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| **Abstract:** | This report summarizes progress achieved ITU-T standardization from January to August 2020, 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 240 new and revised ITU-T Recommendations from January to August 2020. Appendix I lists these ITU-T Recommendations and related texts and summarizes their contents.

**IMT-2020/5G:** New ITU standards describe characteristics of transport networks to support 5G (G.8300), resource pooling for scalable 5G network slice service management and orchestration (Y.3154), and energy-efficient device-to-device communication for 5G (Q.5022). A new Supplement aims to build awareness on use cases and migration aspects of 5G (Y.Suppl.34).

**Machine learning for IMT-2020/5G:** New ITU standards provide a functional architecture of machine learning-based QoS assurance for 5G (Y.3175), a framework for evaluating intelligence levels across 5G and future networks (Y.3173), and a framework for data handling to enable machine learning in 5G and future networks (Y.3174).

**Video coding:** Approved in August 2020, the new “Versatile Video Coding” (VVC, H.266) standard advances the state of the art of video compression and has unprecedented application versatility. Developed by the Joint Video Experts Team with MPEG, VVC will halve the bitrate needed to stream videos, for the same quality level, relative to “High Efficiency Video Coding” (H.265), and a quarter relative to “Advanced Video Coding” (H.264).

**Transport, access and home:** The 50 texts approved in the reporting period include new ITU standards providing characteristics of transport networks to support IMT-2020/5G (G.8300) and the generic functional architecture of the optical media network (G.807). New Technical Reports provide considerations on the use of GNSS as a primary time reference in telecommunications (GSTR-GNSS) and the use of G.hn in industrial applications (GSTP-HNIA).

**Numbering misuse:** Revised guidelines for ITU-T action on reported misuse of E.164 number resources (E.156) describe new cases of misuse and more efficient means of combating misuse. The revised E.156 better reflects the differences between directly assigned resources, so-called “global numbers” under the responsibility of the TSB Director, and indirectly assigned resources under the responsibility of Member States. It aims to improve reporting on the misuse of indirectly assigned resources, recommending the use of email notifications to a pre-determined mailing list rather than the registration of the report of misuse for action by TSB.

**Digital financial services:** New ITU standards introduce QoS and QoE aspects of digital financial services (G.1033), a methodology to test the QoE of digital financial services (P.1502), and security requirements FinTech services built on open platform architectures (X.1149).

**Network 2030:** New Supplements provide describe capabilities, performance and design of new communications services for Network 2030 applications (Y.Suppl.66) and representative use cases and key network requirements for Network 2030 (Y.Suppl.67). A related Technical Report describes the driving forces and vision towards Network 2030.

**IP performance measurement:** A new Supplement (Y.Suppl.60) provides guidance the interpretation of measurements taken with the ITU standard for IP service performance assessment (Y.1540). The 2019 revision of Y.1540 defines IP-layer capacity parameters in ways that cater to performance assessment, and provides requirements for methods of measurement of IP-layer capacity.

**Intelligent QoS:** New ITU standards address intelligent network analytics and diagnostics (E.475) and the creation and performance testing of machine learning-based models to assess the impact of the transmission network on speech quality for 4G voice services (P.565).

**Crowdsourcing QoS:** A new ITU standard details the crowdsourcing approach to the assessment of end-to-end QoS in fixed and mobile broadband networks (E.812). Work on E.812 was initiated by national regulatory authorities and developed collaboratively with representatives of network operators, vendors, analytics companies, and academia.

**Virtual reality and cloud gaming**: New ITU standards introduce the factors influencing QoE for virtual reality services (G.1035), an opinion model predicting QoE for cloud gaming services (G.1072), and dimension-based subjective quality evaluation for video content considering five perceptual dimensions (P.918).

**Intelligent transport systems:** New ITU standards describe security threats to connected vehicles (X.1371) and provide security guidelines for V2X (vehicle-to-everything) communication (X.1372), QoE metrics for mobile telephony communication during rail travel (G.1034), an in-car communication audio specification for travellers’ safety (P.1150), and use cases and requirements for vehicular multimedia networks (F.749.3).

**Quantum information technology:** New ITU standards continue to refine aspects of quantum key distribution (QKD) networks, such as with functional requirements for QKD networks (Y.3801), a functional architecture (Y.3802), key management (Y.3803), and control and management (Y.3804). A new Technical Report highlights security considerations for QKD networks (TR.sec-qkd).

**Personal data protection:** A new ITU standard provides the technical framework of handling systems for personally identifiable information in IoT environments (X.1363).

**Cloud computing security:** New ITU standards address the security of network as a service (X.1604) and public infrastructure as a service (X.1605).

**Identifiers for unmanned aerial vehicles:** A new ITU standard provides an identification mechanism for unmanned aerial vehicles using object identifiers (X.677).

**Distributed ledger technology (DLT):** New ITU standards provide requirements for distributed ledger systems (F.751.0), assessment criteria for DLT platforms (F.751.1), a reference framework for DLTs (F.751.2), a security framework for DLT (X.1402), and security guidelines for using DLT for decentralized identity management (X.1403), and in cloud computing context blockchain as a service (Y.3530).

**DLT for cities:** New ITU standards address blockchain of things as a decentralized service platform (Y.4464), blockchain-based data exchange and sharing (Y.4560) and blockchain-based data management (Y.4561), and blockchain-based unified Key Performance Indicator data management (Y.4907). A new Supplement data processing and management aspects of blockchain for IoT and smart cities (Y.Suppl.62).

**Environment and circular economy:** New ITU standards provide an assessment method for circular scoring (L.1023) and provide for the assessment and scoring of the sustainability performance of office buildings (L.1371).

**Energy efficiency:** New ITU standards address smart energy management for datacentres (ITU-T L.1381) and telecommunication rooms (ITU-T L.1382).

**Climate change:** A new Supplement (ITU-T L.Suppl.37) provides guidance to operators of mobile networks, fixed networks and datacentres on setting 1.5°C-aligned targets compliant with L.1470. L.1470) highlights that compliance with the UNFCCC Paris Agreement will require the ICT industry to reduce GHG emissions by 45 per cent from 2020 to 2030. The recommended emission-reduction targets are the first targets specific to the ICT industry to be approved by the Science Based Target Initiative (SBTi).

**Internet of Things:** New ITU standards address IoT requirements for the support of edge computing (Y.4208), universal communication modules of mobile IoT devices (Y.4210), digital entity architecture for IoT interoperability (Y.4459) and combatting counterfeiting in IoT (Y.4808), open IoT identity correlation service (Y.4462), delegation services for IoT devices (Y.4463), IoT services based on Visible Light Communications (Y.4465 and Y.4474), spare computational capability exposure of IoT devices for smart homes (Y.4469), SensorThings API – Sensing (Y.4473), lightweight intelligent software for IoT devices (Y.4475), agility by design for ICT systems security used in IoT (Y.4807), security for narrowband IoT (X.1364), security for smart metering services in smart grids (X.1332), and identity-based cryptography in support of IoT services (X.1365).

**Smart sustainable cities:** New ITU standards address the interoperation of smart ports with smart cities (Y.4209), open data in smart cities (ITU-T Y.4461), smart greenhouse services (Y.4466), data structure and data transfer protocol for automotive emergency response systems (Y.4467 and Y.4468), AI service exposure for smart cities (Y.4470), and smart fire smoke detection services (Y.4558),

**ICT device theft:** A new ITU standard provides a framework for combating the use of stolen mobile devices (Q.5051) and a new Technical Report considers the reliability of IMEI (QTR-RLB-IMEI).

**Big data:** New ITU standards provide the requirements of big data driven networking (Y.3652) and data preservation (Y.3604). A new Supplement assesses the status of big data adoption in developing countries following a survey of ITU-T members (Y.Suppl.65)

**Accessibility:** A revised ITU standard provides accessibility profiles for IPTV systems (H.702 (V2)) and new ITU standards address annotation methods for biosignal data (H.862.2), voice management interfaces for human-care services (H.862.3), and information service systems for visually impaired persons (F.922). New Technical Papers provide a guideline on web-based remote sign language interpretation (FSTP.ACC-WebVRI) and an overview of assistive listening systems (FSTP-ACC-ALD).

**Telecoms management:** New ITU standards provide requirements for telecommunication anti-fraud management in the TMN (M.3362), data management in the TMN (M.3363) and on-site telecommunication smart maintenance management function (M.3364). New ITU standards also provide a generic information model for on-site telecommunication smart maintenance (M.3164) and framework of smart operation, management and maintenance (M.3041).

**Numbering resources for trials:** Revised ITU standards provide criteria and procedures for temporary allocations of E.164 numbering resources (E.164.2) and temporary allocations of MNCs within the shared MCC 991 (E.212 Amd.2) for international non-commercial trials.

**Codes for M2M/IoT and emergency services:** A new Supplement defines criteria for assigning E.164 identification codes and E.212 Mobile Network Codes under shared MCCs for M2M/IoT services (E.Suppl.11). A new Technical report provides an overview of a technical solution for identifying the call location in support of emergency services (TR.CLE).

**Economic and policy issues:** New ITU standards describe shared uses of telecommunication infrastructure as possible methods for enhancing the efficiency of telecommunications (D.264), optimizing terrestrial cable utilization across multiple countries to boost regional and international connectivity (D.265), an enabling environment for voluntary commercial arrangements between telecommunications network operators and over-the-top application providers (D.266), and a policy framework including principles for digital identity infrastructure (D.267/X.1261). A new Supplement describes principles for increased adoption and use of mobile financial services through effective consumer protection mechanisms (D.Suppl.4).

**Broadband cable and TV:** New ITU standards address IP cable modems with the fourth and fifth generations of transmission systems for interactive cable television services (J.225 and J.224), embedded common interface for exchangeable conditional access / digital rights management solutions (J.112, J.113, J.114, J.115 and J.115.1), downloadable conditional access system for bidirectional networks (J.1031, J.1032 and J.1033), smart TV operating systems (J.1203 and J.1204), the remote management of cable set-top boxes by auto configuration server (J.299), and IP video broadcast for CATV networks (J.1211).

**Protocols and test specs:** A new ITU standard addresses signalling for distributed infrastructure ENUM networking for IMS (Q.3643) and a new Supplement addresses signalling for IMS emergency telecommunications (Q.Suppl.72). New ITU standards also address interconnection between trustable network entities (Q.3057), energy-efficient device-to-device communication for 5G (Q.5022), time constraint IoT-based applications over SDN (Q.3745), managed P2P communications (Q.609.5), and the compatibility testing of SDN-based equipment using OpenFlow protocol (Q.3963).

***Supporting collaboration***

Open platforms such as [ITU-T focus groups](https://www.itu.int/en/ITU-T/focusgroups/Pages/default.aspx) and collaboration initiatives like the [AI for Good Global Summit](https://aiforgood.itu.int/), the the [ITU Challenge on AI and Machine Learning in 5G](https://www.itu.int/en/ITU-T/AI/challenge/2020/Pages/default.aspx), the [United for Smart Sustainable Cities (U4SSC) Initiative](https://www.itu.int/en/ITU-T/ssc/united/Pages/default.aspx), the [Financial Inclusion Global Initiative (FIGI)](https://www.itu.int/en/ITU-T/extcoop/figisymposium/Pages/default.aspx) and the new [Digital Currency Global Initiative](https://www.itu.int/en/ITU-T/extcoop/dcgi/Pages/default.aspx) support the development of new partnerships in emerging fields of ICT innovation. These platforms assist in clarifying the contributions expected of various stakeholders, including the contribution expected of ITU standardization.

The new [Digital Currency Global Initiative](https://www.itu.int/en/ITU-T/extcoop/dcgi/Pages/default.aspx) is a collaboration between ITU and Stanford University established in July 2020. The Initiative will continue the dialogue and research initiated by the ITU-T Focus Group on Digital Currency including Digital Fiat Currency on pilot implementations of digital currency, their use cases, applications and developing specifications for technical standards that will foster adoption, universal access, and ultimately financial inclusion.

Over 500 competitors from over 50 countries have entered the [ITU Challenge on AI and Machine Learning in 5G](https://www.itu.int/en/ITU-T/AI/challenge/2020/Pages/default.aspx) to showcase their talent and test their concepts on real data and real-world problems. Applying ITU standards, competitors are enabling, creating, training and deploying machine learning models and gaining hands-on experience with AI and machine learning in areas relevant to communication networks. The Challenge will culminate with the Grand Challenge Finale to be held virtually from 15 to 17 December 2020. The Challenge is kindly sponsored the Telecommunications Regulatory Authority of the United Arab Emirates (Gold Sponsor) and Cisco and ZTE (Bronze Sponsors).

More than 100 cities worldwide are evaluating their progress towards the SDGs with “[Key Performance Indicators for Smart Sustainable Cities](https://www.itu.int/en/ITU-T/ssc/united/Pages/publication-U4SSC-KPIs.aspx)” based on ITU standards, indicators promoted by U4SSC. The [U4SSC implementation programme](https://www.itu.int/en/ITU-T/ssc/united/Pages/U4SSC-IP.aspx) is supporting cities’ pursuit of the SDGs by working together with national administrations and city leaders to building a comprehensive approach to smart city development, looking at both KPI evaluations and wider national contexts for planning and action. New U4SSC reports include “[A Guide to Circular Cities](https://www.itu.int/en/publications/Documents/tsb/2020-U4SSC-A-guide-to-circular-cities/index.html)” and [eight associated case studies](https://www.itu.int/en/ITU-T/ssc/united/Pages/publications-U4SSC.aspx), as well as a range of [city snapshots, factsheets and verification reports](https://www.itu.int/en/ITU-T/ssc/united/Pages/publication-U4SSC-KPIs.aspx) sharing the results of the latest KPI evaluations.

ITU has seen renewed emphasis on all areas of ITU work capable of contributing to epidemic preparedness, with AI, smart cities, digital financial services and quality of service (QoS) forming prime examples in ITU-T. Pandemics are the focus of a “breakthrough track” within the [AI for Good Global Summit](https://aiforgood.itu.int/programme-2020/). The [U4SSC implementation programme](https://www.itu.int/en/ITU-T/ssc/united/Pages/U4SSC-IP.aspx) includes a workstream dedicated to capturing the best practices established by cities’ response to COVID-19. A new ad-hoc goup within the [ITU-WHO Focus Group on Artificial Intelligence for Health](https://www.itu.int/go/fgai4h) aims to establish best practices in the use of AI at each lifecycle of a public health emergency. In a [series of webinars](https://aiforgood.itu.int/programme-2020/), the FIGI community has shared insight into the role played by telecoms services, digital payments and fintech in preparing for and responding to pandemics. The Quality of Service Development Group has transformed its annual face-to-face meeting into a series of [QoS-themed webinars](https://www.itu.int/en/ITU-T/webinars/Pages/qsdg.aspx) considering the importance of high-quality ICT services to pandemic preparedness and response.

The twelfth edition of the ITU Kaleidoscope conference will take place from 7 to 11 December 2020 on the topic of [Industry-driven digital transformation](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2020/Pages/default.aspx). A virtual conference by design, Kaleidoscope 2020 will feature a global representation of expert views and demos. From early research prototypes to production-ready systems, a [Call for Demos](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2020/Pages/demos.aspx) is welcoming emerging concepts in applied research as well as concepts already seeing application in industry.

The ITU Journal: *ICT Discoveries* published its final special issue on “[The future of video and immersive media](https://www.itu.int/en/journal/2020/001/Pages/default.aspx)”. This complete issue was published in July 2020 and includes twelve original research papers exploring the state of the art in multimedia as well as history review article on the Emmy-winning development of the first edition of the JPEG image compression standard.

The ITU Journal has since renewed its title to renew its focus on the future. Launched in August 2020 with a new [Editor-in-Chief](https://www.itu.int/en/journal/j-fet/Pages/editorial-board.aspx), the [ITU Journal on Future and Evolving Technologies](https://www.itu.int/en/journal/j-fet/Pages/default.aspx) – free of charge for both readers and authors – will provide complete coverage of all communications and networking paradigms.

In line with the co-publishing agreement signed between ITU and Tsinghua University Press Ltd. in 2019, the new joint ITU-Tsinghua journal on [Intelligent and Converged Networks](http://icn.tsinghuajournals.com) published its first issue in June 2020.

ITU standardization platform

ITU-T membership has maintained growth in 2020 despite the impact of COVID-19. Eight Sector Members and 22 Associates joined ITU-T in the reporting period, amounting to a total of 30 new members. This translates into a net increase of 18 ITU-T members in 2020 (not including Academia). In addition, 17 new Academia members joined ITU in the reporting period.

New ITU-T members include companies in cloud applications, cybersecurity, IoT/M2M connectivity, distributed ledger technologies, AI and machine learning, autonomous networking, micro optical switch semiconductors, cable television, video technologies, test equipment for electromagnetic field assessment, smart city solutions, IP performance measurement, and esports.

The ITU Council SME Pilot Project has transitioned into the new SME fee structure available to Associates meeting certain eligibility criteria. Currently, 13 organizations enjoy this modality of participation in ITU-T study groups.

ITU’s communications and membership divisions continue to strengthen joint processes for outreach to stakeholders in ITU-T standardization. ITU-T news is now published on [MyITU News](https://www.itu.int/en/myitu/News), a new platform designed to guide readers to news, publications and events customized to their interests.

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 of UNECE which aims to improve gender balance in standards development and ensure that the content and impacts of standards are gender responsive.

TSB supports the achievement and the implementation 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.

2020 has highlighted the value of ITU-T’s electronic working environment. Virtual meetings and electronic working methods have come to form the principal platform for ITU standardization work as part of the global response to COVID-19. ITU members engaged in standards development and preparations for the ITU World Telecommunication Standardization Assembly (WTSA-20) are making optimal use of the personalized [MyWorkspace](https://www.itu.int/net4/ITU-T/myworkspace/) platform and associated TSB services and tools such as MyMeetings.

Over 12,500 pages of ITU-T Recommendations and Supplements were published between January and August 2020. 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 11 AAP Recommendations between January and August 2020, 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. Participation in ITU workshops and symposia has increased as a result of COVID-19. With all ITU-T workshops and symposia held virtually with MyMeetings, workshops and symposia are welcoming a greater number and diversity of particpants.

# Annex – Full Report of activities in ITU-T (from January to August 2020)

# 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 240 new and revised ITU-T Recommendations from January to August 2020. Appendix I lists these ITU-T Recommendations and related texts and summarizes their contents. A selection of ITU standards and related texts approved from January to August 2020 is provided below.

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**Intelligent QoS:** New ITU standards address intelligent network analytics and diagnostics (E.475) and the creation and performance testing of machine learning-based models to assess the impact of the transmission network on speech quality for 4G voice services (P.565).

**Crowdsourcing QoS:** A new ITU standard details the crowdsourcing approach to the assessment of end-to-end QoS in fixed and mobile broadband networks (E.812). Work on E.812 was initiated by national regulatory authorities and developed collaboratively with representatives of network operators, vendors, analytics companies, and academia.

**Virtual reality and cloud gaming**: New ITU standards introduce the factors influencing QoE for virtual reality services (G.1035), an opinion model predicting QoE for cloud gaming services (G.1072), and dimension-based subjective quality evaluation for video content considering five perceptual dimensions (P.918).

**Intelligent transport systems:** New ITU standards describe security threats to connected vehicles (X.1371) and provide security guidelines for V2X (vehicle-to-everything) communication (X.1372), QoE metrics for mobile telephony communication during rail travel (G.1034), an in-car communication audio specification for travellers’ safety (P.1150), and use cases and requirements for vehicular multimedia networks (F.749.3).

**Quantum information technology:** A new ITU standard provides functional requirements for quantum key distribution (QKD) networks (Y.3801) and a new Technical Report highlights security considerations for QKD networks (TR.sec-qkd).

**Personal data protection:** A new ITU standard provides the technical framework of handling systems for personally identifiable information in IoT environments (X.1363).

**Cloud computing security:** New ITU standards address the security of network as a service (X.1604) and public infrastructure as a service (X.1605).

**Identifiers for unmanned aerial vehicles:** A new ITU standard provides an identification mechanism for unmanned aerial vehicles using object identifiers (X.677).

**Distributed ledger technology (DLT):** New ITU standards provide requirements for distributed ledger systems (F.751.0), assessment criteria for DLT platforms (F.751.1), a reference framework for DLTs (F.751.2), a security framework for DLT (X.1402), and security guidelines for using DLT for decentralized identity management (X.1403), and in cloud computing context blockchain as a service (Y.3530).

**DLT for cities:** New ITU standards address blockchain of things as a decentralized service platform (Y.4464), blockchain-based data exchange and sharing (Y.4560) and blockchain-based data management (Y.4561), and blockchain-based unified Key Performance Indicator data management (Y.4907). A new Supplement data processing and management aspects of blockchain for IoT and smart cities (Y.Suppl.62).

**Environment and circular economy:** New ITU standards provide an assessment method for circular scoring (L.1023) and provide for the assessment and scoring of the sustainability performance of office buildings (L.1371).

**Energy efficiency:** New ITU standards address smart energy management for datacentres (ITU-T L.1381) and telecommunication rooms (ITU-T L.1382).

**Climate change:** A new Supplement (ITU-T L.Suppl.37) provides guidance to operators of mobile networks, fixed networks and datacentres on setting 1.5°C-aligned targets compliant with L.1470. L.1470) highlights that compliance with the UNFCCC Paris Agreement will require the ICT industry to reduce GHG emissions by 45 per cent from 2020 to 2030. The recommended emission-reduction targets are the first targets specific to the ICT industry to be approved by the Science Based Target Initiative (SBTi).

**Internet of Things:** New ITU standards address IoT requirements for the support of edge computing (Y.4208), universal communication modules of mobile IoT devices (Y.4210), digital entity architecture for IoT interoperability (Y.4459) and combatting counterfeiting in IoT (Y.4808), open IoT identity correlation service (Y.4462), delegation services for IoT devices (Y.4463), IoT services based on Visible Light Communications (Y.4465 and Y.4474), spare computational capability exposure of IoT devices for smart homes (Y.4469), SensorThings API – Sensing (Y.4473), lightweight intelligent software for IoT devices (Y.4475), agility by design for ICT systems security used in IoT (Y.4807), security for narrowband IoT (X.1364), security for smart metering services in smart grids (X.1332), and identity-based cryptography in support of IoT services (X.1365).

**Smart sustainable cities:** New ITU standards address the interoperation of smart ports with smart cities (Y.4209), open data in smart cities (ITU-T Y.4461), smart greenhouse services (Y.4466), data structure and data transfer protocol for automotive emergency response systems (Y.4467 and Y.4468), AI service exposure for smart cities (Y.4470), and smart fire smoke detection services (Y.4558),

**ICT device theft:** A new ITU standard provides a framework for combating the use of stolen mobile devices (Q.5051) and a new Technical Report considers the reliability of IMEI (QTR-RLB-IMEI).

**Big data:** New ITU standards provide the requirements of big data driven networking (Y.3652) and data preservation (Y.3604). A new Supplement assesses the status of big data adoption in developing countries following a survey of ITU-T members (Y.Suppl.65).

**Accessibility:** A revised ITU standard provides accessibility profiles for IPTV systems (H.702 (V2)) and new ITU standards address annotation methods for biosignal data (H.862.2), voice management interfaces for human-care services (H.862.3), and information service systems for visually impaired persons (F.922). New Technical Papers provide a guideline on web-based remote sign language interpretation (FSTP.ACC-WebVRI) and an overview of assistive listening systems (FSTP-ACC-ALD).

**Telecoms management:** New ITU standards provide requirements for telecommunication anti-fraud management in the TMN (M.3362), data management in the TMN (M.3363) and on-site telecommunication smart maintenance management function (M.3364). New ITU standards also provide a generic information model for on-site telecommunication smart maintenance (M.3164) and framework of smart operation, management and maintenance (M.3041).

**Numbering resources for trials:** Revised ITU standards provide criteria and procedures for temporary allocations of E.164 numbering resources (E.164.2) and temporary allocations of MNCs within the shared MCC 991 (E.212 Amd.2) for international non-commercial trials.

**Codes for M2M/IoT and emergency services:** A new Supplement defines criteria for assigning E.164 identification codes and E.212 Mobile Network Codes under shared MCCs for M2M/IoT services (E.Suppl.11). A new Technical report provides an overview of a technical solution for identifying the call location in support of emergency services (TR.CLE).

**Economic and policy issues:** New ITU standards describe shared uses of telecommunication infrastructure as possible methods for enhancing the efficiency of telecommunications (D.264), optimizing terrestrial cable utilization across multiple countries to boost regional and international connectivity (D.265), an enabling environment for voluntary commercial arrangements between telecommunications network operators and over-the-top application providers (D.266), and a policy framework including principles for digital identity infrastructure (D.267/X.1261). A new Supplement describes principles for increased adoption and use of mobile financial services through effective consumer protection mechanisms (D.Suppl.4).

**Broadband cable and TV:** New ITU standards address IP cable modems with the fourth and fifth generations of transmission systems for interactive cable television services (J.225 and J.224), embedded common interface for exchangeable conditional access / digital rights management solutions (J.112, J.113, J.114, J.115 and J.115.1), downloadable conditional access system for bidirectional networks (J.1031, J.1032 and J.1033), smart TV operating systems (J.1203 and J.1204), the remote management of cable set-top boxes by auto configuration server (J.299), and IP video broadcast for CATV networks (J.1211).

**Protocols and test specs:** A new ITU standard addresses signalling for distributed infrastructure ENUM networking for IMS (Q.3643) and a new Supplement addresses signalling for IMS emergency telecommunications (Q.Suppl.72). New ITU standards also address interconnection between trustable network entities (Q.3057), energy-efficient device-to-device communication for 5G (Q.5022), time constraint IoT-based applications over SDN (Q.3745), managed P2P communications (Q.609.5), and the compatibility testing of SDN-based equipment using OpenFlow protocol (Q.3963).

Active ITU-T Focus Groups (see section 6):

* [AI for Health](https://www.itu.int/en/ITU-T/focusgroups/ai4h/Pages/default.aspx)
* [Vehicular Multimedia](https://www.itu.int/en/ITU-T/focusgroups/vm/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 ITU-T under COVID-19

2020 has highlighted the value of ITU-T’s electronic working environment.

Virtual meetings and electronic working methods have come to form the principal platform for ITU standardization work as part of the global response to COVID-19. ITU members engaged in standards development and preparations for the ITU World Telecommuncation Standardization Assembly (WTSA-20) are making optimal use of the personalized [MyWorkspace](https://www.itu.int/net4/ITU-T/myworkspace/) platform and associated TSB services and tools such as MyMeetings.

With the continued and evolving threat of COVID-19 since mid-January 2020, ITU-T meetings first provided facilities for remote participation in addition to physical attendance. With the “force majeure” of COVID-19 in Switzerland and around the world, and the introduction of associated measures to control the pandemic beginning 12 March 2020, ITU-T meetings became fully virtual(no physical presence allowed in ITU HQ in Geneva), fellowships were suspended, and several virtual ITU-T study group meetings have since operated in English without interpretation.

|  |  |  |  |
| --- | --- | --- | --- |
| **Place, Dates** | **Meeting** | **Physical, virtual** | **Remarks** |
| Geneva, 27 January - 7 February 2020 | ITU-T SG15 | Physical | Exceptional arrangements to provide remote observation or participation for delegates unable to travel. |
| Geneva, 10-14 February 2020 | TSAG | Physical | Real-time captioning; interpretation in six languages; and remote participation using new tool Interprefy as well as a webcast. |
| Geneva, 4-13 March 2020 | ITU-T SG11 | Physical | Interactive remote participation for all sessions during the entire SG11 meeting, including decision-making sessions, using Interprefy for the opening and closing plenaries. |
| Geneva, 13 March 2020 | ITU-T SG13 | Physical | Remote participants able to in decision-making sessions. |
| Virtual, 17-26 March 2020 | ITU-T SG17 | Fully virtual | First fully virtual ITU-T study group meeting, with a closing e-plenary in English only. |
| Virtual, 31 March - 9 April 2020 | ITU-T SG3 | Fully virtual | English only; automated AI translation of meeting documents with TSB AI tool; and remote participants able to express their views in decision-making sessions. |
| Virtual, 15-24 April 2020 | ITU-T SG12 | Fully virtual | Closing e-plenary in English only. |
| Virtual, 16-23 April 2020 | ITU-T SG9 | Fully virtual | Remote participants able to express their views in decision-making sessions. |
| Virtual, 11-20 May 2020 | ITU-T SG5 | Fully virtual | Closing e-plenary in English only. |
| Virtual, 27 May - 5 June 2020 | ITU-T SG2 | Fully virtual | English only; automated AI translation of meeting documents with TSB AI tool; and captioning for selected sessions. |
| Virtual, 29 May 2020 | ITU-T SG17 | Fully virtual | Special e-plenary session of SG17 in English only. |
| Virtual, 7 July 2020 | ITU-T WP1/9 | Fully virtual | Closing e-plenary in English only. |
| Virtual, 7 July 2020 | ITU-T WP2/9 | Fully virtual | Closing e-plenary in English only. |
| Virtual, 20-31 July 2020 | ITU-T SG13 | Fully virtual | Closing e-plenary in English only. |
| Virtual, 22-31 July 2020 | ITU-T SG11 | Fully virtual | English-Russian interpretation on MyMeetings at the closing plenary. |
| Virtual, 22 June - 3 July 2020 | ITU-T SG16 | Fully virtual | Interpretation trial in MyMeetings in Chinese for part of the closing plenary. |
| Virtual, 6-16 July 2020 | ITU-T SG20 | Fully virtual | Closing e-plenary in English only. |
| Virtual, 24-28 August 2020 | ITU-T SG3 | Fully virtual | French-English interpretation on MyMeetings. |
| Virtual, 24 August - 3 September 2020 | ITU-T SG17 | Fully virtual | Closing e-plenary in English only. |
| Virtual, 7-8 September 2020 | ITU-T SG2 | Fully virtual | English only, with captioning for all sessions. |
| Virtual, 7-11 September 2020 | ITU-T SG12 | Fully virtual | Closing e-plenary in English only. |
| Virtual, 7-18 September 2020 | ITU-T SG15 | Fully virtual | Planned. Closing e-plenary in English only. |
| Virtual, 18 September 2020 | Interregional meeting for preparation of WTSA-20 | Fully virtual | Planned. Interpretation in all official ITU languages on MyMeetings. |
| Virtual, 21-25 September 2020 | TSAG | Fully virtual | Planned. Interpretation in all official ITU languages on MyMeetings. |
| Virtual 29-30 September 2020 | ITU-T SG5RG-AP | Fully virtual | Planned. English only. |
| Virtual, 19-23 October 2020 | SG5 | Fully virtual | Planned. Closing e-plenary in English only. |

In conjunction with virtual ITU-T study group meetings, four 'BSG Hands-On SG effectiveness training' sessions were carried out virtually. 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 ITU-T study groups, drafting contributions to meetings, presenting proposals, collaborative working methods and building consensus.

May to July 2020 hosted a series of webinars on [Insights on Digital Financial Services during COVID-19](https://www.itu.int/en/ITU-T/webinars/Pages/dfs.aspx). The Quality of Service Development Group has transformed its annual face-to-face meeting into a series of [QoS-themed webinars](https://www.itu.int/en/ITU-T/webinars/Pages/qsdg.aspx). In addition, several ITU workshops were turned into electronic webinars; through some planned (joint) workshops had to be cancelled or be postponed.

The [AI for Good Global Summit](https://aiforgood.itu.int/programme-2020/) will remain online, all year, over 2020 and 2021, featuring weekly programming across multiple formats, platforms and time-zones, including keynotes, expert webinars, project pitches, Q&As, performances, demos, interviews, networking and more. AI for Good ‘Breakthrough tracks’ on food, gender and pandemics will present the latest developments in their work from 21-30 September 2020.

# 3 Conformity, interoperability and testing

## 3.1 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.

CASC conducted two meetings (March and July 2020). During its meeting in July, IEC presented the roles and requirements for Testing Laboratories and Certification Bodies in relation to the potential joint peer-assessment laboratory service (joint ITU/IEC TL recognition procedure) and joint conformity assessment programme (joint ITU/IEC certification schemes). It was indicated that, as a non-profit organization, there is a need to cover IECEE cost of operations to implement the IECEE Operational Document (OD-2026) specifying the requirements of the TL recognition process for ITU. The financial implications of the IECEE programme with ITU are therefore as follows:

* TLs shall pay around 14,000 Swiss francs for the TL recognition assessment;
* ITU shall also pay 45,000 Swiss francs annually to IEC to maintain the new scheme.

The discussions of the July IEC meeting highlighted that CASC’s plan is to implement a simple and transparent procedure that allows TLs to be recognized by ITU in order to populate the ITU Product Conformity Database, following the request of WTSA-16 that ITU collaborate with IECEE and ILAC in this regard. It also highlighted that ITU has received several requests from TLs wishing to be recognized by ITU, asking CASC to provide guidance on the way forward.

The July IEC meeting also discussed the largely positive responses received from a questionnaire evaluating market need for a joint ITU/IEC TL recognition procedure and certification scheme for ITU-T Recommendations, a questionnaire distributed by ITU-T CASC at the request of IECEE Certification Management Committee Working Group 33 ‘ITU requirements’ (IECEE CMC WG33).

Considering the unanticipated costs to be incurred by TLs, a CASC meeting following in July decided against the continued development of the proposed joint TL recognition procedure. CASC also decided to suspend the continued developed of the proposed joint certification scheme to provide ITU-T study groups the opportunity to provide CASC feedback on whether or not such joint certification scheme would be of interest to ITU-T study groups, taking into consideration all financial implications. The relevant LSs have been sent to ITU-T study groups and IECEE.

Also during July CASC meeting, ILAC presented outcomes of and ILAC survey to identify TLs accredited to perform testing in accordance with ITU-T Recommendations. The response rate was reasonable at 68 per cent. CASC encouraged ILAC to propose procedures on further collaboration at the next CASC meeting. It is assumed that these procedures could allow CASC to recognize TLs provided by ILAC, without additional assessment. The relevant LS has been sent to ILAC.

## 3.2 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-series Supplement 4 "Number portability – Capability set 1 requirements for service provider portability (All call query and Onward routing)", tested to ITU-T Q.3905.

# 4 Accessible ITU-T meetings

ITU-T provides accessibility 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.

American Sign Language (ASL), British Sign Language (BSL) and real-time captioning were provided for:

* Q26/16 Rapporteur meeting (18, 20-21 May 2020), Q26/16 meeting during the ITU-T SG16 meeting in June-July 2020.
* the JCA-AHF meetings on 21 May 2020 and on 1 July 2020.
* Captioning was provided for:
* the [IRG-AVA](https://www.itu.int/en/irg/ava/Pages/default.aspx) meeting on 14 February 2020 and on 25 June 2020.

Webinar sessions on accessibility were organized during WSIS Forum 2020:

* [Make Listening Safe and create the world where nobody's hearing is put in danger due to unsafe listening](https://www.itu.int/net4/wsis/forum/2020/Agenda/Session/124) by ITU-T and WHO on 13 July 2020
* [How to engage the whole audience: Innovation in media accessibility](https://www.itu.int/net4/wsis/forum/2020/Agenda/Session/132) by the IRG-AVA on 15 July 2020.
* [ICTs and Accessibility: Leaving Nobody Behind in the age of Smart Cities and Advances in Technology](https://www.itu.int/net4/wsis/forum/2020/Agenda/Session/141) by the JCA-AHF on 17 July 2020.

TSB contributed to the following ITU events:

* [Accessible Americas 2019](https://www.itu.int/en/ITU-D/Regional-Presence/Americas/Pages/EVENTS/2019/23940.aspx) (Quito, 20-22 November 2019)
* [Accessible Europe 2019](https://www.itu.int/en/ITU-D/Regional-Presence/Europe/Pages/Events/2019/AE/AccessibleEurope.aspx) (Malta, 4-6 December 2019).

# 5 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). All meeting reports can be found on the IPR AHG website at <https://itu.int/en/ITU-T/ipr/Pages/adhoc.aspx>.

# 6 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.

## 6.1 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 on topics related to quantum key distribution networks (QKDN) and the network aspects of quantum information technologies (QITs) beyond QKDN.**

**Chief among its list of priorities is the analysis of high-potential use cases of QITs in ICT networks and the harmonization of associated terminology. This analysis will conclude with the delivery of Technical Reports on terminology and use cases related to QKDN and QIT beyond QKDN. Additionally, the group will also inform the ‘pre-standardization’ aspects with the production of Technical Reports on QKDN transport technologies and protocols and a survey of the implications of QITs on networks. The group’s ‘pre-standardization' study on will culminate with the delivery of the standardization landscape and outlook on QITs, analyzing the challenges to standardization and identifying validated standardization needs.**

## 6.2 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)) has concluded a Machine Learning toolset for communication networks comprising ten technical specifications, with about half of this toolset already published as ITU standards. The key standard of this toolset (Y.3172) describes an architectural framework for networks to accommodate current as well as future use cases of Machine Learning.

Over 500 competitors from over 50 countries have entered the [ITU Challenge on AI and Machine Learning in 5G](https://www.itu.int/en/ITU-T/AI/challenge/2020/Pages/default.aspx) to showcase their talent and test their concepts on real data and real-world problems. Applying ITU standards such as Y.3172, competitors are enabling, creating, training and deploying machine learning models and gaining hands-on experience with AI and machine learning in areas relevant to communication networks. The Challenge will culminate with the Grand Challenge Finale to be held virtually from 15 to 17 December 2020. The Challenge is kindly sponsored the Telecommunications Regulatory Authority of the United Arab Emirates (Gold Sponsor) and Cisco and ZTE (Bronze Sponsors).

## 6.3 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) FG NET-2030 has concluded its activities and submitted eight deliverables to its parent ITU-T Study Group 13; among those are four technical reports, three technical specifications, and one white paper dealing with vision for Network 2030. Two of the above listed deliverables were approved for publication as Supplements 66 and 67 to the ITU-T Y.3000-series of ITU-T Recommendations. They deal with Network 2030 services and selected use cases and key network requirements for Network 2030. The group examined how emerging technologies can enhance network capabilities to meet the demands of 5G systems and future innovations. The group studied new media, services and architectures to identify communication needs and use cases for the year 2030 and beyond. In focus were applications including augmented and virtual reality and holograms, and time-sensitive applications in fields such as telemedicine and industrial automation.

## 6.4 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 20 topic areas ("use cases"), addressing health issues including breast cancer, neurodegenerative diseases, vision loss, skin lesions, cardiovascular diseases, and venomous snakebites. The topic areas is supported by various working groups covering a range of “horizontal” topics, such as regulatory considerations, ethics, data quality, data assessment, and clinical evaluation. It has also established an ad hoc group that is collecting best practice information on the use of AI and other digital technologies for health emergency responses, using COVID-19 as an initial template.

## 6.5 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. This first deliverable has been approved as an ITU standard (F.749.3) during the reporting period as part of the work of its parent ITU-T Study Group 16.

## 6.6 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 group’s 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.

## 6.7 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 Focus Group is studying requirements of AI and other emerging technologies to ensure environmental efficiency and related strategies for implementation, assessment and measurement. The group’s work also supports ITU’s ongoing studies of the environmental requirements of 5G systems. Its work 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.

# 7 Collaboration in standardization

## 7.1 Coordination and cooperation among ITU Sectors

Collaboration with ITU-R and with ITU-D is a standing agenda point of TSAG, where TSAG examines existing methods and approaches to collaboration 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](https://www.itu.int/en/irg/ava): Intersector Rapporteur Group on Audiovisual Media Accessibility, among ITU-T SG9, ITU-T SG16 and ITU-R SG6.
* [IRG-AVQA](https://www.itu.int/en/irg/avqa): Intersector Rapporteur Group on Audiovisual Quality Assessment, among ITU-T SG12 and ITU-R SG6. A virtual meeting was held in March 2020, in conjunction with the Video Quality Expert Group (VQEG). The same setup is planned for later this year.
* [IRG-IBB](https://www.itu.int/en/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.

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

TSB organizes conference calls and face-to-face meetings with ITU’s Regional Offices on a regular basis at the initiative of the TSB Director, with the objective of improving coordination and increasing the efficiency of the overall operations, events and activities of ITU-T and TSB. This activity has grown in importance as part of the approach WTSA-20, with regional preparations for WTSA led the Regional Organizations (APT, ATU, CEPT, CITEL, League of Arab States, and RCC). This activity has led to significant improvements in the overall coordination of ITU-T/TSB operations, events and activities taking place in the Regions and has contributed to greater awareness of ITU-T standardization activities in each Region. TSB will continue to enhance the collaboration and the cooperation with the ITU Regional Offices, as well as with relevant regional and other international organizations dealing with standards and ICTs.

## 7.3 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 2020 will be “Protecting the planet with standards”.

**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. No CTO/CxO meetings have been taking place since January 2020.

**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 together with nine other UN bodies developed a report on “[frontier technologies to protect the environment and tackle climate change](https://www.itu.int/en/publications/Documents/tsb/2020-Frontier-Technologies-to-Protect-the-Environment-and-Tackle-Climate-Change/index.html)”. Additionally, ITU is one of the partners of the Circular Economy Partnership and is co-leading the partnership’s working group on Circular Design and Takeaway & Collection.

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

More than 100 cities worldwide are evaluating their progress towards the SDGs with “[Key Performance Indicators for Smart Sustainable Cities](https://www.itu.int/en/ITU-T/ssc/united/Pages/publication-U4SSC-KPIs.aspx)” based on ITU standards, indicators promoted by U4SSC. U4SSC is also developing a ‘[Global Smart Sustainable City Index](https://www.itu.int/en/ITU-T/ssc/united/Pages/thematic-groups.aspx)’ derived from these KPIs. New U4SSC reports include “[A Guide to Circular Cities](https://www.itu.int/en/publications/Documents/tsb/2020-U4SSC-A-guide-to-circular-cities/index.html)” and [eight associated case studies](https://www.itu.int/en/ITU-T/ssc/united/Pages/publications-U4SSC.aspx), as well as a range of [city snapshots, factsheets and verification reports](https://www.itu.int/en/ITU-T/ssc/united/Pages/publication-U4SSC-KPIs.aspx) sharing the results of the latest KPI evaluations.

The [U4SSC implementation programme](https://www.itu.int/en/ITU-T/ssc/united/Pages/U4SSC-IP.aspx) is supporting cities’ pursuit of the SDGs by working together with national administrations and city leaders to building a comprehensive approach to smart city development, looking at both KPI evaluations and wider national contexts for planning and action.

U4SSC is developing expert guidance on topics including:

* Practitioner guides for the measuring and monitoring of smart city progress.
* ICT-based smart city platforms support the digital transformation of public services and their integrated management.
* Cities’ resilience in the face of emergencies such as COVID-19 and routes to economic and financial recovery.
* Public procurement in the digital age to support city leaders in establishing effective processes for the procurement of ICT solutions for smart cities.
* Tools and mechanisms to finance smart city projects, benefiting from the contributions of a wide variety of smart city stakeholders in the public and private sectors.
* The potential for frontier technologies to contribute to smart city innovation, looking at smart-city use cases of technologies in fields such as Artificial Intelligence and blockchain.
* Low-cost solutions not reliant on extensive infrastructure or highly skilled labour, an area of U4SSC work particularly relevant to small and medium-sized cities and cities in developing countries.

**Digital financial inclusion (see more in Section 9):** The[Financial Inclusion Global Initiative (FIGI)](https://www.itu.int/en/ITU-T/extcoop/figisymposium/Pages/default.aspx) 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.

FIGI is designed to advance research in digital finance and accelerate digital financial inclusion in developing countries. The FIGI Security, Infrastructure and Trust Working Group led by ITU developed an additional four reports in 2020. The FIGI Symposium which was planned in June 2020 was moved to June 2021 due to the COVID-19 pandemic.

The new [Digital Currency Global Initiative](https://www.itu.int/en/ITU-T/extcoop/dcgi/Pages/default.aspx) is a collaboration between ITU and Stanford University established in July 2020. The Initiative will continue the dialogue and research initiated by the ITU-T Focus Group on Digital Currency including Digital Fiat Currency on pilot implementations of digital currency, their use cases, applications and developing specifications for technical standards that will foster adoption, universal access, and ultimately financial inclusion. See more in section 9.

**AI for Good:** The [AI for Good Global Summit](https://aiforgood.itu.int/programme-2020/) series identifies practical applications of AI with the potential to accelerate progress towards the SDGs. Close to 40 UN organizations are partners of the AI for Good Global Summit. Now in its fourth edition, this year’s AI for Good Global Summit is being held online all year, and will continue to connect AI innovators with public and private-sector decision-makers in the interests of stimulating the discovery and delivery of “AI for Good” solutions for all. The AI for Good series has been arranged into three streams (Build, Learn, Experience) with the following service offerings:

Build:

* AI for Good Breakthroughs
* AI for Good Innovation Factory
* AI for Good Machine Learning 5G Challenge
* AI for Good Repository

Learn:

* AI for Good Keynotes
* AI for Good Webinars
* AI for Good Perspectives
* AI for Good On the Go!

Experience:

* AI for Good Artistic Intelligence
* AI for Good Demos

Following TSAG discussions on the matter in September 2019 (see [TSAG-R8](https://www.itu.int/md/T17-TSAG-R-0008/en)), a [roundtable](https://www.itu.int/en/ITU-T/extcoop/ai-data-commons/202001/Pages/default.aspx) was convened at ITU headquarters on 30-31 January 2020 to discuss the mission and composition of a Global Initiative to support the implementation of beneficial AI-based solutions to accelerate progress towards the SDGs.

Attended by around 100 participants (including AI specialists, data owners, and infrastructure providers from the private sector, academia, governments, UN agencies and standards bodies), the roundtable highlighted the need for the Global Initiative to maximize collaboration in order to:

* Match problem owners with providers of solutions using AI and data
* Scale and sustain AI-based projects
* Make available and accessible capabilities, resources, datasets, know-how, guidelines, frameworks and standards as a common good

At the roundtable, two working groups (on repositories and on marketplaces) were established and one project was identified (Global AI services platform, initially introduced at an AI for Good Global Summit) to progress toward achieving the mission of the Global Initiative, summarized [here](https://news.itu.int/join-global-initiative-ai-data-commons/).

On 16 July 2020, as part of the AI for Good webinar series, the Global Initiative launched the [Global Data Pledge project](https://aiforgood.itu.int/events/global-data-pledge/) to help identify, support and make available data as a common global resource.

## 7.4 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.

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

Other standardization bodies with which TSB is expanding cooperation include the Pan American Standards Commission, the Pacific Area Standards Congress, and the South Asian Regional Standards Organization. A brief overview of related engagements in 2020 can be found below.

**African Regional Organization for Standardisation (ARSO):** TSB participated in the "Webinar: COVID-19 Interventions - The Standardisation Solution", 30 June 2020.

**Pacific Area Standards Congress (PASC):** The TSB Director participated in the PASC virtual meeting session with ISO, IEC and ITU, 20 May 2020, organized by the PASC Secretariat which is this year held by the National Standardization Agency of Indonesia (BSN).

**Standards Australia:** TSB participated in a virtual training session organized by Standards Australia on “Indo Pacific Digital Trade Standardisation Initiative - training on international participation”, 25 May 2020.

# 8 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 include: 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.

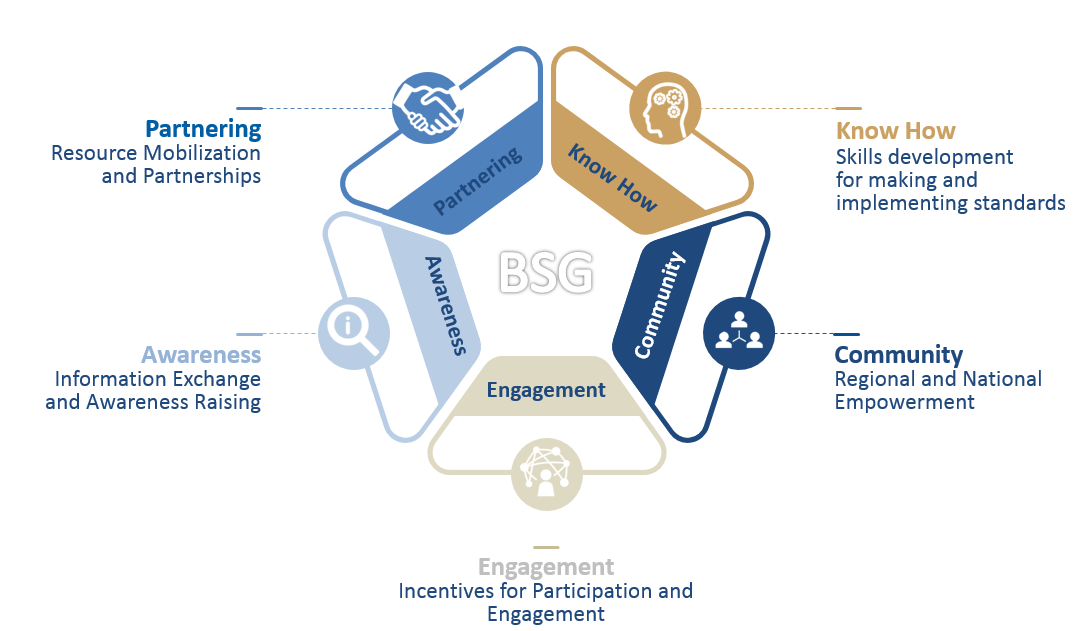


Figure 1 - Five pillars of the BSG Programme

## 8.1 BSG hands-on training sessions

ITU-T regularly carries out 'BSG Hands-On SG effectiveness training' in response to WTSA Resolution 44. These trainings focus on the development of practical skills to maximize the effectiveness of developing countries' participation in the ITU-T standardization process, covering topics including strategies for participation in SGs, drafting contributions to meetings, presenting proposals, collaborative working methods, building consensus and utilization of TSB tools and services.

These BSG training sessions have welcomed 150 delegates in 2020.

A BSG training session was organized in collocation with SG11 and SG13 in March 2020.  
A BSG session was delivered during the SG13-RGAFR meeting in Abuja, Nigeria, 5-6 February 2020. A BSG-related session on ITU-T Approval Processes on regional Recommendations and on the ITU-T A.5 qualification and justification process was given during the SG3RG-AFR virtual meeting, 6-10 July 2020.

Considering the shift to fully virtual ITU-T meetings in response to COVID-19, four virtual BSG training sessions have been organized since May 2020 and additional trainings are being planned for the remaining quarter of 2020

**8.1.1 BSG training on services and tools**

On occasion, TSB also offers trainings on the use of TSB services and tools. These trainings introduce services and tools including remote participation, MyWorkspace and publications. Such BSG trainings facilitate more active and efficient participation in ITU-T work, particularly in view of the upcoming WTSA-20. For more on TSB services and tools, see section 15.

## 8.2 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. About 300 participants attended the eight Regional Group meetings held since January 2020:

* Three in Africa (SGs 3, 12 and 13)

1. SG3-RG-AFR: virtual, 6-10 July 2020: 34 participants.
2. SG12-RG-AFR: N'Djamena, Chad, 4-5 March 2020: 50 participants.
3. SG13-RG-AFR: Abuja, Nigeria, 5-6 February 2020: 115 participants.

* One for the Americas (SG3)
  1. **SG3-RG-LAC: virtual, 15-17 July 2020: 23 participants.**
* One for the Arab States (SG3)

1. SG3-RG-ARB: virtual, 28 July 2020: 12 participants.

* One for Asia and Oceania (SG3).

1. SG3-RG-AO: virtual, 15-17 July 2020: 23 participants, followed by ad-hoc SG3RG-AFR e-meeting on 15 July 2020.

* Two for Eastern Europe, Central Asia and Transcaucasia (SG3, SG20).

1. SG3-RG-EECAT: Minsk, Belarus, 4 March 2020: 18 participants.
2. SG20-RG-EECAT: Minsk, Belarus, 5 March 2020: 20 particpants.

## 8.3 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.).

One [ITU Regional Standardization Forum (RSF)](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/bsg) and one regional ITU workshop took place during the reporting period:

* [ITU Regional Standardization Forum (RSF)](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/bsg) on [“Smart sustainable cities: from concept to implementation”](https://www.itu.int/en/ITU-D/Regional-Presence/CIS/Pages/EVENTS/2020/03_Minsk/03_Minsk.aspx), Minsk, Belarus, 3 to 5 March 2020.
* [7th SG13 Regional Workshop on "Standardization of future networks towards Building a better connected Africa"](https://www.itu.int/en/ITU-T/studygroups/2017-2020/13/sg13rgafr/Pages/default.aspx), 3-4 February 2020, Abuja, Nigeria.

## 8.4 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).

## 8.5 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](https://academy.itu.int/index.php/training-courses/full-catalogue/audio-based-indoor-and-outdoor-network-navigation-system-persons-vision-impairment-1) 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.

## 8.6 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.

## 8.7 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).

SG13 recently agreed an [ITU-T Technical Report on the “Use of ITU-T Recommendations by Developing Countries”](https://www.itu.int/md/meetingdoc.asp?lang=en&parent=T17-SG13-200720-TD-PLEN-0306) which presents the analysis and interpretation of the results of a questionnaire on use of ITU-T Recommendations in developing countries.

## 8.8 Fellowships

The table below shows the fellowships awarded during the period from January to August 2020. 40 fellowships were requested, and 33 fellowships were awarded. Of the 33 fellowships awarded, 30 fellowships were used and 3 were cancelled.

| Meeting | Fellows | | Total |
| --- | --- | --- | --- |
| Female | Male |
| ITU-T SG15, Geneva, 27 January – 7 February 2020 | 0 | 6 (1 cancelled) | 6 fellowships awarded, 5 participants |
| ITU-T SG13RG-AFR and Regional Workshop, Abuja, Nigeria, 3-6 February 2020 | 0 | 4 (1 cancelled) | 4 fellowships awarded, 3 participants |
| TSAG, Geneva, 10-14 February 2020 | 2 | 7 (1 cancelled) | 9 fellowships awarded, 8 participants |
| SG12RG-AFR N’Djamena, Chad, 4-5 March 2020 | 0 | 6 | 6 fellowships awarded, 6 participants |
| ITU-T SG11, Geneva, 4–13 March 2020 | 1 | 7 | 8 fellowships awarded, 8 participants |

# 9 Using ICTs to bridge the financial inclusion gap

Pursuant to WTSA-16 [Resolution 89](https://www.itu.int/dms_pub/itu-t/opb/res/T-RES-T.89-2016-PDF-E.pdf), TSB has implemented a number of activities aimed at enhancing the use of ICTs in bridging the financial inclusion gap through the following:

* 1. The Financial Inclusion Global Initiative (FIGI)
  2. Standardization activities in ITU-T Study Groups
  3. DFS Webinar Series during COVID-19
  4. Digital Currency Global Initiative

## 9.1 Financial Inclusion Global Initiative (FIGI)

FIGI was established in 2017 as a three-year programme of collective action to advance research in digital finance and accelerate digital financial inclusion in developing countries. FIGI is led jointly by ITU, the World Bank Group and the Committee on Payments and Market Infrastructures, with support from the Bill & Melinda Gates Foundation. FIGI funds national implementations in three countries, namely China, Egypt and Mexico, and has three Working Groups: (1) Electronic Payment Acceptance, (2) Digital ID Working Group led by the World Bank, and (3) Security, Infrastructure and Trust Working Group (SIT WG) led by ITU.

The Security, Infrastructure, and Trust (SIT) Working Group held eight e-meetings in 2020. Following the eight technical reports developed in 2019, three technical reports were developed by the SIT Working Group in the reporting period:

* Best practices for mitigating vulnerabilities of DFS applications operating in USSD and STK environments
* Methodology for measurement of QoS parameters for interoperability and cross-border mobile money payment use cases
* DFS consumer competency framework

Four additional reports are expected to be completed in 2020:

* Security audit of DFS applications under Android
* Legal aspects of Distributed Ledger Technologies (DLT)
* Use of telecom data
* Application Programming Interfaces in digital finance

The next FIGI Symposium, initially planned for June 2020, has been rescheduled to June 2021.

## 9.2 Standardization Activities in ITU-T Study Groups

**ITU-T Study Group 11**

Question 2/11 “Signalling requirements and protocols for services and applications in emerging telecommunication environments” studies the vulnerabilities of different protocols and their impact on different industries including digital financial services.

In October 2019, SG11 organized a “Brainstorming session on SS7 vulnerabilities and the impact on different industries including digital financial services” which discussed means to enhance the security mechanisms of existing protocols. In October 2019, SG11 agreed the Technical Report ITU-T TR-SS7-DFS “SS7 vulnerabilities and mitigation measures for digital financial services transactions”.

In April 2020, SG11 approved the new ITU standard Q.3057 “Signalling requirements and architecture for interconnection between trustable network entities” in support of existing and emerging networks, considering that the security of existing signalling protocols is the cornerstone of the trust relationship between DFS provides and their customers.

ITU-T SG11 is also in the process of developing a Technical Report on low resource requirement, quantum-resistant, resource-efficient encryption of USSD messages for use in digital financial services. This work is examining new technologies for end-to-end USSD encryption and assessing the potential to integrate such technologies into existing USSD technology and reference architecture.

**ITU-T Study Group 12**

New ITU standards introduce QoS and QoE aspects of digital financial services (G.1033), a methodology to test the QoE of digital financial services (P.1502). The standards are based on the results of the ITU-T Focus Group on Digital Financial Services and the FIGI Security, Infrastructure and Trust Working Group, and were developed under Question 13/12, responsible for multimedia QoS and QoE issues.

In its submissions to WTSA-20, SG12 included one new Question dedicated to the study of perceptual and field assessment principles for QoS and QoE of digital financial services.

**ITU-T Study Group 16**

The new Question 22/16 on Distributed ledger technologies (DLT) and e-services continues part of the work of the now closed [ITU-T Focus Group on the Application of Distributed Ledger technology](https://www.itu.int/en/ITU-T/focusgroups/dlt/Pages/default.aspx).

DLTs are building blocks to many verticals, including digital financial services, in particular when a trusted third party is not involved. Topics of interest for DFS being studied by Q22/16 include digital evidence services, digital invoices and smart contracts.

Two Technical Papers and three ITU standards have been approved:

* [HSTP.DLT-UC](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=16354): Distributed ledger technologies: Use cases
* [HSTP.DLT-RF](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=16353): Distributed ledger technology: Regulatory framework
* [F.751.0](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14071): Requirements for distributed ledger systems
* [F.751.1](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14705): Assessment criteria for distributed ledger technology (DLT) platforms
* [F.751.2](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14706): Reference framework for distributed ledger technologies.

The following work items are under development:

* [F.DLT-FIN](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=16656): Financial distributed ledger technology application guideline
* [H.DLT-DE](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=15071): Digital evidence services based on distributed ledger technologies
* [H.DLT-GTI](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=16653): DLT governance and technical interoperability framework
* [H.DLT-INV](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=16367): General framework of DLT-based invoices
* [H.DLT-TFR](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=16368): Technical framework for DLT regulation
* [H.DLT-VERI](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=16366): Formal verification framework for smart contract
* [HSTP.DLT-Risk](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=16658): DLT-based application development risks and their mitigations.

The latest information can be found at: <https://itu.int/ITU-T/workprog/wp_search.aspx?sg=16&q=22>.

**ITU-T Study Group 17**

As FinTech changes the way consumers access financial products and services, interfaces between FinTech start-ups and traditional providers have become a common source of cyber vulnerabilities. ITU-T SG17 is developing technical and procedural specifications to ensure that risk-based security management is implemented at every lifecycle stage. Component and interface aspects of FinTech systems and services are under study in Question 7/17 “Secure application services” and Question 14/17 “Distributed ledger technology security”.

A new ITU standard describes security requirements FinTech services built on open platform architectures ([X.1149](https://www.itu.int/rec/T-REC-x/recommendation.asp?lang=en&parent=T-REC-X.1149)). Work is underway on the work item [X.str-dlt](https://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14372) to describe security requirements for digital payment services using distributed ledger technology.

## 9.3 DFS webinar series during COVID-19

TSB organized the [Insights on DFS webinar series](https://www.itu.int/en/ITU-T/webinars/Pages/dfs.aspx) focusing on digital financial services with the objective of providing insights on the innovative applications of telecommunications services, digital payments and fintech in addressing COVID-19 triggered social distancing and lockdown and share lessons learned from governments and DFS stakeholders on the measures that they are implementing. Ten webinars were held between May and July 2020 attracting over 870 unique participants from 105 countries. The webinars focused on topics such as digital identity, strong authentication technologies, security of digital financial transactions, handling fraud and scams, digital credit technologies and central bank digital currency.

## 9.4 Digital Currency Global Initiative

The [Digital Currency Global Initiative](https://www.itu.int/en/ITU-T/extcoop/dcgi/Pages/default.aspx) is a collaboration between ITU and Stanford University and its main objectives are:

* Conduct further research on technical architecture, security, the technical implications and challenges in deployment caused by regulatory and policy requirements for central bank digital currency and other digital currencies, technology trends in digital currency and the use cases related to financial inclusion, operational efficiency and interoperability;
* Develop a set of metrics by which to evaluate the robustness of various digital currency technologies against the requirements set by various stakeholders.
* Identify areas for standardization to enable implementation of digital currency;
* Organize a conference on an annual basis to share information on best practices, technical standards and lessons learned on digital currency implementation.

The Digital Currency Global Initiative will continue the dialogue and research initiated by the ITU-T Focus Group on Digital Currency including Digital Fiat Currency on pilot implementations, use cases, applications and developing specifications for technical standards that will foster adoption, universal access, and ultimately financial inclusion.

Participation is open to all interested parties.

The first e-meeting of the Digital Currency Global Initiative was held 22-23 July 2020 and some 157 participants from 40 countries participated in the event. The participants include Central Banks, digital currency platform providers, fintech companies, payment service providers, academia and international organizations.

The activities of the Digital Currency Global Initiative are focused around three main pillars: engagement, innovative use and standardization. Three working groups were set up under the Standardization pillar during the first meeting:

* Architecture, Interoperability Requirements and Use Cases (AIRU)
* Policy and Governance (PG)
* Security and Assurance (SA)

The main objectives of the Innovative Use pillar will be to study pilot implementations of digital currencies and to develop the appropriate benchmarking and evaluation frameworks through the Digital Currency Lab to be set up by Stanford University. Under the Engagement pillar the objective will be to provide a platform for sharing lessons learned on digital currency projects and organise an annual conference to disseminate the findings of the working groups and the Digital Currency Lab.

# 10 Membership

## 10.1 Snapshot of ITU-T membership in 2020

ITU-T membership has maintained growth in 2020 despite the impact of COVID-19. Eight Sector Members and 22 Associates joined ITU-T in the reporting period, amounting to a total of 30 new members. This translates into a net increase of 18 ITU-T members in 2020 (not including Academia). In addition, 17 new Academia members joined ITU in the reporting period.

New ITU-T members include companies in cloud applications, cybersecurity, IoT/M2M connectivity, distributed ledger technologies, AI and machine learning, autonomous networking, micro optical switch semiconductors, cable television, video technologies, test equipment for electromagnetic field assessment, smart city solutions, IP performance measurement, and esports.

TSB continues to place increased emphasis on tailored outreach to membership prospects while also enhancing the level of account management offered to ITU-T’s existing membership. Targeted outreach, campaigns and participation at events (currently virtual) are supported by the TSB study groups department together with ITU’s membership and communications divisions.

## 10.2 ITU-T news moves to MyITU

ITU’s communications and membership divisions continue to strengthen joint processes for outreach to stakeholders in ITU-T standardization. ITU-T news is now published on [MyITU News](https://www.itu.int/en/myitu/News), a new platform designed to guide readers to news, publications and events customized to their interests. With the support of a coordinated social media strategy led by the ITU General Secretariat, ITU-T news consistently features among the most popular ITU content each year. ITU-T news articles are increasingly supported by video, animations and infographics.

## 10.3 Evolution of ITU-T membership

**New Sector Members in 2020:**

IBM; Zhejiang Dahua Technology Co. Ltd.; Cox Communications; Huawei Technologies Switzerland AG; Asiainfo Technologies (China), Inc.; InterDigital Canada Ltee; Rakuten Mobile, Inc; Global Esports Federation.

**New Associates in 2020:**

Tampnet (SG2); Podsystem Ltd. (SG2); Inspur Tianyuan Communication Information System Co., Ltd.(SG2); Wavecontrol, S.L. (SG5); Sky Group (SG9); Vaulto Communication Technologies Ltd. (SG11); Speedchecker Ltd. (SG12) Wuhan Rayton Network Technology Co., Ltd (SG13); Jiangsu Zhongtian Technology Co., Ltd.(SG15); Idea Electronic Systems (SG15); AEPONYX inc (SG15); Onchain Solutions (Shanghai Distributed Technology Co., Ltd.) (SG16); Hangzhou Qulian Technology Co., Ltd.(SG16); Beijing Zhongdun Security Technology Development Co.(SG16); PwC UK (SG16); Shenzhen Transsion Holdings Co. Limited (SG16); ePaiLive Auction (Beijing) Co., Ltd.(SG16); Multiledgers (SG16); Zennous SA (SG20); Innov-Alliance-Tech (SG20); ITRI International Inc. (SG20); BigchainDB GmbH (SG20).

**New Academia in 2020:**

Szechenyi Istvan University; King Abdullah University of Science and Technology; George Washington University; Council for Scientific and Industrial Research; Big Data Academy of the Institute of Computing Technology Chinese Academy of Sciences; Harbin Institute of Technology; Stanford University; Nanjing Research Institute of Next-generation Artificial Intelligence; Shenyang Institute of Automation Chinese Academy of Sciences; Universidad Nacional de Córdoba; Universidad Rio Cuarto; Universidad Nacional de San Luis; Universidad Nacional de Tucumán; Wuhan University; Northwestern Polytechnical University; State Grid Hubei Electric Power Research Institute; Tongji University; Private Institution Kostanay Engineering and Economics University;

**Total ITU-T Sector Members, Associates and Academia (31 December 2009 – 31 August 2020):**

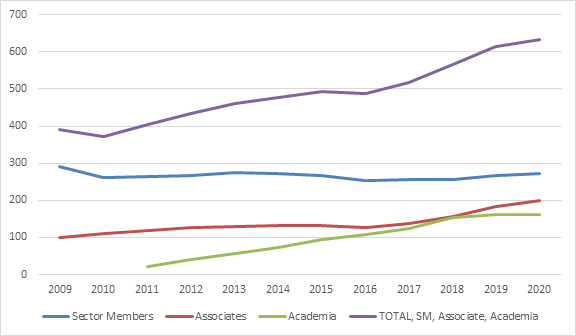
The following table and figure illustrate the evolution of ITU-T membership from 31 December 2009 to 31 August 2020 (noting that the Academia membership category opened in 2011).

**Table 1: Evolution of ITU-T membership from 31 December 2009 to 31 August 2020**

|  | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sector Members | 290 | 261 | 263 | 267 | 274 | 272 | 266 | 253 | 257 | 257 | 268 | 271 |
| Associates | 101 | 111 | 119 | 128 | 130 | 132 | 132 | 128 | 137 | 157 | 184 | 199 |
| Academia | ‑ | ‑ | 23 | 40 | 58 | 73 | 95 | 107 | 124 | 153 | 163 | 162 |
| TOTAL | 391 | 372 | 405 | 435 | 462 | 477 | 493 | 488 | 518 | 567 | 615 | 632 |

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 2009 to 31 August 2020**



NOTE – The Academia category was created in 2011.

## 10.2 Conclusion of SME Pilot Project and implementation of a reduced Associate fee structure for SMEs

The ITU Council SME Pilot Project has transitioned into the new SME fee structure available to Associates meeting certain eligibility criteria. Currently, the following organizations enjoy this modality of participation:

|  |  |  |
| --- | --- | --- |
| **Organization** | **Study Group** | **Area of Interest** |
| Wavecontrol, S.L. | SG5 | EMF monitoring procedures |
| Vaulto Communication Technologies | SG11 | Abuse of SS7 vulnerabilities to commit financial fraud |
| Speedchecker | SG12 | Crowdsourcing approach for the assessment of end-to-end quality of service in fixed and mobile broadband networks |
| Focus Infocom Ges. F. Informatik u. Telekomm. mbH | SG12 | Operational aspects of telecommunication network service quality |
| OPTICOM Dipl.-Ing. M. Keyhl GmbH | SG12 | Next-Generation Mobile voice quality testing |
| Opensignal | SG12 | Crowdsourcing approach for the assessment of end-to-end quality of service in fixed and mobile broadband networks |
| AEPONYX inc | SG15 | Next-generation PON systems to enable a higher data transmission capacity through multiple frequency channels |
| Hangzhou Qulian Technology Co., Ltd. | SG16 | Distributed ledger technologies and e-services |
| Onchain Solutions (Shanghai Distributed Technology Co., Ltd.) | SG16 | Distributed ledger technologies and e-services |
| Multiledgers | SG16 | Distributed ledger technologies and e-services |
| Innov-Alliance-Tech | SG20 | Sensors, management and monitoring software |
| BigchainDB GmbH | SG20 | General interest with a focus on AI related work items |
| Zennous SA | SG20 | Next Generation Urban Measurement Methodology |

# 11 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 of 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.

# 12 Academia

## 12.1 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 topics of growing strategic relevance to ITU membership.

The twelfth edition of the ITU Kaleidoscope conference will take place virtually from 7 to 11 December 2020 on the topic of [Industry-driven digital transformation](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2020/Pages/default.aspx). This year the conference continues to be technically co-sponsored by the IEEE Communications Society (IEEE ComSoc) and is also supported by the IEEE Technology and Engineering Management Society (IEEE TEMS). Initially intended to take place in Ha Noi, Vietnam, the academic conference will now be held as a fully online conference.

Kaleidoscope 2020 will feature a global representation of expert views and demos. From early research prototypes to production-ready systems, a [Call for Demos](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2020/Pages/demos.aspx) is welcoming emerging concepts in applied research as well as concepts already seeing application in industry.

## 12.2 ITU Journal

The ITU Journal: *ICT Discoveries* published its final special issue on “[The future of video and immersive media](https://www.itu.int/en/journal/2020/001/Pages/default.aspx)”. This complete issue was published in July 2020 and includes twelve original research papers exploring the state of the art in multimedia as well as history review article on the Emmy-winning development of the first edition of the JPEG image compression standard.

The ITU Journal has since renewed its title to renew its focus on the future. Launched in August 2020 with a new [Editor-in-Chief](https://www.itu.int/en/journal/j-fet/Pages/editorial-board.aspx), the [ITU Journal on Future and Evolving Technologies](https://www.itu.int/en/journal/j-fet/Pages/default.aspx) – free of charge for both readers and authors – will provide complete coverage of all communications and networking paradigms.

In line with the co-publishing agreement signed between ITU and Tsinghua University Press Ltd. in 2019, the new joint ITU-Tsinghua journal on [Intelligent and Converged Networks](http://icn.tsinghuajournals.com) published its first issue in June 2020.

## 12.3 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), Indonesia (2018) and Serbia (2019). These events are held in conjunction with the annual International Cooperation for Education about Standardization (ICES) conferences.

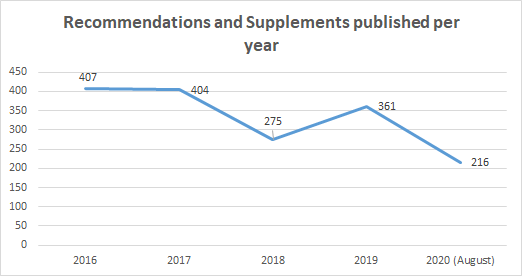
# 13 Publications

Over 12,500 pages of ITU-T Recommendations and Supplements were published between January and August 2020. Figure 4 illustrates the number of Recommendations (including Supplements) published per year since 2016, noting that 2020 covers only until end August.

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 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**

# 15 Services and tools

Electronic working methods offer crucial support to members engaged in ITU-T standardization work. TSB is continuously developing new applications and services, while enhancing existing services, to maintain and expand ITU-T's advanced electronic working environment.

## 15.1 ITU-T databases

Following databases are made available for ITU-T delegates and secretariat staff:

* [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 14.6 for more details)ICT standards landscape:
  + Access Network Transport Standards
  + Cloud Computing
  + Home Network Transport Standards
  + ICT Security Standards
  + IMT-2020
  + IoT & Smart Sustainable Cities Standards
  + ITS Communication Standards

## 15.2 MyWorkspace

[MyWorkspace](https://www.itu.int/net4/ITU-T/myworkspace/) is a user-friendly mobile platform that centralizes a set of applications and services developed to strengthen electronic working methods for the work of ITU-T, as stated in WTSA Resolution 32. Since the first version was released in 2017, more than 4000 users have visited it, with an average of 500 visits per month. The platform is accessible online and as a mobile application (Android & iOS). Secure access to MyWorkspace is enabled through ITU User Account (TIES) credentials.

The following applications and services are available in MyWorkspace:

* [MyMeetings](https://www.itu.int/myworkspace/#/my-workspace/remote_participation): Remote participation service based on an open-source solution and customized in-house to support requirements of both statutory and non-statutory ITU-T meetings.
* [MyEvents](https://www.itu.int/myworkspace/#/my-workspace/myevents): Events management platform, which provides real time ITU-T events agenda, list of registered participants, speakers and exhibitors, as well as a ‘matchmaking’ function to enable networking among participants.
* [All Events](https://www.itu.int/myworkspace/#/my-workspace/allevent): Simplified calendar view of events, with links to access detailed information.
* [ITU Translate](https://www.itu.int/myworkspace/#/my-workspace/translate): Machine translation tool based on neural network, trained in-house on ITU documents official translations and supporting all six (6) UN official languages.
* [ITU-T Cloud](http://tsbcloud.itu.int): ITU premises storage service allowing users to share and exchange up to 10 GB of files per user.
* [Mailing list](https://www.itu.int/myworkspace/#/my-workspace/mails): Subscription management with search functionality.
* [Community](https://www.itu.int/myworkspace/#/my-workspace/community): MyWorkspace user’s directory.
* Suggested meeting documents: A proposed list of documents based on pre-set user interests, with the option to bookmark favourites.
* [Profile](https://www.itu.int/myworkspace/#/profile): User personal information and interests.

## 15.3 ITUSearch

[ITUSearch](https://www.itu.int/search) is a mobile-friendly search engine covering all ITU documents, websites, publications, and other type of resources. On average, 70,000 searches are performed each month using ITUSearch.

The latest version of the search engine released last year includes following search category:

* [All](https://www.itu.int/search#?target=All&ex=false&q=TSAG&fl=0): Searches on all ITU resources with filtering features on Sectors, types of content and languages.
* [Multimedia](https://www.itu.int/search#?target=Media&ex=false&q=TSAG&fl=0): Searches on ITU Facebook and Twitter accounts posts.
* [Social media](https://www.itu.int/search#?target=Social%20media): Searches on ITU Flickr and YouTube accounts resources.
* [Basic text](https://www.itu.int/search#?target=Base%20text&ex=false&q=Resolution%2032&fl=0&sector=t&group=all&collection=General): Specialized full text search on latest ITU and Sectors Assemblies and Conferences in force basic texts in the six (6) UN official languages.

## 15.4 ITU-T services & tools announcements

A service announcements webpage for Electronic Working Methods (EWM) keeps the ITU-T community up to date with the latest tools available and services enhancements provided.

## 15.5 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).

## 15.6 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.

A new [Numbering Applications Monitor](https://extranet.itu.int/sites/itu-t/studygroups/2017-2020/sg2/SitePages/Numbering%20Applications%20Monitor.aspx) site is now available for ITU-T SG2 experts who wish to follow the progress of numbering resource applications in real time. The site may be accessed only using a valid ITU user account (ITU-T Members or Associates of ITU-T SG2).

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" was revised in June 2020 to include new cases of misuse and to investigate more efficient means of combating misuse. The revised text of the Recommendation better reflects the different types of numbering resources between directly assigned resources, so called global numbers, which are the responsibility of the Director TSB, and indirectly assigned resources, numbers that are the responsibility of Member States. The latest changes make the reporting of the indirectly assigned resources more effective through email notification to a pre-determined mailing list of misuse rather than registration of the report of misuse for action by TSB.

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.*

## 15.7 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/>)
* Pathway #1: Circular Design (<https://extranet.itu.int/sites/itu-t/initiatives/circulardesign>)
* Digital Currency Global Initiative (<https://extranet.itu.int/sites/itu-t/initiatives/dcgi>)
* Project on E-waste (<https://extranet.itu.int/sites/itu-t/initiatives/E-waste>)
* Focal points and coordinators for WTSA-20 from regional organizations (<https://extranet.itu.int/sites/itu-t/wtsa-20/prepmeet/Lists/ContactSheet/DefViewContacts.aspx>)

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.

## 15.8 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.

## 15.9 Electronic meetings

In the last few months, TSB has made some important changes and improvements to its electronic meeting facilities due to the COVID-19 pandemic. MyMeetings, the ITU-T open source solution for electronic meetings introduced in January 2019 by TSB, is now used as the main platform to organize ITU-T statutory meetings. The tool features some important elements found in ITU-T physical meetings, including participants’ list and affiliation, multilingual support, moderated floor request and captioning. In addition, the tool has put in place several layers of access control to make sure that only registered participants can have access to Statutory meetings. MyMeetings is also been used to host Rapporteur Group Meetings and non-statutory events, such as webinars. Other electronic meeting tools, such as Zoom, are also provided by TSB for hosting fully online (virtual) and any on-demand ad-hoc meetings. Statistics on e-meetings for the 2018, 2019 and 2020 are shown below.

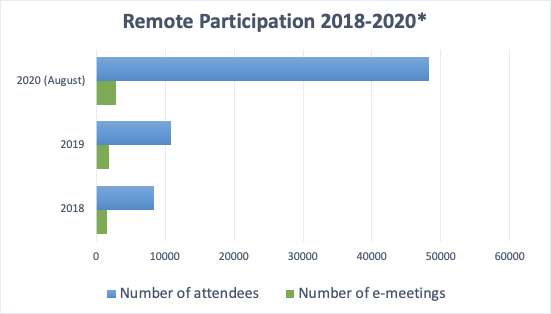


Figure 5 – Remote participation and e-meetings

## 15.10 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 11 AAP Recommendations between January and August 2020, in accordance with requests received from ITU-T SGs and linguistic groups, and within the available budget.

## 15.11 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. Participation in ITU workshops and symposia has increased as a result of COVID-19. With all ITU-T workshops and symposia held virtually with MyMeetings, workshops and symposia are welcoming a greater number and diversity of particpants.

The following ITU-T workshops and symposia, arranged by venue, were organized by TSB from January to August 2020:

**ITU Headquarters, Geneva:**

* [Joint IEEE 802 and ITU-T Study Group 15 Workshop](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/202001/Pages/default.aspx), Geneva, Switzerland, 25 January 2020.
* [Future Networked Car Symposium (FNC 2020)](https://www.itu.int/en/fnc/2020/Pages/default.aspx), Geneva, Switzerland, 5 March 2020.

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

* [Sixth ITU Workshop on Network 2030 and Demo Day](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/20200113/Pages/default.aspx), Lisbon, Portugal, 13-14 January 2020.
* [ITU Workshop on Explainable AI (XAI) for Autonomous and Assisted Driving](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/20200121/Pages/default.aspx), London, United Kingdom, 21 January 2020.
* ITU Forum "Smart sustainable cities: from concept to implementation"   
  3-5 March 2020, Minsk, Belarus
* [Joint ITU-ETSI Workshop on "Machine Learning in communication networks”](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/20200318/Pages/default.aspx), Sophia Antipolis, France, 16 March 2020.

**Africa:**

* [Seventh SG13 Regional Workshop on "Standardization of Future Networks towards Building a Better Connected Africa"](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/standardization/20200203/Pages/default.aspx), Abuja, Nigeria, 3-4 February 2020.
* [ITU Workshop on Network Performance, Quality of Service and Quality of Experience](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/qos/202003/Pages/default.aspx), N’Djamena, Chad, 2-3 March 2020.

**Americas:**

* [8th ITU/WHO Workshop on Artificial Intelligence for Health](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/ai4h/202001/Pages/default.aspx), Brasilia, Brazil, 21 January 2020.

**Arab states:**

* WUF10 Networking event on "Governing and managing smart sustainable cities"  
  10 February 2020, Abu Dhabi, UAE

**Fully virtual meetings:**

* [Webinar on "Using international standards to tackle the e-waste challenge"](https://www.itu.int/en/ITU-T/climatechange/Documents/Events/Webinar_explore_a_circular_vision_%20for_the_ICT_sector.pdf), Virtual Meeting, 1 and 2 April 2020.
* [Webinar on "Explore a circular vision the ICT sector"](http://www.brsmeas.org/Default.aspx?tabid=3574&meetId=46965D8E-C675-EA11-BFFE-005056857856&lang=en), Virtual Meeting, 14 and 16 April 2020/
* Webinar on "Using digital financial services to curb the threat of the pandemic", Virtual Meeting, 14 May 2020.
* Webinar on "Benefits of Digital ID to enable governments and private sector response to the pandemic- Part 1", Virtual Meeting, 20 May 2020.
* Webinar on "Benefits of Digital ID to enable governments and private sector response to the pandemic- Part 2", Virtual Meeting, 21 May 2020.
* Webinar on "Digital credit and consumer protection", Virtual Meeting, 11 June 2020.
* Webinar on "Digital Credit Technologies and Financial Inclusion", Virtual Meeting, 23 June 2020.
* Webinar on “Accelerating cities’ transformation through standards”, Virtual Meeting, 25 June 2020.
* Meeting of the Joint Coordination Activity on Internet of Things and Smart Cities and Communities (JCA-IoT and SC&C), Virtual Meeting, 26 June 2020.
* Webinar on " Central Bank Digital Currency and Digital Financial Inclusion", Virtual Meeting, 26 June 2020.
* Webinar on "Digital currency applications and need for standards", Virtual Meeting, 29 June 2020.
* Webinar on "Handling of Digital Finance Crimes and Scams", Virtual Meeting, 30 June 2020.
* Webinar on "Tracking Digital Financial Crimes and Fraud", Virtual Meeting, 10 July 2020.
* Webinar on " Interoperability and resiliency requirements of Digital Payments System", Virtual Meeting, 27 July 2020.
* DLT Interoperability, Virtual Meeting, 5 August 2020.
* Webinar on " Crowdsourcing for regulators – Case studies and frameworks", Virtual Meeting, 27 August 2020.

# 16 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-TD789](https://www.itu.int/md/T17-TSAG-200921-TD-GEN-0789)) assigns action items to the operational provisions in the Resolutions and also reports information on the progress of the implementation of those action items.

# 17 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.994.1 Amd.1 “Handshake procedures for digital subscriber line transceivers - Amendment 1”**](https://www.itu.int/rec/T-REC-G.994.1-202003-P!Amd1) includes the following new technical material:

– codepoints for support of ITU-T G.9701 extended range of *Tg1’*.

[**ITU-T G.997.2 Amd.1 “Physical layer management for G.fast transceivers - Amendment 1”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14195) integrates the Corrigendum 1 to ITU-T Rec G.997.2 (2019) and includes in addition:

- Add managed objects for the support of RMC sub-carrier masking

- Add managed objects for the support of TGVN

- Add managed objects for the support of PREFNDR.

[**ITU-T G.9701 (2019) Amd.2 “Fast access to subscriber terminals (G.fast) - Physical layer specification: Amendment 2”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14218) includes a new Annex on targeted generalized vectoring with non-active G.9701 supporting lines (TGVN).

[**ITU-T G.9710 "Multi-gigabit fast access to subscriber terminals (MGfast) – Power spectral density specification"**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14022) 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

[**ITU-T G.984.3 (2014) Amd.1 “Gigabit-capable passive optical networks (G-PON): Transmission convergence layer specification”**](https://www.itu.int/rec/T-REC-G.984.3-202003-P!Amd1) describes the transmission convergence layer for gigabit-capable passive optical networks – a family of flexible access networks capable of providing a range of broadband and narrow-band services, operating at the rates of 2.48832 Gbit/s downstream and 1.24416 or 2.48832 Gbit/s upstream. This Recommendation includes the specifications of the following:

• gigabit PON transmission convergence (GTC) layer framing;

• upstream time division multiple access mechanism;

• physical layer operation, administration and maintenance (OAM) messaging channel;

• principles and signalling mechanism of the upstream dynamic bandwidth assignment;

• optical network unit (ONU) activation method;

• forward error correction;

• security.

This Recommendation forms an integral part of the G.984-series of ITU-T Recommendations that, together, specify a single coherent set of access transmission systems. The present Amendment provides necessary extensions to support Class D ODN.

[**ITU-T G.987.3 (2014) Amd.1 “10-Gigabit-capable passive optical networks (XG-PON): Transmission convergence (TC) layer specification - Amendment 1”**](https://www.itu.int/rec/T-REC-G.987.3-202003-P!Amd1) describes the transmission convergence layer for 10 gigabit capable passive optical network systems – a family of flexible access network systems that operate over a point-to-multipoint optical access infrastructure at nominal data rates in the order of 10.0 Gbit/s in at least one direction, while providing a wide range of broadband and narrow-band services to end-users. The present Amendment extends to the G.987.3 the concept of Cooperative DBA and the general DBA framework, which have been developed in the context of G.989.3, and extends the maximum number of the burst allocation series per ONU in a BWmap to 16.

[**ITU-T G.988 (2017) Amd.3 “ONU management and control interface (OMCI) specification: Amendment 3”**](https://www.itu.int/rec/T-REC-G.988-202003-P!Amd3) adds:

• Support for the discovery of Extended VLAN tagging operation configuration data ME enhanced mode through the ONU3-G ME.

• Support for Extended VLAN ME tagging operation configuration data ME enhanced mode.

• Corrections to Table 9.1.5-1 “Plug-in unit types”.

[**ITU-T G.989.3 (2015) Amd.3 “40-Gigabit-capable passive optical networks (NG-PON2): Transmission convergence layer specification - Amendment 3”**](https://www.itu.int/rec/T-REC-G.989.3-202003-P!Amd3) clarifies the use of SeqNo in the upstream PLOAM messages, clarifies the distinction between Performance Monitoring counters and other Performance Monitoring parameters, and provides regular specification maintenance.

I.1.3 Optical fibres

[**ITU-T G.654 (revised) “Characteristics of a cut-off shifted single-mode optical fibre and cable”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14198) describes the geometrical, mechanical and transmission attributes of a single-mode optical fibre and cable which has the zero-dispersion wavelength around 1 300 nm wavelength, and which is loss-minimized and cut-off wavelength shifted at around the 1 550 nm wavelength region. This is the latest revision of this Recommendation that was first created in 1988. In this version the attenuation coefficient of G.654.E to specify a wavelength dependency for estimating optical system design has been changed. Also, in this version a note has been added for cable cut-off wavelength when G.654.E fibre is used at central frequencies for applications specified in Recommendation G.698.2.

[**ITU-T G.9806 “Higher speed bidirectional, single fibre, point-to-point optical access system (HS-PtP)”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14196) describes a higher speed bidirectional single fibre point-to-point optical access system than the data rate in existing ITU-T point-to-point access systems. It supports 10 Gbit/s and above for the optical access services including the optical distribution network (ODN) specification, the physical layer specification, services requirements and the operation, administration and maintenance (OAM) specification.

[**ITU-T L.105/L.87 Amd.1 “Optical fibre cables for drop applications Amendment 1”**](https://www.itu.int/rec/T-REC-L.105-202003-I!Amd1) aims to provide the latest standard development and application experience of drop cables in China.

[**ITU-T Technical Report LSTR-GLSR (revised) “Guide on the use of ITU-T L-series Recommendations related to optical technologies for outside plant”**](https://www.itu.int/pub/publications.aspx?lang=en&parent=T-TUT-L-2020-GLR) contains a functional grouping of the ITU-T Recommendations on:

- optical cable construction for all kinds of terrestrial application, including marinized terrestrial cables;

- optical infrastructures, including node elements, installation techniques and network design;

- outside plant maintenance, operation and support management, including disaster management issues;

- passive optical components.

For each Recommendation, there is a short description of the purpose, content and, in many cases, the evolution of the content in the subsequent versions. The main purpose of this guide is to give to developing countries an improved capability in the application of standards, while the telecommunication industry, particularly manufacturers and operators, could benefit from the greater involvement of developing countries in the making and application of standards. The guide could also have a wider use among manufacturers and operators who are not directly involved in the preparation of this group of Recommendations and they could find the guide to be a useful tool both for rapidly focusing on the Recommendation(s) of specific interest and for better understanding the meaning and the objectives of each Recommendation.

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

I.1.5 Optical transmission systems

[**ITU-T G.709/Y.1331 (revised) “Interfaces for the optical transport network (OTN)”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14199) defines the requirements for the optical transport network (OTN) interface signals of the optical transport network, in terms of:

– OTN hierarchy

– functionality of the overhead in support of multi-wavelength optical networks

– frame structures

– bit rates

– formats for mapping client signals.

Edition 6.0 of this Recommendation includes the text of Amendments 1, 2, 3, Corrigendum 1 and 2 to Edition 5.0 of this Recommendation, addition of 25 and 50 Gbit/s OTU, ODU and OPU frame formats and multiplexing of lower rate ODUk/flex signals into these two OPUs, extension of the supported ODUflex(IMP) bit rates to any rate, specification of frequency synchronous OTU and ODU and addition of a new appendix with examples of ODUflex(GFP) and ODUflex(IMP) clock generation methods. Edition 6.0 furthermore clarifies that the ODUflex(GFP) bit rate can be any rate and is not limited to the recommended bit rates, updates the OTN interface terminology, corrects the replacement signal definitions for some of the Ethernet client signals and restricts the FlexE aware sub-rate granularity to 25 Gbit/s.

[**ITU-T G.709.4 “OTU 25 and OTU 50G short reach interfaces”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14201) specifies an interface for an OTU25 and OTU50 short-reach interconnect application.

[**ITU-T G.807 "Generic functional architecture of the optical media network"**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=13997) 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.875 (revised) “Optical transport network: Protocol-neutral management information model for the network element view”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14241) provides a protocol-neutral management information model for managing network elements in the optical transport network (OTN). The model contains the managed entities and their properties that are useful to describe the information exchanged across interfaces defined in the ITU-T M.3010 telecommunications management network (TMN) architecture. The protocol-neutral management information model shall be used as the base for defining protocol-specific management information models, for example, common management information service element (CMISE), common object request broker architecture (CORBA) and simple network management protocol (SNMP) information models. Mapping from the protocol-neutral entities into protocol-specific objects is a decision of the specific protocol modelling design and should be described in the protocol-specific information model Recommendations. The 2020 revision of this Recommendation up-versions the UML model tool to Papyrus v4.1.0 and the profile to v0.2.17; updates and cleans up the model for ODU, adding support for ODUCn, ODU Delay Measurement, GCC1/2 management, ODU clients (aligning with G.709 v6), OTU and FlexO; add the model for GFP management; deprecates duplicated attributes and associations; un-deprecates the OTU CTP object classes and fixes some other errors.

[**ITU-T G.sup.58 (revised) “Optical transport network module framer interfaces”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?rec=13825) describes several interoperable component to component multilane interfaces (across different vendors) to connect an optical module (with or without digital signal processor (DSP)) to a framer device in a vendor's equipment supporting 25G, 40G, 50G, 100G or beyond 100G optical transport network (OTN) interfaces. Only the structure of the 11G, 28G or 56G physical lanes of the different OTN module framer interface (MFI) examples is provided in this Supplement. For their electrical characteristics, the OIF-CEI IA specifications can be used. This Supplement relates to Recommendation ITU-T G.709/Y.1331.

I.1.6 Transport network control aspects

I.1.7 Ethernet over transport networks

[**ITU-T G.8001 Imp (revised) “Implementers' guide for Recommendation ITU-T G.8001/Y.1354 (2020)”**](https://www.itu.int/rec/T-REC-G.Imp8001-202002-I) is an Implementers' Guide for Recommendation ITU-T G.8001/Y.1354 (2016-04). This version contains all updates submitted up to and including those at Study Group 15 meeting in January/February 2020.

[**ITU-T G.8032/Y.1344 (revised) “Ethernet ring protection switching”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14205) defines the automatic protection switching (APS) protocol and protection switching mechanisms for Ethernet layer network (ETH) ring topologies. Included are details pertaining to Ethernet ring protection characteristics, architectures and the ring APS (R-APS) protocol. This revision updates references, removes items formerly considered for further study and incorporates terms formerly defined in ITU-T Recommendation G.8001/Y.1354 (2016).

I.1.8 MPLS over transport networks

I.1.9 Synchronization and timing

[**ITU-T G.781 (revised) “Synchronization layer functions for frequency synchronization based on the physical layer”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14240) defines the atomic functions that are part of the two synchronization layers, the synchronization distribution (SD) layer and the network synchronization (NS) layer. It also defines some atomic functions, part of the transport layer, which are related to synchronization. These functions describe the synchronization of SDH, Ethernet, and OTN NEs and how these NEs are involved in network synchronization. The specifications in this Recommendation are the superset of functionality of three regional standards bodies. Care should be taken when selecting from this Recommendation. Not every atomic function defined in this Recommendation is required for every application. Different subsets of atomic functions may be assembled in different ways according to the combination rules given in Recommendations ITU-T G.783, ITU-T G.705, ITU-T G.8021, ITU-T G.8121, and ITU T G.798 to provide a variety of different capabilities. Network operators and equipment suppliers may choose which functions must be implemented for each application.

[**ITU-T G.8260 (revised) “Definitions and terminology for synchronization in packet networks”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14206) provides the definitions, terminology and abbreviations used in ITU T Recommendations on timing and synchronization in packet networks.

[**ITU-T G.8261/Y.1361 (2019) Amd.1 “Timing and synchronization aspects in packet networks - Amendment 1”**](https://www.itu.int/rec/T-REC-G.8261-202003-P!Amd1) provides the following updates:

− Addition of new TDEV mask to clause 9.2.1.4.

[**ITU-T G.8262 (2018) Amd.1 “Timing characteristics of synchronous equipment slave clock - Amendment 1”**](https://www.itu.int/rec/T-REC-G.8262-202003-P!Amd1) provides the following updates:

- Updates References

- Adds a note in clause 9.2.1

- Changes Figure 13 in Clause 11.2.1

- Adds PAM4 interfaces in Appendix III

- Adds a sentence in Appendix VII.

[**ITU-T G.8271 (revised) “Time and phase synchronization aspects of telecommunication networks”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14209) defines time and phase synchronization aspects in packet networks. It specifies the suitable methods to distribute the reference timing signals that can be used to recover the phase synchronization and/or time synchronization according to the required quality. The requirements for the synchronization characteristics that are specified in this Recommendation must be adhered to in order to ensure interoperability of equipment produced by different manufacturers and a satisfactory network performance.

[**ITU-T G.8271.1/Y.1366.1 (revised) “Network limits for time synchronization in packet networks with full timing support from the network”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14210) specifies the maximum network limits of phase and time error that shall not be exceeded. It specifies the minimum equipment tolerance to phase and time error that shall be provided at the boundary of packet networks at phase and time synchronization interfaces. It also outlines the minimum requirements for the synchronization function of network elements. This Recommendation addresses the case of time and phase distribution across a network by a packet-based method with full timing support to the protocol level from the network.

[**ITU-T G.8272 (2018) Amd.1 “Timing characteristics of primary reference time clocks - Amendment 1”**](https://www.itu.int/rec/T-REC-G.8272-202003-P!Amd1) provides the following updates:

• Modified the scope.

• In clause 6, amend the final sentence (immediately before clause 6.1) to read (insertions highlighted):

• In clause 6.2, new sentence is added.

• Replace the second paragraph after Figure I.4 of clause I.3.1.

[**ITU-T G.8273 (2018) Amd.1 “Framework of phase and time clocks - Amendment 1”**](https://www.itu.int/rec/T-REC-G.8273-202003-P!Amd1) provides the following updates:

− Updates References

− Adds Appendix IV

− Editorial changes in Annex B and minor edits throughout the document.

[**ITU-T G.8273.2/Y.1368.2 Amd.1 (revised) “Timing characteristics of telecom boundary clocks and telecom time slave clocks for use with full timing support from the network - Amendment 1”**](https://www.itu.int/rec/T-REC-G.8273.2-202003-P!Amd1) provides the following updates:

− Updates the title of the recommendation

− Updates References

− Adds a Note in clause 7.1.1

− Adds a reference to [ITU-T G.8260] and a Note in clause 7.1.4

− Adds Noise tolerance for clock class C

− Makes editorial changes and updated Appendix V for T-BC chains

− Changes 1 PPS to 1PPS (without space) throughout the Recommendation.

[**ITU-T G.8273.4/Y.1368.4 “Timing characteristics of telecom boundary clocks and telecom time slave clocks for use with partial timing support from the network”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14214) specifies minimum requirements for time and phase synchronization equipment used in synchronization network that operates in the assisted partial timing support (APTS) and partial timing support (PTS) architectures.

[**ITU-T G.8275.1/Y.1369.1 (revised) “Precision time protocol telecom profile for phase/time synchronization with full timing support from the network”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14215) contains the ITU-T precision time protocol (PTP) profile for phase and time distribution with full timing support from the network. It provides the necessary details to utilize IEEE 1588 in a manner consistent with the architecture described in Recommendation ITU T G.8275/Y.1369.

[**ITU-T G.8275.2/Y.1369.2 (revised) “Precision time protocol telecom profile for phase/time synchronization with partial timing support from the network”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14216) contains the ITU-T precision time protocol (PTP) profile for phase/time distribution with partial timing support from the network (unicast mode). It provides the necessary details to utilize IEEE 1588 in a manner consistent with the architecture described in Recommendation ITU-T G.8275/Y.1369. This Recommendation defines the PTP profile for unicast mode only. Future editions of this Recommendation may contain a separate profile for a mixed unicast/multicast case.

[**ITU-T G.Sup.68 “Synchronization OAM requirements”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?rec=14232) provides an overview of Synchronization operations, administration, maintenance (OAM), includes fault management, performance monitoring, alarms and events.

[**ITU-T Technical Report GSTR-GNSS “Considerations on the use of GNSS as a primary time reference in telecommunications**”](https://www.itu.int/pub/publications.aspx?lang=en&parent=T-TUT-HOME-2020-1) provides information relevant to optimal GNSS reception in telecom applications where highly accurate time recovery is critical. Unlike commonly used GNSS navigation applications, where position is the goal, the focus in telecom is on accurate time recovery with stationary receivers, which provide accurate time to such equipment as primary reference time clocks (PRTCs) and base stations in mobile networks.

I.1.10 Cable

[**ITU-T J.1 (revised) “Terms, definitions and acronyms for television and sound transmission and integrated broadband cable networks”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14275) compiles all the definitions related to television and sound transmission, and integrated broadband cable networks, and which are in force in J-series and N-series Recommendations developed under the responsibility of SG9. The Recommendation is regularly updated to reflect newly-approved terms and definitions.

[**ITU-T J.216 (revised) “Second-generation modular headend architecture in systems for interactive cable television services - IP cable modems”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14276) defines the second generation of headend architectures for high-speed data-over-cable systems. The second-generation of headend architecture introduces a number of new features that build upon what was present in previous Cabinet DOCSIS Recommendations ITU-T J.223.1 and ITU-T J.223.2. This Recommendation includes key new features for the CMC III device (also known as the remote-PHY device).

NOTE – The structure and content of this Recommendation have been organized for ease of use through direct reference to the original source material, based on the recognition of CableLabs by ITU as an ITU-T A.5 organization (<https://www.itu.int/en/ITU-T/extcoop/Pages/sdo.aspx>).

[**ITU-T J.224 (revised) “Fifth-generation transmission systems for interactive cable television services - IP cable modems”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14277)defines the fifth generation of high-speed data-over-cable systems. The fifth-generation transmission systems introduce a number of new features that build upon what was present in previous ITU-T Recommendations namely ITU-T J.112, ITU-T J.122, ITU-T J.222.x-series, and ITU-T J.223.x-series. This Recommendation includes key new features for the physical (PHY) layer and defines full duplex data over cable service interface Specification (DOCSIS) mode of operation, including enhancements to the media access control (MAC) layer protocols as well as requirements for upper layer protocols such as Internet protocol (IP), dynamic host configuration protocol (DHCP), etc. The fifth-generation cable modem specifications fully incorporate the fourth generation specifications.

NOTE – The structure and content of this Recommendation have been organized for ease of use through direct reference to the original source material, based on the recognition of CableLabs by ITU as an A.5 organization (<https://www.itu.int/en/ITU-T/extcoop/Pages/sdo.aspx>).

[**ITU-T J.225 “Fourth-generation transmission systems for interactive cable television services - IP cable modems”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14278) defines the fourth generation of high-speed data-over-cable systems. The fourth-generation transmission systems introduce a number of new features that build upon what was present in previous Recommendations [ITU-T J.112], [ITU-T J.122], [ITU-T J.222], and [ITU-T J.223]. This Recommendation includes key new features for the physical (PHY) layer and defines Full Duplex DOCSIS® Mode of operation, including enhancements to the media access control (MAC) layer protocols as well as requirements for upper layer protocols (e.g., IP, DHCP, etc.). The fourth-generation cable modem specifications are incorporated fully in this Recommendation. An informative Supplement [b-ITU-T J Suppl. 10] contains the correspondence between the DOCSIS versions and the ITU-T Recommendations revisions and generations.

NOTE – The structure and content of this Recommendation have been organized for ease of use through direct reference to the original source material, based on the recognition of CableLabs by ITU as an A.5 organization (<https://www.itu.int/en/ITU-T/extcoop/Pages/sdo.aspx>).

[**ITU-T J.299 “Functional Requirements for remote management of cable STB by Auto Configuration Server (ACS)”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14279) describes the functional requirements for Auto Configuration Server (ACS) and STB connected each other for remote maintenance purpose. ACS is usually used to remotely set up and maintain customer premises equipment (CPE) such as STB. The major purpose of the new Recommendation is to specify basic requirements for remote maintenance in the cable TV system.

[**ITU-T J.1012 “Embedded common interface for exchangeable CA/DRM solutions; CA/DRM container, loader, interfaces, revocation”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=13573) is part of a multi-part deliverable covering the conditional access/digital rights management (CA/DRM) container, loader, interfaces, revocation for the embedded common interface for exchangeable CA/DRM solutions specification. This ITU-T Recommendation is a transposition of the ETSI standard [b- ETSI GS ECI 001-3] and is a result of a collaboration between ITU-T SG9 and ETSI ISG ECI. Modifications have been introduced to clauses 2, 7.7.2.5.2, 9.4.4.6.2, 9.4.6.1, 9.5.2.2, 9.8.1, 9.8.2, 10.2, I-2 and to the Bibliography. Some additional editorial corrections were necessary.

[**ITU-T J.1013 “Embedded Common Interface (ECI) for exchangeable CA/DRM solutions; The Virtual Machine”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=13574) is part of a multi-part deliverable covering the virtual machine for the embedded common interface (ECI) for exchangeable conditional access/digital rights management (CA/DRM) solutions specification. This ITU-T Recommendation is a transposition of the ETSI standard [b- ETSI GS ECI 001-4] and is a result of a collaboration between ITU-T SG9 and ETSI ISG ECI. A minor modification was done in clause 7.3.7.1.

[**ITU-T J.1014 “Embedded common interface for exchangeable CA/DRM solutions; Advanced Security - ECI-specific functionalities”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=13575) is one part of a multi-part deliverable covering the ECI-specific functionalities of an advanced security system for the embedded common interface (ECI) for exchangeable conditional access/digital rights management (CA/DRM) solutions specification. This ITU-T Recommendation is a transposition of the ETSI standard [b- ETSI GS ECI 001-5-1] and is a result of a collaboration between ITU-T SG9 and ETSI ISG ECI. Modifications have been introduced to clauses 1, 3.2, 6.1, 6.2, 6.3 and 8.2.3 as well as editorial corrections and the substitution of the term “content processing system” by “Secure Video Path”.

[**ITU-T J.1015 “Embedded common interface for exchangeable CA/DRM solutions: The advanced security system – Key ladder block”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=13576) is part of a series covering the advanced security system key ladder block for the embedded common interface for exchangeable conditional access/digital rights management (CA/DRM) solutions specification. This ITU-T Recommendation is a transposition of the ETSI standard [b-ETSI GS ECI 001-5-2] and is a result of a collaboration between ITU-T SG9 and ETSI ISG ECI.

[**ITU-T J.1015.1 “Embedded common interface for exchangeable CA/DRM solutions: The advanced security system – Key ladder block: Authentication of control word-usage rules information and associated data”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=13837) is part of a series covering the advanced security system key ladder block for the embedded common interface for exchangeable conditional access/digital rights management (CA/DRM) solutions specification.

[**ITU-T J.1031 “Downloadable Conditional Access System for Bidirectional Network; Requirements”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14280) specifies requirements for the two-way downloadable conditional access system (DCAS) for bidirectional network. A two-way DCAS protects broadcast content/services and controls consumer entitlements in the same way as what traditional conditional access (CA) systems do, and enables a two-way terminal device, such as a set-top-box (STB), to adapt to a new CA system by downloading and installing a new CA system’s client software without changing hardware. In particular, a two-way DCAS can work in bidirectional cable TV networks and other bidirectional networks such as broadband cable networks.

[**ITU-T J.1032 “Downloadable Conditional Access System for Bidirectional Network; System Architecture”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14355) specifies a system architecture for the two-way downloadable conditional access system (DCAS) for bidirectional network. A two-way DCAS protects broadcast content/services and controls consumer entitlements in the same way as what traditional conditional access (CA) systems do, and enables a two-way terminal device, such as a set-top-box (STB), to adapt to a new CA system by downloading and installing a new CA system’s client software without changing hardware. In particular, a two-way DCAS can work in bidirectional cable TV networks and other bidirectional networks such as broadband cable networks.

[**ITU-T J.1033 “Downloadable Conditional Access System for Bidirectional Network; The Terminal”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14356) specifies a terminal for the two-way downloadable conditional access system (DCAS) for bidirectional network. A two-way DCAS protects broadcast content/services and controls consumer entitlements in the same way as what traditional conditional access (CA) systems do, and enables a two-way terminal device, such as a set-top-box (STB), to adapt to a new CA system by downloading and installing a new CA system’s client software without changing hardware. In particular, a two-way DCAS can work in bidirectional cable TV networks and other bidirectional networks such as broadband cable networks.

[**ITU-T J.1203 “The specification of a smart TV operating system”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14281) defines the detailed specification of a smart television operating system (TVOS) to enable integrated broadcast and broadband (IBB)-capable cable set-top box (STB) and TV to apply to broadcasting services and IP-based interactive services provided by cable television operators and third-party providers. By running the smart TV operating system, the IBB capable STB and TV will be able to provide subscribers with advanced and personalized services by downloading and installing advanced and personalized apps from cable operators' platforms and third-party platforms, which are interconnected with the related cable operators' platforms. Recommendation ITU-T J.1203 is developed in accordance with the requirements defined in [ITU-T J.1201] and based on the architecture defined in [ITU-T J.1202]. This Recommendation provides a specification for administrations and entities who intend to implement smart TV operating system.

[**ITU-T J.1204 “The security framework of a smart TV operating system”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14357) defines the security framework of a smart television operating system (TVOS) to enable integrated broadcast and broadband (IBB)-capable cable set-top box (STB) and TV to apply to broadcasting services and IP-based interactive services provided by cable television operators and third-party providers. By running the smart TV operating system, the IBB capable STB and TV will be able to provide subscribers with advanced and personalized services by downloading and installing advanced and personalized apps from cable operators' platforms and third-party platforms, which are interconnected with the related cable operators' platforms. Recommendation ITU-T J.1204 intends to specify the smart TV operating system security framework, which exploits the popular hardware based TEE technology and has multiple security defence capabilities.

[**ITU-T J.1211 “Specifications of IP Video Broadcast (IPVB) for CATV Networks”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14282): In recent years, IP-based video services have been developed rapidly in CATV networks, especially the highly asymmetric IP-based services with large bandwidth, such as 4K, 8K and VR, whose single program bandwidth might easily exceed 35Mbps or even up to 100Mbps. This requires huge downlink bandwidth of transmission channels and poses challenges to the existing CATV technologies. For this scenario, it is necessary to propose a solution with low cost and low complexity for meeting the bandwidth requirements of the current asymmetric IP-based video service. This recommendation specifies an IPVB technology, which simply adds a one-way IP-based video broadcast system to the existing low-cost bidirectional CATV networks. The IPVB can greatly increase the bandwidth of downlink programs, and at the same time, have the characteristics of low cost and low complexity. The IPVB in downlink transmits IP-based video streams through broadcast channels which are identified by multicast IP addresses and UDP port numbers, and broadcasts all the IP-based video streams through the CATV networks to all subscribers. By cooperating with the uplink channel provided by the existing bidirectional access networks, it is capable of providing varieties of IP-based high bitrate video services in CATV networks.

[**ITU-T J.Suppl.7 “Embedded Common Interface (ECI) for exchangeable CA/DRM solutions; Guidelines for the implementation of ECI (EG)”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14286) serves as a guidance document, which contains performance parameters and values as well as use cases for the Embedded Common Interface (ECI) for exchangeable CA/DRM solutions and complements ECI-related ITU-T Recommendations covering the ECI Ecosystem. This ITU-T Supplement is a transposition of the ETSI Group Report [b-ETSI GR ECI 004] and is a result of a collaboration between ITU-T SG9 and ETSI ISG ECI. A minor amendment was introduced with new clause 6.4.

[**ITU-T J.Suppl.8 “Embedded Common Interface (ECI) for exchangeable CA/DRM solutions; Trust Environment (TE)”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14287) addresses details of a Trust Environment for the Embedded Common Interface (ECI) for exchangeable CA/DRM solutions and complements ECI-related ITU-T Recommendations covering the ECI Ecosystem. This ITU-T Supplement is a transposition of the ETSI standard [b- ETSI GS ECI 001-6] and is a result of a collaboration between ITU-T SG9 and ETSI ISG ECI.

[**ITU-T J.Suppl.9 “Embedded Common Interface (ECI) for exchangeable CA/DRM solutions; System Validation (VAL)”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14288) addresses scenarios for System Validation for the Embedded Common Interface (ECI) for exchangeable CA/DRM solutions and complements ECI-related ITU-T Recommendations covering the ECI Ecosystem. This ITU-T Supplement is a transposition of the ETSI standard [b- ETSI GS ECI 002] and is a result of a collaboration between ITU-T SG9 and ETSI ISG ECI.

[**ITU-T J.Suppl.10 “Correspondence Between CableLabs DOCSIS Specifications and ITU-T J-series Recommendations”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14289) is to clarify the relationship between the multiple generations of CableLabs DOCSIS specifications and the ITU-T J-series of DOCSIS-based recommendations.

[**ITU-T Technical Paper JSTP-AFDI “Analysis and related solutions for full duplex interference”**](https://www.itu.int/pub/publications.aspx?lang=en&parent=T-TUT-CABLETV-2020-1) describes that several primary interferences will impact the in-band full-duplex CM performance, and the interference mitigation solutions are provided.

[**ITU-T Technical Paper JSTP-IBBDTV “Integrated broadcast-broadband digital TV application cooperated with server for functional extension including functions of digital TV reception and processing**](https://www.itu.int/pub/publications.aspx?lang=en&parent=T-TUT-CABLETV-2020)**”** describes an integrated broadcast-broadband (IBB) digital TV application cooperated with server for functional extension including functions of digital TV reception and processing. In the current CATV systems, services are dependent on functions of a set top box (STB); thus, the services that require functions beyond the capabilities of an STB cannot be introduced. This system allows for the introduction of new services that require furthering the capabilities of the existing STBs and smoothly transitioning to new STB models. The system is built on an IBB system as defined in [ITU-T J.207]. This system comprises servers and STBs with the following features. The server receives a cable broadcast signal, processes the required content elements and applications, and transfers the processed outputs to STBs. The STB presents the delivered processed outputs, and provides user-interactive functions.

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

[**ITU-T H.644.3 “Functional architecture of multimedia content delivery networks”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14340) specifies the common functional architecture for multimedia content delivery network. The Functions and Functional blocks within this common functional architecture and the related reference points are specified in this Recommendation for matching the requirements of various kinds of content ingestion, content distribution and content delivery within different network and platform. In addition, this Recommendation also gives some examples of the related service features, workflows, implementation guide and the security aspects in Appendixes. This Recommendation is intended to provide the references for MCDN providers to help them to build the common infrastructures of a multimedia content delivery network. With this Recommendation, it is benefit for different multimedia content providers to dispatch their content to the different types of end-users by taking advantage of a common MCDN capability.

**ITU-T Q.3058 “Signalling architecture of orchestration in NGNe” (under approval):** 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 Recommendation specifies the mapping of reference points to interfaces in the signalling architecture of orchestration in NGNe, and provides the signalling requirements of the interfaces and defines the protocols used for interfaces. The descriptions of the requirements, the functional architecture and the reference points of orchestration in NGNe are aligned with [ITU-T Y.2323] and [ITU-T Y.2324].

**ITU-T Q.3059 “Signalling requirements for service function discovery” (under approval)** specifies the signalling requirements for service function discovery based on its functional architecture. The signalling is for service function path controller to discover and select the service function.

**ITU-T Q.3060 “Signalling architecture of the fast deployment emergency telecommunication network to be used in a natural disaster” (under approval)**: In the last decade, climate change and natural disasters affected most of the countries all over the globe. The consequence such as tropical storms, floods and droughts directly affect social and various industrial sectors including ICT.

In this regard, the deployment of special emergency telecommunication network becomes a first and important aid for civilians afflicted by natural disasters. The rapid deployment of such networks is fundamental.

Currently, the emergency systems, which are used in a natural disaster cases, are based on the existing technologies such as space-based networks (e.g. Iridium, etc.). However, in forthcoming 5G and IoT era, there are some technologies which may play an important role in helping to provide wide number of ICT services from simple voice/video communication up to telemetry exchange, to name a few. All these services which are rapidly deployed in harmed country may sufficiently change the situation and help to save life of victims of natural hazard events.

The goal of this Recommendation is to describe the functional elements, services and signaling architecture of emergency telecommunication network which can be rapidly deployed in a country affected by a natural disaster.

[**ITU-T Q.3643 “Signalling architecture of distributed infrastructure ENUM networking for IMS”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14243) defines the framework and signalling architecture for distributed ENUM networking in support of IMS interconnection. Based on the signalling architecture of distributed ENUM model, it specifies the signalling procedures of ENUM profile management and ENUM resolution. The signalling requirements and protocols to be applied for interfaces of distributed ENUM networking are addressed as well.

**ITU-T Q.3645 “Protocol at interface between two distributed ENUM servers for IMS” (under approval)** defines protocol at the interface between two Distributed ENUM Servers (DES) of distributed ENUM system in support of IMS interconnection. Based on the functions and signalling requirements defined in [ITU T Q.3643], this Recommendation provides the reference model, procedures, protocol, and message specification for the interface between two DES.

**ITU-T Q.3720 “Procedures for vBNG acceleration with programmable acceleration card” (under approval)** specifies the framework, working modes, and procedures for vBNG acceleration with programmable acceleration card.

**ITU-T Q.3915 “Set of parameters of vBNG for monitoring” (under approval):** Virtual Broadband Network Gateway has been developed as an entry point for telecommunication providers to introduce network function virtualization (NFV). This draft Recommendation focuses on monitoring of virtual Broadband Network Gateway (vBNG) in NFV. This Recommendation provides the set of parameters that indicate the state and event of vBNG.

**ITU-T Q.3961 “Parameters for evaluating bottleneck of web-browsing service” (under approval)**: If the QoS of web-browsing service drops, ISPs and ICPs hope to be able to immediately find the reasons, fix the faults and improve web-browsing service. To achieve the above aims, this Recommendation specifies parameters for evaluating bottleneck of the web-browsing service. These parameters can be divided into four groups: parameters in the application layer, parameters in the transportation layer, parameters in the network layer and the characteristic parameters. The relationship between these parameters is also introduced in this Recommendation.

**ITU-T Q.4064 “Interoperability testing requirements of virtual Broadband Network Gateway” (under approval)** aims to specify virtual BNG (vBNG) interoperability testing requirements. Firstly, as a basic background, this Recommendation introduces the overview of vBNG and interoperability testing of vBNG, which includes but not limited to the definition, characteristics, general capabilities of vBNG as well as the overview of interoperability testing of vBNG. The description of use cases of vBNG will be provided as appendix. Base on analysis of involved vBNG capabilities in use cases, the corresponding derived requirements of vBNG’s interoperability testing will be introduced.

**ITU-T Q.4066 “Testing procedures of Augmented Reality applications” (under approval)**: Augmented reality (AR) is a collection of new technologies that perform the function of displaying digital information to a user through special devices (smartphone, AR glasses, projectors, etc.) allowing data to be displayed in visual (3D objects, video, images, etc.), audio or text format alongside real-world objects. Besides, augmented reality offers the possibility of physical objects and virtual entities, which can make additional delays in the process of data transformation. Because testing procedures for augmented reality are significantly different from traditional applications, this Recommendation defines approaches for testing for various applications of AR.

**ITU-T Q.4100 “Hybrid peer-to-peer (P2P) communications: Functional architecture” (under approval)** specifies functional architecture of hybrid peer-to-peer overlay networking architecture. The hybrid P2P network makes use of advantages of tree-based overlay network and mesh-based overlay network. This Recommendation specifies related components with detailed composition of functional entities based on their atomic functionalities. This also specifies the reference points to be used for further protocol specification among those components. In addition, this Recommendation provides high-level information flows for various application services based on hybrid overlay network such as IoT, blockchain and multimedia live streaming.

**ITU-T Q.5052 “Addressing mobile devices with duplicate unique identifier” (under approval):** The presence and detection of duplicate unique identifiers on mobile networks and identifying the authenticity of a device are two key problems that stakeholders are looking to find solutions for. The detection mechanisms discussed in this documentation are based on post-processing mobile network data to identify devices for blocking purposes based on criteria defined by individual national regulatory bodies. Through incorporation of one or more of these mechanisms, systems can identify and address the problem that duplicate or cloned devices present to governments, operators, and consumers. A combination of one or more methodologies described in this document can be employed at any given time. The decision regarding the methodology or methodologies to employ will determine the level of effectiveness of a country’s detection mechanism.

[**ITU-T X.609.5 (revised) “Managed P2P communications: Overlay management protocol”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14247) specifies a multimedia streaming overlay management protocol (MSOMP) that runs on the interface among entities of managed P2P communications. The management functionalities covered in this Recommendation include overlay network management including creation, modification, and termination and peer management including membership control and information maintenance. The protocol is applicable to various services such as multimedia streaming service and content distribution service over managed P2P communications. This Recommendation provides protocol operations and message formats.

**ITU-T X.609.9 “Managed P2P communications: Overlay content management protocol” (under approval)** specifies overlay content management protocol that supports of managing overlay content to be distributed over managed peer-to-peer network. This protocol is used between peer and IXS (index server) to manipulate the meta information needs to be shared among peers within a same overlay network. This Recommendation provides protocol message syntax and basic operations with information flows. In addition, this provides extended operations for using this protocol for various application services such as content distribution, multimedia streaming and data streaming.

**ITU-T X.609.10 “Managed P2P communications: Signalling requirements for data streaming” (under approval)** defines the signalling requirements for data streaming that runs on the reference points among related entities of the managed P2P communications. Data streaming service is a service that delivers the data which a data source generates continuously or on a specific event. Different from audio or video frames in multimedia streaming service, each data generated by the data source in the data streaming service can be processed independently. This Recommendation also addresses service procedures for providing data streaming services based on managed peer-to-peer networks.

[**ITU-T Y.2029 Amd.1 “A multi-path transmission control in multi-connection - Amendment 1 - New Annex A: Network equipment based multi-path transmission”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=12510)provides the text of network equipment based multi-path transmission including the necessity and technical considerations, capability requirements, scenarios, and information flows for supporting network equipment based multi-path transmission.

**ITU-T Y.2245 “”Service model of the Agriculture Information based Convergence Service” (under approval):** Agricultural data is the key foundation for Smart Farm models, in which a wide range of Information and Communication Technology (ICT) such as IoT and Big Data are converged, to be operated and managed. Given the fact that every single stage in Smart Farm models from crop growing to selling requires appropriate data, it is crucial to have a well-established service model for data collection and its provision. This service model should gather and process data before providing it for users to enhance their farm business. By convergence of various data collected from each stage of production, the model should ensure higher quality of service. During the production stage, the convergence services are provided to increase crop quality and yield and reduce farm maintenance costs. This Recommendation provides more details about the service model.

[**ITU-T Y.Suppl.66 “Network 2030 Services: Capabilities, performance and design of new communications services for the Network 2030 applications”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?rec=14385) tries to assess the new services and capabilities required by network 2030. This Supplement includes common terminology and definitions necessary for describing new services. It also analyses gaps in existing communication technology to provide the reasoning behind the new communication services that are proposed in this document.

[**ITU-T Y.Suppl.67 “Representative use cases and key network requirements for Network 2030”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?rec=14386) presents at first seven representative use cases for Network 2030 with their potential key network requirements: Holographic Type Communications (HTC); Tactile Internet for Remote Operations (TIRO); Intelligent Operation Network (ION); Network and Computing Convergence (NCC); Digital Twin (DT); Space-Terrestrial Integrated Network (STIN); Industrial IoT (IIoT) with cloudification. Then, five overarching abstract requirement dimensions are proposed and scored relatively in order to compare the requirements of each use case, graphically. The rationale for consideration of these abstract dimensions is stated in detail, as well as an analysis of each use case from the abstract dimension perspective.

[**ITU-T Technical report NET2030-DF “Driving Forces and Vision towards Network 2030”**](https://www.itu.int/pub/publications.aspx?lang=en&parent=T-TUT-NET2030-2020) aims to provide a holistic vision for Network 2030, and analyses some fundamental driving forces by presenting four new network capability driven use cases and services. Accordingly, future-oriented challenges with potential network requirements are stated as well. Overall, this report provides an overview of Network 2030, finally leading to the three pillars of Network 2030, in terms of new applications, new services and new infrastructures.

**ITU-T Technical report “Use of ITU-T Recommendations by Developing Countries” (under publication)**: A standard is defined as a document established by consensus and approved by a recognized body. In the UN, the ITU-T is the recognized body for Telecommunication Standardization whose output Standards are known as ITU-T Recommendations. Countries use standards to maximize compatibility, interoperability, safety, repeatability, and quality among others. The ITU-T standardization process involves its members in the development of the standards, which they later utilize. The development of any standard is motivated by a present need to solve a problem or a future need to solve future problems. The expectation is that all countries on either side of development, to actively participate in both the production and utilization of the standards. There is however a perception that there is less utilization of the ITU-T standards by Developing Countries.

This document presents the analysis and interpretation of the results of the questionnaire on use of ITU-T Recommendations in Developing Countries.

I.2.3 IMT-2020/5G networks

[**ITU-T G.8300 “Characteristics of transport networks to support IMT-2020/5G”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14217) defines the requirements for the layer one transport network support for the 5G fronthaul, midhaul and backhaul networks as defined later in this document.

[**ITU-T Q.5022 “Signalling procedure of energy efficient device-to-device communication for IMT-2020 network”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14246): According to different surveys, the number of wireless devices may reach trillions by 2020. The massive increase of wireless devices will lead to different interconnection and communications challenges. In this regard, most of wireless devices would need to use D2D communication. In general, D2D communication may bring additional benefits to new wireless devices such as higher throughput, better cell coverage, spectrum efficiency and other valuable features of the cellular networks. However, still, there is a need to specify a procedure which may switch between two algorithms used for D2D communication according to the cell status, as follows:

* communication algorithm which is used in a stable condition of the cell;
* communication algorithm which is used in the situation when the serving Base Station (BS) becomes unavailable in certain period of time.

This procedure should be based on an energy efficient intra-cell clustering and the procedure should be able to reuse frequency between clusters. The key advantage of the procedure is the reducing of the signalling overhead.

The Recommendation describes a D2D communication procedure to be used as a part of the IMT-2020 control plane.

**ITU-T X.1811 “Security guidelines for applying quantum-safe algorithms in 5G systems” (under approval)** identifies threats raised by quantum computing to fifth generation (5G) systems through assessing the security strength of currently used cryptographic algorithms. This Recommendation briefly reviewed quantum safe algorithms, including both symmetric and asymmetric types, and provides guidelines for applying quantum safe algorithms in 5G systems.

**ITU-T Y.3075 “Requirements and capabilities of Information Centric Networking routing and forwarding based on control and user plane separation in IMT-2020” (under approval)** specifies service requirements and functional requirements of ICN routing and forwarding based on control and user plane separation in IMT-2020. In addition, the capabilities of ICN routing and forwarding in control plane and data plane are described with considering different scenarios. Finally, the security consideration is discussed.

**ITU-T Y.3076 “Architecture of ICN-enabled Edge Network in IMT-2020” (under approval)** specifies the requirements and architecture about ICN-enabled edge network in IMT-2020. 1) From the service and network operation point of view, it discusses detailed requirements of ICN-enabled Edge network in IMT-2020. 2) It provides architecture of ICN-enabled edge network. 3) It describes the key functions and interfaces to satisfy the requirements of ICN-enabled edge network.

**ITU-T Y.3109 “QoS requirements and framework for virtual reality delivery using mobile edge computing supported by IMT-2020” (under approval)** specifies Quality of Service (QoS) requirements and a framework for virtual reality delivery using mobile edge computing in IMT-2020. It first provides an introduction on virtual reality delivery using mobile edging computing supported by International Mobile Telecommunications (IMT) 2020 network. It then specifies QoS requirements and a framework. The classification of VR services and the detailed VR service factors that become a basis for identifying requirements are specified in Appendix I and II. The typical VR user cases and guidelines for deployments of VR services are described in Appendix III and VI.

**ITU-T Y.3134 “IMT-2020 fixed mobile convergence functional requirements for management and orchestration” (under approval)** gives specification about IMT-2020 FMC functional requirements for management and orchestration in order to realize unified network management and resource orchestration functions in IMT-2020 FMC context. The functional requirements include general aspect, resource aspect, service aspect, user aspect and performance aspect of IMT-2020 FMC functional requirements for management and orchestration. The afore-mentioned functional requirements are beneficial to network operators and service providers to design, deploy and operate network in IMT-2020 FMC context.

**ITU-T Y.3136 “Session management for fixed mobile convergence in IMT-2020 networks” (under approval)** describes the scenarios, general requirements and design principles of session management (SM) for fixed mobile convergence (FMC) in IMT-2020 networks. This Recommendation describes the functional architecture and key functions of session management for supporting FMC in IMT-2020 networks. This Recommendation provides information flows of PDU session management and traffic routing management for FMC in IMT-2020 networks.

**ITU-T Y.3150 (revised) “High-level technical characteristics of network softwarization for IMT-2020” (under approval)**: With the global recognition of the usefulness of network slicing technology, which is the most typical substantiation of the network softwarization approach, this Recommendation describes how network softwarization and network slicing contribute to IMT-2020 systems. It explores network slicing from two viewpoints: vertical and horizontal aspects. The Recommendation further describes network slicing for mobile fronthaul/backhaul, introduction to advanced data-plane programmability, and capability exposure. These technical characteristic descriptions are expected to lead to their detailed study.

This revision contains i) the change of a basic model, which contains SDN, NFV, cloud computing and other technical environments, and ii) security consideration for network slicing. In addition, informative information on hierarchical orchestration is included.

[**ITU-T Y.3154 “Resource pooling for scalable network slice service management and orchestration in the IMT-2020 network”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14254): Managing the lifecycle of network slices has recently caught much attention as well as constructing end-to-end network slices. Especially, the agility and flexibility in resource allocation to network slices becomes more important for rapid service delivery to network slice service customers in the IMT-2020 network. This Recommendation describes scalable service management and orchestration framework using the middle layer named ‘Resource Pool’, which intensively stores a variety of virtual resources information collected from the underlying infrastructure layer relevant to network slice instances. Network slice instances can be created from the resources reserved according to network slice service demand forecast. The proposed approach in this Recommendation is generic and thus applicable to wide variety of organizational entities in network slicing such as network infrastructure provider, network slice provider, network slice service provider, and network slice service customer.

**ITU-T Y.3155 “Enhanced SDN Data Plane for IMT-2020” (under approval)** provides the requirements and high-level architecture of enhanced SDN data plane (ESDP) for IMT-2020 which is aiming to provide improved support for relevant requirements of the network. Based on the high-level architecture, it specifies functional blocks, reference points, and work flow of ESDP.

**ITU-T Y.3156 “Framework of network slicing with AI-assisted analysis in IMT-2020 networks” (under approval)**: For the future enhanced operation and maintenance management of network slicing with the purpose of satisfying users' service level agreement (SLA) requirements, this Recommendation describes the requirements and functional roles of AI-assisted analysis which supports the lifecycle management and orchestration of network slicing.

[**ITU-T Y.3173 “Framework for evaluating intelligence levels of future networks including IMT-2020”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14133)specifies a framework for evaluating the intelligence of future networks including IMT-2020. A method for evaluating the intelligence levels of future networks including IMT-2020 is introduced. An architecture view for evaluating network intelligence levels 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 levels 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”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14134): 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.3175 “Functional architecture of machine learning based quality of service assurance for the IMT-2020 network”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14255) specifies a functional architecture of machine learning based quality of service (QoS) assurance for the international mobile telecommunications 2020 (IMT-2020) network. It first provides an overview of architectural framework for machine learning in IMT-2020 [ITU-T Y.3172]. It then describes the functional architecture of machine learning based QoS assurance for the IMT-2020 network including the reference points. It finally specifies the procedures of machine learning based QoS assurance for the IMT-2020 network.

**ITU-T Y.3176 “Machine learning marketplace integration in future networks including IMT-2020” (under approval)** provides high-level requirements and the architecture for integrating ML marketplaces in future networks including IMT-2020. Based on these requirements, the architecture for the integration of ML marketplaces is described taking into account the architectural framework in [ITU-T Y.3172] as a basis.

[**ITU-T Y.Suppl.59 to ITU-T Y.3100 of Recommendations “IMT-2020 standardization roadmap”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?rec=14233) represents the snapshot of the current status of standardization activities on IMT-2020. It is based on the IMT-2020 standards roadmap, an online project maintained by the JCA-IMT2020 since its establishment.

[**ITU-T Y.Suppl.64 “Awareness on Use Cases and Migration Aspects of IMT-2020”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?rec=14383)**:** IMT-2020 is rapidly evolving and for many organizations, including administrations, it is important to have awareness of these new developments. At this stage, it is critical to have awareness on use cases of IMT-2020 and possible migration scenarios from existing networks to IMT-2020. This Supplement to the ITU-T Recommendation series Y.3100 on IMT-2020 has been developed to provide awareness, on use cases and migration aspects of IMT-2020. The supplement was developed by Q5/13 with initial collaboration of Q20/13.

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"**](https://www.itu.int/rec/T-REC-G.9960-202002-I!Amd1) includes the extension of the Recommendation to operate on an extended bandwidth over coaxial and phoneline mediums, multi-level coding and RCM schemes.

[**ITU-T G.9960 (2018) Amd.2 “Unified high-speed wire-line based home networking transceivers - System architecture and physical layer specification”**](https://www.itu.int/rec/T-REC-G.9960-202007-I!Amd2) includes a new Annex R on the use of reverse power feeding techniques for G.hn over coaxial media, and adds a field to the PHY frame header of the MAP to better control PSD levels in complex networks such as those for Smart Grid applications.

[**ITU-T G.9961 (2018) Amd.1 "Unified high-speed wireline-based home networking transceivers – Data link layer specification: Amendment 1"**](https://www.itu.int/rec/T-REC-G.9961-202002-I!Amd1) 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.

[**ITU-T G.9961 (2018) Amd.2 “Unified high-speed wireline-based home networking transceivers - Data link layer specification - Amendment 2”**](https://www.itu.int/rec/T-REC-G.9961-202007-I!Amd2) includes a new Annex D on IEEE 802.1X port-based network access control, means for delivering management data across the A interface, and support for a wider range of applications of the G.hn technology (e.g., means to indicate the category of applications and actual application that the domain is implementing).

[**ITU-T G.9962 Amd.1 “Unified high-speed wire-line based home networking transceivers - Management specification - Amendment 1”**](https://www.itu.int/rec/T-REC-G.9962-202007-P!Amd1) includes a new logical interface between the Security Controller Entity and the Domain Master Management Entity.

[**ITU-T G.9964 (2011) Amd.3 “Unified high-speed wireline-based home networking transceivers – Power spectral density specification - Amendment 3”**](https://www.itu.int/rec/T-REC-G.9964-202002-P!Amd3)includes the extension of the Recommendation to operate on an extended bandwidth over coaxial and phoneline mediums.

[**ITU-T G.9991 (2019) Amd.1 “High-speed indoor visible light communication transceiver - System architecture, physical layer and data link layer specification (Amendment 1)”**](https://www.itu.int/rec/T-REC-G.9962-202007-P!Amd1) includes updates on security to accept IEEE 802.1X-based authentication and alignment with G.9960/G.9961 Recommendations.

**ITU-T Technical Paper “Use of G.hn in Industrial Applications”** summarizes a set of use cases for G.hn based PLC in industrial applications. Each use case is discussed by description and requirement for PLC technology. This document intends to provide guidance for G.hn based PLC technology to enter a new area beyond home network.

I.2.5 Smart Grid

[**ITU-T X.1332 “Security guidelines for smart metering service in smart grids”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14086): This Recommendation provides security guidelines for smart metering services to enable service providers to implement appropriate security measures to ensure security of their service. This Recommendation identifies security threats and attack methods against smart metering services and specifies security requirements and capabilities to mitigate these threats and attacks accordingly.

I.2.6 Software-defined networking

**ITU-T X.1046 “Guideline on software-defined security in SDN (Software-defined Networking)/NFV (Network Function Virtualization) network” (under approval)** specifies a framework of software-defined security – in software defined networks (SDN) and the network functions virtualization (NFV) network. This new framework utilizes the key advantages of SDN/NFV technologies such as on-demand capacity scale-in/scale-out, dynamic and intelligent security policy control in regarding the real-time network status, separated deploy of control layer and data forwarding layers, full view of traffic for monitoring and unified security policy setting.

I.2.7 Cloud computing

[**ITU-T X.1604 “Security requirements of network as a service (NaaS) in cloud computing”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14093) analyses security threats and challenges on network as a service (NaaS) in cloud computing and specifies security requirements of NaaS in NaaS application, NaaS platform and NaaS connectivity aspects based on corresponding cloud capability types.

[**ITU-T X.1605 “Security requirements of public infrastructure as a service (IaaS) in cloud computing**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14094)**”:** Infrastructure as a service (IaaS) platforms and virtualized services face different, and perhaps more, challenges and threats than traditional information technology infrastructure and application. IaaS platforms that share computing, storage and networking services need protections specific to threats in IaaS environment. This Recommendation aims to document security requirements of public IaaS in order to help IaaS providers to improve security of IaaS platform throughout the planning, building and operating stages.

**ITU-T X.1606 “Security requirements for communications as a service application environments” (under publication)** identifies security threats and recommends security requirements for communications as a service (CaaS) application environments. This Recommendation describes scenarios and features of CaaS containing multi-communication capabilities. Then it identifies specific threats arising from unique CaaS features and recommends appropriate CaaS security requirements.

**ITU-T Y.3525 “Cloud computing - Requirements for cloud service development and operation management” (under approval)** specifies functional requirements of cloud service development and operation management based on the analysis of corresponding use cases.

**ITU-T Y.3530 “Cloud computing - Functional requirements for blockchain as a service” (under approval)**: Blockchain as a service (BaaS) is a cloud service category in which the capabilities provided to the cloud service customer are the ability of setting up blockchain platform, and development decentralized application using blockchain technologies. In BaaS, an integrated developing environment (IDE) for CSCs is provided to create, deploy and operate decentralized applications. This Recommendation introduces blockchain and blockchain as a service. This Recommendation also provides functional requirements of blockchain as a service which is derived from use cases.

I.2.8 Big data

**ITU-T F.743.20 “Assessment framework for big data infrastructure” (under approval)** gives an assessment framework of big data infrastructure, which includes functional metrics, performance metrics, scalability metrics, security metrics, operation metrics and compatibility metrics.

**ITU-T X.1750 “Guidelines on security of big data as a service for Big Data Service Providers” (under publication):** Big data as a service (BDaaS) is a cloud service category that provides cloud service customers with capabilities to collect, store, analyse, visualize and manage big data, as specified in ITU-T Y.3600. With remarkable growth of data volumes and rapid development of big data business, big data infrastructure has become the central facility to provide BDaaS. Consequently, significant security issues arise for BDaaS. For example, open source big data software design sometimes fails to take security into consideration from the beginning. New technologies introduced by big data analytics can also result in failure of traditional security protection measures. Recommendation X.GSBDaaS analyses security challenges BDaaS faces, identifies security roles and responsibilities for provision of BDaaS, as well as a security framework for a big data infrastructure. It also specifies security protection measures that should be satisfied for services and components related to BDaaS.

**ITU-T X.1751 “Security guidelines on big data lifecycle management for telecommunication operators” (under publication)** analyses security vulnerabilities and provides security guidelines on the big data lifecycle management for telecommunication operators. With rapid development of big data technology, the value of data has substantially increased. Big data bring new opportunities to telecommunication services. Previously, data were siloed and managed independently in different telecommunication service systems. Data aggregation and fusion trends are inevitable with the construction of big data services. In the process of data fusion convergence, data flow on platforms and in service processes. Data face various security vulnerabilities at different stages of its lifecycle. This Recommendation introduces specific characteristics of telecommunication big data services and data categories, analyses security vulnerabilities of big data lifecycle management, specifies security guidelines for telecommunication operators.

[**ITU-T Y.3604 “Big data – Overview and requirements for data preservation”**](ttps://www.itu.int/ITU-T/recommendations/rec.aspx?id=14138) 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.

**ITU-T Y.3605 “Big data - Reference architecture” (under approval)** defines Big Data Reference Architecture (BDRA) that can serve as a fundamental reference point for big data standardization and which provides an overall framework for the basic concepts and principles of big data. The Recommendation provides a description of reference architecture concepts, two distinct viewpoints including user view and functional view, and also cross cutting aspects. Furthermore, the Recommendation addresses layering framework, functional components within framework and detailed functional descriptions for big data.

[**ITU-T Y.3652 “Requirements of big data driven networking”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14256): Big data driven networking (bDDN) is a group of technologies and methods to facilitate network operation, administration, maintenance and optimization etc. based on the big data generated by the network and a series of methods and tools. That is to say, big data generated by the network are used to serve for the network and make the network better. This Recommendation specifies requirements of big data driven networking. This Recommendation studies general requirements for big data driven networking, requirements of big data plane for big data driven networking, requirements of network plane for big data driven networking, requirements of management plane for big data driven networking, interface requirements for big data driven networking.

I.2.9 Network Management

[**ITU-T M.3041 “Framework of smart operation, management and maintenance”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14181) 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.3164 “Generic information model for on-site telecommunication smart maintenance”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14319) introduces the generic information model for on-site telecommunication smart maintenance. In this Recommendation, the definition and description of the generic information object classes, attributes and the relationship between object classes are provided. This Recommendation also provides examples of each information object class and a diagram of all the example instances.

[**ITU-T M.3362 “Requirements for Telecommunication anti-Fraud Management in the TMN”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14197) describes the requirements for telecommunication anti-fraud management in the telecommunication management network (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”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14182) 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”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14183) 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.266 “Versatile video coding”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14336) provides text for the new video coding Recommendation entitled “Versatile video coding” (VVC). This Recommendation has been designed with two primary goals. The first of these is to specify a video coding technology with a compression capability that is substantially beyond that of the prior generations of such standards, and the second is for this technology to be highly versatile for effective use in a broadened range of applications. Some key application areas for the use of this standard particularly include ultra-high definition video, video with a high dynamic range and wide colour gamut, and video for immersive media applications such as 360° omnidirectional video projected using a common projection format such as the equirectangular or cubemap projection formats, in addition to the applications that have commonly been addressed by prior video coding standards. This Recommendation was developed collaboratively with ISO/IEC JTC 1/SC 29, and corresponds with ISO/IEC 23090-3 as technically aligned twin text.

[**ITU-T H.274 “Versatile supplemental enhancement information messages for coded video bitstreams”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14337) provides text for a new Recommendation that specifies the syntax and semantics of video usability information (VUI) parameters and supplemental enhancement information (SEI) messages for use with coded video bitstreams. The VUI parameters and SEI messages defined in this Recommendation may be conveyed within coded video bitstreams in a manner specified in a video coding specification or may be conveyed by other means as determined by the specifications for systems that make use of such coded video bitstreams. This Recommendation is particularly intended for use with coded video bitstreams as specified by Rec. ITU-T H.266 | ISO/IEC 23090-3, although it is drafted in a manner intended to be sufficiently versatile and generic that it may also be used with other types of coded video bitstreams. This Recommendation was developed collaboratively with ISO/IEC JTC 1/SC 29, and corresponds with ISO/IEC 23002-7 as technically aligned twin text.

**ITU-T T.701.11 “Guidance on audio descriptions (twin text of ISO/IEC TS 20071-11:2019, Information technology - Guidance on alternative text for images - Part 11)” (under approval)** gives guidance on how to create text alternatives (also known as "alt-text") and what information to put in text alternatives.

This Recommendation applies to all still images that are used in any type of electronic document. It also applies to individual images within a slide show. The alternative text guidance provided in this Recommendation is not applicable to moving images (e.g. movies). This Recommendation is a twin text with ISO/IEC 20071-11:2019 "Information technology – User interface component accessibility – Part 11: Guidance on text alternatives for images", prepared by ISO/IEC JTC1 SC35 "User interfaces".

I.3.2 Intelligent, interoperable visual surveillance systems

I.3.3 IPTV and digital signage

[**ITU-T H.702 (V2) (revised) “Accessibility profiles for IPTV systems”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14341) defines three profiles for accessibility features in IPTV systems, with increasing levels of support. Accessibility information such as caption, sign language and audio description that are sent separately from video contents to IPTV terminal devices. By defining the above profiles, persons with disabilities can choose more easily the terminal devices that have the functions they need. The set of parameters within each profile were identified in consultation with the assistance of persons with disabilities participating in the work of ITU-T. This version includes the accessibility profiles for cognitive disabilities and appendix about an example for H.702 based system, and harmonizes the latest term definitions.

[**ITU-T H.704 “Enhanced UI framework for IPTV terminal device - Gesture control interface”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14343) defines the general requirements, functional elements and interfaces supporting enhanced capability of user interaction by gesture recognition and controlling over IPTV terminal devices, based on the enhanced user interface (UI) framework defined in [ITU-T H.703]. Those functional elements are described in the gesture controlling enabler and gesture recognition enabler defined in this Recommendation. Moreover, the procedures of interaction between gesture recognition device and gesture-controlled device are defined with the recommended information used in the interaction. This Recommendation enables the gesture controlling feature in the Enhanced IPTV User Interface defined in [ITU-T H.703]. With those features, users can control the operation of IPTV applications in an IPTV terminal device in a convenient, natural and comfortable way.

I.3.4 Immersive live experience

[**ITU-T H.430.5 “Reference models for immersive live experience (ILE) presentation environment”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14338): In order to reproduce a highly realistic experience and sense of immersiveness for audiences at a viewing site on par with the experience of audiences at the event site at the same time, and also to reduce the design and setup times of ILE viewing sites, this Recommendation specifies reference models for the Immersive Live Experience (ILE) presentation environment. This document provides three reference models for proscenium, open, and arena style presentation environments, and provides functional blocks and some implementation guidelines for ILE viewing sites as informative information.

[**ITU-T H.627 (V2) (revised) “Signalling and protocols for a video surveillance system”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14342) defines the detailed signalling flows and relevant protocols of a video surveillance system, based on the requirements defined in Recommendation ITU-T F.743V2 and the functional architecture defined in Recommendation ITU-T H.626 (V2). This revision updates the title of this Recommendation, adds the overall requirements, revises the signalling flows and relevant protocols.

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

[**ITU-T TP GSTP-IPTV-QoS “Technical Paper: Performance metrics for end-to-end IPTV video quality”**](https://www.itu.int/pub/T-TUT-IPTV-2020-QOS) describes useful QoS performance metrics for video quality of IPTV service in all domains of IPTV architecture intended to enhance end-to-end video quality and, as a result, improving quality of experience of end-users. Detailed explanation of measurement methodologies of these metrics on each domain from headend to home network is presented.

I.3.6 New services and applications

[**ITU-T F.735.1 “Requirements for software defined camera”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14323): With the development of hardware and intelligent algorithms, various intelligent algorithms are developed for massive scenarios. In order to meet the various scenarios and requirements, cameras supporting algorithms on-demand deployment and online upgrade without service interruption are needed. Software-defined camera is a kind of IPU (see [ITU-T F.743.1]), which provides a technical approach to decouple hardware and software and to support algorithms on-demand deployment, online upgrade without services interrupting, continuous online learning to adapt to various scenarios. This Recommendation defines the typical scenarios, functional architecture and requirements of such software- defined camera.

[**ITU-T F.743.11 “Requirements for video surveillance with mobile premises units”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14324) defines requirements for video surveillance with mobile premises units. Mobile premises units can effectively enhance the flexibility of surveillance perspectives, expand surveillance scenarios and the application scope of video surveillance technology. Meanwhile, since the current wireless communication technology can support the mobile wireless transmission of video or image data, the application of wireless communication technology to mobile premises units can greatly improve the flexibility of video surveillance and construct a comprehensive video surveillance system. This Recommendation describes the application scenarios and the requirements for video surveillance with mobile premises units.

[**ITU-T F.743.20 “Assessment framework for big data infrastructure”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14325) gives an assessment framework of big data infrastructure, which includes functional metrics, performance metrics, scalability metrics, security metrics, operation metrics and compatibility metrics.

[**ITU-T F.743.21 “Framework for data asset management”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14326) defines data asset management framework with its corresponding objects, activities and supports. Objects of data asset management are data assets, which include master data, metadata and other data assets. Activities include data standards management, data model management, data quality management, data security management, data valuation management, and data sharing management. In order to ensure the management, the corresponding people in charge, rules and regulations, and technology tools are needed.

[**ITU-T F.746.10 “Architecture for spontaneous dialog processing system for language learning”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14327) defines the architecture, functional entities, and interfaces for a spontaneous dialog processing system for language learning service which is described in [ITU-T F.746.5]. The scope of this Recommendation is focused on describing the architecture with different functional components in spontaneous dialog processing system, which are: input/output management, dialog understanding, dual dialog management and generation, dialog knowledge management, incremental dialog knowledge learning, unstructured spontaneous speech recognition management and language learning function. This Recommendation together with the existing standards "Framework for language learning system based on speech and natural language processing (NLP) technology" [ITU-T F.746.5] will support the future systems which are expected to be equipped with dialog processing and language learning functions for advanced user experiences.

[**ITU-T F.746.11 “Interfaces for intelligent question answering system”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14328) defines interfaces for Intelligent Question Answering Service. This recommendation defines the interfaces among functional modules to support intelligent Question Answering service described in [ITU-T F.746.3]. The scope of this Recommendation is focused on describing the interfaces among different functional components in intelligent question answering (QA) system: natural language processing function, question analysis function, candidate answer generation function, and answer inference/generation function. This Recommendation together with the existing standards "Intelligent Question Answering Service Framework" [ITU-T F.746.3] and "Metadata for Intelligent Question Answering Service" [ITU-T F.746.7] will support the future systems which are expected to be equipped with QA functions for advanced user experiences.

[**ITU-T F.748.11 “Metrics and evaluation methods for deep neural network processor benchmark”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14329) provides the benchmarking framework, evaluation metrics and methods, and the application scenarios for deep neural network processors while doing training and inference task. This can be used to guide relevant parties to test, select or evaluate the deep neural network processor under the specified application scenarios. The establishment of relevant application performance evaluation benchmarks can objectively reflect the current state of the AI processor by providing objective metrics and comparison dimensions.

[**ITU-T F.749.3 “Use cases and requirements for the vehicular multimedia networks”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14330): The vehicular multimedia networks (VMN) consist of the vehicular multimedia service platform (VMSP), broadcast and communication networks, and the vehicular multimedia system (VMS) in the vehicle. This Recommendation specifies use cases and requirements for the VMN, including overview, connectivity, intelligent human machine interfaces (HMI) for the VMS, privacy considerations, content rights protection in a converged network environment, copyright and rights management support for content delivery, security, safety, and definition of vehicular multimedia configurations. A series of Recommendations for vehicular multimedia networks is under the responsibility of ITU- T SG16. This Recommendation is a part of that series and gives the requirements and user cases for the VMN.

[**ITU-T F.749.12 “Framework for communication application of civilian unmanned aerial vehicle”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14331): The civilian unmanned aerial vehicles are widely used in industry and consumer areas such as agriculture and plant protection, power line and petroleum pipeline inspection, police & traffic security surveillance, disaster monitoring, aerial photography & videography, express delivery, forestry and forest fire monitoring, meteorological, resource and scientific research etc. This Recommendation presents the general framework for communication application of CUAV and its functional entities, reference points, etc.

I.4.1 Internet of Things and Smart City

[**ITU-T Q.3745 “Protocol for time constraint IoT-based applications over SDN”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14244): Traffic generated by smart devices becomes a significant part of the Internet. Smart devices require mobility and guaranteed quality of services which need to be managed. Potentially, SDN and NFV based technologies (IMT-2020) will be used for managing all types of services and therefore, SDN is to be tasked to manage these kinds of demands as well. A significant number of the available Internet services require the exact value of network parameters such as latency, jitter, RTT and bandwidth. Using SDN capabilities for managing network parameters, will give a possibility to implement new services such as a tactile Internet, augmented reality, e-health applications. In this regard, the protocol is proposed to ensure the transfer of the requested (by IoT server) network performance requirements for IoT applications in SDN and NFV based networks (IMT2020). This protocol is to be used for interconnection between the IoT server and the Orchestrator application layer (Management application).

[**ITU-T X.1363 “Technical framework of personally identifiable information (PII) handling system in Internet of things (IoT) environment”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14087)**:** specifies a technical framework for PII handling in IoT environment with single or multiple service providers. In IoT environment, some IoT devices have capability to collect PII data. As PII data are useful for various types of services, data can be shared among multiple service providers. The technical framework specified in this Recommendation provides a mechanism to protect IoT users’ PII data when collected, shared and used by one or more IoT service providers.

[**ITU-T X.1364 “Security requirements and framework for narrow band Internet of things”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14088): aims to analyse potential deployment scheme and typical application scenarios of NB-IoT. It specifies security threats and requirements specific to the NB-IoT deployments and thus establishes a security framework for the operator to safeguard these new technology applications.

[**ITU-T X.1365 “Security methodology for the use of identity-based cryptography in support of Internet of things services over telecommunication networks”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14089)provides a security methodology for the use of identity-based cryptography public key technology in support of IoT services over telecommunications networks including mechanisms of identity management, key management architecture, key management operations and authentication.

**ITU-T X.1366 “Aggregate message authentication schemes for Internet of things (IoT)” (under publication)**: The number of Internet of things (IoT) devices is increasing, and in the near future there will be an enormous number of devices connected to the IoT network including 5G. This Recommendation specifies two message authentication schemes. One is an aggregate message authentication (AMA) scheme for IoT as a basic mechanism. The other is an interactive aggregate message authentication (IAMA) scheme with interactive protocol in a lightweight and secure manner. Both aggregate message authentication schemes can be applied for ensuring "entity (identity) authentication" as well as for ensuring "message authentication". These schemes may not be applicable in all use cases for utilizing IoT devices, but they are quite effective and suitable for use cases in the following conditions where:

• Message authentication is required from tens to tens of thousands of IoT devices.

• Data/message being handled for an authentication process that occurs frequently and intermittently.

For example, "surveillance applications for use of image data" and "remote telemetry" such as monitoring of plant/factory operations and health monitoring are the typical candidates of use cases for these schemes.

**ITU-T X.1367 “Standard format for Internet of things error logs for security incident operations” (under publication)**: There are two issues to handle security incidents from the Internet of things (IoT) ecosystem: The first is the incompatibility of protocols between computer networks using transmission control protocol/Internet protocol (TCP/IP) and IoT edge devices. The second is the lack of compatibility of error codes among edge device manufacturers. Recommendation X.1367 specifies a standardized error log format that can be placed in a protocol payload, such as syslog [b-IETF RFC 5424] to be used for converting an error log information issued by an edge device to the standard error log format. Recommendation X.1367 also specifies a standardized error code table to solve the second issue. As a result, security incidents across computer networks and networks for IoT edge devices can be integrally managed.

**ITU-T X.1368 “Secure software update procedure for IoT devices” (under approval):** This Recommendation specifies: 1) basic models and procedures for securely updating firmware/software (FW/SW) of Internet of things (IoT) devices; and 2) requirements and capabilities for updating IoT FW. A common secure update procedure is specified with general requirements. This procedure allows common IoT SW/FW updates to be securely implemented among stakeholders in the IoT environment, such as IoT device developers and IoT system/service providers. This Recommendation focuses on updating FW, but it is applicable to updating any other SW of IoT devices.

**ITU-T Y.4208 “IoT requirements for support of edge computing”**: 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”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14163)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.4210 “Requirements and use cases for universal communication module of mobile IoT devices”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14371)**:** As an important part of mobile IoT devices, the universal communication module is a key component to achieve economies of scale for mobile IoT devices, accelerate the progress of research and development, and promote the application of new mobile IoT technologies. This Recommendation specifies requirements for universal communication module of mobile IoT devices. Related use cases are provided in Appendix I, universal communication module reference types are described in Appendix II.

**ITU-T Y.4459 “Digital entity architecture framework for IoT interoperability”**: This Recommendation introduces 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”:** This Recommendation 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”**: 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.4462 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”**: This Recommendation 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”**: This Recommendation 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”**: This Recommendation 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”**: 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”**: 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”**: 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.4469 “Reference architecture of spare computational capability exposure of IoT devices for smart home”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14372) introduces spare computational capability exposure (SCCE) of Internet of things (IoT) devices for smart home and provides the characteristics and reference architecture of SCCE. In addition, it provides common procedures and several use cases to illustrate the concepts and the reference architecture of SCCE. SCCE is a functional entity in the smart home that facilitates IoT applications to make full use of spare computational capabilities of IoT devices in smart home scenarios. SCCE collects the spare computational capabilities exposed by IoT devices and provides them to IoT applications. With using SCCE, the spare computational capabilities of IoT devices can be used by IoT applications instead of the cloud to reduce the requirements of cloud computing and network resources.

[**ITU-T Y.4470 “Reference architecture of artificial intelligence service exposure for smart sustainable cities”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14373) introduces artificial intelligence service exposure (AISE) for smart sustainable cities (SSC), and provides the common characteristics and high-level requirements, reference architecture and relevant common capabilities of AISE. AISE is one of the basic supporting functional entities for smart sustainable cities, with which SSC services can use uniform reference points (exposed by AISE) to integrate and access the AI capabilities of AI services (e.g., machine learning services for image recognition, natural language processing services, traffic prediction services etc.). In addition, AISE can collect and open SSC data, and it supports AI services to train and perform AI capabilities in AISE in SSCs.

**ITU-T Y.4471 “Functional architecture of network-based driving assistance for autonomous vehicles” (under approval)** defines a reference functional architecture of network-based driving assistance (NDA) for autonomous vehicles. It clarifies the concept of NDA, specifies key functional entities and defines reference points between entities. The use cases and operational procedures are also provided in an informative appendix.

For improvement in the driving of autonomous vehicles, coordination between vehicles and infrastructures need to be improved with network technologies to provide the increasing transportation services and application requirements. NDA can improve the safety and efficiency of automated driving with capabilities of cooperative perception and decisions.

**ITU-T Y.4472 “Open data application programming interface (APIs) for IoT data in smart cities and communities” (under approval):** A growing number of smart cities and Administrations are inclined to collaborate and mutualize their efforts and resources for IoT deployments and open data sharing. This Recommendation intends to study the concept and potential of developing a secured open and interoperable API in the context of IoT deployment and open data management in smart cities. It will analyse current solutions implemented by Administrations around the world, where applicable, including those adopted by smart cities, to share their data through open and interoperable interfaces. It will subsequently specify an open and interoperable API for secured Open Data architecture as well as to support IoT data interoperability for smart cities.

This Recommendation presents a complete set of Open APIs dedicated to smart cities offering different features covering the needs of interoperable smart city framework development. In order to achieve interoperability among heterogeneous platforms and development of smart cities, the Recommendation proposed “interoperability points” in southbound and northbound in smart city framework. It provides a list of core API sets focusing on data interoperability, including context data management APIs, data transactions APIs, data storage APIs, and security APIs. Through the mechanism of subscriptions, it is possible to get a performant and scalable context data managment. The data storage APIs allow a granular management of the saved data for all cases, in particular both for open data and private data. The data transaction APIs facilitate exposure and access to the data through a data marketplace. In addition, security and privacy APIs are seriously taken into account to provide secure data exchange. It should be noted that data interoperability with open APIs can be completed with using common data models which is briefly discussed. Common data models built upon the collaboration with several standard fora and European projects are opened to public to use of them. The development of interoperable framework makes smart city platforms cost-efficient, flexible and extendable. The interoperability is not a choice but a must in smart city systems that embeds multiple verticals.

[**ITU-T Y.4473 “SensorThings API – Sensing”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14375) specifies the SensorThings application programming interface (API) which provides an open standard-based and geospatial-enabled framework to interconnect Internet of things (IoT) devices, data, and applications over the Web. The SensorThings API is an open standard, and that means it is non-proprietary, platform-independent. It builds on a rich set of proven-working and widely-adopted open standards, such as the Web protocols and the Open Geospatial Consortium (OGC) sensor Web enablement (SWE) standards, including the ISO/OGC observation and measurement data model. The SensorThings API is extensible and can be applied to not only simple but also complex use cases. This Recommendation provides a standard way to manage and retrieve observations and metadata from heterogeneous IoT sensor systems. The SensorThings API uses representational state transfer (REST) principles, an efficient JavaScript object notation (JSON) encoding, message queuing telemetry transport (MQTT) protocol, flexible OASIS open data protocol (OData) and uniform resource locator (URL) conventions.

[**ITU-T Y.4474 “Functional architecture for IoT services based on Visible Light Communications”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14376) describes the functional architecture for Internet of Things (IoT) services based on Visible Light Communications (VLC), which includes functional requirements, functional architecture, messages and information flows.

[**ITU-T Y.4475 “Lightweight intelligent software framework for IoT devices”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14377) addresses the concept of the lightweight intelligent software framework (LISF) which supports IoT applications requiring intelligent processing, and enables it working on resource-limited IoT devices. It identifies general requirements and provides a functional architecture of LISF based on the IoT reference model [ITU-T Y.4000].

[**ITU-T Y.4558 “Requirements and functional architecture of smart fire smoke detection service”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14378)**:** Fire smoke detection service is usually deployed in indoor environment like residential buildings, factories, shopping malls, hotels, office buildings, etc. With the development of society and economy, fire smoke detection service is playing a more and more important role in people's life, but there are some issues, including inefficient maintenance and management, non-real-time device failure detection, non-real-time fire alarms notification and poor service experience.

In order to solve the above issues, Smart Fire Smoke Detection (SFSD) service can not only detect the smoke concentration through sensors and trigger a fire alarm when it reaches a certain threshold to prevent disaster, but also send the alarm information to the cloud platform through network, thus relevant departments and personnel can be notified in time through Web/APP/SMS/Voice/Instant Message Client, etc. The SFSD service can provide many benefits, including efficient maintenance and management, real-time alarm report, real-time faults report and good service experience. Based on these observations, this Recommendation describes requirements and functional architecture of SFSD service.

**ITU-T Y.4559 “Requirements and functional architecture of base station inspection services using unmanned aerial vehicles” (under approval)**: The changes being experienced in weather conditions and the aging of materials may cause damage to base stations, which will affect network service quality and even cause safety incidents. Network operators need to carry out timely and periodic inspection and maintenance operations. Due to the long-term, high-intensity and high-altitude nature of these operations, the base station inspection (BSI) services conducted manually are dangerous, inefficient and costly.

Unmanned aerial vehicles (UAVs) with mature flight control and sensing capabilities can be used not only in the normal working environment but also in some extreme working environments. Therefore, BSI using UAVs can replace most manual inspections through a network connection and reduce the risk of inspection and ensure the safety of personnel. To achieve automation functions, the UAV needs to bear corresponding flight control, sensing and capturing, and communication capabilities, and it is necessary to develop a BSI supporting platform with corresponding functions to fulfil the automation and safety requirements of BSI services using UAVs.

This Recommendation describes requirements and functional architecture of BSI services using UAVs. It focuses on how to effectively provide inspection services for the base station using BSI-dedicated UAVs (BSI-UAVs).

**ITU-T Y.4807 “Agility by design for Telecommunications/ICT Systems Security used in the Internet of Things”**: This Recommendation 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.4808 “Digital entity architecture framework to combat counterfeiting in IoT”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14381): There are challenges related to the use and circulation of counterfeit devices in the market, including adverse consequences for users, governments and the private sector.

As documented in the ITU-T Technical Report on Counterfeit ICT equipment [b-ITU-T TR on Counterfeit ICT Equipment], there are a lot of technical solutions which are widely used for combating counterfeit products over the globe. The report indicates that RFID tags are among technologies which are used for combating counterfeiting. While this may be true, there are some difficulties associated with securing these systems with regard to the access control exercised to write on the tags. There are solutions established for combating counterfeit devices for specific technologies and/or industries which may not be applicable to all use cases. On the other hand, there are such solutions which may be applicable to all use cases, these solutions are based on the ITU-T Recommendations such as ITU –T Y.4459 “Digital entity architecture framework for Internet of things interoperability" and ITU-T X.1255 “Framework for discovery of identity management information”. Resolution 188 (Busan, 2014) on combating counterfeit telecommunication/information and communication technology devices recognized (in recognizing e) that Recommendation ITU-T X.1255, which is based on the digital entity architecture, provides a framework for discovery of identity management information. A digital entity architecture, as described in ITU-T Y.4459, 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.

Digital entity architecture provides additional means of security (e.g. public key infrastructure) features to authenticate the parties involved in the identifiers registration process. Other industry approaches to combat counterfeiting are available. They rely on commonly acknowledged identifiers including, but not limited to MAC, IMEI, RFID, …etc. Systems based on digital entity architecture may be considered as one category of candidate tools which allow vendors/industries (not only ICT industry) to store their products’ profile in digital form. Therefore, this Recommendation can be used in different industries such as ICT, pharmaceutical, automotive, avionic.

[**ITU-T Y.4907 “Reference architecture of blockchain-based unified KPI data management for smart sustainable cities”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14382) provides a reference architecture for blockchain-based unified KPI (key performance indicator) data management for smart sustainable cities (BKDMS). This Recommendation provides the concept, characteristics and high-level requirements of BKDMS. A reference architecture including capabilities of its functional entities is described in details, and unified structures of KPI data are also introduced with which to ensure BKDMS realizable.

**ITU-T Y.4908 “Performance evaluation frameworks of e-health systems in the IoT” (under approval)**: Currently e-health systems are being implemented by governments and stakeholders to increase the effectiveness, efficiency and the quality of health care services. The Internet of things (IoT) as a relatively new technology is transforming e-health systems to further enhance health care services. However, this transformation concomitantly creates a need for effective performance evaluation frameworks of e-health systems in the IoT. This Recommendation addresses this need for effective performance evaluation frameworks of e-health systems in the IoT and includes:

– A classification of e-health services in the IoT

– A non-exhaustive set of non-functional performance evaluation factors applicable to the e-health systems in the IoT

– Performance evaluation frameworks for e-health systems in the IoT.

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

[**ITU-T X.1371 “Security threats to connected vehicles”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14090) describes security threats to connected vehicles. These threats can be referred to and utilized in other Recommendations developed by ITU-T to consistently develop Recommendations in the context of the security aspects of intelligent transport systems (ITSs).

[**ITU-T X.1372 “Security guidelines for Vehicle-to-Everything (V2X) communication systems”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14091) identifies threats in V2X communication environments and specifies security requirements for V2X communication to mitigate these threats. This Recommendation also provides description of possible implementation of V2X communication with security.

**ITU-T X.1374 “Security requirements for external device with vehicle access capability” (under approval)** describes security threats in two parts, the interfaces which are used to communicate between a vehicle and its external devices, and the external device which communicates to the vehicle. This Recommendation provides security requirements for such external interfaces and external devices with vehicle access capability in telecommunication network environments to address identified threats depending on types of access interfaces. Interfaces and external devices with vehicle access capability include the remote keyless entry (RKE) system with smart key, a diagnostic tool and a wireless dongle using on-board diagnostic II (OBD-II) port, telematics control units with wireless communication devices and so on.

**ITU-T X.1375 “Methodologies for intrusion detection system on in-vehicle system” (under approval)** provides methodologies for intrusion detection systems (IDSs) on in-vehicle networks. This Recommendation mainly focuses on how to detect intrusion and malicious activities on in-vehicle networks such as those using controller area network (CAN) that cannot be supported by general IDSs currently used in Internet deployments. This Recommendation includes classifications and analyses of attack types used on in-vehicle networks. It then provides methodologies for detecting intrusions and malicious activities within CAN-based in-vehicle networks that cannot be supported by general IDSs.

**ITU-T X.1376 “Security-related misbehaviour detection mechanism for connected vehicles” (under approval):** As connectivity of vehicles increases, the number of vulnerabilities is rising due to the development of complex technology. These vulnerabilities bring more threats to connected vehicles. Analysis of a large amount of automotive data is very useful for assessing security of connected vehicles. Recommendation X.1376 describes a security-related misbehaviour detection mechanism for connected vehicles to help stakeholders to utilize automotive data to improve vehicle security.

I.4.5 Connected health: e-Health

[**ITU-T H.841 (revised) “Conformance of ITU-T H.810 personal health system: Personal Health Devices interface Part 1: Optimized Exchange Protocol: Personal Health Device”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14344) provides a test suite structure (TSS) and the test purposes (TP) for personal health devices 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.841 is a transposition of Continua Test Tool DG2016, Test Suite Structure & Test Purposes, Personal Health Devices Interface; Part 1: Optimized Exchange Protocol. Personal Health Device (Version 1.11, 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. The updates include the following aspects:

– Updates related to the inclusion of the value “7946” according to CDG2017 document, H812.1 H.812.1 - Observation Upload, corresponding to “MDC\_TIME\_SYNC\_EBWW” and according to bugzilla 1164 and 1165.

**[ITU-T H.850.1 (revised) “Conformance of ITU-T H.810 personal health system: Personal Health Devices interface Part 10A: Transcoding for Bluetooth Low Energy: Personal Health Gateway – Thermometer”](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14345)** provides a test suite structure (TSS) and the test purposes (TP) for the transcoding of thermometer data by personal health gateways in the Personal Health Devices (PHD) interface of thermometer device 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.850.1 is a transposition of clause 3.3 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. The updates include the following aspects:

– Updates related to the value of the Reg-Cert-Data-List according to the CDG2017-Q2.

[**ITU-T H.850.2 (revised) “Conformance of ITU-T H.810 personal health system: Personal Health Devices interface Part 10B: Transcoding for Bluetooth Low Energy: Personal Health Gateway - Blood pressure”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14346) provides a test suite structure (TSS) and the test purposes (TP) for the transcoding of blood pressure 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.850.2 is a transposition of clause 3.4 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. The updates include the following aspects:

– Updates related to the value of the Reg-Cert-Data-List according to the CDG2017-Q2.

[**ITU-T H.850.3 “Conformance of ITU-T H.810 personal health system: Personal Health Devices interface Part 10C: Transcoding for Bluetooth Low Energy: Personal Health Gateway - Heart-rate”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14347) provides a test suite structure (TSS) and the test purposes (TP) for the transcoding of heart rate 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.850.3 is a transposition of clause 3.5 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. The updates include the following aspects:

– Updates related to the value of the Reg-Cert-Data-List according to the CDG2017-Q2.

[**ITU-T H.850.4 (revised) “Conformance of ITU-T H.810 personal health system: Personal Health Devices interface Part 10D: Transcoding for Bluetooth Low Energy: Personal Health Gateway - Glucose meter”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14348) provides a test suite structure (TSS) and the test purposes (TP) for the transcoding of glucose meter 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.850.4 is a transposition of clause 3.6 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. The updates include the following aspects:

– Updates related to the value of the Reg-Cert-Data-List according to the CDG2017-Q2.

[**ITU-T H.850.5 (revised) “Conformance of ITU-T H.810 personal health system: Personal Health Devices interface Part 10E: Transcoding for Bluetooth Low Energy: Personal Health Gateway - Weighing scales”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14349) provides a test suite structure (TSS) and the test purposes (TP) for the transcoding of weighing scales 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.850.5 is a transposition of clause 3.7 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. The updates include the following aspects:

– Updates related to the value of the Reg-Cert-Data-List according to the CDG2017-Q2.

[**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=14350) 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. The updates include the following aspects:

– Updates related to the value of the Reg-Cert-Data-List according to the CDG2017-Q2.

[**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=14351) 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. The updates include the following aspects:

– Updates related to the value of the Reg-Cert-Data-List according to the CDG2017-Q2.

[**ITU-T H.862.1 “Data model for sleep management services”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14352): 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 reference model of the sleep management service and sleep safety services were introduced in ITU H.862.0. This Recommendation describes the data model for the sleep management services. The scope of this Recommendation is focused on the structured model of data for expressing data collected from sensors as information such as sleep time, sleep stage, and sleep goal to apply to sleep management services.

In many fields of human factors including healthcare, sleep data can be obtained from a variety of sensors such as EEG, ECG, pulse, motion, sound. From the data, sleep time and sleep quality can be calculated. A general sleep management services that can handle multiple devices independently of the raw data should be able to represent the quantity and quality of sleep. This can be present the sleep stage and its time.

[**ITU-T H.862.2 “Framework of annotation methods for biosignal data”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14353)**:** In many fields of human factors including healthcare, various types of data are produced by different institutions. Biosignals are various signal-based data obtained from the human body and include voice, temperature, ECG, EEG and EMG. The purpose of this Recommendation is to define the framework of annotation methods for biosignal data. The scope of this Recommendation is focused on the method of temporally expressing the occurrence interval of an event generated from a biosignal, and the ontology for label mapping.

In recent years, the use of biosignal data in diagnosis, treatment, and health management has become an important issue. Health data generated from different medical sites and individuals contain various information about health conditions, and a unified method of expressing annotation biosignal data is required to allow interoperability. This Recommendation covers the ontology for label mapping.

[**ITU-T H.862.3 “Requirements of voice management interface for human-care services”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14354): Human-care services are related issues for improvement of the quality of life providing what is necessary for the health, welfare, and protection of people. Various voice-based services are being developed from a nursing robot to care patients and to identify problems through conversation with patients, to the technology for early diagnosis of dementia from voice. This Recommendation describes requirements of voice management user interface (UI) for human-care services. The scope of this Recommendation is focused on the classification of users and services for voice UI in human-care services such as healthcare fields.

The technology of speech recognition in traditional healthcare sector has been used only to enhance the convenience of medical personnel in producing medical records. However, recent speech recognition services and research have improved the convenience of typing beyond simple user interface through natural dialogue with users. In addition, it has become possible to manage customer's health, such as checking and improving their health status.

This Recommendation proposes a service model through the speech recognition interface in human-care services such as healthcare fields using several scenarios to apply speech recognition technology.

I.5.1 New security standards

[**ITU-T J.1204 “The security framework of a smart TV operating system”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14357) defines the security framework of a smart television operating system (TVOS) to enable integrated broadcast and broadband (IBB)-capable cable set-top box (STB) and TV to apply to broadcasting services and IP-based interactive services provided by cable television operators and third-party providers. By running the smart TV operating system, the IBB capable STB and TV will be able to provide subscribers with advanced and personalized services by downloading and installing advanced and personalized apps from cable operators' platforms and third-party platforms, which are interconnected with the related cable operators' platforms. Recommendation ITU-T J.1204 intends to specify the smart TV operating system security framework, which exploits the popular hardware based TEE technology and has multiple security defence capabilities.

[**Recommendation ITU-T X.510 | ISO/IEC 9594-11 “Information technology – Open Systems Interconnection – The Directory: Protocol specifications for secure operations”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14320)specifies a general protocol, called the wrapper protocol, that provides cyber security for protocols designed for protection by the wrapper protocol. The wrapper protocol provides authentication, integrity and optionally confidentiality (encryption). The wrapper protocol allows cyber security to be provided independently of the protected protocols, which means that the security may be enhanced without affecting protected protocol specifications. The wrapper protocol is specified without specifying specific cryptographic algorithms but is designed for plucking-in cryptographic algorithms as required. The wrapper protocol is designed for easy migration of cryptographic algorithms, as stronger cryptographic algorithms become necessary.

Recommendation ITU-T X.510 | ISO/IEC 9594-11 contains recommendations for how other Recommendations and International Standards may include features for migration of cryptographic algorithms, and it includes ASN.1 specifications to be applied for that purpose. Recommendation ITU-T X.510 | ISO/IEC 9594-11 also specifies three protocols that make use of the protection of the wrapper protocol. This includes a protocol for maintenance of authorization and validation lists (AVLs), a protocol for subscribing of public-key certificate status and a protocol for accessing a trust broker.

[**ITU-T X.677 “Identification mechanism for unmanned aerial vehicles using object identifiers”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14039) analyses the requirements for a full life-cycle management and operating identity recognition of unmanned aerial vehicles (UAVs) with security considerations. It also 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.1052 (revised) “Organization information security management guideline” (under approval)** provides best practices for information security management for telecommunication organizations to support Recommendation ITU-T X.1051. This recommendation is based on a process approach to describe a set of security management areas, which gives guidelines of telecommunication organizations to fulfil the control objectives defined in Recommendation ITU‑T X.1051. The management areas including asset management, incident management, risk management policy management and map the controls defined by Recommendation ITU-T X.1051 to achieve methodologies.

[**ITU-T X.1054 (revised) “Information security, cybersecurity and privacy protection - Governance of information security”**](https://www.itu.int/rec/T-REC-x/recommendation.asp?lang=en&parent=T-REC-X.1054) **:** Information security is a key issue for organizations, amplified by rapid advances in attack methodologies and technologies, and corresponding increased regulatory pressures. The failure of an organization’s information security controls can have many adverse impacts on an organization and its interested parties including but not limited to the undermining of trust. Governance of information security is the use of resources to ensure effective implementation of information security, and provides assurance that:

• directives concerning information security will be followed; and

• the governing body will receive reliable and relevant reporting about information security related activities.

This assists the governing body to make decisions concerning the strategic objectives for the organization by providing information about information security that may affect these objectives. It also ensures that information security strategy aligns with the overall objectives of the entity.

Managers and others working in organizations need to understand:

• the governance requirements that affect their work; and

• how to meet governance requirements that require them to take action.

**ITU-T X.1148 “Framework of de-identification process for telecommunication service providers” (under publication):** Telecommunication organizations collect, manage, use, and share data about individuals, including personally identifiable information. As a result, they utilize data de-identification techniques to protect individuals’ data. This Recommendation describes a framework of de-identification process with operational steps and specifies data release models and data stages in a de-identification process for telecommunication service providers based on data lifecycle model and roles of stakeholders.

[**ITU-T X.1149 “Security framework of open platform for FinTech services”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14250) describes an open platform architecture for financial technology (FinTech) services. It also specifies threats and vulnerabilities of open platform, open API usage procedure for FinTech services, and detailed security requirements to open platform of FinTech services from both financial company and FinTech company sides. Appendix to this Recommendation includes some use cases of the proposed open platform.

**ITU-T X.1216 “Requirements for collection and preservation of cybersecurity incident evidence” (under publication**) describes a general procedure for cybersecurity incident response and investigation, analyses sources of cybersecurity incident evidence and specifies capability requirements for tools used for collection and preservation of such evidence an investigative process. This Recommendation also specifies reliability assurance requirements for these tools as guidelines to developers who design tools for such purpose.

**ITU-T X.1217 “Framework and guidelines for applying threat intelligence in telecom network operation” (under approval):** Threat intelligence from a telecommunication operator’s point of view is a collection of organized, analysed and refined information about potential and current attacks that may threaten an organization. This information can also include attackers’ motivations, intentions, characteristics and methods, along with their modus operandi or techniques, tactics and procedures. In the area of network and information security, the occurrence of large-scale and unexpected cybersecurity incidents has triggered the urgent need for threat intelligence. Threat intelligence can help an organization reduce risk and improve overall security. A unified taxonomy, grammar and presentation of threat intelligence has been defined so that threat intelligence can be shared between different organizations. This Recommendation specifies guidelines for applying threat intelligence in telecommunication network operation after an overview analysis.

**ITU-T X.1218 “Requirements and guidelines for dynamic malware analysis in a sandbox environment” (under approval):** The unknown malware is a common method used for avoiding detection used in advanced attacks, in particular APTs (Advanced Persistent Threat). For example, a targeted attack using phishing email weaponized with unknown malwares can achieve a successful initial compromise easily. Thus for detection of advanced attacks, special attention and defense measurements should be taken at detection of unknown malwares. The purpose of this Recommendation is to analyze threats related to unknown malwares, and put forward the specific requirements of detecting the unknown malwares based on dynamic behavior analysis.

**ITU-T X.1254 (revised) “Entity authentication assurance framework” (under publication)** defines three entity authentication assurance levels (i.e., AAL1 – AAL3), and the criteria and threats for each of the three levels of entity authentication assurance. Additionally, it:

• specifies a framework for managing the assurance levels;

• provides guidance concerning control technologies that are to be used to mitigate authentication threats, based on a risk assessment;

• provides guidance for mapping the three levels of assurance to other authentication assurance schemas; and

• provides guidance for exchanging the results of authentication that are based on the three levels of assurance.

**ITU-T X.1279 “Framework of enhanced authentication using telebiometrics with anti-spoofing detection mechanisms” (under publication)** provides an architectural framework of enhanced authentication using telebiometrics with anti-spoofing detection. This Recommendation analyses threats to traditional telebiometric authentication solutions and specifies an architectural framework, authentication process flows and security considerations for enhanced authentication using telebiometrics with anti-spoofing detection mechanisms.

[**ITU-T X.1451 “Risk identification to optimize authentication”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14252) specifies a risk identification function in an ICT service system as a pre-processor before the authentication function is invoked. It enables the ICT service system to optimize user authentication based on identified risks. With this specific risk identification function, the ICT service system can make choices on authentication mechanisms adaptively to its users and achieve multiple benefits such as: 1) to improve user experiences; 2) to increase the capacity and reduce the per transaction cost of user authentication; and 3) to reduce the risk of user identity forgery.

**ITU-T X.1452 “Technical framework for security services provided by operators” (under approval):** Due to the growing number of innovations in services in network and telecommunication domains, operators do face the pressing need to explore new services based on their network and services capabilities. In this transformation, operators have not only accumulated new assets and experiences with technologies and services for network and telecommunication, but also the capability of offering security services based on the full extend of their network and infrastructure deployments and operations. The specific nature of this class of services makes them exhibit a number of differences with the more traditional telecommunication services (e.g. phone call, short message, mobile network access). In this context, the portfolio of security services that are currently in production and explored by the operators need a specific integration with the resources and assets of the telecommunication network and infrastructure; the risk level on this portfolio is actually higher should the security service itself be compromised as it is precisely supposed to turn the operator offering it as the 'security provider' for the end market customers. A compromise of the service will result in lost of trust by customers and will span through the whole range of the services offered by the operator and will significantly increase the overall Churn level and customer satisfaction and loyalty. Therefore the security assurance defined as the degree of confidence reached in the security service needs to be studied thoroughly. In order to offer technical reference for the operators and guarantee the security, the guidelines of the security services provided by the operator need to be analyzed and established. This recommendation aims to classify the potential use cases of the security service provided by operators, analyze the specific requirements for the security service and thus provides the guidelines for the operator to safeguard and improve the security service.

**ITU-T Technical Report “Security framework for quantum key distribution in telecom network”:** Facing challenge from quantum computers, quantum safe cryptography is becoming increasingly important.

Quantum key distribution (QKD) is a technology using quantum physics to securely exchange symmetric encryption keys. This technology solves the problem of key distribution by allowing the exchange of cryptographic keys between two remote parties with information-theoretic security, guaranteed by the fundamental laws of physics. These keys can then be used securely with conventional cryptographic algorithms.

Post-quantum cryptography (PQC) refers to cryptographic algorithms which are resilient to attacks by quantum computers. Some post-quantum cryptographies, such as lattice-, code- or hash-based cryptosystems, are currently believed to be quantum-safe until proven otherwise.

These two technologies, i.e., QKD and PQC are two pillars complementary to each other for quantum‑safe cryptography. QKD can be used as a key establishment alternative and QKD deployment is used to secure operators' backbone communications. PQC is a collection of cryptographic algorithms considered to be secure against quantum computer for end-point security.

This Technical Report only studies the perspective of QKD. Although QKD technologies have been developed for several decades, there is a need to develop a QKD framework to satisfy requirements from the telecom network's perspective.

**ITU-T Technical Report “Problems, requirements and potential solutions for OID resolution”** identifies problems, requirements and potential solutions for OID resolution. The problems include local performance and global resolution of missing OID subtrees. Technical requirements for possible solutions are also discussed. Finally, potential technical solutions, administrative and operational guidance are provided.

**ITU-T Technical Report “Security in telecommunications and information technology (7th edition)”** provides a broad introduction to the Information and Communication Technology (ICT) security work of the ITU-T and, more specifically, it summarizes how the ITU-T is responding to global cybersecurity challenges with Recommendations, technical reports, guidance documents and outreach initiatives. It is primarily directed towards those who have responsibility for, or an interest in, information and communications security in organizations and the related standards, as well as those who simply need to gain a better understanding of ICT security issues.

**ITU-T Technical Report “Successful use of security standards (2nd edition)”** presents examples of how ITU-T Recommendations are used today in the market place to help protect networks, people, data and critical infrastructure. The report focuses on how approved security-related ITU-T Recommendations can be successfully deployed. Examples, of individual Recommendations (such as ITU-T X.805) and families of Recommendations (such as CYBEX) are considered.

**ITU-T Technical Report “Description of the incubation mechanism and ways to improve it”:** SG17 took the initiative to develop a strategy of transformation of security studies in three steps where the first step was about the creation of an incubation mechanism to deal with innovation at a much more timely manner. Whilst this incubation mechanism proved to be successful in pilot, a lot of the documentation describing it got diluted in too many temporary documents. It was therefore felt the need for a reference live document that can codify this incubation mechanism and fundamentally incrementally answer the question:

* How to bring innovation in cybersecurity standardization in Study Group 17 in a timely manner?

This technical papers’ purpose is precisely to answer this question. As any mechanism can be improved it will as well review and analyse what other SDOs are doing to bring innovation and perhaps it will help SG17 to constantly review and improve this mechanism.

**ITU-T Technical Report “Strategic approaches to the transformation of security studies”** is the synthesis of all the results delivered by the correspondence group on transformation of security studies under the mandate of ITU-T SG17 from August 2017 to August 2020. It includes the contextualization of this work and the methodological aspects considered. It describes the strategic thinking that the correspondence group developed. It covers the short, mid and long-term aspects of the transformation of security studies.

ITU-T Technical Report “Unified Security Model (USM) - a neutral integrated system approach to Cybersecurity”: The Unified Security Model and architecture presented here is a universal “all matters security” architecture, that is neutral and agnostic. It has the potential to facilitate security control mass interoperability and security response automation.

I.5.2 Quantum key distribution networks

[**ITU-T Y.3801 “Functional requirements for quantum key distribution networks”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14258) specifies functional requirements for quantum layer, key management layer, QKDN control layer and QKDN management layer for quantum key distribution networks (QKDN).

**ITU-T Y.3802 “Quantum key distribution networks - Functional architecture” (under approval)** defines a functional architecture model of quantum key distribution (QKD) networks. In order to realize this model, it specifies detailed functional elements and reference points, architectural configurations and basic operational procedures of QKD networks (QKDN).

**ITU-T Y.3803 “Quantum key distribution networks – Key management” (under approval)**: Quantum Key Distribution (QKD) protocols provide the means to distribute a symmetric random bit strings as a secure key that can be proven to be secure even against an eavesdropper, who has unbounded computational ability. A basic element of QKD is a pair of QKD modules linked by a QKD link that allows two remote parties to share secure keys. A QKD network consists of two or more QKD links and trusted nodes (QKD nodes), where any pair of two QKD nodes can share secure keys via QKD links and key relay. In the end, these keys are supplied to cryptographic applications in user networks. To implement the QKD network (QKDN) and appropriately integrate with the user network, an overview of the QKD technologies, including network capabilities, conceptual structure, layered model, basic functions and components, and its relation to the user network, is given in Recommendation ITU-T Y.3800.

To operate the QKDN efficiently and securely, key management is the highest priority issue because without this, most of meaningful QKD operations and services cannot be realized. The key management includes, at least, storing keys generated by QKD modules, relaying keys between the nodes of the QKDN, and supplying keys to cryptographic applications upon requests from users, all in secure manners. The standardization of these issues is essential to realize the interoperability for QKDN, ensuring security, and widening applications of QKD.

The objective of this Recommendation is to provide the help for design, deployment, and operation of key management of QKDN. Overall structure and basic functions of QKDN are first reviewed along with Recommendation ITU-T Y.3800, requirements of QKDN are second reviewed along with Recommendation ITU-T Y.3801, and then functional elements and procedures of key management are described in this Recommendation.

**ITU-T Y.3804 “Quantum Key Distribution Networks - Control and Management” (under approval)**: To realize secure, stable, efficient, and robust operations of and services by a quantum key distribution (QKD) network as well as to manage a QKD network (QKDN) as a whole and support user network management, this Recommendation specifies functions and procedures for QKDN control and management based on the requirements specified in Recommendation ITU-T Y.3801.

**ITU-T X.1710 “Security framework for quantum key distribution networks" (under approval)** specifies a framework for quantum key distribution networks (QKDNs) including requirements and measures to combat security threats. This Recommendation specifies a simplified QKDN structure and the relevant security threats. Security requirements and corresponding security measures are then specified on that basis.

**ITU-T X.1714 “Key combination and confidential key supply for quantum key distribution networks" (under approval)** aims to specify the security requirements for both the key combination and the key supply from the QKDN to cryptographic applications.

I.5.3 Trust

[**ITU-T Q.3057 “Signalling requirements and architecture for interconnection between trustable network entities”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14242) specifies the signalling architecture and requirement for interconnection between trustable network entities in support of existing and emerging networks. Based on the architecture, it specifies the interfaces and signalling requirements between the functional entities and signalling procedures to be applied.

**ITU-T Y.3055 “Framework for Trust based Personal Data Management” (under approval)**: Data becomes more important for various industries, and data stakeholders aggregate personal data from various data sources to find new values. To increase benefits from personal data utilization with the balance of privacy protection, it is important to support trust based personal data management that considers the trust in personal data utilization processes. Thus, this Recommendation provides a framework for trust based personal data management. It introduces the necessity of trust based personal data management based on the analysis of personal data management. Then, it identifies various requirements for trust based personal data management. After identifying the requirements, this Recommendation provides a framework architecture specifying related functional blocks and reference points with relevant information flows. Details of prospective technologies for personal data management and a trust evaluation model with a specific use case are described in informative appendices.

NOTE – In this Recommendation, some capabilities and applications may be related to regulation in some countries. In this case, non-functional aspects related to regulation are out of scope.

I.5.4 Distributed Ledger Technology

[**ITU-T F.751.0 “Requirements for distributed ledger systems”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14332) defines the requirements of distributed ledger systems. The distributed ledger system ensures the security of the data in the ledger and prevents malicious tampering. This makes distributed ledger systems potentially applicable to medical records and other record management activities, such as identity management, transaction processing, document sources, food traceability and voting. The scope of this Recommendation focuses on the basic and advanced requirements of the distributed ledger systems.

[**ITU-T F.751.1 “Assessment criteria for distributed ledger technology (DLT) platforms”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14333) defines assessment criteria for DLT platforms aim to assist implementers to evaluate and compare different platforms. Those 27 criteria covered the core functions, application functions, operation functions, and ecosystem of DLT platform. This Recommendation also defines the performance of DLT platform affected by environment and deployment reasons.

[**ITU-T F.751.2 “Reference framework for distributed ledger technologies”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14334) defines the reference architecture for distributed ledger technology (DLT), the hierarchical relationship and specific functions of the DLT architecture, important modules and specific functions in the structure of DLT, the main technical route and direction of the core module in the DLT. It can be used as a guideline for DLT service providers to build system, and for the organizations to select and use a DLT platform.

**ITU-T X.1400 “Terms and definitions for distributed ledger technology”(under approval)** contains a baseline set of terms and definitions for distributed ledger technology (DLT). The definitions provide a basic characterization of the term, and where appropriate, a note is included to provide additional clarity. It is based on Focus Group Technical Report ITU-T FG DLT D1.1:2019, FG DLT D1.1 Distributed ledger technology terms and definitions.

[**ITU-T X.1402 “Security framework for distributed ledger technology”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14251): Distributed ledger technology (DLT) is usually seen as a peer to peer distributed ledger based on a group of technologies for a new generation of transactional applications, which maintains a continuously growing list of cryptographically secured data records against tampering and revision. DLT can help establish trust, accountability, transparency and efficiency while streamlining business processes. However, DLT is also facing security challenges and threats specific to DLT systems and DLT application scenarios. Based on analysis of security threats and security requirements to DLT, Recommendation ITU-T X.1402 describes security capabilities that could mitigate the related security threats and specifies a security framework methodology to determine how to use these security capabilities to mitigate security threats for a specific DLT system.

**ITU-T X.1403 “Security guidelines for using DLT for decentralized identity management” (under publication)**: Distributed Ledger Technology and its specific implementations such as Blockchain offer a unique opportunity for utilizing a trust infrastructure and a platform that could be useful in enabling trusted federation for exchanging identity attributes and identity information. This Recommendation provides a telecom-specific privacy and security considerations for using DLT data in identity management.

**ITU-T X.1404 “Security assurance for distributed ledger technology”(under approval):** A distributed ledger technology (DLT) is defined as a shared digital ledger, or a continually updated list of all transactions. Assurance is the degree of confidence that the process or deliverable meets defined characteristics or objective. Security assurance is the capability of a DLT system to determine, with some level of certainty, that a claim to a particular security of DLT can be trusted to actually be the claimant's "true" security. An assurance level is a quantitative expression of assurance agreed among the relevant parties. A consensus mechanism such as Proof of Work uses computational power to validate new blocks of data in the distributed ledger system. This Recommendation defines three levels of security assurance for the distributed ledger technology. It also defines security assurance components and criteria for each of three levels of security assurance for each security assurance components. It also provides a mapping between specific threats and security assurance components and a mapping between specific capabilities and security assurance components.

**ITU-T Y.3530 “Cloud computing - Functional requirements for blockchain as a service” (under approval)**: Blockchain as a service (BaaS) is a cloud service category in which the capabilities provided to the cloud service customer are the ability of setting up blockchain platform, and development decentralized application using blockchain technologies. In BaaS, an integrated developing environment (IDE) for CSCs is provided to create, deploy and operate decentralized applications. This Recommendation introduces blockchain and blockchain as a service. This Recommendation also provides functional requirements of blockchain as a service which is derived from use cases.

**ITU-T Y.3531 “Cloud computing - Functional requirements for machine learning as a service” (under approval)** provides cloud computing requirements for machine learning as a service (MLaaS), which addresses requirements from use cases. Machine learning as a service is a cloud service category in which the capability provided to the cloud service customer is the provision and use of machine learning framework. Machine learning framework is a set of functionalities for provisioning machine learning data as well as training, deploying, and managing machine learning model.

On the perspective of cloud computing service provisioning, this Recommendation provides the functional requirements for MLaaS to identify functionalities such as machine learning data pre-processing, machine learning model training, machine learning model testing, and etc. Also, this Recommendation aligned with the cloud computing reference architecture of [ITU-T Y.3502].

[**ITU-T Y.4560 “Blockchain-based data exchange and sharing for supporting Internet of things and smart cities and communities”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14379)**:** Blockchain is an emerging technology, its most important characteristics are traceable, un-erasable, immutable, and time-stamped. It is able to efficiently ensure integrity, authenticity, and auditability for all transactions. Blockchain has important impacts and benefits for data exchange and sharing in support of Internet of things (IoT) and smart cities and communities (SC&C). In most of the IoT and SC&C scenarios, it is necessary to ensure data processing, circulation, sharing and management for all trust operations. Blockchain technologies can meet these needs. This Recommendation specifies the requirements, functional models, a platform and deployment modes of blockchain-based data exchange and sharing for supporting IoT and SC&C.

[**ITU-T Y.4561 “Blockchain-based Data Management for supporting Internet of things and smart cities and communities”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14380)**:** Along with the development of the Internet of things (IoT) and smart cities and communities (SC&C), various applications have different kinds of requirements for data management, and there are many challenges, especially in data representing, data processing, data service provisioning, and other aspects in a secure and effective manner. Meanwhile, blockchain as an emerging technology possesses the characteristics of trust, transparency, traceability and accountability. It has the potential capabilities to solve the existing issues in data management. This Recommendation specifies the requirements, generic reference model, common capabilities and procedures of blockchain-based data management.

**ITU-T Y.4907 “Reference architecture of blockchain-based unified KPI data management for smart sustainable cities”:** This Recommendation provides a reference architecture for blockchain-based unified KPI (key performance indicator) data management for smart sustainable cities (BKDMS). This Recommendation provides the concept, characteristics and high-level requirements of BKDMS. A reference architecture including capabilities of its functional entities is described in details, and unified structures of KPI data are also introduced with which to ensure BKDMS realizable.

I.6.1 Green ICT standards

**ITU-T L.1023 “Assessment method for Circular Scoring” (under approval)** outlines an assessment methodology for circularity scoring of ICT goods. The assessment method consists of three steps:

1) Setting the relevance and applicability (*R*) of each criteria for circular product design (*CCPD*) for the ICT good at hand,

2) Assess the margin of improvement (*MI*) of each *CCPD*,

3) Calculate the circularity score from 0 to 100 % for the ICT good at hand for all three Circular Design Guideline Groups (*CDGGs*). This includes:

* Using a predefined value matrix to identify the % score from 0 to 100 for each combination of *R×MI*.
* Average the included *CCPDs* for the ICT good at hand separately for all three *CDGGs:* Product Durability, Ability to Recycle, Repair, Reuse, and Upgrade from equipment and manufacturer level.

**ITU-T L.1310 (revised) “Energy efficiency metrics and measurement methods for telecommunication equipment” (under approval)** contains the definition of energy efficiency/performance metrics test procedures, methodologies and measurement profiles required to assess the energy efficiency/performance of telecommunication equipment. Energy efficiency/performance metrics and measurement methods are defined for telecommunication network equipment and small networking equipment. These metrics allow for the comparison of equipment within the same class, e.g., equipment using the same technologies. The comparison of equipment in different classes is out of the scope of this Recommendation.

[**ITU-T L.1371 “A methodology for assessing and scoring the sustainability performance of office buildings”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14304) provides a consistent framework for building owners, managers and operators to critically assess, score and improve the sustainability performance of office buildings in ten key areas; Energy, Water, Air, Comfort, Health & Wellness, Purchasing, Custodial, Waste, Site, and Stakeholders. The framework described in this Recommendation provides a set concrete and measurable steps to reduce the environmental impacts, and specifically the Greenhouse Gas emissions, of existing office buildings, thus contributing to the achievement of the Sustainable Development Goal 11 ‘Make cities and human settlements inclusive, safe, resilient and sustainable’. The Annex to this Recommendation specifically contains an assessment scoring methodology to allow owners and managers to undertake a self assessment to evaluate their building’s current status and track progress going forward.

[**ITU-T L.1381 “Smart energy solution for data centre”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14305): The smart control strategy on whole data centre energy system including the different power feeding solutions and cooling solutions are considered to get the higher energy efficiency and decrease the whole energy consumption. Firstly, for multiple energy input system, PV, wind, fuel cells, the grid, power generator and batteries were connected to the system. How to control these different energy inputs in smart way to increase the energy efficiency and also decrease the carbon emission will be considered in this Recommendation. In addition, for smart cooling system, how to use the outside cool air and maximize utilization of ICT side cooling such as ICT rack cooling, row cooling methods and liquid cooling etc. This Recommendation focuses on smart energy solutions for data centre to achieve green and sustainable goals including environmental friendly, decreasing carbon emissions, increasing energy efficiency and extending product life etc.

[**ITU-T L.1382 “Smart energy solution for telecommunication rooms”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14306) provides requirements on the power supply mode of the three-layer architecture of the telecommunication rooms. It aims to drive future-oriented network deployment for the ICT industry, maximize the energy efficiency , the use of renewable resources, and social resources in the digital era, and reduce energy and resource consumption while ensuring network performance and user experience, innovative ICT technologies are used to promote network energy saving, emission reduction, circular economy development, and continuously drive all parties in the industry chain to jointly build green networks and low-carbon societies. In addition, this standard provides suggestions and requirements on the deployment of three types of telecommunication rooms, which can be used as a reference for telecom operators to build the target network evolution strategies for telecommunication room power supply. This standard accelerates network deployment, reduces CAPEX and OPEX, optimizes investment efficiency, and guides ICT industry transformation and optimization. The new networking architecture, new power supply technologies, and specifications mentioned in this document will also effectively promote the upgrade of industry technologies.

[**ITU-T L.Suppl.37 “Guidance to operators of mobile networks, fixed networks and data-centres on setting 1.5°C aligned targets compliant with Recommendation ITU-T L.1470”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14318) supports information and communication technology (ICTs) organizations in setting science-based targets for greenhouse gases (GHGs) according to the decarbonisation pathways, described in detail in Recommendation ITU-T L.1470 ‘GHG emissions trajectories for the ICT sector compatible with the UNFCCC (United Nations Framework Convention on Climate Change) Paris Agreement’, aligned to the IPCC Special Report on 1.5°C and developed to be used as a sectoral target-setting approach by the Science Based Targets Initiative (SBTi). This supplement focuses exclusively on ICT organizations operating mobile networks, fixed networks and/or data centres. Guidance for further ICT sub-sectors will be covered separately.

I.6.2 Electromagnetic fields

[**ITU-T K.21 (2019) Amd.1 “Resistibility of telecommunication equipment installed in customer premises to overvoltages and overcurrents – Amendment 1: Resistibility of telecommunication equipment installed in customer premises to overvoltages and overcurrents”**](https://www.itu.int/rec/T-REC-K.21-202006-I!Amd1) refers to Annex A. Annex A applies to special environments, one factor being that the primary protection has a poor earth connection that does not meet the requirements of Recommendation ITU-T K.66. This condition is simulated by increasing the STP earth resistance (R1) from zero to 100. People have missed this change, possibly because the test circuit diagram is in Recommendation ITU-T K.44. To alert readers of this a text note has been inserted in the Comments column.

[**ITU-T K.45 (2019) Amd.1 "Resistibility of telecommunication equipment installed in the access and trunk networks to overvoltages and overcurrents – Amendment 1: Resistibility of telecommunication equipment installed in the access and trunk networks to overvoltages and overcurrents”**](https://www.itu.int/rec/T-REC-K.45-202006-I!Amd1) refers to Annex A. Annex A applies to special environments, one factor being that the primary protection has a poor earth connection that does not meet the requirements of Recommendation ITU-T K.66. This condition is simulated by increasing the STP earth resistance (R1) from zero to 100. People have missed this change, possibly because the test circuit diagram is in Recommendation ITU-T K.44. To alert readers of this a text note has been inserted in the Comments column.

[**ITU-T K.50 (2018) Amd.1 “Safe limits for operating voltages and currents in telecommunication systems powered over the network Amendment 1: Safe limits for operating voltages and currents of telecommunication systems powered over the network”**](https://www.itu.int/rec/T-REC-K.50-202006-I!Amd1) updates Figure 3 to refer to ITU-T K.50 clauses rather than IEC 60950-1 clauses.

**ITU-T K.56 (revised) “Protection of radio base stations against lightning discharges” (under approval)** presents the techniques applied to a telecommunication radio base station in order to protect it against lightning discharges. The need of protection is obtained from the methodology contained in IEC 62305-2, which is used to determine the relevant lightning protection level (LPL) for the installation. The protection techniques for the external area cover the lightning protection system (LPS), bonding procedures, earthing and the installation of surge protective devices (SPDs) at the power meter station. The protection techniques for the equipment building cover the feeder and lighting cables, the electric power conductors, the telecommunication cabling and the earthing/bonding procedures applied to cable trays and equipment frames. This Recommendation also provides guidelines in order to achieve adequate protection of the telecommunication equipment based on the coordination between equipment resistibility, SPD protection level and installation characteristics.

[**ITU-T K.64 (revised) “Safe working practices for outside equipment installed in particular environments”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14294) describes working practices for service personnel to help them work safely in telecommunication installations in three specific environments. The specific environments covered in this Recommendation are characterized by wet conditions or close proximity to exposed metallic parts. The working practices apply to telecommunication plants with voltage levels higher than the limits defined for analogue PSTN circuits, such as remote feeding telecommunication current or voltage (RFT-C or RFT-V) circuits. This version of Recommendation ITU-T K.64 includes a warning regarding contact with terminals carrying RFT circuits with small parts of the body, e.g., back of the hand. The references have been updated to include the IEC 62368 series.

[**ITU-T K.83 (revised) “Monitoring of electromagnetic field levels”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14294) gives guidance on how to make long-term measurements for the monitoring of electromagnetic fields (EMF) in the selected areas that are under public concern, in order to show that EMFs are under control and under the limits. The purpose of this Recommendation is to provide for the general public clear and easily available data concerning electromagnetic field levels in the form of results of continuous measurement.

[**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=14296) are many possible methods of exposure assessment and each of them has its own advantages and disadvantages. Draft revised Recommendation ITU-T K.91 gives guidance on how to assess and monitor human exposure to radio frequency (RF) electromagnetic fields (EMFs) in areas with surrounding radiocommunication installations based on existing exposure and compliance standards in the 9 kHz to 300 GHz range. This includes procedures for 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. Recommendation ITU-T K.91 includes an electronic attachment containing an uncertainty calculator and the Watt guard modules.

**ITU-T K.112 (revised) “Lightning protection, earthing and bonding: Practical procedures for radio base stations” (under approval)** provides a set of practical procedures related to the lightning protection, earthing and bonding of a radio base station (RBS). It considers two types of RBS: those that are stand-alone installations, comprising a tower and the associated equipment and those that are installed on the roof of a building. In both cases, this Recommendation provides the procedures for the design and installation of the lightning air-termination system, down-conductors, earthing network, bonding conductors and surge protective devices (SPDs). This includes the specification of the materials, anti corrosion protection and special treatment for rocky areas. Particular attention is directed to the protection of the navigation light systems and of the electric power conductors that feed the RBS, especially in the case where the RBS is installed on the roof of a building. Annex A presents practical examples of earthing network design, whereas Annex B presents an overview of the techniques for measuring the earthing resistance and the earth resistivity.

[I**TU-T K.146 “Management of interferences on telecommunication transmissions on copper other than speech”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14299) deals with the management of electromagnetic interference produced by electrified railways traction systems on telecommunication systems in DSL frequency band. This Recommendation defines only a procedure to evaluate the acceptability of an electromagnetic DSL draft interference and gives:

– the criteria defining the Quality of Service that has to be reached;

– the limits of the commercial ADSL offer guaranteed by an Internet Service Provider in conjunction with a telecom operator if necessary, in the vicinity of potential disturbing railway;

– the installation conditions of electrified traction and telecommunication systems under which the recommendation applies.

This Recommendation helps to establish a contract between Internet Service Providers in conjunction with telecommunication operators if necessary and railway operators in order to clearly share responsibilities, and, as a consequence, if necessary, the relevant expenses for mitigation measures.

[**ITU-T K.147 “Ethernet port resistibility testing for overvoltages and overcurrents”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14300)**:** Ethernet, using twisted pair cabling, is a ubiquitous communications link, which also can act as a powering feed. Usually Ethernet is implemented as a star network and terminal ports can be independently tested for resistibility. Where equipment has multiple independent Ethernet ports, such as central hubs, switches, or repeaters, then testing is required for inter-port resistibility. Resistibility testing needs to test for lightning transients coupled into network by magnetic induction, earth potential rise, resistive coupling and transient coupling by voltage limiting operation of surge protective functions or flashover. The voltage limiting operation may convert common-mode surges into differential-mode surges in the signal path. It is also possible for AC mains power faults to couple into the network. This Recommendation covers the different “IEEE 802.3 Ethernet” implementations, their configurations, how surges are coupled into the system and what surge mitigation measures are used. Following this overview, the rational for the different surge and power fault test circuit approaches and when they are specified is given.

[**ITU-T K.Suppl.1 (revised) – “ITU-T K.91 – Guide on electromagnetic fields and health”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14316): The objective of Supplement 1 to the ITU-T K-series Recommendations, Guide on electromagnetic fields and health, is to answer questions commonly posed by the public on EMF and to address related concerns. This Guide on electromagnetic fields and health aims to:

• Provide electromagnetic field (EMF) information and education resources suitable for all communities, stakeholders and governments.

• Support clarification of the science by referencing the WHO and other stakeholders (see Note) that provide information that is particularly useful in helping to clarify scientific uncertainties e.g., in the areas of radio frequency (RF) technology, infrastructure implementation, usage and consequential EMF exposure.

NOTE – The primary reference on EMF and health is the World Health Organization (WHO). The primary reference on EMF assessment methods is the International Telecommunication Union (ITU) and the International Electrotechnical Commission (IEC).

[**ITU-T K.Suppl.20 “RF Exposure evaluation around base station installed underground”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14317): Measurement and computation methods of human exposure to electromagnetic fields (EMFs) from fixed radio sources like mobile base stations have been standardized and published as ITU-T K-series Recommendations and IEC 62232. These also includes these methods prescribed in Japanese regulation, and have been basically assumed to be applied to radio sources installed above the ground. Underground base stations for use in small cells of fourth generation (4G) mobile networks are installed underground to construct service areas above the ground. Supplement <No.> to ITU-T K-series Recommendations contains the measurement results of radio frequency exposure from underground base stations, in order to evaluate the exposure from these base stations.

I.6.4 Emergency communication & disaster relief

[**ITU-T Q.Supplement 72 “Signalling requirements for IMS emergency telecommunications service in support of multiple accesses”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14388) defines the signalling requirements for IMS emergency telecommunications service in support of multiple accesses including fixed broadband, Wi-Fi, 4G and 5G networks.

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”](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14177) outlines the procedures for reporting and taking action regarding alleged misuse of numbers. It also outlines the procedures that the TSB Director should undertake upon receipt of 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.156 Amd.1 “Guidelines for ITU-T action on reported misuse of E.164 number resources – Amendment 1: Appendix IV: Suggested guidelines for regulators, administrations and operating agencies authorized by Member States for dealing with number misappropriation”**](https://www.itu.int/rec/T-REC-E.156-202006-P!Amd1) reproduces verbatim the attachment to WTSA Resolution 61 (Rev. Dubai, 2012) on “Suggested guidelines for regulators, administrations and operating agencies authorized by Member States for dealing with number misappropriation”.

[ITU-T E.164.2 (revised) “E.164 numbering resources for trials”](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14178) contains the criteria and procedures for an applicant to be temporarily assigned a three-digit identification code within the shared ITU-T 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 Amd.2 “The international identification plan for public networks and subscriptions - Annex G: Assignment of shared E.212 mobile country codes (MCC) for trials”](https://www.itu.int/rec/T-REC-E.212-202006-P!Amd2) contains the criteria and procedures for an applicant to be temporarily assigned a two digit mobile network code (MNC) within the shared E.212 mobile country code 991 for the purpose of conducting an international non-commercial trial.

ITU-T E.212 (2016) Amd.3 “The international identification plan for public networks and subscriptions - Annex H: Criteria and procedures for the assignment and reclamation of shared ITU-T E.212 mobile country codes (MCC) for regional and other international organizations (ROIO)/standards development organization (SDO)-specified networks and their respective mobile network codes (MNCs)” (under approval) provides criteria for assignment of shared E.212 resources for specific use cases to applicants that are regional and other international organizations (ROIO)/standard development organization (SDO)-specified networks.

[ITU-T E.218 Amd.1 “Management of the allocation of terrestrial trunk radio Mobile Country Codes - Annex B: 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)”](https://www.itu.int/rec/T-REC-E.218-202006-P!Amd1) specifies the administration of global terrestrial trunk radio access mobile network codes by the ITU-T by detailing the scope of the resource covered by the annex. The annex also specifies the principles used for assignment, the criteria for assignment (against which applications for assignment of a global terrestrial trunk radio access mobile network codes will be assessed), the process for considering the application, and the circumstances under which a terrestrial trunk radio access mobile network code would be reclaimed.

[**ITU-T E-Suppl.11 “Criteria for M2M/IoT-Related Assignments under Recommendation ITU-T E.164.1 and Recommendation ITU-T E.212 Annex A”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14321) defines criteria for assigning E.164 Identification codes and E.212 Mobile Network Codes under shared MCCS for M2M/IoT services.

[**ITU-T E.164 Suppl.2 “Supplement 2 to Recommendation ITU-T E.164: Number portability”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14311) defines standard terminology for a common understanding of the different aspects of number portability within an ITU-T E.164 numbering scheme. It identifies numbering and addressing formats, call flows, network architectures and routing approaches that will provide alternative methods of implementation. It also proposes some examples of the administrative and operational processes required for the successful implementation of number portability.

[**ITU-T TR.CLE “Technical Report on identify call location for emergency service”**](https://www.itu.int/pub/publications.aspx?lang=en&parent=T-TUT-DIS-2020) provides an overview of the technical solution of identifying the call location of the emergency service.

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 uses of telecommunication infrastructure as possible methods for enhancing the efficiency of telecommunications”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=13918) proposes a set of possible methods to help telecommunication providers save costs and enhance efficiency through the shared uses of telecommunication infrastructure, including passive and active infrastructure sharing, including when enabled by aggregation of frequency bands assigned to operators who have acquired property rights over the spectrum to enable active infrastructure sharing implementation.

[**ITU-T D.265 “Optimizing terrestrial cable utilization across multiple countries to boost regional and international connectivity”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14268) provides a collaborative framework that can be applied in order to promote optimal cable utilization across multiple countries and boost regional and international connectivity. The framework is based on a proportional allocation model, which allocates circuits based on the length of fibre contributed to the terrestrial multi-country end-to-end cable network.

[**ITU-T D.266 “Enabling environment for voluntary commercial arrangements between telecommunications network operators and OTT providers”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14269) addresses the measures for strengthening the commercial cooperation between over the top (OTT) providers and telecom operators. Given that network operators and OTTs are part of the international telecommunication/ICT ecosystem, this Recommendation encourages relevant stakeholders to work towards an enabling regulatory environment that supports and encourages the development of innovative business models in line with the advancement of technology and innovations, which are changing faster than ever.

[**ITU-T D.267/X.1261 “Policy framework including principles for digital identity infrastructure”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14270) sets out a policy framework including principles for digital identity infrastructure while recognizing the sovereign right of each Member State to regulate its telecommunications.

**ITU-T D.600R Annex B “Cost methodology for the regional tariff group for Africa applicable to the international automatic telephone service – Annex B: Guidelines for implementing efficient cost models for telecommunication service tariffs in the Africa region” (under approval)** provides guidelines to Member States of the Africa region for the construction of costing model, within the framework of the approval of prices of telecommunication services, taking into account the technological development and innovation in the field of telecommunications as well as the specificity of each country.

**ITU-T D.607R “One Network Area Roaming” (under approval)**, based on African regional experiences, aims to promote regional integration by bringing down the high cost of mobile roaming. It provides a framework and tools for facilitating and making affordable international telecommunications services to and from Africa’s countries.

**ITU-T D.1041 “Policy and methodological principles for determining colocation and access charges” (under approval)**: Co-location is an important telecommunications wholesale service essential to a competitive telecommunications landscape and a sustainable environment, as it eliminates the need for operators to build-out new or replicate existing infrastructure. A key component for encouraging co-location is the establishment of reasonable co-location access and service rates on the principles of fairness and equity.

[**ITU-T D.Suppl.4 “Supplement 4 to ITU-T D-series Recommendations: ITU-T D.263 – Supplement on Principles for increased adoption and use of mobile financial services (MFSs) through effective consumer protection mechanisms”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14239) sets out a number of principles for encouraging adoption and use of MFS services through the establishment of adequate consumer protection mechanisms, such as information availability and transparency, quality of service, data protection and privacy, customer redress fraud prevention as well as contracts and disclosure guidelines.

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

[**ITU-T E.812 “Crowdsourcing approach for the assessment of end-to-end QoS in fixed and mobile broadband networks”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14272): End-user equipment, consumer premise equipment and its software have evolved to become faster, more powerful and able to perform data collection. This has enabled the crowdsourcing approach which seeks to increase the amount of technical parameters which can be collected from end-users without modification to existing hardware and software. Increasingly, players such as regulators and service providers have started to assess end-to-end QoS through a crowdsourcing approach. However, assessment using data collected through the crowdsourcing approach can be deployed in multiple ways and different approach provides different view of QoS. This Recommendation outlines the different crowdsourcing approaches used to assess end-to-end QoS on both fixed and mobile broadband networks.

[**ITU-T G.1035 “Influencing factors on quality of experience (QoE) for virtual reality (VR) services”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14274) classifies virtual reality services and identifies the key QoE factors of VR.

[**ITU-T P.501 (revised) “Test signals for use in telephony and other speech-based applications”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14271) describes test signals that are applicable for several purposes in telephony and other speech-based applications. Recommendation ITU-T P.501 gives a wide variety of test signals starting with low complexity test signals up to test signals with a high degree of complexity incorporating many typical parameters of speech. Besides technical signals, such as sine waves or noise, more speech-like signals are described. Recommendation ITU-T P.501 describes the principles of signal construction for each type of test signal. Characteristic properties, such as power density spectra, probability density functions or shaping filter responses, are shown. Recommendation ITU-T P.501 gives an overview of the typical application of the test signals described. This overview is a guideline giving general application rules. The detailed description of the application, however, should be found in the individual Recommendations describing the measurement procedures for specific applications. In order to avoid problems in creating the test signals described, all these test signals are freely available for download from the ITU-T test signals database.

Annex A proposes two test signals [a pseudo noise sequence (PN-sequence) with a low crest factor and a logarithmically distributed multi-sine wave] for the measurement of terminal coupling loss (TCL). Annex B provides speech files and noise sequences to be used in combination with objective speech quality evaluation methods. This speech material does not replace the speech material found in Supplement 23 to the ITU T P-series Recommendations. Appendix I provides a description of the processing applied to the speech signals in clause 7.3. This Recommendation includes an electronic attachment containing the set of freely available test signals described in the Recommendation.

[**ITU-T P.863 Amd.1 “Perceptual objective listening quality prediction - Amendment 1: Revised Appendix III – Prediction of acoustically recorded narrowband speech”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14283) replaces Appendix III which gives advice on how ITU-T P.863 can be used for the prediction of listening quality of acoustically recorded speech data in a narrowband context.

[**ITU-T P.1203.3 Amd.1 “Parametric bitstream-based quality assessment of progressive download and adaptive audiovisual streaming services over reliable transport - Quality integration module Amendment 1 - Adjustment of the audiovisual quality”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14284) introduces an adjustment of the audiovisual quality of ITU-T P.1203.3 for the case of very low audio quality and long stalling events.

[**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”**](https://www.itu.int/rec/T-REC-Y.1540-202002-P!Amd1): 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. Annex B provides a second, more capable search algorithm for the IP capacity method of measurement defined in Annex A.

[**ITU-T Y Suppl.60 “Interpreting Y.1540 Maximum IP-Layer Capacity Measurements”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14285) provides information on interpreting Y.1540 Maximum IP-Layer Capacity Measurements, described in Annex A and Annex B. The supplement to provide useful information for those who measure various technologies. Much has been learned as part of the extensive testing campaigns thus far, and there is more to learn. Therefore, this Supplement may be updated frequently and readers are encouraged to ensure that they have the most recent version.

I.9 Conformity, interoperability and testing

I.9.3 SIP-IMS conformity assessment and interconnection testing

I.9.8 Testing Internet of things

**ITU-T Q.4062 “Framework for IoT Testing” (under approval)**: The IoT is one of the global infrastructures for the information society, delivering advanced services by interconnecting things based on, existing and evolving, interoperable information and communication technologies. Such a global infrastructure can be achieved by use of multiple access technologies for different types of communication networks such as BAN, PAN, LAN, WLAN, LPWAN, FAN, MAN, WAN and Cellular networks. Conformance and interoperability tests not only for domains with single access technology but also for the integrated domains with multiple access technologies are required. The main goal of this Recommendation is to specify the testing framework for IoT to accommodate the tests for such integrated domains with multiple access technologies. Conformance and interoperability tests for domains served by single unified access technology have been taken into account by relevant SDOs and therefore are out of scope of this Recommendation. This Recommendation describes the types of the tests for the domains with multiple access technologies and specifies the test procedures and the considerations correspond to the testing types.

**ITU-T Q.4063 “The framework of testing of identification systems used in IoT” (under approval)**: The concept of the Internet of Things, defined in Recommendation ITU-T Y.4000/Y.2060, nowadays plays an important role for telecommunication and information technologies. According to a forecast, the number of Internet of Things in the foreseeable future will be hundreds of billions pieces, and further it will grow up to trillions. It is essential that most of customers of telecommunication networks will be IoT-based devices in the near future. In other words, all objects which are surround us might become IoT. The IoT, in accordance with the Recommendation ITU-T Y.4050/Y.2069, are things which have a network address and have the ability to integrate it. The penetration of IoT devices is going very fast and therefore, requires the standardization of identification procedures and relevant testing methods.

Also, bearing in mind that there are a lot of applications of Internet of Things, the testing of their identity might be considered as a very important issue as it allows customer to ensure the authenticity of the IoT. The classification of IoT, in terms of testing of their identification systems and the relevant testing approaches are subjects of this Recommendation.

I.9.9 Testing energy efficiency of base stations

I.9.10 Testing cloud computing

I.9.11 Testing SDN

[**ITU-T Q.3963 “The compatibility testing of SDN-based equipment using OpenFlow protocol”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14245): One of the challenges in the area of software-defined networking is to ensure the compatibility of solutions from various producers at all layers of the NFV and SDN network. There are many SDN solutions, both open-source and proprietary; each is unique in terms of the software implementation by the object, which, even if it delivers the functionality required by the standard, is still at risk in certain cases of the network failing or holding up traffic owing to a loss of the OpenFlow connection between the SDN switch and controller of the programmable network, exposing the operator (network owner) to the risk of financial and other losses (e.g. of customers). To prevent such situations, when installing equipment on a telecommunication network, the operator will test the equipment in question for compatibility with other devices already operating on the network. In the case of SDN, tests are required to check the compatibility of OpenFlow protocol modules of each version installed on the device being tested.

This Recommendation has been developed with a view to harmonizing existing practices in the area of compatibility testing of devices using the OpenFlow operating system.

I.10 Mainstreaming accessibility in ICTs

[**ITU-T F.922 “Requirements of information service systems for visually impaired persons”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14335) provides requirements for establishing an information service system for visually impaired persons (ISS-VIP) which is based on mobile internet. ISS-VIP is constructed in C/S mode, VIPs and volunteers could access this system through their client software, and use the service provided by this system, or provide service for another person through this system. ISS-VIP provides three kinds of services, i.e. image recognition service, video assist service and trip companion service.

**ITU-T H.702 (V2) (revised) “Accessibility profiles for IPTV systems” (under approval)** defines three profiles for accessibility features in IPTV systems, with increasing levels of support. Accessibility information such as caption, sign language and audio description that are sent separately from video contents to IPTV terminal devices. By defining the above profiles, persons with disabilities can choose more easily the terminal devices that have the functions they need. The set of parameters within each profile were identified in consultation with the assistance of persons with disabilities participating in the work of ITU-T. This version includes the accessibility profiles for cognitive disabilities and appendix about an example for H.702 based system, and harmonizes the latest term definitions.

**ITU-T H.704 “Enhanced UI framework for IPTV terminal device - Gesture control interface” (under approval)** defines the general requirements, functional elements and interfaces supporting enhanced capability of user interaction by gesture recognition and controlling over IPTV terminal devices, based on the enhanced user interface (UI) framework defined in [ITU-T H.703]. Those functional elements are described in the gesture controlling enabler and gesture recognition enabler defined in this Recommendation. Moreover, the procedures of interaction between gesture recognition device and gesture-controlled device are defined with the recommended information used in the interaction. This Recommendation enables the gesture controlling feature in the Enhanced IPTV User Interface defined in [ITU-T H.703]. With those features, users can control the operation of IPTV applications in an IPTV terminal device in a convenient, natural and comfortable way.

I.11 Combating Counterfeiting and the use of stolen ICT devices

[**ITU-T Q.5051 “Framework for combating the use of stolen mobile devices”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14140): 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. 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 could occur across international 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).

Therefore, this 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.

**Technical Report ITU-T QTR-RLB-IMEI “Reliability of IMEI”** **(under publication)** contains a study on the reliability of IMEI, including information about key vulnerabilities to IMEI reprogramming on mobile devices, challenges to make the IMEI non-reprogrammable, effects of IMEI tampering on mobile users, brand owners, manufacturers, service providers, regulators, governments, law enforcement agencies and on national security. It addresses key challenges faced by a range of stakeholders that arise from cloned/tampered IMEIs, including concerns about the misuse of IMEI numbers raised by Member States at ITU Council-17 and ITU Council-18. It also proposes ways to improve IMEI reliability and preventive steps for solving the issues on a national and international level.

I.12 Signalling Protocols

I.13 Formal Languages and Identification

**ITU-T X.680 | ISO/IEC 8824-1 (revised) “Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation” (under approval)** provides a notation called Abstract Syntax Notation One (ASN.1) for defining the syntax of information data. It defines a number of simple data types and specifies a notation for referencing these types and for specifying values of these types. The ASN.1 notations can be applied whenever it is necessary to define the abstract syntax of information without constraining in any way how the information is encoded for transmission.

**ITU-T X.681 | ISO/IEC 8824-2 (revised) “Information technology – Abstract Syntax Notation One (ASN.1): Information object specification” (under approval)** provides the ASN.1 notation which allows information object classes as well as individual information objects and sets thereof to be defined and given reference names. An information object class defines the form of a conceptual table (an information object set) with one column for each field in the information object class, and with each complete row defining an information object.

**ITU-T X.682 | ISO/IEC 8824-3 (revised) “Information technology – Abstract Syntax Notation One (ASN.1): Constraint specification” (under approval)** provides the ASN.1 notation for the general case of constraint and exception specification by which the data values of a structured data type can be limited. The notation also provides for signalling if and when a constraint is violated.

**ITU-T X.683 | ISO/IEC 8824-4 (revised) “Information technology – Abstract Syntax Notation One (ASN.1): Parameterization of ASN.1 specifications” (under approval)** defines the provisions for parameterized reference names and parameterized assignments for data types which are useful for the designer when writing specifications where some aspects are left undefined at certain stages of the development to be filled in at a later stage to produce a complete definition of an abstract syntax.

**ITU-T X.690 | ISO/IEC 8825-1 (revised) “Information technology – ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER)” (under approval)** defines a set of Basic Encoding Rules (BER) that may be applied to values of types defined using the ASN.1 notation. Application of these encoding rules produces a transfer syntax for such values. It is implicit in the specification of these encoding rules that they are also used for decoding. This Recommendation | International Standard defines also a set of Distinguished Encoding Rules (DER) and a set of Canonical Encoding Rules (CER) both of which provide constraints on the Basic Encoding Rules (BER). The key difference between them is that DER uses the definite length form of encoding while CER uses the indefinite length form. DER is more suitable for the small encoded values, while CER is more suitable for the large ones. It is implicit in the specification of these encoding rules that they are also used for decoding.

**ITU-T X.691 | ISO/IEC 8825-2 (revised) “Information technology – ASN.1 encoding rules: Specification of Packed Encoding Rules (PER)” (under approval)** describes a set of encoding rules that can be applied to values of all ASN.1 types to achieve a much more compact representation than that achieved by the Basic Encoding Rules and its derivatives (described in Rec. ITU-T X.690 | ISO/IEC 8825-1).

**ITU-T X.692 | ISO/IEC 8825-3 (revised) “Information technology – ASN.1 encoding rules: Specification of Encoding Control Notation (ECN)” (under approval)** defines the Encoding Control Notation (ECN) used to specify encodings (of ASN.1 types) that differ from those provided by standardized encoding rules such as the Basic Encoding Rules (BER) and the Packed Encoding Rules (PER).

**ITU-T X.693 | ISO/IEC 8825-4 (revised) “Information technology – ASN.1 encoding rules: XML Encoding Rules (XER)” (under approval)** specifies rules for encoding values of ASN.1 types using the Extensible Markup Language (XML).

**ITU-T Z.161 (revised) “Testing and Test Control Notation version 3: TTCN-3 core language” (under approval)** 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. This revision of the Recommendation contains amendments, clarifications, corrigenda and editorial corrections.**ITU-T Z.161.3 (revised) “Testing and Test Control Notation version 3: TTCN-3 language extensions: Advanced parameterization” (under approval)** defines the advanced parameterization 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.161.4 (revised) “Testing and Test Control Notation version 3: TTCN-3 language extensions: Behaviour types” (under approval)** defines the behaviour types 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” (under approval)** 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.

**ITU-T Z.161.7 (revised) “Testing and Test Control Notation version 3: TTCN-3 language extensions: Object-Oriented Features” (under approval)** 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.165.1 (revised) “Testing and Test Control Notation version 3: TTCN-3 language extensions: Extended TRI” (under approval)** defines the extended TRI 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 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 this Recommendation.

**ITU-T Z.166 (revised) “Testing and Test Control Notation version 3: TTCN-3 control interface (TCI)” (under approval)** 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 V4.12.1). 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 V4.12.1 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.167 (revised) “Testing and Test Control Notation version 3: Using ASN.1 with TTCN-3” (under approval)** defines a normative way of using ASN.1 as defined in Recommendations ITU-T X.680, ITU-T X.681, ITU-T X.682 and ITU-T X.683 with TTCN-3. The harmonization of other languages with TTCN-3 is not covered by this Recommendation. This revision of the Recommendation contains amendments, clarifications, corrigenda and editorial corrections.

I.14 Rules and Procedures, Working Methods

[**Manual for rapporteurs and editors (14 February 2020)**](https://www.itu.int/oth/T0A0F00002C/) provides guidance to rapporteurs and editors in their day-to-day performance of the task given to them. The manual covers the requirements for meetings, the preparation of Recommendations, and the necessary reports.

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