.

The latest version, version 3.0, was released in the second quarter of 2019. Version 3.0 includes enhances the user interface and includes a new section for ITU-T events. MyWorkspace is accessible through a responsive website and new mobile application (Android & iOS). Secure access to MyWorkspace is enabled through ITU User Account (TIES) credentials.

The following services are available from the platform:

* ITU-T experts directory
* Chat service for real-time communication
* Meeting documents with the option to bookmark favourites
* Mailing list subscriptions
* Calendar of ITU-T events with filters by working group
* User profile management (CRM profiles) and additional preferences
* New applications included in 2019:
* Neural-net based machine translation prototype for documents in the six official languages (including formatting)
* Remote participation service frequently used by SGs, based on an open-source tool
* New ITU-T events service, fully integrated with CRM events and registered participants, including a ‘matchmaking’ feature to enhance delegate networking.

## 13.3 ITU search engine

The mobile-friendly [ITU search engine](https://www.itu.int/net4/ITU-T/search/Landing) facilitates access to ITU documents, websites, publications and other resources. 2018 saw the expansion of the tool from ITU-T resources to the resources of all ITU Sectors. An average of 15,000 searches take place each month.

The latest version of the search engine was released in December 2018. This latest version includes:

* Filters to narrow searches by Sector, type of document or language
* New collections available:
  + Meeting documents and websites from all ITU Sectors
  + Social media (ITU Facebook and Twitter accounts) and Multimedia (ITU Flickr and YouTube accounts)
* New section to search resolutions and decisions of ITU governing bodies
* Multilingual search, support any of the six official languages.

## 13.4 ITU-T services & tools announcements

A service announcements platform, <http://tsbtech.itu.int/>, keeps the ITU-T community up to date with the latest enhancements to the services and tools provided to ITU-T members.

## 13.5 Document Management System for Rapporteur Groups

The Microsoft SharePoint-based Document Management System for ITU-T Rapporteur Group Meetings (RGMs) has been used extensively by the majority of ITU-T SGs, notably SGs 2, 3, 9, 11, 13, 15, 16, 17 and TSAG. Feedback from Rapporteurs drives the continuous improvement of the RGM system.

Current and past RGM meetings can be accessed at <http://itu.int/go/itu-t/rgm>

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

A detailed online user guide for the RGM System, including video tutorials, is available at <http://itu.int/go/itu-t/rgm-guide>

The RGM system is one of several services available in the ITU-T SharePoint collaboration sites. These sites are restricted to ITU-T members and can be accessed using an ITU User Account (TIES).

## 13.6 International Numbering Resources (INRs)

A prototype of a new repository of national numbering plans has been developed and is available at: <https://www.itu.int/net4/itu-t/nnp>. The prototype responds to WTSA Resolution 91 (Hammamet, 2016) on "Enhancing access to an electronic repository of information on numbering plans published by the ITU Telecommunication Standardization Sector". Pursuant to the relevant ITU-T Recommendations, Member States are invited to provide 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.

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

Notifications of national numbering/identification plan updates and assignments or reclamations of national numbering/identification resources are 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 of the Union twice a month. Some 20 annexes are maintained on numbers and codes allocated in accordance with the following recommendations:

* 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".

ITU-T E.156 "Guidelines for ITU-T action on reported misuse of E.164 number resources" is under revision to include new cases of misuse and to investigate more efficient means of combating misuse.

Following the instruction of WTSA Resolution 20 (Rev. Hammamet, 2016), the TSB Director informed ITU Council 2019 of recently received reports of numbering resource misuse. TSB has been working in close collaboration with the experts of ITU-T SG2 in investigating the reported misuse of one particular ITU telephone number.

Member States are encouraged to contribute to the implementation of PP Resolution 190 (Busan, 2014) "Countering misappropriation and misuse of international telecommunication numbering resources", in particular "to continue to study ways and means to improve the understanding, identification and resolution of misappropriation and misuse of ITU-T E.164 telephone numbers through activities of ITU-T and ITU-D SGs" and "develop national legal and regulatory frameworks that are sufficient to ensure best practices in ITU-T E.164 telephone numbering management in order to counter telephone number misappropriation and 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)). ITU has been in the process of implementing these Decisions. Although progress is being achieved in implementing Council Decisions 600 and 601, further assistance from Member States is required either to identify the contact information of UIFN service providers and IIN assignees or ensure that invoices are paid on time. It was also observed that Council Decision 600 encouraged operators to update their list of active UIFNs and return the unused UIFNs to ITU, and that Council Decision 601 improves the precision of the IIN records kept in the ITU database. The following recommendation was approved by ITU Council 2019:

*The list of UIFN service providers in Annex A to Document C19/47 will be marked as "not reachable" in the ITU database. The records for these UIFN service providers are subject to removal from the ITU database and the UIFNs assigned to them are subject for reclamation based on confirmations/notifications from national Administrations/regulators as recommended by Council 2018. Among these UIFN service providers, for the ones to whom invoices for the maintenance fee for 2018 have been sent, the invoices will be cancelled.*

*If the invoices sent to the UIFN service providers in Annex B to Document C19/47 remain unpaid for an extended period, the secretariat will seek assistance from Member States to recover the debt.*

*National Administrations/regulators or authorized agencies are encouraged to provide assistance in identifying the up-to-date contact or status of the UIFN service providers (e.g., if they are no longer in business) listed in Annex C to Document C19/47.*

*The list of IINs for which contact information is pending will be published on ITU website as IINs with the status "assignee not reachable" and will be announced in the ITU Operational Bulletin. National Administrations/regulators or authorized agencies are encouraged to provide assistance in identifying their up-to-date status and/or contact information.*

*For the UIFNs and IINs which are still under consultation with national Administrations/regulators or authorized agencies, their status should be confirmed before 31 October 2019. If no objection is received from national Administrations/regulators or authorized agencies, the corresponding UIFNs and IINs will be considered as no longer active and removed from ITU databases.*

*UIFN service providers or IIN assignees with the status of ADMIN RELATED are not subject to the annual maintenance fee.*

## 13.7 ITU-T SharePoint collaboration sites

The ITU-T SharePoint collaboration sites enable participants in ITU-T working groups to conduct online discussions, work on projects, schedule meetings and manage and store documents in a secure shared environment.

The home of ITU-T SharePoint collaboration sites can be accessed at: <https://extranet.itu.int/sites/ITU-T/>.

A selection of notable collaboration sites are listed below:

* ITU-T SGs (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 ML5G - ITU-T Focus Group on Machine Learning for Future Networks including 5G (<https://extranet.itu.int/sites/itu-t/focusgroups/ML5G/>)
* FG NET-2030 – ITU-T Focus Group on Technologies for Network 2030 (<https://extranet.itu.int/sites/itu-t/focusgroups/net-2030/>)
* FG-AI4H - ITU-T Focus Group on AI for Health (<https://extranet.itu.int/sites/itu-t/focusgroups/ai4h/>)
* FG-VM - ITU-T Focus Group on Vehicular Multimedia  
  (<https://extranet.itu.int/sites/itu-t/focusgroups/vm/>)
* FG-AI4EE - Focus Group on Environmental Efficiency for AI and other Emerging Technologies  
  (<https://extranet.itu.int/sites/itu-t/focusgroups/ai4ee/>)
* FG QIT4N – ITU-T Focus Group on Quantum Information Technology for Networks (<https://extranet.itu.int/sites/itu-t/focusgroups/qit4n>)
* FG-AI4AD – ITU-T Focus Group on Autonomous and Assisted Driving (<https://extranet.itu.int/sites/itu-t/focusgroups/ai4ad>)
* JVDS - ITU-T SG16 & ISO TC22/SC31/WG8 Joint Project Team on Vehicle Domain Service (<https://extranet.itu.int/sites/itu-t/jointgroups/jvds/>)
* IRG-AVA - Intersector Rapporteur Group on Audiovisual Media Accessibility (<https://extranet.itu.int/sites/irg/ava/>)
* CASC - ITU-T Conformity Assessment Steering Committee  
  (<https://extranet.itu.int/sites/itu-t/studygroups/2017-2020/sg11/casc/>)

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

Most of the collaboration sites are restricted to ITU-T members, accessed using an ITU User Account (TIES). Certain collaboration sites are open to non-members, accessed using non-member ITU User Accounts.

## 13.8 Meeting Documents Sync Application

This application enables meeting participants to synchronize documents of ongoing ITU-T SG meetings from the ITU server to their local drive. The application is constantly enhanced and updated following feedback and suggestions from users.

## 13.9 Electronic meetings

TSB continues to improve electronic meeting facilities offered to ITU-T members. 2019 saw the introduction of a new tool for ITU-T electronic meetings with the aim of providing a consistent, efficient service to the ITU-T community. This tool is now being used for all ITU-T statutory meetings. Adobe Connect will continue to be used for multilingual sessions. GoToMeeting and Zoom are used for non-statutory, 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

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

The Standardization Committee for Vocabulary (SCV), composed of ITU-T members expert in all the official languages, serves as focal point to ITU-T SGs in terminology-related matters. SCV guides the adoption of terms and definitions in ITU-T Recommendations in accordance with WTSA Resolution 67.

TSB continues to collect all new terms and definitions proposed by ITU-T SGs, entering them into 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.

TSB also translated 22 AAP Recommendations between January and November 2019, in accordance with requests received from ITU-T SGs and linguistic groups.

## 13.11 Workshops and symposia

ITU workshops and symposia discuss emerging trends in standardization, increase the visibility of ITU-T work, enhance ITU-T collaboration with other bodies, attract and recruit new ITU-T members, and encourage peer-learning relevant to the development and implementation of international standards.

The following ITU workshops and symposia, arranged by venue, were organized by TSB from September to December 2019:

**ITU Headquarters, Geneva:**

* [FIGI Security Clinic: Securing the infrastructure and applications for digital financial services](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/201912/Pages/default.aspx), 4-5 December 2019
* [ITU Workshop on “Data Processing and Management for IoT and Smart Cities & Communities”](https://www.itu.int/en/ITU-T/climatechange/dpm/05/Pages/default.aspx), 25 November 2019.
* ITU Brainstorming Session on “SS7 Vulnerabilities and the Impact on Different Industries including Digital Financial Services”, 22 October 2019.
* [ITU Workshop on “Network 2030](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/2019101416/Pages/default.aspx)”, 14-16 October 2019.
* [ITU Workshop on “The Future of Media”](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/20191008/Pages/default.aspx), 8 October 2019.

**Rest of Europe (see above for Geneva):**

* [Forum on “Environmental Efficiency for AI and other Emerging Technologies”](https://www.itu.int/en/ITU-T/climatechange/Pages/20191014-forum.aspx), Vienna, Austria, 11 December 2019.
* [**Meeting of the Thematic Group on the United for Smart Sustainable City Index**](https://www.itu.int/en/ITU-T/climatechange/Pages/20191014-meeting.aspx), Vienna, Austria, 13 December 2019.
* [ITU Workshop on "Machine Learning for 5G and Beyond"](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/201911/Pages/default.aspx), Berlin, Germany, 5 November 2019.
* [9th Green Standards Week](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/gsw/201910/Pages/default.aspx), Valencia, Spain, 1-4 October 2019.
* [ITU Workshop on “The Future of Vehicular Multimedia](https://www.itu.int/en/ITU-T/focusgroups/vm/Pages/11-9_wsp.aspx)”, Budapest, Hungary, 11 September 2019.
* [ITU Workshop on "The Turing Test for Autonomous Driving - A Global Performance Standard for AI on our Roads"](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/092019/Pages/default.aspx), Budapest, Hungary, 10 September 2019.

**Africa:**

* [ITU-T SG 11 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/201909/Pages/default.aspx), Tunis, Tunisia, 30 September 2019.
* [Session on “Smart Sustainable Cities and Communities”](https://www.itu.int/en/ITU-T/climatechange/Pages/201909.aspx), Addis Ababa, Ethiopia, 5 September 2019.
* [ITU/WHO Workshop on “AI for Health”](https://itu.int/en/ITU-T/Workshops-and-Seminars/ai4h/201909), Zanzibar, Tanzania, 2 September 2019.

**Asia and the Pacific:**

* [ITU/WHO Workshop on “AI for Health](https://itu.int/en/ITU-T/Workshops-and-Seminars/ai4h/201911)”, New Delhi, India, 12 November 2019.
* [ITU Regional Standardization Forum on “Addressing Competition Issues in ICT Economy”](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/bsg/201910/Pages/default.aspx), Colombo, Sri Lanka, 1 October 2019.
* [ITU Workshop on “The Future of Cable TV for Asia & Pacific”](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/20190903/Pages/default.aspx) , Guangzhou, China, 3 September 2019.

**Arab States**:

* [Inter-Regional Standardization Forum on "Operational issues on numbering, emergency service and OTTs"](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/201910/Pages/default.aspx), Dubai, UAE, 22 October 2019.

**Americas:**

* [Kaleidoscope 2019: “ICT for Health: Networks, Standards and Innovation](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2019/Pages/default.aspx)”, Atlanta, U.S., 4-6 December 2019,.
* World Cities Day: Session on "Smart and sustainable cities: Changing the world: innovations and better life for future generations", UN Headquarters, New York, U.S., 31 October 2019.

# 14 Implementation of WTSA Resolutions and A-series ITU-T Recommendations

WTSA Resolution 22 instructs the TSB Director to report to TSAG on the implementation of WTSA resolutions and actions to be undertaken pursuant to their operative paragraphs. WTSA Resolution 22 also instructs the TSB Director to report to TSAG on the implementation of the A-series ITU-T Recommendations.

WTSA Resolutions are available at <http://www.itu.int/pub/T-RES>.

The updated WTSA-16 Action Plan ([TSAG TD657](https://www.itu.int/md/T17-TSAG-200210-TD-GEN-0657)) assigns action items to the operational provisions in the Resolutions and also reports information on the progress of the implementation of those action items.

At the September 2019 TSAG meeting, TSAG approved revisions of ITU-T A.1, A.5, A.13 and A.25. A-series ITU-T Recommendations are available at <https://itu.int/rec/T-REC-A>.

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

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

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.

TSB continues to map ITU-T objectives, outputs and results to the SDG goals and targets and the WSIS Action Lines.

# 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.9701 (2019) Amd.1 "Fast access to subscriber terminals (G.fast) – Physical layer specification – Amendment 1"**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14019) includes enhancements to DTA functionality.

**ITU-T G.9710 "Multi-gigabit fast access to subscriber terminals (MGfast) – Power spectral density specification"** **(under approval)** specifies power spectral density (PSD) mask requirements for Multi-gigabit fast access to subscriber terminals (MGfast), a set of tools to support reduction of the transmit PSD mask, and a methodology for transmit PSD verification. It supports operation over both twisted pair and coaxial cable media.

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

I.1.3 Optical fibres

[**ITU-T G.9804.1 "Higher Speed Passive Optical Networks: Requirements**"](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14024) serves as a guide to the development of higher speed PON systems, by identifying sets of applications that can be addressed by a particular system, and defining the requirements for each of those systems. It is anticipated that there may have several distinct systems, such as higher speed single channel (TDMA-PON), higher speed multi-channel (TWDM-PON), and higher speed point to point overlay PONs.

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

I.1.5 Optical transmission systems

[**ITU-T G.798 (2017) Amd.2 "Characteristics of optical transport network hierarchy equipment functional blocks - Amendment 2"**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=1399)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.

Amendment 1 contains text modifications and additions for:

– moving the ODUkP to Ethernet MAC layer and Ethernet Reconciliation sublayer adaptation functions from ITU-T G.8021 to ITU-T G.798.

– supporting the adaptation of ODUkP to Ethernet Coding sublayer for 25 Gb/s, 200 Gb/s and 400 Gb/s Ethernet signals.

– alignment with ITU-T G.8023.

– replacing Appendix VIII to align with ITU-T G.872 and ITU-T G.873.1

Amendment 2 contains text modifications and additions for:

– OTSi to OTU4 adaptation function with SC-FEC.

– OTSi to FlexO-1-SC adaptation function.

– alignment with ITU-T G.709.1.

**ITU-T G.807 "Generic functional architecture of the optical media network" (under approval)** describes the generic functional architecture of the optical media network that supports the propagation of signals in the context of a transport network. This description is independent of the client digital information that is being carried by a signal in the media network.

[**ITU-T G.872 (revised) "Architecture of optical transport networks (OTN)"**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=13086)describes the functional architecture of the optical transport network (OTN) using the modelling methodology described in Recommendations ITU-T G.800, ITU-T G.805 and ITU-T G.807. The OTN functionality is described from a network level viewpoint, taking into account, the characteristic information of clients of OTN, client/server layer associations, networking topology, layer network functionality and optical media network structure, that provide multiplexing, routing and supervision of digital clients. The media portion of the network is described in terms of media constructs, media elements and optical signal maintenance entities.

I.1.6 Transport network control aspects

I.1.7 Ethernet over transport networks

I.1.8 MPLS over transport networks

I.1.9 Synchronization and timing

I.1.10 Cable

[**ITU-T J.1600 "Premium Cable Network Platform (PCNP) – Framework"**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=13977) specifies the framework of the Premium Cable Network Platform (PCNP) for the cable TV and broadband network that exploit the cloud based artificial intelligence and network data to optimize the network and TV services, thus enable the high satisfaction of user's experience of perceptual aspects of services.

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

[**ITU-T H.644.2 “Virtual content delivery network: Network virtualization”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14111) specifies the functional architecture, its related functions and functional blocks that implement content delivery network (CDN) virtualization by utilizing the networking virtualization technologies. Based on the functional architecture and functions, this Recommendation also introduces the various technical solutions of the CDN nodes virtualization utilizing the current network virtualization technologies, such as network function virtualization and software-defined networks. With this Recommendation, a CDN service provider and manufacturer have the opportunity to build their CDN nodes and the related services based on a common virtualized infrastructure, which could extend the delivery service with the lower investments. The quality of multimedia service which is relied on the VCDN solutions will be improved as well.

[**ITU-T X.609.8 “Managed P2P communications: Management protocol for live data sources”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14147) describes the management protocol for live data sources in MP2P communications which is an overlay protocol runs in application layer to manage a live data from multiple data source. The examples of live data generated from data source include a live sensor data, a live CCTV stream and they can be applicable to disaster recovery, autonomous vehicle, etc. This Recommendation specifies the identification, functions and the procedures of the data sources involved.

[**ITU-T Y.2244 “Service model for the Cultivation Plan Service at the pre-production stage”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14126)**:** The Cultivation Plan Service at the pre-production stage is critical in that it supports agricultural producers’ decision by providing related information such as predicted crop production or expected profits for consulting or other agricultural information when they plan to cultivate. A service model is required to derive necessary service features that support these missions. Therefore, the service model for the Cultivation Plan Service including reference architecture, service requirements, and related capabilities is described in this Recommendation.

[**ITU-T Y.2324 “Functional architecture of orchestration in NGNe”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14127)**:** The orchestration in NGNe is of great significance for next generation network evolution, because it takes the coexistence and corporation of traditional network such as NGN and SDN/NFV enabled network into consideration. This draft Recommendation provides the general functional architecture of the orchestration in NGNe, specifies its functional entities and defines the functionalities of these functional entities, and provides descriptions of all reference points of orchestration in NGNe.

[**ITU-T Y.2342 “Scenarios and Capability Requirements of Blockchain in Next Generation Network Evolution”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14128) presents an analysis of the motivations and scenarios of blockchain used in the Next Generation Network Evolution (NGNe). The general high-level requirements of blockchain in NGNe are put forward. Detailed descriptions of the use cases are listed in the appendix. This Recommendation provides the framework of the blockchain for NGNe and specifies the capability requirements that meet the needs of Next Generation Network (NGN) and the blockchain framework. The framework provided in this Recommendation is intended for NGNe as defined in Recommendation ITU-T Y.2340, however, it could be applied as appropriate to other types of telecom networks (e.g. IMT-2020 and Future Network).

I.2.3 IMT-2020/5G networks

[**ITU-T Y.3108 “Capability exposure function in the IMT-2020 networks”**](file:///C:\Users\almnini\AppData\Local\Microsoft\Windows\INetCache\Content.Outlook\PMNYBMTV\Y.3108)specifies design principles, architecture and reference points of the capability exposure function (CEF) in the IMT-2020 networks. Exposed capabilities brought by network softwarization and the architecture of IMT-2020 and functionalities that support the capability exposure of IMT-2020 are specified in the Recommendation.”

[**ITU-T Y.3132 “Mobility management for fixed mobile convergence in IMT-2020 networks”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14130) presents the scenarios, requirements and design principles of mobility management (MM) for fixed mobile convergence (FMC) in IMT-2020 networks, which supports the network evolution and accommodates convergent services in fixed and mobile networks. This Recommendation presents the mobility management functional architecture for supporting FMC in IMT-2020 networks and information flows of location management, handover control and coordination management in IMT-2020 networks.

[**ITU-T Y.3133 “Capability Exposure enhancement for supporting FMC in IMT-2020 networks”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14131) describes the requirements of the capability exposure for supporting FMC in IMT-2020 networks, then defines the functional architecture, the function entities, the procedures and the high level API descriptions for network capabilities exposure for supporting FMC in IMT-2020 networks. In particular, the enhancement capabilities requirements include: unified authentication, authorization and charging, user’s access type and capability, multi-access edge computing, unified customization of QoS capabilities, FMC network slice control, session management and mobility management, unified user data.

[**ITU-T Y.3153 “Network slice orchestration and management for providing network services to 3rd party in the IMT-2020 network”**](file:///C:\Users\almnini\AppData\Local\Microsoft\Windows\INetCache\Content.Outlook\PMNYBMTV\Y.3153): The IMT-2020 network in which embedded a capability exposure functionality enables 3rd party to directly use a customised network slice under certain a restriction in order to efficiently provide optimized solutions for different market scenarios which have diverse their own requirements. Automated processes for orchestration and management is also important from the perspective of efficiency. The objective of this Recommendation is to describe the requirements, architecture, key functionalities and typical procedures of network slice orchestration and management for providing network services to 3rd party in the IMT-2020 network.

**ITU-T Y.3173 “Framework for evaluating intelligence level of future networks including IMT-2020” (under approval)** specifies a framework for evaluating intelligence of future networks including IMT-2020. A method for evaluating intelligence level of future networks including IMT-2020 is introduced. An architecture view for evaluating network intelligence level is also described according to the architectural framework specified in [ITU-T Y.3172]. In addition, the relationship between the framework described in this Recommendation and corresponding work in other standards or industry bodies, as well as the application of the method for evaluating network intelligence level on several representative use cases are also provided.

**ITU-T Y.3174 “Framework for data handling to enable machine learning in future networks including IMT-2020”** **(under approval)**: A framework for data handling to enable machine learning in future networks including IMT-2020 is described in this Recommendation. The requirements for data collection and processing mechanisms in various usage scenarios for machine learning in future networks including IMT-2020 are identified along with the requirements for applying machine learning output in the machine learning underlay network. Based on this, a generic framework for data handling and examples of its realization on specific underlying networks are described.

[**ITU-T Y.Suppl.55 to ITU-T Y.3170-series “Machine learning in future networks including IMT-2020: use cases”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14100) describes the use cases of machine learning in future networks including IMT-2020. For each use case description, along with the benefits of the use case, the most relevant possible requirements related to the use case are provided. Classification of the use cases into categories is also provided.

I.2.4 Home networking

**ITU-T G.9960 (2018) Amd.1 "Unified high-speed wire-line based home networking transceivers - System architecture and physical layer specification: Amendment 1" (under approval)** belongs to the family of ITU-T G.996x Recommendations. Recommendation ITU-T G.9960 specifies the system architecture and physical (PHY) layer for wireline-based home networking transceivers which are capable of operating over premises' wiring, including inside telephone wiring, coaxial cable, and power-line wiring. It complements the data link layer (DLL) specification in Recommendation ITU-T G.9961, and the power spectral density (PSD) specification in Recommendation ITU-T G.9964. Amendment 1 includes the extension of the Recommendation to operate on an extended bandwidth over coaxial and phoneline mediums.

**ITU-T G.9961 (2018) Amd.1 "Unified high-speed wireline-based home networking transceivers – Data link layer specification: Amendment 1" (under approval)** belongs to the family of ITU-T G.996x Recommendations. Recommendation ITU-T G.9961 specifies the data link layer (DLL) for wireline-based home networking transceivers capable of operating over premises wiring including inside telephone wiring, coaxial cable, and power-line wiring. It complements the system architecture and physical (PHY) layer specification in Recommendation ITU-T G.9960, and the power spectral density (PSD) specification in Recommendation ITU-T G.9964. Amendment 1 includes a new physical layer specification. This new physical layer provides new modulation mechanisms (e.g. Multi Level Coding) and Robust Communication Mode (RCM) and allows the system to be operated over an extended bandwidth for coaxial and phoneline mediums.

I.2.5 Smart Grid

I.2.6 Software-defined networking

I.2.7 Cloud computing

[**ITU-T Y.3509 “Cloud computing - Functional architecture for data storage federation”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14135)specifies the DSF functions based on DSF logical components identified in [ITU-T Y.3505], the DSF functional architecture and its reference points. This Recommendation also provides relationships between the DSF functional architecture and the cloud computing reference architecture defined in [ITU-T Y.3502].

[**ITU-T Y.3524 “Cloud computing maturity requirements and framework”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14136) provides functional framework and requirements for cloud computing maturity. It introduces the overview of cloud computing maturity and identifies the cloud computing maturity model including cloud customer management module, cloud resource management module, cloud service management module and cloud security management module. Additionally, this Recommendation provides cloud computing maturity requirements derived from use cases.

I.2.8 Big data

[**ITU-T Y.3603 “Big data – Requirements and conceptual model of metadata for data catalogue”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14137)describes general concept of metadata and its utilization in a big data ecosystem. Also, this Recommendation provides requirements and a conceptual model of metadata for data catalogue as well as the XML schema of metadata as an example. This metadata supports finding data easier, and is used for exchange, preservation, integration, and provenance of data in a big data ecosystem.

**ITU-T Y.3604 “Big data – Overview and requirements for data preservation”** **(under approval)** provides the overview of big data preservation and its requirements which are derived from the corresponding use cases. It addresses the subjects of overview of big data preservation, functional requirements of big data preservation as well as use cases of big data preservation.

I.2.9 Network Management

**ITU-T M.3041 “Framework of smart operation, management and maintenance”** **(under approval)** introduces framework of smart operation, management and maintenance (SOMM). In this Recommendation, characteristics, scenarios and the functional architecture of SOMM are provided to support service operation, network management, and infrastructure maintenance for both traditional non-SDN/NFV and SDN/NFV aware networks. This Recommendation also describes the relationship of the functional architecture of SOMM with logical layered architecture (LLA) of telecommunications management network (TMN).

**ITU-T M.3362 “Requirements for Telecommunication anti-Fraud Management in the TMN”** **(under approval)** describes the requirements for Telecommunication anti-Fraud Management in the TMN, the functional framework for combating telecommunication fraud management and the functional description. The requirements for telecommunication anti-fraud management include fraud detection management, fraud monitoring management, fraud mitigation management and fraud information sharing management. This Recommendation also describes telecommunication fraud scenarios including nuisance calls and spoofing calls.

**ITU-T M.3363 “Requirements for data management in the TMN”** **(under approval)** describes the requirements for data management in the TMN, the functional framework for data management and the functional description. The data refers to the different categories of telecommunication data in BSS and OSS. The requirements for data management include metadata management, data lifecycle management, data quality management, data security management, data configuration management, data service management.

**ITU-T M.3364 “Requirements for on-site telecommunication smart maintenance management function”** **(under approval)** introduces requirements for on-site telecommunication smart maintenance management function. In this Recommendation, the requirements for telecommunication smart maintenance function are provided, which include on-site patrol, on-site overhaul, on-site troubleshooting, evaluation of maintenance work, management of maintenance knowledge base, management of service activation function, management of network resource, management of SMAT. This Recommendation also provides use cases of SMAT in TSMS.

I.3.1 Video and image coding

[**ITU-T H.222.0 (2019) Amd.1 “Information technology - Generic coding of moving pictures and associated audio information: Systems: Carriage of JPEG XS in MPEG-2 TS”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14105)adds support for the carriage of data encoded according to ISO/IEC 21122-1, also known as JPEG XS, to Rec. ITU-T H.222.0 (08/2018) | ISO/IEC 13818-1:2019.

[**ITU-T H.265 (V7) (revised) “High efficiency video coding”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14107): This revision adds additional SEI messages for fisheye video information and annotated regions, and also includes corrections to various minor defects in the prior content of the Specification. 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 a not-yet-published edition of ISO/IEC 23008-2.

I.3.2 Intelligent, interoperable visual surveillance systems

I.3.3 IPTV and digital signage

[**ITU-T H.753 “Scene-based metadata for IPTV services”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14112)**:** Scene-based metadata (SBM) for IPTV services defines the metadata element and format for content distribution over an IPTV terminal device and describes metadata management functions of SBM, which basically supports IPTV multimedia application frameworks in the Recommendation ITU-T H.760 series. This enables various content providers and distribution platforms to use standardized metadata during the process of content distribution and service provision. Therefore, this can maximize metadata generation and distribution efficacy through avoiding unnecessary data conversion and duplication. Moreover, intelligent and personalized smart broadcast service can be generated in convenience with using the metadata. In addition, this standard can be used by not only terrestrial broadcasting service provider and CATV/IPTV broadcasting service provider, but also third-party media providers and end users. As well, this standard can provide smart media application eco-system by applying media commerce, advertisement, education, etc. Scene-based metadata is based on ITU-T IPTV functional architecture and terminal devices defined in the ITU-T H.720-series and service defined in the Recommendation ITU-T H.750. This Recommendation also describes the Web-based functions for scene-based metadata service and the scene-based service workflow.

[**ITU-T H.764 (V2) (revised) “IPTV services enhanced script language”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14124)describes an object-oriented programming language called "Internet protocol television services enhanced script language (IPTV SESL)" as one of multimedia application frameworks for web-based IPTV services. This language is used to perform computations and provide interoperability among multimedia applications within an IPTV terminal device environment. IPTV SESL is classified into "Core script profile" and "Extended script profile" in this Recommendation. The core script profile describes a subset of objects defined in LIME-Script of Recommendation ITU-T H.762. The extended script profile defines the additional objects to perform video and interactivity related computations. This Recommendation describes the requirements of properties, functions and methods of IPTV SESL to be supported by these two profiles. This revision corrects or clarifies the definitions of some properties and methods in extended script profile and makes some editorial modifications.

I.3.4 Immersive live experience

[**ITU-T H.430.4 “Service configuration, media transport protocols, signalling information of MMT for Immersive Live Experience (ILE) systems”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14108)**:** ILE services are realized by several types of information such as video, audio, lighting and stage effects, and the information should be transferred synchronously from source site to viewing sites. This document identifies service configuration, system structure, media transport protocol and signalling information for Immersive Live Experience (ILE) systems using ISO/IEC 23008-1 (MPEG Media Transport). This specifies constrains to ISO/IEC 23008-1 for ILE systems.

[**ITU-T H.626 (V2) (revised) “Architectural requirements for video surveillance system”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14109)**:** The video surveillance system has the functions of display and storage of the multimedia (such as video, audio and image) captured by multiple remote cameras over an IP network for multiple users, as well as remote control, alarm and linkage actions, recording and playback. Recommendation ITU-T H.626V2 defines the functional architecture for video surveillance system based on IP networks. This Recommendation defines the model, architecture, entities and reference points of the video surveillance system. This Recommendation also defines the hierarchy model for deployment and the interworking between the video surveillance systems and other multimedia systems. This revision updates the title, deletes requirements and service flows, revises the architecture and reference points according to the latest development and changes.

[**ITU-T H.629.1 “Scenarios, framework and metadata for digitalized artwork images display system”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14110) identifies the typical application scenarios (e.g., museum, art gallery, home, etc.) of digitalized artwork images display system; it identifies metadata for the content provider, the display terminal and the digital artworks in the digitalized artwork images display system; it identifies the specifications of electro-optical for the display terminal in the digitalized artwork images display system; and it provides the measurement methods and evaluation guidance for the electro-optical parameters.

I.3.5 Standards to assess quality of video communications and applications

[**ITU-T G.1033 “QoS and QoE aspects of digital financial services”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14065)highlights important aspects related to Quality of Service (QoS) and Quality of Experience (QoE) which shall be considered in the context of Digital Financial Services (DFS). It builds upon the discussions in the (now closed) ITU-T Focus Group Digital Financial Services. The continuation of work on QoS and QoE aspects is undertaken by the Financial Inclusion Global Initiative (FIGI).

I.3.6 New services and applications

[**ITU-T F.740.1 “Requirements for an information service of objects in museums”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14101) describes the requirements for an information service of objects in museums (ISOM) and the capabilities of key components of this information service. This information service can improve museum users' experience by collecting information about the exhibits and other related information from different parties and showing all the information in appropriate ways.

[**ITU-T F.743 (revised, V2) “Requirements and service description for video surveillance”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14102) defines a video surveillance service based on IP networks. The video surveillance service provides the display and storage of the video captured by multiple remote cameras over an IP network for multiple users. It also provides other functionalities such as remote control and alarming. This Recommendation provides the service description, a brief system model, service scenarios and requirements for the video surveillance service. The requirements for the video surveillance service are derived from the scenarios of different applications that a video surveillance service can support. Therefore, the service requirements meet the needs of different kinds of users and enable interoperability among video surveillance systems of different telecom operators and units of different vendors. This revision updates the title of this Recommendation, some technical content descriptions, and video surveillance system requirements in clause 8.

[**ITU-T F.743.10 “Requirements for mobile edge computing enabled content delivery networks”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14103) specifies the general framework, scenarios and requirements of the mobile edge computing (MEC) enabled content delivery network (CDN). It is also specified the requirements of the MEC functions on which the CDN edge node is relied. The deployment of CDN edge node with MEC system is described in the general framework. Several user cases are introduced in this Recommendation to illustrate the usage of the MEC enabled CDN. This Recommendation provides a new solution to enhance the current CDN service by adopting the MEC technology. MEC enabled CDN, consisting of conventional CDN and mobile edge CDN, is an effective way to reduce latency to improve user experience and save bandwidth for backbone network. In addition, deployment and maintenance costs are reduced.

[**ITU-T F.749.11 “Requirements of civilian unmanned aerial vehicles enabled mobile edge computing”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14104)**:** Civilian unmanned aerial vehicles (CUAV) enabled mobile edge computing (MEC) utilizes CUAV as mobile edge computing platform to realize a flexible, efficient and on-demand computing service which can be rapidly deployed and move according to the practical service needs of devices. This Recommendation describes the framework and specifies the requirements of CUAV-MEC system, including functional requirements, service requirements and security requirements. This Recommendation also provides a comprehensive framework of the MEC service through CUAV. CUAV-MEC can provide fast, dynamic, effective edge service for devices in hotspot and disaster scenarios, etc. Benefitting from the characteristics of flexible accessibility and on-demand services, CUAV-MEC can reduce the computation delay and improve service quality.

I.4.1 Internet of Things and Smart City

[**ITU-T Y.4208 “IoT requirements for support of edge computing”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14162&lang=en)**:** Some of the capabilities offered by the IoT, e.g., capabilities for computing, storage and analytics, are evolving in closer proximity to the IoT data sources. This Recommendation provides an overview on related challenges faced by the IoT and describes how the IoT supporting edge computing may address these challenges. From the edge computing deployment perspective, service requirements for support of edge computing capabilities in the IoT are identified as well as related functional requirements. As example, scenarios of edge computing deployment in different application domains, edge computing scenarios for Vehicle-to-Everything and for smart manufacturing are provided in Appendix I.

**ITU-T Y.4209 “Requirements for interoperation of the smart port with the smart city” (under approval)** provides the requirements for Smart Port interoperation with Smart Cities and other smart elements. Additionally, these requirements are the foundation that enables the provision of enhanced smart services by the Smart Port (which may also benefit Smart Cities), also described in this Recommendation.

[**ITU-T Y.4459 "Digital entity architecture for IoT interoperability"**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=13861) introduces the digital entity architecture and its prospective in addressing interoperability and security among IoT applications.

This Recommendation defines an architecture framework for information-oriented services that makes use of existing infrastructures, including the Internet infrastructure, to enhance secure and managed information sharing over a distributed networking environment. It defines an architecture framework for information management based on the use of digital entity, and a common set of secure services that will help the registration, discovery, resolution, and dissemination of such digital entities. The set of services is designed to facilitate sharing across any storage boundaries, any heterogeneous application boundaries, and any organization boundaries.

Digital entity architecture defines a minimum set of needed architectural components, and services to provide a generic information and service interoperability. It will facilitate the interoperability of identification, description, representation, access, storage and security of IoT devices. This architecture framework encourages a common security and management interface across different IoT applications.

Under a digital entity architecture, information represented in digital form is structured as digital entity, each of which has an associated unique persistent identifier. However, metadata contained in the digital entities (e.g. location of the object) could be updated without changing its identifier.

The identifier allows the digital entities to be identified and discovered, regardless where they are located or stored. Digital entities are not confined within any particular application boundary and may be moved from host to host, accessed from application to application, shared from organization to organization, without losing its ownership or management control, in order to enhance interoperability. The digital entity’s data model allows ownership and access control information to be defined by data owners independently of any specific applications.

This Recommendation can be used with different identification and addressing protocols (e.g. IP and/or non IP based networks).

**ITU-T Y.4461 “Framework of open data in smart cities” (under approval)** defines a framework of open data in smart cities. It clarifies the concept of open data in smart cities, analyses the benefits of open data in smart cities, identifies the key phases, key roles and activities of open data in smart cities and describes the framework and general requirements of open data in smart cities. The use cases are also provided in an informative appendix.

[**ITU-T Y.4462 “Requirements and functional architecture of open IoT identity correlation service”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14165)**:** Open IoT identity correlation service, or open IoT ICS, is a service to map identities among devices, third party services, and transactions. Recommendation ITU-T Y.IoT-ics specifies the reference architecture of open IoT ICS which supports Internet of things (IoT) devices to access multiple third party service providers. This Recommendation clarifies the concept of the open IoT ICS, identifies its basic capabilities, common requirements and also provides the reference architecture and relevant high-level common procedures for open IoT ICS.

[**ITU-T Y.4463 “Framework of delegation service for IoT devices”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14166) is a framework of the delegation service for transferring ownership (i.e., access rights to the IoT devices) among authorized IoT devices. This Recommendation describes overview and types of the delegation service in IoT environment. It also describes the requirements and architectural models of the delegation service.

[**ITU-T Y.4464 “Framework of blockchain of things as decentralized service platform”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14167)introduces a decentralized IoT service platform, blockchain of things (BoT), which is enabled by blockchain-related technologies. This Recommendation analyses the concept, common characteristics and high-level requirements of BoT, and provides common capabilities and functionalities, general procedures, and relevant use cases for BoT. BoT, works in a decentralized service mode and is capable of enhancing many aspects of IoT. It has the advantages of blockchain-related technologies, especially for building decentralized data storage and management, crowding decision-making and automatic interactions.

[**ITU-T Y.4465 “Framework of IoT Services based on Visible Light Communications”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14168)describes a framework of Internet-of-Things (IoT) services based on Visible Light Communications (VLC). After describing the technical overview of VLC and the concepts of IoT services based on VLC, this Recommendation describes requirements and a reference model.

[**ITU-T Y.4466 “Framework of smart greenhouse service”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14169)**:** A smart greenhouse service enables precision farming with help of IoT devices (such as sensors and actuators) installed in a smart greenhouse. A smart greenhouse service collects information about both environment and crop-growth status, and then analyses the information to produce an optimal growth model for each crop. With the optimal growth model, a smart greenhouse service can maximize agricultural productivity and improve crop quality. In addition, it can enhance user convenience. To describe a smart greenhouse service framework, this Recommendation specifies requirements, a reference model, a functional architecture and interfaces for a smart greenhouse service.

[**ITU-T Y.4467 “Minimum set of data structure for automotive emergency response system”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14170)**:** An automotive emergency response system (AERS) for aftermarket devices defined in the Recommendation ITU-T Y.4119 is designed to bring rapid assistance to driver and/or passengers involved in accidents. For a normal operation purpose of the AERS, an accident related data (so-called minimum set of data, MSD) needs to be sent from an automotive emergency detection device (AEDD) to an automotive emergency response center (AERC). An MSD includes mandatory information and optional information. Mandatory information of an MSD is a set of information that shall be included in an MSD when an AEDD performs normal operation. Optional information of an MSD is a set of information on an accident that can be additionally included to give more information to AERC. This Recommendation specifies an MSD structure and encoding rule for an AERS.

[**ITU-T Y.4468 “Minimum set of data transfer protocol for automotive emergency response system”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14171)**:** An automotive emergency response system (AERS) for aftermarket devices defined in the Recommendation ITU-T Y.4119 is designed to bring rapid assistance to driver and/or passengers involved in accidents. For a normal operation purpose of the AERS, an accident related data (so-called minimum set of data, MSD) needs to be sent from an automotive emergency detection device (AEDD) to an automotive emergency response center (AERC). This Recommendation specifies an MSD transfer protocol to provide the rules of an MSD transfer operations between an AEDD and an AERC in an AERS.

[**ITU-T Y.4556 "Requirements and functional architecture of smart residential community"**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=13863) presents the key components and specifies requirements and the functional architecture of smart residential community (SRC).

[**ITU-T Y.4807 “Agility by design for Telecommunications/ICT Systems Security used in the Internet of Things”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14172) addresses possible improvement of security and stability of the Internet of Things by ensuring the supporting Telecommunications/ICT systems and related infrastructure — protocols, standards, etc. — have the flexibility to keep up with advances in Telecommunications/ICT security and cryptography. This document intentionally does not provide guidance on specific cryptosystems, standards or algorithms.

**ITU-T Y.4903/L.1603 (revised) “Key performance indicators for smart sustainable cities to assess the achievement of sustainable development goals” (under approval)** gives general guidance to cities and provides key performance indicators (KPIs) for smart sustainable cities (SSCs) to help cities achieve sustainable development goals (SDGs). This document provides the most effective means to benchmarking and disseminating best practices in utilizing ICTs and other technologies to enhance cities’ sustainability and connect their smart strategies to the SDGs through an inclusive process. These KPIs are designed to evaluate the role and performance of Information Communication Technologies (ICTs) in the three key dimensions of a city: Economics, Environment, and Society and Culture. The Indicators are uniquely coordinated to allow cities to measure their progress on reaching the ambitious targets set by the SDGs.

[**ITU-T Y.4904 "Smart sustainable cities maturity model"**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=13864) contains a maturity model for smart sustainable cities. This maturity model helps identify the goals, levels and key measures that are recommended for cities to effectively examine their current situation and determine critical capabilities needed to progress toward the long-term goal of becoming SSCs.

[**ITU-T Y.Suppl.56 “Use cases of smart cities and communities”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14174)provides a set of use cases related to Smart Cities and Communities (SC&C). The SC&C use cases described in this Supplement are in pilot or commercial phase. The use case collection is expected to provide useful information for the definition of common requirements of SC&C and for other future studies on SC&C. It is also expected this information will benefit the study of the relationship between city scales and SC&C solutions, and will provide examples of the social and economic benefits. The use cases in this Supplement may also help to plan the deployment of similar smart city solutions in other cities.

[**ITU-T Y.Suppl.57 to ITU-T Y.4409 “Implementation Guidelines to Recommendation ITU-T Y.4409”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14175)provides the implementation guidelines to [ITU-T Y.4409]. This Supplement describes implementation based on the functional architecture for the home energy management system (HEMS) and home network services specified in [ITU-T Y.4409] with regards to the information models for the devices connected to the home network, the communications protocols and the management for the home network. This Supplement also describes implementation of connecting devices with corresponding information models.

[**ITU-T Y.Supp.58 “Internet of Things and smart cities and communities standards roadmap”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14176) presents the Joint Coordination Activity on Internet of Things and Smart Cities and Communities (JCA-IoT and SC&C) roadmap which contains a collection of standards and ITU-T Recommendations related to Internet of Things (IoT), smart cities and communities (SC&C), network aspects of identification systems, including RFID (NID) and ubiquitous sensor networks (USN).

I.4.4 Connected vehicles, automated driving and intelligent transport systems

I.4.5 Connected health: e-Health

[**ITU-T H.810 (revised) “Interoperability design guidelines for personal connected health systems: Introduction”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14113)**:** 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. These guidelines focus on the following interfaces:

– Personal Health Devices (PHD) interface – Interface between a Personal Health Device (PHD) and a Personal Health Gateway (PHG).

– Services interface – Interface between a Personal Health Gateway (PHG) and the Health & Fitness Service (HFS).

– Healthcare Information System (HIS) interface – Interface between the HFS and the Healthcare Information System (HIS).

[**ITU-T H.813 (revised) “Interoperability design guidelines for personal connected health systems: Healthcare Information System interface”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14114)**:** The Continua Design Guidelines (CDG) defines a framework of underlying standards and criteria that ensure the interoperability of devices and data used for personal connected health services. The Continua Design Guidelines also contains design guidelines (DGs) that further clarify underlying standards or specifications by reducing options or by adding missing features to improve interoperability. ITU-T H.813 focuses on the following interface:

– HIS-IF – Interface between Health & Fitness services (HFS) and the Healthcare Information System (HIS).

[**ITU-T H.830.15 (revised) ”Conformance of ITU-T H.810 personal health system: Services interface Part 15: FHIR Observation Upload: Health & Fitness Service sender”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14115) provides a test suite structure (TSS) and the test purposes (TPs) for fast healthcare interoperability resource (FHIR) Observation Upload through the Health & Fitness Service (HFS) sender in the Services interface, based on the requirements defined in the Recommendations of the ITU-T H.810 sub-series, of which Recommendation ITU T H.810 (2017) is the base Recommendation. The objective of this test specification is to provide a high probability of interoperability at this interface.

Recommendation ITU-T H.830.15 includes an electronic attachment with the protocol implementation conformance statements (PICSs) 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 system: Personal Health Devices interface Part 2: Optimized Exchange Protocol: Personal Health Gateway”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14116) provides a test suite structure (TSS) and the test purposes (TPs) for personal health gateways (PHGs) using the IEEE 11073-20601 optimized exchange protocol in the Personal Health Devices (PHD) interface, based on the requirements defined in the Recommendations of the ITU-T H.810 sub-series, of which Recommendation ITU T H.810 (2017) is the base Recommendation. The objective of this test specification is to provide a high probability of interoperability at this interface. Recommendation ITU-T H.842 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 1.8, 2017-03-14), 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 system: Personal Health Devices interface Part 4: Continua Design Guidelines: Personal Health Gateway”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14117) provides a test suite structure (TSS) and the test purposes (TP) for Personal Health Gateways (PHGs) in the Personal Health Devices (PHD) interface, based on the requirements defined in the Recommendations of the ITU-T H.810 sub-series, of which Recommendation ITU T H.810 (2017) is the base Recommendation. The objective of this test specification is to provide a high probability of interoperability at this interface. Recommendation ITU-T H.844 is a transposition of Continua Test Tool DG2016, Test Suite Structure & Test Purposes, Personal Health Devices Interface; Part 4: Continua Design Guidelines. Personal Health Gateway (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.845.17 (revised) “Conformance of ITU-T H.810 personal health system: Personal Health Devices interface Part 5Q: Power status monitor”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14118) provides a test suite structure (TSS) and the test purposes (TPs) for the power status monitor (PSM) of personal health devices in the Personal Health Device (PHD) interface, based on the requirements defined in the Recommendations of the ITU-T H.810 sub series, of which Recommendation ITU T H.810 (2017) is the base Recommendation. The objective of this test specification is to provide a high probability of interoperability at this interface. 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"**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14119) provides a test suite structure (TSS) and the test purposes (TP) for Personal Health Gateways in the Personal Health Devices (PHD) interface, based on the requirements defined in the Recommendations of the ITU-T H.810 sub-series, of which Recommendation ITU T H.810 (2017) is the base Recommendation. The objective of this test specification is to provide a high probability of interoperability at this interface. Recommendation ITU-T H.846 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. 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. This 2019 revision includes the power status monitor of Personal Health Devices device specialization (ISO/IEEE 11073-10427:2018) test cases as well as minor corrections.

**[ITU-T H.850 (revised) “Conformance of ITU-T H.810 personal health system: Personal Health Devices interface Part 10: Transcoding for Bluetooth Low Energy: Personal Health Gateway - General requirements”](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14120)** provides a test suite structure (TSS) and the test purposes (TP) for the general requirements when transcoding by personal health gateways in the Personal Health Devices (PHD) interface of application-level data between the Bluetooth Low Energy Bluetooth Generic Attribute Profile (GATT) format and the IEEE 11073-20601 data format, of which Recommendation ITU T H.810 (2016) is the base Recommendation. The objective of this test specification is to provide a high probability of interoperability at this interface. Recommendation ITU-T H.850 is a transposition of clause 3.2 of Continua Test Tool DG2016, Test Suite Structure & Test Purposes, Personal Health Devices Interface; Part 10: PHD Transcoding Whitepaper. Personal Health Gateway (Version 1.7, 2017-07-18), 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.

This Recommendation was originally approved as a single part, but due to its large size it was split at publication time into eight sub-parts for easier use, maintenance and expandability:

– ITU-T H.850 with the general requirements;

– ITU-T H.850.1 with thermometer PHD requirements;

– ITU-T H.850.2 with blood pressure PHD requirements;

– ITU-T H.850.3 with heart rate PHD requirements;

– ITU-T H.850.4 with glucose meter PHD requirements;

– ITU-T H.850.5 with weighing scales PHD requirements;

– ITU-T H.850.6 with pulse oximeter PHD requirements;

– ITU-T H.850.7 with continuous glucose monitoring PHD requirements.

[**ITU-T H.850.6 (revised) “Conformance of ITU-T H.810 personal health system: Personal Health Devices interface Part 10F: Transcoding for Bluetooth Low Energy: Personal Health Gateway - Pulse oximeter”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14121) provides a test suite structure (TSS) and the test purposes (TP) for the transcoding of pulse oximeter data by personal health gateways in the Personal Health Devices (PHD) interface of application-level data between the Bluetooth Low Energy Bluetooth Generic Attribute Profile (GATT) format and the IEEE 11073-20601 data format, of which Recommendation ITU T H.810 (2016) is the base Recommendation. The objective of this test specification is to provide a high probability of interoperability at this interface. Recommendation ITU-T H.850.6 is a transposition of clause 3.8 of Continua Test Tool DG2016, Test Suite Structure & Test Purposes, Personal Health Devices Interface; Part 10: PHD Transcoding Whitepaper. Personal Health Gateway (Version 1.7, 2017-07-18), 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.850.7 (revised) “Conformance of ITU-T H.810 personal health system: Personal Health Devices interface Part 10G: Transcoding for Bluetooth Low Energy: Personal Health Gateway - Continuous glucose monitoring”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14122) provides a test suite structure (TSS) and the test purposes (TP) for the transcoding of continuous glucose monitoring data by personal health gateways (PHGs) in the Personal Health Devices (PHD) interface of application-level data between the Bluetooth Low Energy Bluetooth Generic Attribute Profile (GATT) format and the IEEE 11073-20601 data format, of which Recommendation ITU T H.810 (2016) is the base Recommendation. The objective of this test specification is to provide a high probability of interoperability at this interface. Recommendation ITU-T H.850.7 is a transposition of clause 3.9 of Continua Test Tool DG2016, Test Suite Structure & Test Purposes, Personal Health Devices Interface; Part 10: PHD Transcoding Whitepaper. Personal Health Gateway (Version 1.7, 2017-07-18), 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.862.0 “Requirements and framework for ICT sleep management service models”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14123)**:** Sleep could affect labour productivity, healthcare in many fields of human factors. While previous sleep management markets focused on furniture including bedding and medical sleep management, current trends include a new form of sleep management technology, including a convergence of existing sleep management methodology and ICT. The purpose of this Recommendation is to define requirements and framework for ICT sleep management services. The scope of this Recommendation is focused on the reference model of the sleep management service and introduces sleep safety services and sleep quality improvement services. Solutions exist for sleep monitoring and sleep status check services that use a variety of sensors and technologies. While they lead to quantitative expansion of sleep management services, they are difficult to integrate into one service due to the different sleep visualization methods that vary across different service devices. To address these challenges, the task will propose approaches to ensure interoperability by expressing various types of sleep data in an integrated process. This Recommendation defines a service model and requirements concerning sleep monitoring and sleep status check services to ensure interoperability of sleep management services.

I.5.1 New security standards

[**ITU-T X.500 (revised) “Edition 9 of Rec. ITU-T X.500 | ISO/IEC 9594-1 Information technology - Open Systems Interconnection - The Directory: Overview of concepts, models and services”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14031)introduces the concepts of the Directory and the DIB (Directory Information Base) and overviews the services and capabilities which they provide.

[**ITU-T X.501 (revised) “Edition 9 of Rec. ITU-T X.501 | ISO/IEC 9594-2 Information technology - Open Systems Interconnection - The Directory: Models”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14032) provides a number of different models for the Directory as a framework for the other Recommendations in the ITU-T X.500-series. The models are the overall (functional) model, the administrative authority model, generic Directory Information models providing Directory User and Administrative User views on Directory information, generic Directory System Agent (DSA) and DSA information models and operational framework, and a security model.

[**ITU-T X.509 (revised) “Edition 9 of Rec. ITU-T X.509 | ISO/IEC 9594-8 Information technology - Open Systems Interconnection - The Directory: Public-key and attribute certificate frameworks”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14033) defines frameworks for public-key infrastructure (PKI) and privilege management infrastructure (PMI). It introduces the basic concept of asymmetric cryptographic techniques. It specifies the following data types: public-key certificate, attribute certificate, certificate revocation list (CRL) and attribute certificate revocation list (ACRL). It also defines several certificates and CRL extensions, and it defines directory schema information allowing PKI and PMI related data to be stored in a directory. In addition, it defines entity types, such as certification authority (CA), attribute authority (AA), relying party, privilege verifier, trust broker and trust anchor. It specifies the principles for certificate validation, validation path, certificate policy etc. It includes a specification for authorization validation lists that allow for fast validation and restrictions on communications.

[**ITU-T X.511 (revised) “Edition 9 of Rec. ITU-T X.511 | ISO/IEC 9594-3 Information technology - Open Systems Interconnection - The Directory: Abstract service definition”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14034) defines in an abstract way the externally visible services provided by the Directory, including bind and unbind operations, read operations, search operations, modify operations, operations to support password policies and operations to support interworking with LDAP. It also defines errors.

[**ITU-T X.518 (revised) “Edition 9 of Rec. ITU-T X.518 | ISO/IEC 9594-4 Information technology - Open Systems Interconnection - The Directory: Procedures for distributed operation”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14035) specifies the procedures required for a distributed directory consisting of a mix of Directory System Agents (DSAs) and lightweight directory access protocol (LDAP) servers acting together to provide a consistent service to its users, independent of the point of access. It also describes procedures for protocol conversion between the directory access protocol/directory system protocol (DAP/DSP) protocols and the LDAP protocol.

[**ITU-T X.519 (revised) “Edition 9 of Rec. ITU-T X.519 | ISO/IEC 9594-5 Information technology - Open Systems Interconnection - The Directory: Protocol specifications”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14036) specifies the Directory Access Protocol, the Directory System Protocol, the Directory Information Shadowing Protocol and the Directory Operational Binding Management Protocol which fulfil the abstract services specified in Recommendation ITU-T X.501 | ISO/IEC 9594-2, Recommendation ITU-T X.511 | ISO/IEC 9594-3, Recommendation ITU-T X.518 | ISO/IEC 9594-4 and Recommendation ITU-T X.525 | ISO/IEC 9594-9. It includes specifications for supporting underlying protocols to reduce the dependency on external specifications. The protocols may be encoded using all standard ASN.1 encoding rules.

[**ITU-T X.520 (revised) “Edition 9 of Rec. ITU-T X.520 | ISO/IEC 9594-6 Information technology - Open Systems Interconnection - The Directory: Selected attribute types”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14037) defines a number of attribute types and matching rules which may be found useful across a range of applications of the Directory. One particular use for many of the attributes defined is in the formation of names, particularly for the classes of objects defined in Rec. ITU-T X.521 | ISO/IEC 9594-7. Other attributes types, called notification attributes, provide diagnostic information. This Recommendation | International Standard defines context types which supply characteristics associated with attribute values. It also includes definitions for LDAP syntaxes relevant for attribute types and matching rules.

[**ITU-T X.521 (revised) “Edition 9 of Rec. ITU-T X.521 | ISO/IEC 9594-7 Information technology - Open Systems Interconnection - The Directory: Selected object classes”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14038) defines a number of selected object classes and name forms which may be found useful across a range of applications of the Directory. An object class definition specifies the attribute types which are relevant to the objects of that class. A name form definition specifies the attributes to be used in forming names for the objects of a given class.

[**ITU-T X.525 (revised) “Edition 9 of Rec. ITU-T X.525 | ISO/IEC 9594-9 Information technology - Open Systems Interconnection - The Directory: Replication”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14047)specifies a shadow service which Directory system agents (DSAs) may use to replicate Directory information. The service allows Directory information to be replicated among DSAs to improve service to Directory users, and provides for the automatic updating of this information.

**ITU-T X.677 “Identification mechanism for unmanned aerial vehicles using object identifiers” (under approval)** analyses requirements for full life-cycle management and operating identity recognition of unmanned aerial vehicles (UAVs) with security considerations and specifies an identification mechanism for UAVs using object identifiers (OIDs), including detailed specifications of assignment rules and registration procedures of OIDs used for UAVs.

[**ITU-T X.1044 “Security requirements of network virtualization”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14042) analyses security challenges and threats to network virtualization (NV), and specifies security requirements for the physical resources layer, virtual resources layer and logically isolated network partition (LINP) layer in NV.

[**ITU-T X.1045 “Security service chain architecture for networks and applications”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14043) supports provision of customized dynamic and adaptive security services for networks and applications. This Recommendation defines the security service chain and an architecture design for the security service chain. This Recommendation applies the security service chain to networks and applications. This Recommendation also enables tracing network attacks to their resources in a service function chain (SFC) overlay network with high performance and the mitigating/preventing of those attacks automatically.

[**ITU-T X.1059 “Implementation guidance for telecommunications organizations on risk management of their assets globally accessible in IP-based networks”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14045) provides guidance for telecommunications organizations on risk management of their assets globally accessible in IP-based networks, the assets of which are exposed directly to hackers and attackers. These assets may also be connected to the traditional (and even old) assets of legacy telecommunication networks, which might have some design level vulnerabilities that could be difficult to fix. Therefore, it would be practical to consider all the assets globally accessible in IP-based networks (AGIT) of a telecommunication organization as a whole, and to introduce some specific security controls to continuously reduce the overall risks and strengthen the overall security of telecommunication services and networks. It is suggested that the assets globally accessible in IP-based networks have a high priority to adopt these proposed controls, which might also be applicable to other assets.

[**ITU-T X.1232 “Technical framework for countering advertising spam in user generated information”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14085)analyses scenarios and characteristics of advertising spam, and specifies a reference framework and process flows to help Internet service providers to counter advertising spam. It specifies a framework for reducing advertising spam, improving the user experience.

[**ITU-T X.1401 “Security threats of distributed ledger technology”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14092)**:** Distributed Ledger Technology (DLT) provides a technical mechanism for achieving verifiable trust through consensus and collective decision-making. DLT also involves maintaining ledgers in a decentralized way and using crypto-mechanisms that can deliver some intrinsic security features. However, a distributed ledger system still has security limitations, for example, confidentiality must be added depending on use case, data sensitivity and applicable data privacy regulations. Recommendation ITU-T X.1401 provides a structured and systematic threat analysis method to design, implement, operate a distributed ledger system and to evaluate its security.

[**ITU-T X.1702 “Quantum noise random number generator architecture”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14095) defines a generic functional architecture of a quantum entropy source, a common method to estimate and validate the entropy of a noise source under evaluation, and a common method to specify randomness extractors when they are part of the implemented system. In contrast to the causal nature of classical physics, the inherently probabilistic nature of quantum physics is particularly suited to implement noise sources with an entropy that can be estimated based on information theory. However, there are not yet any existing standards that explicitly distinguish between noise sources based on quantum physics and classical physics. This Recommendation is an add-on to existing noise or entropy source standards that allow specification of whether the noise source under evaluation is based on quantum physics or not.

[**ITU-T Y.3800 "Overview on networks supporting quantum key distribution”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=13990)specifies an overview on networks supporting quantum key distribution (QKD). This Recommendation aims to provide support for design, deployment, operation and maintenance to implement QKD networks (QKDNs) in terms of standardized technologies. The relevant network aspects for conceptual structure, layered model and basic functions are within the scope of the Recommendation to support its implementation.

I.5.2 Trust

I.6.1 Green ICT standards

[**ITU-T L.1210 “Sustainable power-feeding solutions for 5G networks”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14079&lang=en)defines power-feeding solutions for 5G, converged wireless and wireline access equipment and networks, taking into consideration their enhanced requirements on service availability and reliability, new deployment scenarios, along with the environmental impact of the proposed solutions. The minimum requirements of different solutions, including power-feeding structures, components, backup, safety requirements and environmental conditions, are also defined. This Recommendation is applicable to the powering of both mobile and fixed access network elements, in particular equipment that have similar configurations and needs.

[**ITU-T L.1022 "Circular Economy: Definitions and concepts for material efficiency for Information and Communication Technology"**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=13962)contains a guide to circular economy (CE) aspects, parameters, metrics, indicators for information and communication technology (ICT) based on current approaches, concepts and metrics of the CE as defined in existing standards, while considering their applicability for ICT. In this Recommendation ICT is defined as based on OECD [b-ISIC]. This Recommendation discusses the special considerations and challenges in a broader and more in depth context for all ICT defining parameters, metrics, and indicators with the intention to guide the vertical standardization of the material efficiency for ICT. The guideline aims to examine the kinds of standards that are available and to assess their relevance for ICT product groups citing examples of interrelated relevance throughout the text of the Recommendation.

[**ITU-T L.1305 “Data centre infrastructure management system based on big data and artificial intelligence technology”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14080) contains technical specifications of data centre infrastructure management (DCIM) system, with the following aspects being covered: principles, management objects, management system schemes, data collection function requirements, operational function requirements, energy saving management, capacity management for information and communication technology (ICT) and facilities, other operational function requirements and intelligent controlling on systems to maximize green energy use. Other items such as: maintenance function requirements, early alarm and protection based on big data analysis and intelligent controlling on systems to decrease the cost for maintenance are also considered.

[**ITU-T L.1316 “Energy efficiency framework”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14081) contains a framework of documents for collecting standards on energy efficiency metrics/key performance indicators (KPIs), measurement methodologies and energy management solutions for information and communication technology (ICT) equipment. The Recommendation suggests the selection of the appropriate document to reference when determining energy efficiency.

[**ITU-T L.1380 “Smart energy solution for telecom sites”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14082) focuses on smart energy solutions for telecom sites, mainly on the performance, safety, energy efficiency and environmental impact, when the system is fed by various types of energy such as photovoltaic (PV) energy, wind energy, fuel cells and the grid. The Recommendation also considers smart energy control. For example, if the grid is off, how can the energy flows be managed to achieve higher energy efficiency, get more green energy, etc.

[**ITU-T L.1451 “Methodology for assessing the aggregated positive sector-level impacts of ICT in other sectors”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14083)**:** To date no international comprehensive methodology exists to assess the environmental impact of information and communication technology (ICT) at sector level, or to assess the aggregated positive effects of the ICT sector on other sectors of the economy. Without a standard methodology evaluating the positive impacts of ICT, the role of ICTs in the fight against global warming will be only partially perceived. Recommendation ITU-T L.1451 addresses the need to contribute to achieve the targets and goals of the 2030 Agenda for Sustainable Development and specially its Sustainable Development Goal 13 (SDG13), the Connect 2030 Agenda and the Paris Agreement from a global perspective. This Recommendation addresses the opportunity to use a computable general equilibrium (CGE) model as a possible methodology for simultaneously assessing the environmental and economic impacts of ICTs at sectoral level.

[**ITU-T L.1470 “GHG emissions trajectories for the ICT sector compatible with the UNFCCC Paris Agreement”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14084)provides detailed trajectories of GHG emissions for the global ICT sector and sub-sectors which are quantified for the year 2015 and estimated for 2020, 2025 and 2030. In addition, it defines a long-term ambition for 2050. The trajectories, the long-term ambition and the 2015 baseline have been derived in accordance with ITU-T L.1450 and through complementing methods in support of the 1.5oC objective described by the IPCC in its Special Report on 1.5 oC [b-IPCC 1.5] and in support of Science-based Targets initiative (SBTi).

I.6.2 Electromagnetic fields

[**ITU-T K.20 (revised) "Resistibility of telecommunication equipment installed in a telecommunication centre to overvoltages and overcurrents"**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14067) 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 (ESDs). The sources for overvoltages in internal lines, between equipment or racks, are mainly inductive coupling caused by lightning currents being conducted in nearby lightning strikes or lightning currents being conducted in nearby conductors.

Major changes compared with Recommendation ITU-T K.20 (2017) include:

– DC insulation resistance test;

– revised test exemption for internal short cables;

– renaming of some test titles for clarity;

– screened cable exemptions;

– addition of Test 7.10, a twisted pair port transverse/differential test, to Table 7.

[**ITU-T K.39 (revised) “Risk assessment of damages to telecommunication sites due to lightning discharges”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14068)**:** Protective measures against a randomly occurring overvoltage phenomenon like lightning discharges have to a great extent been empirically based. Modern equipment has shown to be more prone to damages compared with older ones. Serious consequences in complexed communication systems may also occur in built-up areas, earlier classified as unexposed. The widespread use of radio stations with high antenna masts for wireless telecommunication has significantly increased the risk for damages due to direct lightning strikes to the site. The need for protection should be based on a risk assessment considering the cost and importance of the system, the electromagnetic environment at the particular site and the probability of damages. The protection levels and the type of protective methods should also be chosen regarding the costs of installation and maintenance of protective devices. An assessment of the probability of overvoltage occurrences and the sensitivity of the existing telecommunication installation shall give a possibility to attain a well-balanced protection of the whole system. Protective measures to eliminate severe injuries to people during thunderstorms are especially important at exposed sites that are permanently or temporarily manned.

[**ITU-T K.40 (revised) “Protection against lightning electromagnetic pulses in telecommunication centres”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14069)**:** Guidelines for the design of an effective protective system for a telecommunication structure against lightning electromagnetic pulse (LEMP) are proposed. The concept of lightning protection zones is introduced as a framework where 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"**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=13952) 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.

Major changes compared with the 2018 version of this Recommendation include:

– Appendices I and II removed and made into K.44 Supplements;

– New twisted pair transverse/differential surge test circuit;

– added Ethernet insulation resistance test to avoid port power cross test;

– revision of the test schematics to improve clarity.

[**ITU-T K.45 (revised) "Resistibility of telecommunication equipment installed in the access and trunk networks to overvoltages and overcurrents"**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=13953) 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 AC power lines or railway systems, earth potential rise due to power faults, direct contact between telecommunication lines and power lines and electrostatic discharges.

Changes compared with Recommendation ITU-T K.45 (2018) include:

• DC insulation resistance test;

• Special requirements Annex.

[**ITU-T K.66 (revised)”Protection of customer premises from overvoltages”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14070) provides Recommendations for bonding and earthing of telecommunication equipment in residential and commercial customer premises;

• refers to Recommendation ITU-T K.21 (2008) for equipment resistibility requirements;

• recommends earthing and bonding requirements to coordinate with the resistibility requirements of Recommendation ITU-T K.21 (2008) and the safety requirements of IEC 60950-1 and IEC 62368;

• recommends the installation practices for bonding of all services and the installation of surge protective devices (SPDs);

• illustrates problems associated with earthing and bonding and provides solutions for these earthing and bonding problems. These include:

1) methods to improve the earthing and bonding;

2) methods of providing additional protection external to the equipment;

3) special resistibility and safety requirements;

• recommends responsibilities for protection at customer premises;

• refers to IEC 62305-3 for protection against direct lightning.

This revision of Recommendation ITU-T K.66 includes an update of the references and a revision of clause 6.3 to include more information on preventing equipment damage. Appendix IV, containing information on special resistibility requirements has been deleted; the reader is directed to Recommendation ITU T K.44 (2008).

[**ITU-T K.73 (revised) “Shielding and bonding for cables between buildings”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14071): Bonding and earthing of telecommunication installations is done for reliability and personnel safety reasons. The evolution of the power architecture of telecommunication systems has created new installation conditions for equipment. To cover these situations, bonding and earthing configurations need to be defined to ensure that adequate reliability and safety are maintained. Recommendation ITU-T K.73 analyses the situation in which equipment, connected together, is installed in different buildings with different earthing and power feeding conditions. This Recommendation also includes installation requirements for equipment located in different buildings, having the same earthing and feeding power conditions, to improve the shielding and bonding of telecommunication and power cable between buildings.

Other Recommendations dealing with bonding and earthing are Recommendation ITU-T K.27, Bonding configurations and earthing inside a telecommunication building, Recommendation ITU T K.35, Bonding configurations and earthing at remote electronic sites and Recommendation ITU T K.66, Protection of customer premises from overvoltages. These Recommendations do not cover how equipment installed in these different environments can be interconnected.

[**ITU-T K.91 (revised) “Guidance for assessment, evaluation and monitoring of human exposure to radio frequency electromagnetic fields”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14072): There are many possible methods of exposure assessment and each of them has its own advantages and disadvantages. Recommendation ITU-T K.91 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.142 “Lightning protection and earthing of video surveillance system”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14073) provides a set of practical procedures related to the lightning protection, earthing and bonding of a Video Surveillance System (VSS). The main objective of this Recommendation is to reduce risk of damage to VSS due to lightning flashes, which will improve the safety and reliability of the VSS itself and its related equipment. This Recommendation also provides the configuration and rating of protection modules required to protect VSS against lightning surges. Usually Video Surveillance System can be used to remotely capture multimedia (such as audio, video, image, alarm signal, etc.) and present them to the end user in a user-friendly manner, based on a managed broadband network with ensured quality, security and reliability. According the type of signal transmitted, the system can be divided into three kinds: analogue; Semi digital-semi analogue; full digital video surveillance system (also be called IP based system); because IP based system are more complicated for lightning protection, IP-Camera systems are not included in this Recommendation. The related scope can be referred to ITU-T K.45.

Annex A presents classification of Video Surveillance System, whereas Appendix I presents an overview of practical procedures of earthing for VSS’s front-end equipment.

Related technical requirements have been adopted in many surveillance products, effectively improved the lightning protection ability and usage of related products, guaranteed network operate normally.

[**ITU-T K.143 “Guidance on safety relating to the use of surge protective devices and surge protective components in telecommunication terminal equipment”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14074)**:** Requirement on bridging between primary circuit and protective earth by SPD in equipment is described in clause 5.5.7 of [IEC 62368-1]. However the standard does not take into consideration the lightning voltage which is larger than that appears in the conditions considered in overvoltage category II, and it does not provide the requirements necessary for lightning protection of class II equipment without earthing in which bridging by SPD/SPCs is usually applied. It is necessary to clarify the electrical requirements for SPDs/SPCs in order to realize both resistibility and safety of telecommunication systems. This Recommendation analyses the influence on human safety of lightning measures bridging across insulation by SPDs. This Recommendation provides guidance for design of lightning protection and requirements of SPDs from the human safety standpoint. The requirements on SPDs/SPCs in MSPD (multi-service SPD) external to the equipment and SPDs installed on lines in a building are not within the scope of this Recommendation.

[**ITU-T K.144 “Surge protective component application guide - Self-restoring thermally activated overcurrent protectors”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14075): Unlike fuses and heat coils, which break the circuit, these series connected self-restoring thermally activated overcurrent protectors (OCPs) automatically reset when the electrical event causing the overcurrent stops, without the need for manual intervention. Self-restoring thermally activated overcurrent protector (OCP) components operate by the increasing in resistance value, which reduces the circuit current when the overcurrent exceeds a given value for a sufficient time. The resistance transition is caused by the component body reaching a critical temperature caused by the i2R heating of the overcurrent flowing through the component. The generic name for components with this type of action is positive temperature coefficient (PTC) thermistors. Being thermally operated, these PTC thermistors generally do not operate for short duration electrical transients, such as coupled lightning currents, but will operate for longer term AC and DC overcurrents. There are two types of material used to make PTC thermistors; ceramic and polymer. Many of the component parameters apply to the both types of material. Some parameters are specific to the material used and these differences are explained. This Recommendation describes PTC thermistor construction, operation, production, ratings, characteristics and gives application examples.

[**ITU-T K.145 “Assessment and management of compliance with RF EMF exposure limits for workers at radiocommunication sites and facilities”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14076) includes guidance on the protection of workers against radio frequency electromagnetic fields (RF-EMF) exposure in their working environment. RF workers range from installation engineers and tower climbers to R&D personnel and laboratory testing engineers. All of them are exposed to stronger RF-EMF fields than the general public. There also RF informed workers who have been provided with information on RF-EMF safe working practices for a site and all other workers who are regarded as members of the public for the purposes on RF-EMF exposure limits. In this Recommendation there is created minimum common safety guidance for telecommunication RF workers around the world.

I.6.4 Emergency communication & disaster relief

[ITU-T E.102 “Terms and definitions for disaster relief systems, network resilience and recovery”](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=13875) applies to disaster relief systems, network resilience and recovery. This Recommendation provides definitions of terms relevant to disaster relief systems, network resilience and recovery, including terms relevant to network architecture, functional elements and interfaces, application level aspects and power supply. Appendix I contains excerpts of the terminology defined by the United Nations International Strategy for Disaster Reduction (UNISDR). Appendix II shows the category classification of terms defined in this Recommendation.

I.6.5 Naming, numbering, addressing and identification

ITU-T E.156 (revised) “Guidelines for ITU-T action on reported misuse of E.164 number resources” (under approval) outlines the procedures for reporting and taking action regarding alleged misuse of numbers. It also outlines the procedures that the TSB Director should undertake when he has received reports of alleged misuse from members, including methods to address and counter any alleged misuse when such reports are brought to his attention.

ITU-T E.164.2 (revised) “E.164 numbering resources for trials” (under approval) contains the criteria and procedures for an applicant to be temporarily assigned a three-digit identification code within the shared E.164 country code 991 for the purpose of conducting an international non-commercial trial. The purpose of the trial will be to determine the viability of a proposed new international public correspondence service.

ITU-T E.212 Annex X “The international identification plan for public networks and subscriptions- Annex X: Assignment of shared E.212 mobile country codes (MCC) for trials” (under approval) contains the criteria and procedures for an applicant to be temporarily assigned a two digit MNC within the shared E.212 mobile country code 991 for the purpose of conducting an international non-commercial trial. The purpose of the trial will be to determine the viability of a proposed new international telecommunication service.

ITU-T E.218 Annex A “Management of the allocation of terrestrial trunk radio Mobile Country Codes – Annex A: Criteria and procedures for the assignment and reclamation of shared ITU-T E.218 terrestrial trunk radio access mobile country codes ((T)MCC) for networks and their respective terrestrial trunk radio access mobile network codes ((T)MNCs)” (under approval) is intended to provide advice to the Director of TSB on how to assign (T)MNCs under shared (T)MCCs for networks. It describes the procedures and criteria to be utilized by the Director of TSB for the assignment and reclamation of mobile network codes ((T)MNCs) associated with shared (T)MCCs for networks.

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

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

**ITU-T D.264 "Shared use of spectrum and telecommunication infrastructure as possible methods for enhancing the efficiency of telecommunications" (under approval)** proposes a set of possible methods to help telecommunication providers save costs and enhance efficiency through the shared use of spectrum and telecommunication infrastructure, including passive infrastructure sharing, active infrastructure sharing and spectrum sharing in the active infrastructure sharing.

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

[**ITU-T E.475 “Guidelines for Intelligent Network Analytics and Diagnostics”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14148)specifies guidelines for intelligent network analytics and diagnostics for managing and troubleshooting networks. The Intelligent Network Analytics and Diagnostics (INAD) function is responsible for aggregating network data and setting up automatic tasks for network maintenance, providing the assurance of appropriate network performance, locating the service degradation area and service channels with poor performance, finding root causes of the detected network faults, probing network status, and predicting the possible network performance degradation at an early stage. Specifically, this Recommendation describes the design considerations, functional architecture, network anomaly analysis models for network analytics and diagnostics. The network anomaly analysis model can be used to assess network anomaly degree, network performance, risk degree, to analyze the location and time of the network impairment and further to determine the root causes of the network impairments and to allow increased network visibility and network fault management automation. This Recommendation also presents the concept of Network Health Indicator (NHI) which provides a numerical indication of the network anomaly degree based on Big Data Analytics. The NHI is not focused on specific multimedia application rating (e.g., rating of specific audio application, video conferencing application) and application layer monitoring. Instead, it aims at network monitoring and evaluation of specific networks (e.g., LAN, WAN, Storage Network, Data Centre Network) and further triggers Network Diagnosis using Big Data based fault diagnosis algorithms and determine the root causes of the network anomaly events.

[**ITU-T E.805 "Strategies to establish quality regulatory frameworks"**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=13949)provides guidance to regulators aiming to establish national or regional regulatory frameworks to monitor and measure quality of service (QoS) and quality of experience (QoE).

[**ITU-T G.1034 “QoE metrics for mobile telephony communication during rail travel”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14150)presents a novel high-level end-to-end KPI for telephony intended to be used in rail and street-bound public transport scenarios where movement is a constituting factor. The methodologies and metrics described in this Recommendation will allow to generate a holistic view of the end-user experience and solid predictions for a wide range of use case parameters based on measurement data, while at the same reducing resources and efforts needed to collect this measurement data. It will extend the existing range of QoS metrics by leveraging the particular properties of public transport scenarios that are defined by repeatability and reproducibility. While the described methodology focuses on telephony, it is easily possible to extend it to cover other types of service tests. This Recommendation will benefit all stakeholders in public transport: rail passengers who will encounter a high QoE, railway operators who will be enabled to provide competitive and attractive services and last but least the network operators, who will be able to optimize their efforts and resources.

[**ITU-T G.1072 “Opinion Model Predicting Gaming QoE for Cloud Gaming Services”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14151)presents an opinion model that predicts the overall gaming Quality of Experience (QoE) of non-expert gamers for cloud gaming services. The model uses an impairment factor approach in which the impact of typical IP network parameters and video encoding parameters on the video and input quality is estimated. The knowledge summarized in ITU-T G.1032 and ITU-T P.809 serves as a basis for the development of the model. The model is a network planning tool which can be used by stakeholders to manage resource allocation and to configure IP-network transmission settings such as the selection of encoding framerates, resolutions, and bitrates, under the assumption that the network is prone to packet loss and latency. Depending on whether the respective stakeholder has a priori knowledge of the type of game being offered through the cloud gaming service, either a default mode, which assumes the game to be highly sensitive towards delays and frame losses as well as highly encoding complex, or an extended mode, which uses adjusted model coeffiecient to increase the prediction accuracy, can be used.

[**ITU-T P.565 “Framework for creation and performance testing of machine learning based models for the assessment of transmission network impact on speech quality for mobile packet-switched voice services”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14152)**:**The output of the framework is a machine learning based speech quality prediction model, which predicts the impact on the speech quality from the IP transport and underlying transport, as well as the jitter buffer in the end client; thus providing a network centric view on the speech quality service delivered on mobile packet switched networks. This is expressed in terms of a MOS-LQO under the assumption of an otherwise clean transmission, without background noise, automatic gain control, voice enhancement devices, transcoding, bridging, frequency response, clock drift or any other impairment not caused by the IP transport and underlying transport. The models according to this framework use information on the temporal structure of the reference signal to identify the importance of individual sections of the bitstream with regard to speech quality. These models do not perform any perceptual analysis of the recorded speech signal. The framework specifies three modules required for the development of these kinds of metrics: the databases generator module, the machine learning module, and the validation module for the trained model. In addition, database content and the features used by the machine learning algorithm are described. The framework also provides a large set of test vectors, in the form of error (jitter and packet loss) patterns files for learning and validation. The recommendation specifies minimum required performance, as well as conditions and requirements for an independent additional validation for models developed based on the framework. The recommendation also specifies implementation requirements. The models developed based on the framework enable the assessment of transmission network impact on speech quality for mobile packet-switched voice services, and therefore benefit operators and regulators alike with a fast and easy speech quality trend monitoring / benchmarking and troubleshooting. In addition, if predictors according to this framework are used together with perceptual speech quality metrics like P.863, it is possible to identify if the source of problems resides inside or outside the transport network observed by the predictor according to this framework and thus a more detailed analysis of the situation can be achieved and consequently troubleshooting of less obvious degradations such as the ones occurring outside of the transport network (e.g. emerged from automatic gain control, voice enhancement devices, transcoding or analog processing) is enabled.

[**ITU-T P.918 “Dimension-based Subjective Quality Evaluation for Video Content”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14153) presents guidelines for the conduction of subjective experiments for the Quality of Experience (QoE) assessment of perceptual video quality dimensions. In addition to scores for the overall video quality, the methodology yields scores for five perceptual dimensions. Each perceptual dimension scores are based on ratings of the amount of degradation present in one system/test condition. The method is designed to be used with naïve subjects. The dimension scores can be used to provide diagnostic information on what may cause the degradation. The perceptual dimensions are described in this document as well as the method to conduct a subjective experiment. Furthermore, we give information about possible test environment and setup, participant instructions, and test material.

[**ITU-T P.1150 “In-Car Communication Audio Specification”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14154) includes communication requirements for in-car communication (ICC). The aim of this Recommendation is to set a base level of function and quality. This Recommendation is aimed at providing an improved communication between all occupants in a motor vehicle. Furthermore, it will ensure the ICC operates to a quality such that the motor vehicle driver does not feel it necessary to turn their head to amplify their voice when talking to other passengers and thus ICC can aid in preventing driver distraction. ICC will utilize integrated microphones and speakers in the motor vehicle cabin to amplify conversation. To meet these requirements, the use of audio zones within a motor vehicle cabin for speech communications between audio zones, and tests to ensure good speech intelligibility and quality between those zones are defined. This Recommendation covers requirements and test methods for:

1. system stability

2. speech intelligibility

3. speech quality

4. talker localization accuracy

The use of wearable headphones (audiophones) by driver or passengers is outside the scope of this Recommendation.

[**ITU-T P.1204 “Video quality assessment of streaming services over reliable transport for resolutions up to 4K”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14155) provides the introductory document for a set of documents that describe model algorithms for monitoring the video quality for streaming using reliable transport (e.g. HTTP-based adaptive streaming over TCP, QUIC). The standard comprises different variants of models for sequence-related (between 5 and 10 sec.) and per-1-second video-quality estimation. The variants differ in the type of input information they use: Bitstream-based, pixel-based, and hybrid (using both bitstream and pixel information). In principle, the per-1-second outputs of these video-quality models can be used together with an audio-quality model for integration into audiovisual quality and, together with information about initial loading delay and media playout stalling events, further into a final per-session model output, an estimate of integral per-session quality (see e.g. ITU-T Recs. P.1203, P.1203.2, P.1203.3). The respective ITU-T work item has formerly been referred to as “P.NATS Phase 2”, and was conducted in collaboration between ITU-T Study Group 12 and the Video Quality Experts Group (VQEG).

The structure of the set of recommendations reflects the different functionality of modules described in each document:

– ITU-T P.1204: Introductory document (this Recommendation)

– DRAFT P.1204.1: Video quality assessment of streaming services over reliable transport for resolutions up to 4K with access to transport information (under development)

– DRAFT P.1204.2: Video quality assessment of streaming services over reliable transport for resolutions up to 4K with access to video frame information (under development)

– ITU-T P.1204.3: Video quality assessment of streaming services over reliable transport for resolutions up to 4K with access to full bitstream information

– ITU-T P.1204.4: Video quality assessment of streaming services over reliable transport for resolutions up to 4K with access to full and reduced reference pixel information

– ITU-T P.1204.5: Video quality assessment of streaming services over reliable transport for resolutions up to 4K with access to transport and received pixel information.

[**ITU-T P.1204.3 “Video quality assessment of streaming services over reliable transport for resolutions up to 4K with access to full bitstream information”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=13846)describes a bitstream-based mode 3 video quality model for monitoring the video quality for streaming using reliable transport (e.g. HTTP-based adaptive streaming over TCP, QUIC). The estimate is validated for videos encoded with H.264, H.265 or VP9 codecs at any resolution up to 4K/UHD resolution for PC monitors and TV and up to QHD (2560x1440) for Smartphone and Tablet displays. The standard provides sequence-related (between 5 to 10 sec.) and per-1-second video-quality estimation. In principle, the per-one-second outputs of this video-quality model can be used together with an audio model for integration into audiovisual quality and, together with information about initial loading delay and media playout stalling events, further into a final per-session model output, an estimate of integral per-session quality (see e.g. ITU-T Recs. P.1203, P.1203.2, P.1203.3). The respective ITU-T work item has formerly been referred to as “P.NATS Phase 2”, and was conducted in collaboration between ITU-T Study Group 12 and the Video Quality Experts Group (VQEG).

The ITU-T P.1204.3 Recommendation addresses three application areas:

– Large-screen presentation as with fixed-network video streaming

– Mobile streaming on handheld devices such as smartphones

– Presentation on tablet-type devices.

[**ITU-T P.1204.4 “Video quality assessment of streaming services over reliable transport for resolutions up to 4K with access to full and reduced reference pixel information”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14157) describes the reduced-reference/full-reference video quality estimation model for P.1204 for monitoring the video quality for streaming using reliable transport (e.g. HTTP-based adaptive streaming over TCP, QUIC). The estimate is validated for video encoded with H.264, H.265 or VP9 codecs at any resolution up to 4K/UHD (3840x2160) resolution for PC monitor and TV and up to QHD (2560x1440) for Smartphone and Tablet displays. The standard provides sequence-related (between 5 to 10 sec.) and per-1-second video-quality estimation. In principle, the per-one-second outputs of these video-quality models can be used together with an audio model for integration into audiovisual quality and, together with information about initial loading delay and media playout stalling events, further into a final per-session model output, an estimate of integral per-session quality (see e.g. ITU-T Recs. P.1203, P.1203.2, P.1203.3). The respective ITU-T work item has formerly been referred to as “P.NATS Phase 2”, and was conducted in collaboration between ITU-T Study Group 12 and the Video Quality Experts Group (VQEG).

The ITU-T P.1204.4 Recommendation addresses three application areas:

– Large-screen presentation as with fixed-network video streaming

– Mobile streaming on handheld devices such as smartphones

– Presentation on tablet-type devices.

[**ITU-T P.1204.5 “Video quality assessment of streaming services over reliable transport for resolutions up to 4K with access to transport and received pixel information”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14158) describes the Hybrid no-reference video quality estimation model for P.1204 for monitoring the video quality for streaming using reliable transport (e.g. HTTP-based adaptive streaming over TCP, QUIC). The estimate is validated for videos encoded with H.264, H.265 or VP9 codecs at any resolution up to 4K/UHD-1 resolution for PC monitors and TV and up to QHD (2560x1440) for Smartphone and Tablet displays. The standard provides sequence-related (between 5 to 10 sec.) and per-1-second video-quality estimation. In principle, the per-one-second outputs of these video-quality models can be used together with an audio model for integration into audiovisual quality and, together with information about initial loading delay and media playout stalling events, further into a final per-session model output, an estimate of integral per-session quality (see e.g. ITU-T Recs. P.1203, P.1203.2, P.1203.3). The respective ITU-T work item has formerly been referred to as “P.NATS Phase 2”, and was conducted in collaboration between ITU-T Study Group 12 and the Video Quality Experts Group (VQEG).

The ITU-T P.1204-series of Recommendations addresses three application areas:

– Large-screen presentation as with fixed-network video streaming

– Mobile streaming on handheld devices such as smartphones

– Presentation on tablet-type devices.

[**ITU-T P.1401 (revised) “Methods, metrics and procedures for statistical evaluation, qualification and comparison of objective quality prediction models”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14159)**:** A stable and self-sustained statistical evaluation procedure is required in the development of objective quality algorithms. This is required regardless of whether the algorithms will be used for estimating subscriber perception of voice, video, audio or multimedia quality. Recommendation ITU-T P.1401 presents a framework for the statistical evaluation of objective quality algorithms regardless of the assessed media type.

[**ITU-T P.1502 “Methodology for QoE testing of digital financial services”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14160) is based on the end-to-end QoS KPI definitions first published in [b-DFS TR]. It details the methodology and connects to a field test using this methodology, which has been conducted in Ghana in the first half of 2018. Money transfer from end user’s devices to other devices or to other entities has become an important element of everyday life in many countries. This service, however, relies on the functionality of mobile networks. Therefore, a connection exists between the functioning, QoS and QoE of money transfer services, and the QoS and proper functioning of those mobile networks, and respective quality metrics and testing methodologies need to be defined. The main part of the present Recommendation describes the testing methodology.

[**ITU-T Y.1540 (revised) “Internet protocol data communication service - IP packet transfer and availability performance parameters”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=13933) defines parameters that may be used in specifying and assessing the performance of speed, accuracy, dependability and availability of IP packet transfer of regional and international Internet protocol (IP) data communication services. The defined parameters apply to end-to-end, point-to-point IP service and to the network portions that provide, or contribute to the provision of, such service in accordance with the normative references specified in clause 2. Connectionless transport is a distinguishing aspect of the IP service that is considered in this Recommendation. Following over 20 years as an in-force Recommendation, the 2019 Edition recognizes many changes in the design of IP services and in the protocols employed by end-users. It introduces the new Annex A that defines IP Capacity parameters in ways that cater toward assessment, and provides requirements for methods of measurement of IP Capacity. This new Annex is the result of years of study, and application of ITU-T Study Group 12 principles of accurately evaluating performance parameters and methods of measurement against a “ground truth” reference in laboratory and field measurements.

**ITU-T Y.1540 Amd.1 “Internet protocol data communication service - IP packet transfer and availability performance parameters - Amendment 1 - Amendment 1: New Annex B – Additional search algorithm for IP-based capacity parameters and methods of measurement”** **(under approval)**: The latest Edition of Recommendation ITU-T Y.1540 incorporates many updates based on the plan to qualify and compare access measurement metrics, methods, models, and tools in a stable and repeatable laboratory environment. Amendment 1 introduces Annex B, which provides a second, more capable search algorithm for the IP capacity method of measurement defined in Annex A.

**ITU-T Technical Report PSTR-PXNR “No-reference pixel-based video quality estimation algorithm” (under publication)** describes the best submission to the P.NATS phase 2 competition for a no-reference pixel-based video quality estimation module, where the winning contributions are intended to be included in the P.1200-series. 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 use case for the module included in this contribution is similar to that of the P.1203.1 modules, estimating the short-term subjective video quality. During the selection process the module presented herein was the best performing in its group (no-reference pixel-based MOS estimators). However, it is not included in the final Recommendation since the performance was lower than what had been a-priori decided by the group as a minimum-performance criterion. The algorithm and resulting performance numbers are instead published as an open ITU-T Technical Report so future modelling work can build on the results from this project. Also, a more appropriate minimum performance criteria can be based on this report, instead of using something more ill-fitting for a purely pixel-based use case, such as encoded bit rate. A Python implementation of the module has been included in an Appendix for reference.

I.9 Conformity, interoperability and testing

I.9.3 SIP-IMS conformity assessment and interconnection testing

[**ITU-T Q.Suppl.71 “Testing methodologies of Internet related performance measurements including e2e bit rate within the fixed and mobile operator’s networks”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14125) describes the testing procedures of data transmission speed within the fixed and mobile operator’s networks which can be established at the national or international level, providing customers of the existing public telecom networks the possibility to estimate the access related performance. The proposed methodology is based on the concept of the ITU-T Q.3960 “Framework of Internet related performance measurements” (2016)

**ITU-T Technical Paper TP-TEST-UE-MS “Guideline for general test procedure and specification for measurements of the LTE, 3G/2G user Equipment/mobile stations (UE/MS) for over-the-air performance testing” (under publication),** which gives an analysis of the work in relevant standardisation organisations (SDOs) and a survey of the requirements, and then describes a common testing methodology for LTE, 3G/2G User Equipment/Mobile Stations (UE/MS) for over-the air (OTA) performance testing.

[**ITU-T Guideline on “ITU-T CASC procedure to appoint ITU-T technical experts”**](https://www.itu.int/en/ITU-T/studygroups/2017-2020/11/Documents/Guideline_CASC_EXP_RP-10-2019.pdf) **(revised)** describes the procedures to appoint an ITU-T technical expert to be involved in the TL assessment teams of existing conformity assessment programmes (e.g. ILAC, IECEE, etc.), for assessing /checking the competence of Testing Laboratories which requested such recognition against one or a set of ITU-T Recommendation(s).

I.9.8 Testing Internet of things

I.9.9 Testing energy efficiency of base stations

I.9.10 Testing cloud computing

I.9.11 Testing SDN

I.10 Mainstreaming accessibility in ICTs

I.11 Combating Counterfeiting

**ITU-T Q.5051 “Framework for combating the use of stolen mobile devices” (under approval)**: With the increased functions and capabilities available on mobile devices, the importance and usage of these devices in people’s daily lives have been growing in recent years. As a side effect, we also observe the rise, in some countries, of actions aimed to steal these devices and generate profit, not only by selling the equipment itself but also by illegally using the information contained on it.

As a response, initiatives are needed to deter the theft and reuse of stolen mobile devices and to protect the consumer data stored on these devices against illegal use. Besides, since it is common to have devices stolen in one country, that may have deployed solutions to mitigate the use of stolen devices, sold into other countries or even regions where similar mitigation measures may not have been taken, it is critical to the success of such initiatives to have coordination and information sharing between the governments and operators from different countries that aims to combat the theft and reuse of stolen mobile devices in a global environment. Otherwise, there is a risk that the illegal trade of stolen devices across borders.

It is important to note that, since most solutions deployed today to deter the device theft and reuse problem rely on unique identifier lists, a common action taken by the traffickers to bypass these actions is to tamper with the device to alter its unique identifier, sometimes choosing an identifier already in use by a legitimate device, to allow the equipment to return to the market and to connect to mobile networks.

In response to this scenario, many countries around the world are engaged not only in combating the use of stolen mobile devices, but also in preventing the devices with unauthorized reprogrammed unique identifiers, commonly described as tampered identifiers, from returning to the network. Meanwhile governments in other countries are challenged and unclear on the best strategies to adopt, mainly due to a lack of knowledge or expertise to understand the issue and the possible solutions, and to make informed choices to deploy solutions, tailored for their individual countries, that could be effective. In this sense, guidelines are necessary to address this challenge, as indicated on the WTSA Resolution 97 (Hammamet, 2016).

For all the above, the present recommendation proposes a framework composed of requirements and a broad range of comprehensive and recommended measures that can be taken and applied to combat the theft and reuse of stolen mobile devices.

I.12 Signalling Protocols

[**ITU-T Q.3055 “Signalling protocol for Heterogeneous IoT gateways”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14141) describes the signalling protocol for heterogeneous IoT gateways.

[**ITU-T Q.3056 “Signalling procedures of the probes to be used for remote testing of network parameters”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14142) describes architecture and signaling procedures to be used for remote testing of network parameters utilizing probes. These procedures include the execution of testing, testing profile templates, storing of measurement results, and authorized access for users to test results. These procedures enable a probe to function as a “black box” recording all events on the subscriber side, and suitable for a trusted system in resolving disputes between various ICT stakeholders.

[**ITU-T Q.3644 “Requirements for signalling network analyses and optimization in VoLTE”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14143) specifies the requirements for signalling network analyses and optimization in Voice over LTE (VoLTE) in which the signalling network refers to the network entities and the signalling exchange which are related to telecommunications services. This Recommendation covers the aspects of overview on signalling network, requirements for signalling collecting, requirements for signalling network analyses, requirements for signalling network optimization and general security considerations in VoLTE.

[**ITU-T Q.3719 “Signalling requirements for the separation of control plane and user plane in vBNG (Broadband Network Gateway)”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14144)specifies architecture, signalling requirements and information flows for the separation of control plane and user plane in vBNG (Broadband Network Gateway).

[**ITU-T Q.3916 “Signalling requirements and architecture for the Internet service quality monitoring system”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14145)**:** Quality of Service (QoS) of Internet services (e.g., web and OTT video) has been attracting attentions of the Internet Service Provider (ISP) and the Internet Content Provider (ICP). To evaluate the above QoS, this Recommendation defines the architecture and signalling requirements of the Internet Service Quality Monitoring (SQM) system. Components, interfaces and interactions among components of the SQM system are described in detail in this Recommendation.

[**ITU-T Q.5002 “Signalling requirement and architecture for media service entity attachment”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14146)**:** Media service providers for different service technologies have always been developing independently in order to satisfy the requirements of their platform and become different verticals, which leads to significant drawbacks and inefficiencies in terms of development. Media service providers using cloud capability have to deal with specific signalling flows for providing media service using an interface, which significantly will increase the complexity for the provider to use different cloud infra providers. Therefore, there is a strong necessary to requirement and architecture for a standard signalling convergence of different cloud infra providers in future media service. This Recommendation specifies the signalling requirement and architecture for media service entity attachment. This Recommendation mainly describes high level signalling requirements and specific requirements for media infra layer, media service layer, API layer and orchestration layer.

**ITU-T Technical Report TR-SS7-DFS “SS7 vulnerabilities and mitigation measures for digital financial services transactions” (under publication),** which contains a result of the Financial Inclusion Global Initiative (FIGI) Security Infrastructure workstream research into SS7 vulnerabilities and their effect on Digital Financial Services (DFS) in the developing world. It describes the researched vulnerabilities, mitigation measures for operators and for DFS providers (which are not operators). This technical report is the baseline for a SG11 work items on improving the security posture of SS7 towards financial services and other public interest OTT services offered over the telecom infrastructure.

I.13 Formal Languages and Identification

[**ITU-T Z.100 (revised) “Specification and Description Language - Overview of SDL-2010”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14051)introduces the Specification and Description Language, intended for unambiguous specification and description of telecommunication systems. The scope of the Specification and Description Language is elaborated in clause 1. The ITU-T Z.100 series for SDL-2010 together form a reference manual for the language. The objective of this Recommendation is to provide an introductory overview to the language and the rest of the reference manual contained in the ITU-T Z.100 series for SDL-2010. The language introduced in this document is more fully defined in other Recommendations in the ITU-T Z.100 series for SDL-2010.

[**ITU-T Z.100 Annex F1 (revised) "Specification and Description Language - Overview of SDL-2010 - Annex F1: SDL-2010 formal definition: General overview"**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14049) provides the motivation for and the main objectives of a formal semantics definition for SDL-2010. It gives an overview of the structure of the formal semantics, and it also contains an introduction to the Abstract State Machine (ASM) formalism, which is used to define the SDL-2010 semantics.

[**ITU-T Z.100 Annex F2 (revised) "Specification and Description Language – Overview of SDL 2010 - Annex F2: SDL 2010 formal definition: Static semantics"**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14050) describes the static semantic constraints of SDL-2010, the mapping to the abstract grammar and the transformations identified by the 'Model' clauses of Recommendations ITU-T Z.101, Z.102, Z.103, Z.104, Z.105 and Z.107, that are included by reference in Recommendation ITU-T Z.100.

[**ITU-T Z.100 Annex F3 (revised) "Specification and Description Language – Overview of SDL 2010 - Annex F3: SDL 2010 formal definition: Dynamic semantics"**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14051) defines the SDL 2010 dynamic semantics.

[**ITU-T Z.101 (revised) “Specification and Description Language - Basic SDL-2010”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14052) defines the basic features of the Specification and Description Language. Together with Recommendations ITU-T Z.100, ITU-T Z.102, ITU-T Z.103, ITU-T Z.104, ITU-T Z.105, ITU-T Z.106 and ITU-T Z.107, this Recommendation is part of a reference manual for the language. The language defined in this document covers the essential features of the language, which is further defined in other Recommendations in the ITU-T Z.100 series.

[**ITU-T Z.102 (revised) “Specification and Description Language - Comprehensive SDL-2010”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14053) defines the comprehensive features of the Specification and Description Language. Together with Recommendations ITU-T Z.100, ITU-T Z.101, ITU-T Z.103, ITU-T Z.104, ITU-T Z.105, ITU-T Z.106 and ITU-T Z.107, this Recommendation is part of a reference manual for the language. The language defined in this document covers features of the language not included in Basic SDL-2010 in Recommendation ITU-T Z.101. These features provide comprehensive coverage of abstract grammar of the language except some data features covered in ITU-T Z.104 (and ITU-T Z.107 for object-oriented data).

[**ITU-T Z.103 (revised) “Specification and Description Language - Shorthand notation and annotation in SDL-2010”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14054) defines the shorthand and annotation features of the Specification and Description Language. Together with Recommendations ITU-T Z.100, ITU-T Z.101, ITU-T Z.102, ITU-T Z.104, ITU-T Z.105, ITU T Z.106 and ITU-T Z.107, this Recommendation is part of a reference manual for the language. The language defined in this document covers features of the language not included in Basic SDL 2010 in Recommendation ITU-T Z.101 or Comprehensive SDL 2010 in Recommendation ITU-T Z.102. Features defined in this Recommendation either do not have their own abstract grammar and are transformed to concrete grammar defined by Recommendations ITU T Z.101, ITU T Z.102 and ITU-T Z.104 (and ITU-T Z.107 for object oriented data), or are annotations with no formal meaning.

[**ITU-T Z.104 (revised) “Specification and Description Language - Data and action language in SDL-2010”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14055) defines the data features of the Specification and Description Language so that data definitions and expressions are well defined. Together with Recommendations ITU-T Z.100, ITU-T Z.101, ITU-T Z.102, ITU-T Z.103, ITU-T Z.105, ITU-T Z.106 and ITU-T Z.107, this Recommendation is part of a reference manual for the language. The language defined in this Recommendation partially overlaps features of the language included in Basic SDL-2010 in Recommendation ITU-T Z.101 and used in Comprehensive SDL-2010 in Recommendation ITU-T Z.102 and the features of Recommendation ITU-T Z.103.

[**ITU-T Z.105 (revised) “Specification and Description Language - SDL-2010 combined with ASN.1 modules”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14056) defines how Abstract Syntax Notation One (ASN.1) modules are usable in combination with Specification and Description Language 2010 (SDL-2010). This text replaces Recommendation ITU-T Z.105 (2003) to align with Recommendations ITU-T Z.100, ITU-T Z.101, ITU-T Z.102, ITU-T Z.103, ITU-T Z.104, ITU-T Z.106 and ITU-T Z.107 for SDL-2010. Recommendation ITU-T Z.105 (2003) replaced the semantic mappings from ASN.1 to SDL-2000 defined in Recommendation ITU-T Z.105 (1999). The use of ASN.1 notation embedded in the Specification and Description Language previously defined in Recommendation ITU-T Z.107 (1999) is not defined by this Recommendation. The main area of application of this Recommendation is the specification of telecommunication systems. The combined use of SDL-2010 and ASN.1 permits a coherent way to specify the structure and behaviour of telecommunication systems, together with data, messages and encoding of messages that these systems use.

This version of Recommendation ITU-T Z.105 includes necessary alignments with ASN.1:2002 Recommendations, mapping of XML values, improved mapping of bit string values and mapping of relevant ASN.1 constructs for extensions.

[**ITU-T Z.106 (revised) “Specification and Description Language - Common interchange format for SDL-2010”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14057) defines the common interchange format of Specification and Description Language (SDL-CIF). The SDL-CIF is intended for the interchange of graphical SDL-2010 specifications (SDL-GR) made on different tools that do not use the same storage format. Prior to the definition of SDL-CIF, the textual phrase representation of SDL-2010 (SDL-PR) was used to interchange specifications with the disadvantage that all graphical information was lost, making the same specifications often look very dissimilar in different environments. With the SDL-CIF, this disadvantage is reduced to a minimum, as it contains most of the graphical information. The SDL-CIF improves the independence from specific tool vendors and allows standards bodies to accept specifications in SDL-CIF irrespective of the tool they use for their internal work. This also improves productivity by allowing specifications to be made on the accustomed tool. All SDL-2010 tool vendors are encouraged to provide facilities for importing and exporting SDL-CIF.

This Recommendation defines how SDL-2010 descriptions are stored in order to be interchanged between tools coming from different vendors. It does not take into account the message sequence chart (MSC) notation. SDL-CIF is an optional part of SDL-2010. SDL-CIF is based on the SDL-PR syntax, the textual phrase representation of SDL-2010 also defined in this Recommendation. SDL-CIF is readable and written by tools as well as users. All the constructs available in SDL-2010 are able to be expressed in graphical form or in the purely textual SDL-PR form. Constraints on graphical presentation are expressed in SDL-CIF by adding specific annotations to SDL-PR. As a result, most SDL-PR descriptions are legal SDL-CIF descriptions. SDL-CIF is an open storage format as it includes a mechanism of tool-specific directives. This mechanism allows an SDL-CIF-compliant tool to extend the format by adding specific information. SDL-CIF is also easily implemented and provides tool vendors with two levels of tool conformance and concepts of mandatory and optional directives.

SDL-PR is an alternative text-only syntax for the Specification and Description Language. Before 2002, SDL-PR was published as part of ITU-T Z.100, but as the main use of this notation is for communication within and between tools the definition has been moved to this Recommendation. SDL-PR is Level 0 SDL-CIF and allows the interchange of syntactically complete SDL-2010 descriptions, usually as a single file per system. Conformance to SDL-PR requires the model to conform to the corresponding semantics defined in Recommendations ITU-T Z.101, ITU-T Z.102, ITU-T Z.103, ITU-T Z.104, ITU-T Z.105 and ITU-T Z.107.

This Recommendation introduces two further levels of SDL-CIF. Two further conformance levels are defined, one at a more liberal SDL-PR level and the second including graphical information. The complete grammar is described with the related semantics. Mandatory and optional directives are described, as well as the format for tool-specific directives. Current tool-specific directives are described in Appendix I.

Two levels of SDL-CIF conformance are defined as level 1 and level 2. Level 1 is very close to SDL-PR, but it supports incomplete descriptions in SDL-2010. Level 2 includes level 1 and is able to capture most of the graphical information of SDL-GR diagrams. An SDL-CIF specification shall identify which of these two levels it complies with. Similarly, tool vendors that use the SDL-CIF should also identify the SDL-CIF level they comply with for their import and export functions.

[**ITU-T Z.107 (revised) “Specification and Description Language - Object-oriented data in SDL-2010”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14058) defines the object-oriented data features of the Specification and Description Language building on the foundation of the data definitions and expressions defined in Recommendation ITU-T Z.104. Together with Recommendations ITU-T Z.100, ITU-T Z.101, ITU-T Z.102, ITU-T Z.103, ITU-T Z.104, ITU-T Z.105 and ITU-T Z.106, this Recommendation is part of a reference manual for the language. The language defined in this Recommendation partially overlaps features of the language included in Basic SDL-2010 in Recommendation ITU-T Z.101 and used in Comprehensive SDL-2010 in Recommendation ITU-T Z.102, and the features of Recommendations ITU-T Z.103 and ITU-T Z.104.

[**ITU-T Z.161 (revised) "Testing and Test Control Notation version 3: TTCN-3 core language"**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14059) defines Testing and Test Control Notation 3 (TTCN-3) intended for specification of test suites that are independent of platforms, test methods, protocol layers and protocols. TTCN-3 can be used for 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 Common Object Request Broker Architecture (CORBA) based platforms and application programming interfaces (APIs). The specification of test suites for physical layer protocols is outside the scope of this Recommendation.

The core language of TTCN-3 can be expressed in a variety of presentation formats. While this Recommendation defines the core language, Recommendation ITU-T Z.162 defines the tabular format for TTCN (TFT) and Recommendation ITU-T Z.163 defines the graphical format for TTCN (GFT). The specification of these formats is outside the scope of this Recommendation. The core language serves the following three purposes:

a) as a generalized text-based test language;

b) as a standardized interchange format of TTCN test suites between TTCN tools;

c) as the semantic basis (and where relevant, the syntactical basis) for the various presentation formats.

The core language may be used independently of the presentation formats. However, neither the tabular format nor the graphical format can be used without the core language. Use and implementation of these presentation formats shall be done on the basis of the core language.

This revision of the Recommendation contains amendments, clarifications, corrigenda and editorial corrections.

[**ITU-T Z.161.2 (revised) "Testing and Test Control Notation version 3: TTCN-3 language extensions: Configuration and deployment support"**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14060) defines the configuration and deployment support package 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 Common Object Request Broker Architecture (CORBA) based platforms, application programming interfaces (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 this Recommendation.

[**ITU-T Z.161.6 (revised) "Testing and Test Control Notation version 3: TTCN-3 language extensions: Advanced matching"**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14061) 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.161.7 “Testing and Test Control Notation version 3: TTCN-3 Language Extensions: Object-Oriented Features”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14062)defines the support for object-oriented features in 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.

[**ITU-T Z.166 (revised) "Testing and Test Control Notation version 3: TTCN-3 control interface (TCI)"**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14063) specifies the control interfaces for Testing and Test Control Notation 3 (TTCN-3) test system implementations. The TTCN-3 control interfaces (TCIs) provide a standardized adaptation for management, test component handling and encoding/decoding of a test system to a particular test platform. This Recommendation defines the interfaces as a set of operations independent of a target language. The interfaces are defined to be compatible with the TTCN-3 standards (see clause 2 of ETSI ES 201 873-6 V4.11.1). The interface definition uses the Common Object Request Broker Architecture (CORBA) Interface Definition Language (IDL) to specify the TCI completely. Clauses 8, 9 and 9.7 of ETSI ES 201 873-6 V4.11.1 present language mappings for this abstract specification to the target languages Java and ANSI C.

This revision of the Recommendation contains amendments, clarifications, corrigenda and editorial corrections.

[**ITU-T Z.169 (revised) "Testing and Test Control Notation version 3: Using XML schema with TTCN-3"**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14064) defines the mapping rules for the world wide web consortium (W3C) schema to Testing and Test Control Notation 3 (TTCN-3) to enable testing of XML-based systems, interfaces and protocols.

This revision of the Recommendation contains amendments, clarifications, corrigenda and editorial corrections.

I.14 Rules and Procedures

[**ITU-T A.1 “Working methods for study groups of the ITU Telecommunication Standardization Sector”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=13851) describes general work methods for ITU‑T study groups. It provides guidelines related to work methods, such as the conduct of meetings, preparation of studies, management of study groups, joint coordination groups, the role of rapporteurs and the processing of ITU‑T contributions and TDs.

[**ITU-T A.5** “**Generic procedures for including references to documents of other organizations in ITU-T Recommendations”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=13852) provides generic procedures for normatively referencing documents of other organizations in ITU-T Recommendations.

[**ITU-T A.13** **“Non-normative ITU-T publications, including Supplements to ITU-T Recommendations”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=13853) describes the process used by ITU-T study groups and the Telecommunication Standardization Advisory Group (TSAG) to develop and agree to publication of informative (non-Recommendation) texts published by ITU-T. The documents using this process include Supplements to ITU-T Recommendations.

[**ITU-T A.25** **“Generic procedures for incorporating text between ITU-T and other organizations”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=13854) addresses the process of incorporating text (in whole or in part, with or without modification) of documents from another organization into an ITU-T Recommendation (or another ITU-T document). Similarly, guidance is provided for other organizations incorporating text (in whole or in part, with or without modification) from ITU‑T Recommendations (or other ITU‑T documents) in their documents.

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