|  |  |  |
| --- | --- | --- |
| ITU logo | INTERNATIONAL TELECOMMUNICATION UNION**TELECOMMUNICATIONSTANDARDIZATION SECTOR**STUDY PERIOD 2017-2020 | **TSAG-TD291-R2** |
| **TSAG** |
| **Original: English** |
| **Question(s):** | N/A | Geneva, 10-14 December 2018 |
| **TD** |
| **Source:** | Director, TSB |
| **Title:** | Report of activities in ITU-T (from February to October 2018) |
| **Purpose:** | Information |
| **Contact:** | TSB TSAG  | E-mail: tsbtsag@itu.int |

|  |  |
| --- | --- |
| **Keywords:** | Standardization; Study Groups; activity report; key results; |
| **Abstract:** | This report summarizes progress achieved ITU-T standardization from February 2018 to October 2018, as well as measures taken by TSB to enhance the ITU-T standardization platform.  |

CONTENTS

Page

[Executive Summary - 4 -](#_Toc531601988)

[Annex – Full Report of activities in ITU-T (from February 2018 to October 2018) - 7 -](#_Toc531601989)

[1 Progress achieved in ITU-T standardization - 7 -](#_Toc531601990)

[2 Conformity, interoperability and testing - 9 -](#_Toc531601991)

[2.1 Conformance Assessment Steering Committee (CASC) - 9 -](#_Toc531601992)

[2.2 ICT Product Conformity Database - 9 -](#_Toc531601993)

[2.3 Testing Internet of Things - 10 -](#_Toc531601994)

[3 Accessible ITU-T meetings - 10 -](#_Toc531601995)

[4 Intellectual property rights - 10 -](#_Toc531601996)

[5 ITU-T Focus Groups: Exploring new directions in ITU standardization - 10 -](#_Toc531601997)

[5.1 Data Processing and Management to support IoT and Smart Cities & Communities - 11 -](#_Toc531601998)

[5.2 Digital Currency including Digital Fiat Currency - 11 -](#_Toc531601999)

[5.3 Application of Distributed Ledger Technology - 11 -](#_Toc531602000)

[5.4 Machine Learning for Future Networks including 5G - 11 -](#_Toc531602001)

[5.5 Technologies for Network 2030 - 11 -](#_Toc531602002)

[5.6 Artificial Intelligence for Health - 11 -](#_Toc531602003)

[5.7 Vehicular Multimedia - 12 -](#_Toc531602004)

[6 Collaboration in standardization - 12 -](#_Toc531602005)

[6.1 Coordination and cooperation among ITU Sectors - 12 -](#_Toc531602006)

[6.2 Coordination and cooperation with the Regions and the Regional Offices - 12 -](#_Toc531602007)

[6.3 General assistance and cooperation - 12 -](#_Toc531602008)

[6.4 MoU and cooperation agreements - 14 -](#_Toc531602009)

[6.5 Cooperation with national and regional standardization organizations - 14 -](#_Toc531602010)

[7 Bridging the standardization gap - 15 -](#_Toc531602011)

[7.1 BSG hands-on training sessions - 16 -](#_Toc531602012)

[7.2 Regional Groups - 16 -](#_Toc531602013)

[7.3 Regional Standardization Forums - 17 -](#_Toc531602014)

[7.4 National Standardization Secretariats - 17 -](#_Toc531602015)

[7.5 e-Learning courses - 17 -](#_Toc531602016)

[7.6 Study Group Mentoring Programme - 18 -](#_Toc531602017)

[7.7 Technical Papers - 18 -](#_Toc531602018)

[7.8 Fellowships - 18 -](#_Toc531602019)

[7.9 Questionnaires for developing countries - 20 -](#_Toc531602020)

[8 Membership - 20 -](#_Toc531602021)

[8.1 Evolution of ITU-T membership - 20 -](#_Toc531602022)

[8.2 Implementation of SME Pilot Project - 21 -](#_Toc531602023)

[9 Gender - 22 -](#_Toc531602024)

[10 Academia - 22 -](#_Toc531602025)

[11 Publications - 23 -](#_Toc531602026)

[12 Media and promotion - 23 -](#_Toc531602027)

[13 Services and tools - 24 -](#_Toc531602028)

[13.1 ITU-T Databases - 24 -](#_Toc531602029)

[13.2 ITU-T MyWorkspace - 24 -](#_Toc531602030)

[13.3 ICT standards landscape - 25 -](#_Toc531602031)

[13.4 ITUSearch 2.0 - 25 -](#_Toc531602032)

[13.5 Machine learning for automatic translation - 25 -](#_Toc531602033)

[13.6 TSBCloud - 25 -](#_Toc531602034)

[13.7 ITU-T services & tools announcements - 25 -](#_Toc531602035)

[13.8 Document Management System for Rapporteur Groups - 25 -](#_Toc531602036)

[13.9 International Numbering Resources (INRs) - 26 -](#_Toc531602037)

[13.10 ITU-T SharePoint collaboration sites - 27 -](#_Toc531602038)

[13.11 Meeting Documents Sync Application - 28 -](#_Toc531602039)

[13.12 Electronic meetings - 28 -](#_Toc531602040)

[13.13 Use in the ITU-T of the official languages of the Union on an equal footing - 29 -](#_Toc531602041)

[13.14 Workshops and symposia - 29 -](#_Toc531602042)

[14 Implementation of WTSA Resolutions and A-series ITU-T Recommendations - 32 -](#_Toc531602043)

[15 ITU-T's activities in the implementation of WSIS and the Sustainable Development Goals - 32 -](#_Toc531602044)

[16 Implementation of trial authorized by TSAG (July 2016 meeting) - 33 -](#_Toc531602045)

[Appendix I – List of approved Recommendations and other approved texts - 34 -](#_Toc531602046)

# Executive Summary

*Progress achieved in ITU-T standardization*

ITU approved around 250 new and revised ITU-T Recommendations from February to November 2018. Appendix I lists these ITU-T Recommendations and related texts and summarizes their contents.

An estimated 95 per cent of international traffic runs over optical transport networks built in conformance with ITU standards. New ITU standards for transport, access and home address radio over fibre, multi-vendor interoperable 100G coherent DWDM (dense wavelength division multiplexing) line interfaces, fibre-optic cable installation in remote areas, software-defined networking in transport networks, visible light communications, and synchronization for IMT-2020/5G.

* [Progress update on ITU standardization for transport, access and home](https://www.itu.int/en/ITU-T/studygroups/2017-2020/15/Pages/exec-sum-201810.aspx)
* ITU-T Study Group 15 accelerates work on 5G transport

Video will account for over 80 per cent of all Internet traffic by 2020. This collaborative video work of IEC, ISO and ITU has been honoured with two Primetime Emmy Awards, the first in 2008 in recognition of ITU H.264 'Advanced Video Coding' and the second in 2017 in recognition of ITU H.265 'High Efficiency Video Coding'. The new Versatile Video Coding project is reporting strong progress.

* [Beyond HEVC: Versatile Video Coding project starts strongly](https://news.itu.int/versatile-video-coding-project-starts-strongly/)

High priority has been assigned to ITU-T standardization work on the non-radio elements of IMT-2020 (5G) systems. Software-driven network management and orchestration continues to transform telecom operations. ITU-T’s 5G work is supporting this transformation with the development of new standards for networking innovation, the evolution of the transport network, and environmental sustainability.

* [Machine Learning for 5G: New ITU Focus Group sets agenda](https://news.itu.int/machine-learning-5g-new-itu-focus-group-sets-agenda/)
* [ITU launches new study on networks & technologies for 2030 and beyond](https://news.itu.int/itu-network-2030/)

ITU-T standardization work for the Internet of Things (IoT) and smart cities aims to support interoperability and efficient data processing and management. The standardization of IoT test specifications is accelerating, supported by the increasing collaboration of ITU-T and oneM2M. More than 50 cities worldwide are measuring their progress using ‘Key Performance Indicators for Smart Sustainable Cities’ based on ITU standards, indicators promoted by the ‘United for Smart Sustainable Cities (U4SSC) initiative’.

* [New ITU case study maps the Moscow ‘smart city’ journey](https://www.itu.int/en/mediacentre/Pages/2018-PR34.aspx)

The ITU-T Focus Group on Artificial Intelligence for Health (FG AI4H), driven in close collaboration by ITU and the World Health Organization (WHO), is working towards the establishment of a framework and associated process for the performance benchmarking of ‘AI for Health’ algorithms. Iterative Calls for Proposals will guide the Focus Group’s development of evaluation methods to assess the degree to which ‘AI for Health’ use cases have achieved Proof of Concept.

* [Artificial Intelligence for Health: ITU and WHO call for proposals](https://news.itu.int/artificial-intelligence-health-call-proposals/)

A new ITU standard offers guidelines for the safe listening of music players in support of the WHO ‘Make Listening Safe’ initiative. The new standard highlights the motivations behind its development: “Hearing loss can occur as a consequence of listening to high levels of sound over prolonged periods of time. The unsafe use of personal audio devices poses a threat to the hearing of millions.”

* [Listen responsibly: New ITU standard to prevent audio devices from causing hearing loss](https://news.itu.int/safe-listening-standard/)

New and updated conformance testing specifications for the ITU-T H.810 Continua Design Guidelines (CDG) in the ITU-T H.810-series of Recommendations reflect updates contained in 4th edition ("Keratin", CDG 2017), with 6 new and 7 revised draft texts under approval. The updates cover testing for new device specializations for power status monitoring and updated glucose monitors, and updates the PCD-1 observation upload capability. ITU-T H.820 contains an overall conformity assessment test plan for testing conformance for H.810 systems.

* [Progress update on ITU standardization for e-health](https://www.itu.int/en/ITU-T/studygroups/2017-2020/16/Pages/results-1807.aspx)

ITU-T work on performance, quality of service (QoS) and quality of experience (QoE) continues to evolve rapidly, in tune with the advances of the ICT industry. New ITU standards address the quality of video gaming, video-telephony applications, communications involving vehicles, adaptive bitrate video streaming, and ICT services at major sporting and entertainment events. ITU-T work to provide technical guidance to regulators promoting QoS is gaining a progressively larger share of the ITU standardization work programme.

* [ITU workshop on Quality of Service regulation](https://news.itu.int/workshop-on-quality-of-service-regulation/)

ITU-T offers a neutral platform for the international community to strengthen the ties between technical innovation, business needs and economic and policy requirements. New ITU standards under approval address the relationship between network operators and providers of over-the-top (OTT) services competition in mobile financial services, and principles for a unified format of price/tariffs/rates-lists used for exchanging telephone traffic.

* [Progress update on ITU standardization for economic and policy issues](https://www.itu.int/en/ITU-T/studygroups/2017-2020/03/Documents/Executive%20Summary%20of%20ITU-T%20Study%20Group%203%20Meeting%20%28Geneva%2C%209%E2%80%9318%20April%202018%29.pdf)

A new ITU standard under approval provides a framework for solution to combat counterfeit ICT devices. This area of work continues to accelerate and has expanded to combat counterfeiting as well as the theft of mobile devices. Renewed emphasis has been placed on the need to concerns surrounding the tampering with or cloning of ICT device identifiers.

* [Combating counterfeit and stolen ICT devices: ITU workshop renews international commitment](https://news.itu.int/renewed-international-commitment-to-combat-counterfeiting/)

The span of ITU-T work on VoLTE/ViLTE includes the deployment of signalling protocols for VoLTE interconnection, relevant numbering issues, QoS considerations, and emergency calls on VoLTE-based networks. New ITU standards address the interconnection of VoLTE/ViLTE-based networks and VoLTE/ViLTE interconnection testing for interworking and roaming scenarios.

* [Progress update on ITU standardization for VoLTE/ViLTE](https://www.itu.int/en/ITU-T/studygroups/2017-2020/11/Pages/exec-sum-201807.aspx)

The growth in the number of contributions and new work items in ITU-T SG17 (“Security”) is impressive (30% increase from September 2018 vs March 2018; 150 work items in ITU-T SG17 out of 800 work items of all study groups). Two new international standards submitted by the FIDO Alliance (‘Fast Identity Online’) to overcome the security limitations of passwords, addressing biometric authentication on mobile devices and the use of external authenticators, such as mobile devices, to authenticate Web users: FIDO UAF 1.1 (Universal Authenticator Framework 1.1) – standardized as ITU X.1277 – supports advanced biometric authentication on mobile devices; and CTAP (Client-to-Authenticator Protocol) – standardized as ITU X.1278 – enables the use of external authenticators such as FIDO security keys and mobile devices to authenticate Web users over USB (Universal Serial Bus), NFC (Near-field communication) and BLE (Bluetooth® Low Energy).

Quantum safe communications and quantum key distribution are new study areas being tackled by ITU Study Group 13 and ITU-T Study Group 17, where also new members have joined ITU-T.

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

* [Data Processing and Management to support IoT and Smart Cities & Communities (FG-DPM)](https://www.itu.int/en/ITU-T/focusgroups/dpm/Pages/default.aspx)
* [Digital Currency including Digital Fiat Currency (FG DFC)](https://www.itu.int/en/ITU-T/focusgroups/dfc/Pages/default.aspx)
* [Application of Distributed Ledger Technology (FG DLT)](https://www.itu.int/en/ITU-T/focusgroups/dlt/Pages/default.aspx)
* [Machine Learning for Future Networks including 5G (FG ML5G)](https://www.itu.int/en/ITU-T/focusgroups/ml5g/Pages/default.aspx)
* [Technologies for Network 2030 (FG NET-2030)](https://www.itu.int/en/ITU-T/focusgroups/net2030/Pages/default.aspx)
* [Artificial Intelligence for Health (FG AI4H)](https://www.itu.int/en/ITU-T/focusgroups/ai4h)
* [Vehicular Multimedia (FG VM)](https://www.itu.int/en/ITU-T/focusgroups/vm)

*ITU standardization platform*

ITU-T membership has taken a sharp upward trajectory. ITU-T has achieved a significant net increase of 26 new memberships in 2018, a 92 per cent improvement over the net increase achieved in 2017. 14 Sector Members and 29 Associates have joined ITU-T in 2018, amounting to 43 new members. New ITU-T members include mobile virtual network operators and enablers (MVNOs and MVNEs), manufacturers of unmanned aerial vehicles, telematics and automotive companies, OTT service providers, energy utilities, and companies specializing in quantum cryptography and quantum communications. See Section 8.

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. The revamped BSG Programme is structured around 5 pillars, responding to WTSA Resolution 44. The 5 pillars of the BSG programme are: Engagement, know-how, community, awareness, and partnering. See Section 7.

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. See Section 2.

Diversity of staff, gender equality and the empowerment of women continue to be among TSB's priorities. TSB continues its efforts to include a gender perspective in all of its activities and programmes under the umbrella of the ITU Gender Task Force. 48 per cent of all TSB staff are women. 37 per cent of professional posts are held by women, and women hold 67 per cent of posts at P5 level. See Section 9.

ITU-T continues to provide leadership in promoting collaboration among bodies relevant to ICT standardization. TSB continues to facilitate an ITU-T presence in activities arranged by other bodies, with a view to promoting other bodies’ engagement with ITU-T workings groups, workshops and related ITU-T collaboration initiatives. See Section 6.

Version 2 of [MyWorkspace](https://www.itu.int/net4/ITU-T/myworkspace/) has been released, with new features based on the feedback from its initial users. MyWorkspace is a new personalized webpage for TIES users that provides easy access to the information and services most valued by ITU-T delegates. The [search engine](https://www.itu.int/net4/ITU-T/search/Landing) returns results from the full collections of ITU documents, publications and web pages. ITU-T Study Groups’ SharePoint collaboration sites continue to be enhanced. A new service announcements news channel, <http://tsbtech.itu.int/>, provides regular updates on new services and tool enhancements available to ITU-T delegates. See Section 13.

Over 9,500 pages of ITU-T Recommendations and Supplements were published between February and September 2018 for free download in reflowable ePub format 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. See Section 11.

TSB continues to translate Recommendations approved under the traditional approval process (TAP), as well as all TSAG reports in all the languages of the Union. In 2018, TSB translated 10 AAP Recommendations in the reporting period, in accordance with requests previously received from the ITU-T Study Groups and linguistic groups, and within the allocated translation budget. See Section 13.

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. For workshops and symposia held in the reporting period, as well as new and evolving features of these events, see Section 13.

# Annex – Full Report of activities in ITU-T (from February 2018 to October 2018)

# 1 Progress achieved in ITU-T standardization

ITU approved more than 290 new and revised ITU-T Recommendations from February to November 2018. Appendix I lists these ITU-T Recommendations and related texts and summarizes their contents.

Executive summaries ITU-T Study Group meetings can be found on the homepages of [ITU-T Study Groups](https://www.itu.int/en/ITU-T/studygroups/Pages/default.aspx). Summaries of the most recent meetings of ITU-T Study Groups are listed below.

* ITU-T Study Group 2 (Operational aspects): [Meeting report, July 2018](https://www.itu.int/md/T17-SG02-R-0008/en)
* ITU-T Study Group 3 (Economic and policy issues): [Executive summary, April 2018](https://www.itu.int/en/ITU-T/studygroups/2017-2020/03/Documents/Executive%20Summary%20of%20ITU-T%20Study%20Group%203%20Meeting%20%28Geneva%2C%209%E2%80%9318%20April%202018%29.pdf)
* ITU-T Study Group 5 (Environment and circular economy): [Executive summary, September 2018](https://www.itu.int/en/ITU-T/studygroups/2017-2020/05/Pages/exec-sum.aspx)
* ITU-T Study Group 9 (Broadband cable and TV): [Executive summary, January 2018](https://www.itu.int/en/ITU-T/studygroups/2017-2020/09/Documents/Executive-summary-2018-01-Geneva.pdf)
* ITU-T Study Group 11 (Protocols and test specifications): [Executive summary, July 2018](https://www.itu.int/en/ITU-T/studygroups/2017-2020/11/Pages/exec-sum-201807.aspx)
* ITU-T Study Group 12 (Performance, QoS and QoE): [Executive summary, May 2018](https://www.itu.int/en/ITU-T/studygroups/2017-2020/12/Pages/1805-summary.aspx)
* ITU-T Study Group 13 (Future networks and cloud): [Executive summary, July 2018](https://www.itu.int/en/ITU-T/studygroups/2017-2020/13/Pages/exec-sum.aspx)
* ITU-T Study Group 15 (Transport, access and home): [Executive summary, October 2018](https://www.itu.int/en/ITU-T/studygroups/2017-2020/15/Pages/exec-sum-201810.aspx)
* ITU-T Study Group 16 (Multimedia): [Executive summary, July 2018](https://www.itu.int/en/ITU-T/studygroups/2017-2020/16/Pages/results-1807.aspx)
* ITU-T Study Group 17 (Security): [Executive summary, March 2018](https://www.itu.int/en/ITU-T/studygroups/2017-2020/17/Pages/1803-summary.aspx); [Executive summary, September 2018](https://www.itu.int/en/ITU-T/studygroups/2017-2020/17/Pages/1809-summary.aspx)
* ITU-T Study Group 20 (IoT and smart cities): [Executive summary, May 2018](https://www.itu.int/en/ITU-T/studygroups/2017-2020/20/Pages/exec-sum-may18.aspx)

An estimated 95 per cent of international traffic runs over optical transport networks built in conformance with ITU standards. New ITU standards for transport, access and home address radio over fibre, multi-vendor interoperable 100G coherent DWDM (dense wavelength division multiplexing) line interfaces, fibre-optic cable installation in remote areas, software-defined networking, visible light communications, and synchronization for IMT-2020/5G.

* [Progress update on ITU standardization for transport, access and home](https://www.itu.int/en/ITU-T/studygroups/2017-2020/15/Pages/exec-sum-201810.aspx)

Video will account for over 80 per cent of all Internet traffic by 2020. This collaborative video work of IEC, ISO and ITU has been honoured with two Primetime Emmy Awards, the first in 2008 in recognition of ITU H.264 'Advanced Video Coding' and the second in 2017 in recognition of ITU H.265 'High Efficiency Video Coding'. The new Versatile Video Coding projects is reporting strong progress.

* [Beyond HEVC: Versatile Video Coding project starts strongly](https://news.itu.int/versatile-video-coding-project-starts-strongly/)

High priority has been assigned to ITU-T standardization work on the non-radio elements of IMT-2020 (5G) systems. Software-driven network management and orchestration continues to transform telecom operations. ITU-T’s 5G work is supporting this transformation with the development of new standards for networking innovation, the evolution of the transport network, and environmental sustainability.

* [ITU-T Study Group 15 accelerates work on 5G transport](https://www.itu.int/en/mediacentre/Pages/2018-CM05.aspx)

ITU-T standardization work for the Internet of Things (IoT) and smart cities aims to support interoperability and efficient data processing and management. The standardization of IoT test specifications is accelerating, supported by the increasing collaboration of ITU-T and oneM2M. More than 50 cities worldwide are measuring their progress using ‘Key Performance Indicators for Smart Sustainable Cities’ based on ITU standards, indicators promoted by the ‘United for Smart Sustainable Cities (U4SSC) initiative’.

* [New ITU case study maps the Moscow ‘smart city’ journey](https://www.itu.int/en/mediacentre/Pages/2018-PR34.aspx)

The ITU-T Focus Group on Artificial Intelligence for Health (FG AI4H), driven in close collaboration by ITU and the World Health Organization (WHO), is working towards the establishment of a framework and associated process for the performance benchmarking of ‘AI for Health’ algorithms. Iterative Calls for Proposals will guide the Focus Group’s development of evaluation methods to assess the degree to which ‘AI for Health’ use cases have achieved Proof of Concept.

* [Artificial Intelligence for Health: ITU and WHO call for proposals](https://news.itu.int/artificial-intelligence-health-call-proposals/)

A new ITU standard offers guidelines for the safe listening of music players in support of the WHO ‘Make Listening Safe’ initiative. The new standard highlights the motivations behind its development: “Hearing loss can occur as a consequence of listening to high levels of sound over prolonged periods of time. The unsafe use of personal audio devices poses a threat to the hearing of millions.”

* [Listen responsibly: New ITU standard to prevent audio devices from causing hearing loss](https://news.itu.int/safe-listening-standard/)

New and updated conformance testing specifications for the ITU-T H.810 Continua Design Guidelines (CDG) in the ITU-T H.810-series of Recommendations reflect updates contained in 4th edition ("Keratin", CDG 2017), with 6 new and 7 revised draft texts under approval. The updates cover testing for new device specializations for power status monitoring and updated glucose monitors, and updates the PCD-1 observation upload capability. ITU-T H.820 contains an overall conformity assessment test plan for testing conformance for H.810 systems.

* [Progress update on ITU standardization for e-health](https://www.itu.int/en/ITU-T/studygroups/2017-2020/16/Pages/results-1807.aspx)

ITU-T work on performance, quality of service (QoS) and quality of experience (QoE) continues to evolve rapidly, in tune with the advances of the ICT industry. New ITU standards address the quality of video gaming, video-telephony applications, communications involving vehicles, adaptive bitrate video streaming, and ICT services at major sporting and entertainment events. ITU-T work to provide technical guidance to regulators promoting QoS is gaining a progressively larger share of the ITU standardization work programme.

* [ITU workshop on Quality of Service regulation](https://news.itu.int/workshop-on-quality-of-service-regulation/)

ITU-T offers a neutral platform for the international community to strengthen the ties between technical innovation, business needs and economic and policy requirements. New ITU standards under approval address the relationship between network operators and providers of over-the-top (OTT) services competition in mobile financial services, and principles for a unified format of price/tariffs/rates-lists used for exchanging telephone traffic.

* [Progress update on ITU standardization for economic and policy issues](https://www.itu.int/en/ITU-T/studygroups/2017-2020/03/Documents/Executive%20Summary%20of%20ITU-T%20Study%20Group%203%20Meeting%20%28Geneva%2C%209%E2%80%9318%20April%202018%29.pdf)

A new ITU standard under approval provides a framework for solution to combat counterfeit ICT devices. This area of work continues to accelerate and has expanded to combat counterfeiting as well as the theft of mobile devices. Renewed emphasis has been placed on the need to concerns surrounding the tampering with or cloning of ICT device identifiers.

* [Combating counterfeit and stolen ICT devices: ITU workshop renews international commitment](https://news.itu.int/renewed-international-commitment-to-combat-counterfeiting/)

The span of ITU-T work on VoLTE/ViLTE includes the deployment of signalling protocols for VoLTE interconnection, relevant numbering issues, QoS considerations, and emergency calls on VoLTE-based networks. New ITU standards address the interconnection of VoLTE/ViLTE-based networks and VoLTE/ViLTE interconnection testing for interworking and roaming scenarios.

* [Progress update on ITU standardization for VoLTE/ViLTE](https://www.itu.int/en/ITU-T/studygroups/2017-2020/11/Pages/exec-sum-201807.aspx)

The growth in the number of contributions and new work items in ITU-T SG17 (“Security”) is impressive (30% increase from September 2018 vs March 2018; 150 work items in ITU-T SG17 out of 800 work items of all study groups). Two new international standards submitted by the FIDO Alliance (‘Fast Identity Online’) to overcome the security limitations of passwords, addressing biometric authentication on mobile devices and the use of external authenticators, such as mobile devices, to authenticate Web users: FIDO UAF 1.1 (Universal Authenticator Framework 1.1) – standardized as ITU X.1277 – supports advanced biometric authentication on mobile devices; and CTAP (Client-to-Authenticator Protocol) – standardized as ITU X.1278 – enables the use of external authenticators such as FIDO security keys and mobile devices to authenticate Web users over USB (Universal Serial Bus), NFC (Near-field communication) and BLE (Bluetooth® Low Energy).

# Quantum safe communications and quantum key distribution are new study areas being tackled by ITU Study Group 13 and ITU-T Study Group 17, where also new members have joined ITU-T.2 Conformity, interoperability and testing

## 2.1 Conformance Assessment Steering Committee (CASC)

The main objective of ITU-T CASC is to set up criteria, rules and procedures to recognize Test Laboratories (TL) with competence in ITU-T Recommendation(s) and register these TLs in the ITU recognized TL list. This effort is supported by a guideline "Testing laboratories recognition procedure" agreed by ITU-T SG11 in 2015. According to requests received from ITU members and ITU-T Study Groups, ITU-T CASC established a list of ITU-T Recommendations (e.g., ITU-T P.1140, ITU-T P.1100 and P.1110, and ITU-T K.116) which may become subjects of the future joint certification schemes.

ITU-T CASC continue collaboration with existing conformity assessment systems and schemes such as IEC and ILAC, including participation in a new Task Force “ITU requirements” which was set up by IECEE Certification Management Committee (CMC).

In July 2018, IEC presented the draft Operational Document (OD) named “ICT Laboratory Recognition Service on ITU–T Recommendations”, which specifies the requirements and processes of the ICT Laboratory Recognition Service based on ITU–T Recommendations. This service is based on IECEE peer assessment processes by using ITU-T recommendations and it will become a standalone service provided by IECEE CB scheme.

It was decided to seek approval of the conceptual, draft, OD in IECEE first, and then CASC will develop its own guideline which would refer to the OD accordingly.

The next meeting will take place during next SG11 meeting in March 2019. More details are available on the ITU-T CASC [web page](https://www.itu.int/en/ITU-T/studygroups/2013-2016/11/Pages/CASC.aspx).

## 2.2 ICT Product Conformity Database

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

* **e-Health** solutions complying with the specifications of ITU-T H.810 “Interoperability design guidelines for personal health systems”, a transposition of the Continua Design Guidelines.
*Note: Six new texts were added to the series of**Recommendations in the ITU-T H.820-H.850 series for conformance testing of e-Health solutions complying with the specifications of ITU-T H.810 “Interoperability design guidelines for personal health systems”. Seven existing testing specifications were revised. The updates allow testing of implementations complying with the 4th edition of ITU-T H.810.*
* **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** products meet the requirements of [ITU-T H.721](https://www.itu.int/itu-t/recommendations/rec.aspx?rec=12458) “IPTV terminal devices: Basic Model” and [ITU-T H.702](http://www.itu.int/itu-t/recommendations/rec.aspx?rec=H.702) “Accessibility profiles for IPTV systems”, tested to [HSTP-CONF H721](http://www.itu.int/pub/T-TUT-IPTV-2015-H721) and [HSTP-CONF-H702](http://www.itu.int/pub/T-TUT-IPTV-2017-H702).
* **Mobile Number Portability (MNP)** products comply with ITU-T Q.Suppl.4/ITU-T Q.3905.

A Technical Paper FSTP-CONF-F921 was also approved, which allows conformance testing of deployments of systems complying with Recommendation ITU-T F.921 "Audio-based indoor and outdoor network navigation system for persons with vision impairment".

## 2.3 Testing Internet of Things

Membership has approved the new ITU standard, Recommendation ITU-T Q.4060 “The structure of the testing of heterogeneous Internet of Things gateways in a laboratory environment”. Following the completion of this standard, a new subcategory of the Q.series was established: Q.4060-Q.4099 “Testing specifications for IMT-2020 and IoT”.

ITU-T is developing three work items on IoT testing:

* Q.39\_FW\_Test\_ID\_IoT “The framework of testing of identification systems used in IoT”
* Q.TI-TEST “Framework of model network for Tactile Internet testing”
* Q.FW\_IoT/Test “Framework for IoT Testing”

Membership has approved the following new standards:

* Recommendation ITU-T Y.4500.13 “oneM2M- Interoperability Testing”
* Recommendation ITU-T Y.4500.15 “oneM2M- Testing framework”

# 3 Accessible ITU-T meetings

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

As an activity of [JCA-AHF](https://www.itu.int/en/ITU-T/jca/ahf/Pages/default.aspx) in addition to its meetings (since last TSAG in February 2018, a meeting was held in Ljubljana, Slovenia on 18 July 2018, report is submitted to TSAG), JCA-AHF organized a workshop on “[Achieving an inclusive society by designing and implementing accessible ICTs](https://www.itu.int/net4/wsis/forum/2018/Pages/Agenda/Session/283#intro)” on 22 March 2018 at [WSIS Forum 2018](https://www.itu.int/net4/wsis/forum/2018/Pages/Agenda#intro).

During this workshop, the first trial within ITU of remote American Sign Language (ASL) Interpretation was successfully conducted with the ASL interpreters being based in Florida, USA and received at ITU headquarters. Remote SL interpretation is not expected to replace on-site SL interpreters but has proven valuable in situations where it not possible to secure an on-site SL interpreter in a specific language at any given time, for example, at the above-mentioned workshop withing WSIS Forum 2018.

# 4 Intellectual property rights

The [TSB Director’s Ad Hoc Group on Intellectual Property Rights (IPR AHG)](http://www.itu.int/en/ITU-T/ipr/Pages/adhoc.aspx) continues its work to protect the integrity of the standards-development process by clarifying aspects of the [ITU-R/ITU-T/ISO/IEC Patent Policy and related Guidelines](http://www.itu.int/en/ITU-T/ipr/Pages/revpatent.aspx) – the Union's main tool to manage the challenges associated with the incorporation of patents in [ITU-T and ITU-R Recommendations](http://www.itu.int/en/ITU-T/publications/Pages/recs.aspx). The next meeting of the group will take place in ITU headquarters in Geneva, 28 January 2019. The meeting will be followed by the third joint ITU-NGMN workshop on open source, 29-30 January 2019, and a meeting of the NGMN IPR Group, 31 January 2019.

Further, ISO and IEC have recently decided to align their guidelines with that of ITU in case Option 3 (refusal to grant licenses) is selected.  The ISO and IEC decision to require in such a situation the patent holder to provide certain additional information permitting patent identification entered into force on 2 November 2018. Please note that these changes do not concern ITU. The revised [Guidelines for implementation of the Common Patent Policy](https://www.itu.int/oth/T0404000001/en) for ITU-T/ITU-R/‌ISO/‌IEC are available from the ITU website at <https://itu.int/en/ITU-T/ipr>, as well as the updated forms and a record of revisions to the Patent Policy.

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

Focus Groups are formed in response to immediate ICT standardization demands, tasked with establishing the basis for subsequent standardization work in ITU-T Study Groups. These groups are the place to explore new directions in ITU standardization. Focus Groups are open to ITU members as well as organizations outside ITU's membership, and these groups are afforded great flexibility in their chosen deliverables and working methods.

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

The [ITU-T Focus Group on Data Processing and Management to support IoT and Smart Cities & Communities (FG-DPM)](https://www.itu.int/en/ITU-T/focusgroups/dpm/Pages/default.aspx) is developing a standardization roadmap for data management, taking into consideration the activities currently undertaken by the various standards developing organizations (SDOs) and forums. FG-DPM is studying, reviewing and surveying existing technologies, platforms, guidelines and standards for data processing and management, including data formats, in support of IoT and Smart Cities. The lifetime of the FG-DPM has been extended for one additional year until July 2019.

## 5.2 Digital Currency including Digital Fiat Currency

The [ITU-T Focus Group Digital Currency including Digital Fiat Currency (FG DFC)](https://www.itu.int/en/ITU-T/focusgroups/dfc/Pages/default.aspx) is a forum for dialogue among players in the banking, fintech and telecom sectors to share information and best practices and showcase innovations, as well as develop a series of deliverables highlighting requirements for network infrastructure and standards in the area of central bank issued digital currency.

## 5.3 Application of Distributed Ledger Technology

The [ITU-T Focus Group on Application of Distributed Ledger Technology (FG DLT)](https://www.itu.int/en/ITU-T/focusgroups/dlt/Pages/default.aspx) aims to deliver an ‘assessment framework’ to support efforts to understand the strengths and weaknesses of DLT platforms in different use cases. The group is also developing a high-level DLT architecture – a reference framework – detailing the key elements of a DLT platform. The Focus Group is studying high-potential DLT use cases and DLT platforms said to meet the requirements of such use cases. These studies guide the Focus Group’s abstraction of the common requirements necessary to describe a DLT architecture and associated assessment criteria.

## 5.4 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)  will propose standardization strategies to assist machine learning in contributing to the efficiency of emerging 5G systems. The group is defining the requirements of machine learning as they relate to interfaces, protocols, algorithms, data formats and network architectures. One of the Focus Group’s ambitions is to address the challenges surrounding the availability and quality of the data required to fuel machine learning algorithms.

## 5.5 Technologies for Network 2030

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

## 5.6 Artificial Intelligence for Health

The [ITU-T Focus Group on Artificial Intelligence 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 process for the performance benchmarking of ‘AI for Health’ algorithms. Iterative Calls for Proposals will guide the Focus Group’s development of evaluation methods to assess the degree to which ‘AI for Health’ use cases have achieved Proof of Concept. The first Call for Proposals aims to identify compelling use cases of AI in strengthening health services and overarching health systems, soliciting AI use cases and associated datasets in the fields of clinical and public health. Proposals should highlight the motivations behind an ‘AI for Health’ use case, the value of performance benchmarking in such cases, and the datasets required to train relevant AI algorithms.

## 5.7 Vehicular Multimedia

The [ITU-T Focus Group on Vehicular Multimedia (FG VM)](https://www.itu.int/en/ITU-T/focusgroups/vm)  is identifying use cases and requirements of vehicular multimedia enabled by converged networks. It is studying architectures, interfaces, protocols, data formats, interoperability, performance evaluation, security and protection of personal information for vehicular multimedia. Its ultimate aim is to and produce a gap analysis of vehicular multimedia standardization in order to identify the relevant scope of possible future ITU-T Recommendations on these topics and develop a roadmap for vehicular multimedia.

# 6 Collaboration in standardization

## 6.1 Coordination and cooperation among ITU Sectors

Collaboration with ITU-R and with ITU-D is a standing agenda point of TSAG, where TSAG examines existing methods and approaches to collaboration and/or cooperation with other sectors, with the view to encouraging ITU-T to work more collaboratively and/or cooperatively in a reciprocal manner, and review is performed on a regular basis based on information received.

TSAG 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 interests to various ITU-T and ITU-R study groups.

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

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

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

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

This activity has led to significant improvements in the overall coordination of standardization operations, events and activities taking place in the Regions. TSB will continue to enhance cooperation with the ITU regional and area offices, as well as with relevant regional and other international organizations dealing with standards.

## 6.3 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 theme of World Standards Day 2018 (14 October 2018) was “International Standards and the Fourth Industrial Revolution”. and ITU, ISO and IEC issued a [press release](https://www.worldstandardscooperation.org/world-standards-day/).

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

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

**ITU’s conformity and interoperability (C&I) programme** is of particular value to developing countries in their efforts to enhance conformity and interoperability of ICT products implementing ITU Recommendations or part thereof.

**Chief Technology Officer meetings**: [CTO and CxO meetings](http://www.itu.int/en/ITU-T/tsbdir/cto/Pages/default.aspx) bring together industry executives to highlight their business priorities and supporting standardization strategies. The annual CTO meeting was held in Durban, South Africa, 9 September 2018, in conjunction with ITU Telecom World 2018. A consultation with North-American CxOs was held in California, United States, 9 May 2018, California, United States.

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

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

**Safe listening:** ITU-T and WHO continue to collaborate in support of the WHO “Make Listening Safe” initiative. Recommendation ITU-T H.870 “Guidelines for safe listening devices/systems” is the first standard to result from this collaboration, focusing focusing on the safe listening of ‘personal or portable audio systems’, particularly music players. Future standards in the series expected to address communications and assistive devices as well as gaming consoles.

**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.

**Smart Sustainable Cities**: The [United for Smart Sustainable Cities (U4SSC)](http://www.itu.int/en/ITU-T/ssc/united/Pages/default.aspx) initiative, supported by 16 UN bodies, advocates for public policy to ensure that ICTs – and ICT standards in particular – play a definitive role in the transition to smart cities.

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

**Project implementing the ITU-UNECE Key Performance Indicators for Smart Sustainable Cities:** More than 50 cities worldwide are measuring their progress using ‘Key Performance Indicators for Smart Sustainable Cities’ based on ITU standards. ITU case studies have been published on the progress achieved in the smart city projects of Dubai, Singapore and Moscow, evaluations undertaken using the Key Performance Indicators.

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

**Identity management:** ITU-T participated in the ID2020 Summit 2018 in New York, United States, 14 September 2018, with a view to exploring the potential for future ITU collaboration with the ID2020 alliance.

## 6.4 MoU and cooperation agreements

**IEC, ISO and ITU** cooperate in standardization to the degree that 10 per cent of all ITU standards are common or aligned texts with the ISO/IEC Joint Technical Committee 1 on Information Technology (ISO/IEC JTC1). The TSB Director participated in a panel on “Cooperation with IEC and ITU” at the ISO General Assembly in September 2018.

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

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

**ITU and OASIS** continue collaboration on ICT security standardization. ITU adoped OASIS Trust Evaluation (2017) as ITU-T X.1276 “Authentication Step-Up Protocol and Metadata Version 1.0” to increase assurance in entity identification using authentication events and related entity information for the purpose of risk mitigation when making access control policy decisions.

**FIDO Alliance** (‘Fast Identity Online’) was recognized in March 2018 as ITU-T A.5 qualified with regard to its technical documentation which has reached the “Proposed Standard Expanded to the world”. ITU adopted two new international standards submitted by the FIDO Alliance to overcome the security limitations of passwords, addressing biometric authentication on mobile devices and the use of external authenticators, such as mobile devices, to authenticate Web users.

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

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

**ITU cooperates with the** **European Committee for Standardization (CEN) and European Committee for Electrotechnical Standardization (CENELEC)** in areas of mutual interest, such as trust, privacy, and intelligent transportation systems.

**ITU and Gesellschaft für Wissenschaftliche Datenverarbeitung Göttingen mbh (GWDG)** – the data and competence centre for the Max Planck Society and the Göttingen University – share information on means to improve user experience, data management, and research and training in information technology and data management.

## 6.5 Cooperation with national and regional standardization organizations

TSB supports the achievement of Objective T.5 of the Strategic Plan of the Union, “Extend and facilitate cooperation with international, regional and national standardization bodies”, by facilitating an ITU-T presence in activities arranged by other standards bodies, with a view to promoting other standards bodies’ engagement with ITU-T workings groups, workshops and related ITU-T collaboration initiatives. TSB’s efforts in this regard have generated positive results, resulting in increasing requests for additional information on ITU-T activities from national and regional standards bodies.

2018 activities with notable participation from other standards bodies include:

* ITU workshop on 5G security, 19 March 2018, Geneva, Switzerland
* ITU workshop on advanced cybersecurity attacks and ransomware, 28 August 2018, , Geneva, Switzerland
* ITU Workshop on Performance, Quality of Service and Quality of Experience for Multimedia Services, 19-20 March 2018, Dakar, Senegal.
* 6th ITU-T Study Group 13 regional workshop for Africa on "Standardization of future networks: What are the future opportunities for Africa?", 26-27 March 2018, Abidjan, Côte D’Ivoire
* 8th ITU Green Standards Week , 9-12 April 2018, Zanzibar, Tanzania.
* The yearly Academic Conference Kaleidoscope 2018, as well as the ITU Journal: ICT Discoveries were also presented.
* The World Smart City Forum, 29-30 November 2018, organized by IEC, ISO and ITU.

TSB continues to increase its engagement with the activities of other standards bodies, including:

**CEN**-**CENELEC:** TSB participates in CEN-CENELEC Annual Meetings, which in 2018 took place in Bled, Slovenia, 21-22 June 2018.

**Pan American Standards Commission (COPANT):** TSB participated in COPANT’s Annual General Assembly in Montego bay, Jamaica, 15-20 April 2018. In September 2018, TSB briefed COPANT executives on the work of ITU-T.

**Pacific Area Standards Congress (PASC)**: TSB participated in the 41st session of PASC in Okayama, Japan, 15-18 May 2018, focusing on discussions aimed strengthen the cooperation among standards bodies. Following the meeting, TSB briefed PASC executives on the work of ITU-T.

**African Organization for Standardization (ARSO):**  TSB participated in the 24th ARSO General Assembly and African Day of Standardization in Durban, South Africa, 18-22 June 2018. In September 2018, TSB briefed ARSO executives on the work of ITU-T.

# 7 Bridging the standardization gap

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

WTSA-16 agreed an Action Plan to address further the disparity in standardization between developed and developing countries, including least-developed countries, Small Island Developing States (SIDS) and countries with economies in transition.

The revamped BSG Programme is structured around 5 pillars, responding to WTSA Resolution 44. The 5 pillars of the BSG programme are: Engagement, know-how, community, awareness, and partnering:

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



Figure 1 - Five pillars of the BSG Programme

## 7.1 BSG hands-on training sessions

ITU-T has introduced the new ‘BSG Hands-On Study Group effectiveness training’ in response to WTSA Resolution 44. The training focuses on the development of practical skills to maximize the effectiveness of developing countries' participation in the ITU-T standardization process, covering topics including strategies for participation in study groups, drafting contributions to meetings, presenting proposals, collaborative working methods and building consensus.



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

## 7.2 Regional Groups

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

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

****In 2018, ITU celebrates 50 years of the existence of ITU-T Regional Groups. The first four Regional Groups under ITU-T Study Group 3 were established in 1968 by the 4th Plenary Assembly of CCITT.

Since February 2018, 15 Regional Groups have held meetings:

* Seven in Africa (Study Groups 2, 3, 5, 11, 12, 13, and 20)
* Two for the Americas (Study Groups 5 and 20)
* Four for the Arab States (Study Groups 2, 5, 17 and 20)
* Two for Asia and the Pacific (Study Groups 3 and 5)
* Two for Eastern Europe, Central Asia and Transcaucasia (Study Groups 11 and 20).

## 7.3 Regional Standardization Forums

Regional Standardization Forums (RSFs) provide tutorials on ITU-T working methods as well as more technically-oriented themes such as human exposure to EMF, 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 Regional Groups to improve the alignment of RSF discussions and the priorities of ITU-T Study Groups, being held in coordination with Regional Groups. RSFs are also raising awareness of our standards activities through the participation of key decision makers (Prime Ministers, Ministers, Heads of Regulators, CEOs, etc.).

The following RSFs were held in 2018:

* ITU Regional Standardization Forum on Emerging Economic, Regulatory and Policy Trends in a Fast-Changing Digital World, Kigali, Rwanda, 5 February 2018
* ITU Regional Standardization Forum on Emerging Economic, Regulatory and Policy Trends in a Fast-Changing Digital World, X’ian, China, 27 August 2018.

## 7.4 National Standardization Secretariats

ITU-T is finalizing new Guidelines for National Standardization Secretariats (NSS), taking into account the Membership feedback on the ["Guidelines on the establishment of a National Standardization Secretariat for ITU-T"](https://www.itu.int/dms_pub/itu-t/oth/0b/1f/T0B1F0000023301PDFE.pdf) first published in 2014. The new Guidelines set out a number of options for developing national procedures and processes to support effective participation in the ITU-T standards-development process.

The working procedures of ITU-T are briefly outlined, together with the benefits of establishing an NSS to support effective participation in ITU-T. An NSS, as described in this document, is the full set of arrangements by which participation in and contributions to ITU-T are coordinated within a country. These arrangements include an “NSS Bureau” to support these activities.

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 telecommunication standardization policies; the number and type of organizations with an interest in telecommunication 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 Study Groups (e.g. whether as an initiator of work items, active contributor or observer in one or more ITU-T Study Groups).

## 7.5 e-Learning courses

One of the new BSG measures adopted under WTSA Resolution 44 was to exploration of the use of e-learning channels for training on ITU-T Recommendations.

In this context, TSB has developed two e-learning courses:

* **Recommendation ITU-T A.1: Working Methods of ITU-T study groups**

The main objectives of the e-learning course are to introduce the structures, management, coordination mechanisms and operating procedures of ITU-T Study Groups as defined in Recommendation ITU-T A.1. The course is intended for delegates participating in ITU-T study group meetings, especially new participants.

The course is comprised of six modules:

‒ Standardization in ITU-T

‒ Managing the study groups

‒ Coordination

‒ Inputs to the study groups

‒ Outputs of the study groups

‒ Further infrastructure supporting the study group process

Each module is a self-contained unit, including course content and quizzes. Scores of at least 80 per cent in the final assessment of the e-learning course result in the award of a certificate of achievement.

* **Introduction to Next Generation Networks**

The course provides an introduction to Next Generation Networks (NGN), building understanding of the forces driving the migration to NGN and their possible impacts on telecommunication regulatory frameworks.

* **Recommendation ITU-T F.921 “Audio-based indoor and outdoor network navigation system for persons with vision impairment”**

The most recent addition to the ITU Academia platform trains developers of systems compliant with Recommendcation ITU-T F.921. The course was developed by Wayfindr, in collaboration with TSB and BDT.

These courses are available on the ITU Academy website at <http://academy.itu.int>.

## 7.6 Study Group Mentoring Programme

In 2011, a mentoring programme for ITU-T Study Groups was introduced. The objective of the mentoring programme is to provide a contact point to assist new delegates with the working methods of ITU-T and to facilitate participation and contributions from developing countries. It has since featured as an important part of the work of ITU-T Study Groups and TSAG.

## 7.7 Technical Papers

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

## 7.8 Fellowships

The table below shows the fellowships awarded during the period from January 2018 until September 2018. 239 fellowships were requested and 176 fellowships were awarded. Of the 176 fellowships awarded, 148 fellowships were used and 28 were cancelled.

| **Meeting** | **Fellows** | **Total** |
| --- | --- | --- |
| **Female** | **Male** |
| ITU-T Study Group 15 MeetingGeneva, 29 January – 9 February 2018 | 0 | 3 | 3 fellowships awarded3 participants |
| ITU-T Study Group 3 RG-AFR Meeting*Kigali, Rwanda 5 – 8 February 2018* | 7 + 1 cancelled | 8 + 1 cancelled | 17 fellowships awarded, 15 participants |
| TSAG Meeting*Geneva 26 February- 2 March 2018* | 0 | 9+ 2 cancelled | 11 fellowships awarded9 participants |
| ITU-T Study Group 5 (WP2/5) Meeting*Geneva 5-9 March 2018* | 1 | 0 | 1 fellowship awarded1 participant |
| ITU-T Study Group 12 RG-AFR Meeting*Dakar, Senegal 19-23 March 2018* | 1 | 6 + 2 cancelled | 9 fellowships awarded7 participants |
| ITU-T Study Group 17 *Geneva 20-29 March 2018* | 2 | 5+ 1 cancelled | 8 fellowships awarded7 participants |
| ITU-T Study Group 13 RG-AFR Meeting*Abidjan, Côte d’Ivoire 26-29 March 2018* | 1 + 1 cancelled | 12+ 1 cancelled | 15 fellowships awarded13 participants |
| ITU-T Study Group 5 RG-AFR and SG5 RG-ARB and SG20 RG-AFR Meetings (Green Standards Week)*Zanzibar, Tanzania 9-12 April 2018* | 3 + 1 cancelled | 7+ 1 cancelled | 12 fellowships awarded10 participants |
| ITU-T Study Group 3 Meeting*Geneva 9-18 April 2018* | 6 + 1 cancelled | 7 | 14 fellowships awarded13 participants  |
| ITU-T Study Group 11 RG-AFR MeetingTunis, Tunisia 23-25 April 2018 | 1 | 2 | 3 fellowships awarded3 participants |
| ITU-T Study Group 2 RG-AFR and SG2 RG-ARB MeetingsTunis, Tunisia 26-27 April 2018 | 2 + 1 cancelled | 5 | 8 fellowships awarded7 participants |
| C&I Training for AFR Region*Tunis, Tunisia 30 April - 4 May 2018* | 0 | 8+ 2 cancelled | 10 fellowships awarded8 participants |
| ITU-T Study Group 12 Meeting*Geneva 1-10 May 2018* | 1 | 4+ 1 cancelled | 6 fellowships awarded5 participants |
| ITU-T Study Group 20 Meeting *Cairo, Egypt 6-16 May 2018* | 2 + 1 cancelled | 5 | 8 fellowships awarded7 participants |
| ITU-T Study Group 11 RG-EECAT and SG20RG-EECAT Meetings*Saint Petersburg, Russia 4-6 June 2018* | 0 | 1 | 1 fellowship awarded1 participant |
| ITU-T Study Group 2 Meeting, *Geneva 4-13 July 2018* | 0 | 5 + 1 cancelled | 6 fellowships awarded5 participants |
| ITU-T Study Group 16 Meeting*Ljubljana, Slovenia 9 – 20 July 2018* | 0 | 2+ 1 cancelled | 3 fellowships awarded2 participants |
| ITU-T Study Group 13 Meeting*Geneva 16-27 July 2018* | 1 | 6 + 1 cancelled | 8 fellowships awarded7 participants |
| ITU-T Study Group 11 Meeting*Geneva 18-27 July 2018* | 0 | 7+ 2 cancelled | 9 fellowships awarded7 participants |
| ITU-T Study Group 3RG-AO Meeting*Xi’an, China 28-31 August 2018* | 1 | 1 + 1 cancelled | 2 fellowships awarded1 participant |
| ITU-T Study Group 17 Meeting*Geneva, 29 August -7 September 2018* | 3 | 5 + 1 cancelled | 9 fellowships awarded8 participants |
| ITU-T Study Group 5 Meeting*Geneva 11-21 September 2018* | 5 | 4 + 3 cancelled | 12 fellowships awarded9 participants |

## 7.9 Questionnaires for developing countries

Two questionnaires on“Big Data Adoption in Developing Countries” and on the “Use of ITU-T Recommendations by Developing Countries”were distributed in July 2018.

Responses to the first questionnaire will inform the development of a new Supplement on “Big Data Adoption in Developing Countries”. The questionnaire is collecting data on the main opportunities, requirements, use cases and challenges relevant to Big Data adoption in developing countries. Its objective is to identify issues that could be addressed by ITU-T Recommendations or related guidelines on the adoption of Big Data technologies in these countries.

Responses to the second questionnaire will support the promotion of ITU-T Recommendations in developing countries, contributing to the BSG programme. The questionnaire is collecting information on how developing countries use ITU-T Recommendations and standards developed by other standards bodies.

# 8 Membership

## 8.1 Evolution of ITU-T membership

ITU-T has achieved a significant net increase of 26 new memberships in 2018, a 92 per cent improvement over the net increase achieved in 2017. 14 Sector Members and 29 Associates have joined ITU-T in 2018, amounting to 43 new members.

New ITU-T members include mobile virtual network operators and enablers (MVNOs and MVNEs), manufacturers of unmanned aerial vehicles, telematics and automotive companies, OTT service providers, energy utilities, and companies specializing in quantum cryptography and quantum communications.

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

TSB Membership and Communications have put increased emphasis on tailored outreach to membership prospects while also enhancing the level of account management to ITU-T’s existing membership.

New Sector Members since January 2018:

Nepal Telecommunications Authority (NTA), SZ DJI Technology Co. Ltd., Telecom Regulatory Authority of India (TRAI), 360 Technology Co, Ltd., OneWeb, Bayernwerk AG, ATDI, Common Market for Eastern & Southern Africa (COMESA), Telematics Industry Application Alliance (TIAA), Tencent Technology (Shenzhen) Company Limited, Hangzhou Hikvision Digital Technology Co.,Ltd., Information Science Academy of China Electronics Technology Group Corporation (ISA CETC), Tata Communications (UK) Limited, Yong Xin Hua Yun Cultural Development Corporation.

New Associates since January 2018:

Cubic Telecom Ltd. (SG2), GloTell B.V. (SG2), Truphone Limited (SG2), 1nce GmbH (SG2), Limitless Mobile Inc. (SG2), JpU Io Ltd. (SG2), Arm Limited (SG2), Internet Initiative Japan (SG3), XOX Com Sdn Bhd (SG3), FraudBuster (SG3), Xiamen SET Electronics Co., Ltd (SG5), Beijing JiShi HuiTong Technology Co.,Ltd (SG9), Shenzhen Skyworth Digital Technology Co. Ltd. (SG9), Toda Network Corporation (SG11), Botswana Fibre Networks (SG15), Yangtze Optical Fibre and Cable Joint Stock Limited Company (SG15), Power Plus Communications AG (SG15), devolo AG (SG15), Corinex Communications (SG15), Applied Optoelectronics, Inc.(SG15), Google Fiber (SG15), Iberdrola (SG15), BOE Technology Group Co. Ltd (SG16), Guizhou Creco Technology Ltd. (SG16), Shenzhen OLYM Information Security Technology Co. Ltd. (SG17), itk AVtobvS Sarl (SG17), ID Quantique (SG17), Quantum Xchange (SG17), Hudson Institute (SG17).

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

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

|  | **2006** | **2007** | **2008** | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sector Members | 344 | 314 | 309 | 294 | 273 | 271 | 278 | 284 | 274 | 267 | 254 |  258 | 262 |
| Associates | 112 | 116 | 134 | 128 | 125 | 136 | 144 | 139 | 134 | 134 | 130 | 139 | 161 |
| Academia | ‑ | ‑ | ‑ | ‑ | ‑ | 25 | 36 | 45 | 86 | 109 | 107 | 125 | 154 |
| TOTAL  | 456 | 430 | 443 | 422 | 398 | 432 | 458 | 468 | 494 | 510 |  491 | 522 | 577 |

NOTE – The Academia category was created in 2011.

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

## 8.2 Implementation of SME Pilot Project

ITU-T Study Groups 5, 11, 16 and 20 have implemented a pilot project to increase the engagement of SMEs in the work of ITU. 15 SMEs were approved by relevant administrations to participate in ITU-T meetings under the pilot.

ITU-T Study Group 16 has experienced positive results. For example, ASTEM (Japan) has contributed significant specifications for standards on accessible IPTV terminals and their testing, which are now found in Recommendation ITU-T H.702 and Technical Paper ITU-T HSTP-CONF-H702. Wayfindr (United Kingdom) brought specifications for audio-based network navigation system for persons with vision impairment and its conformance testing (Recommendation ITU-T F.921 and Technical Paper ITU-T HSTP-CONF-F921). Wayfindr also developed associated online training material found on the ITU Academy platform.

# 9 Gender

TSB continues its efforts to include a gender perspective in all of its activities and programmes under the umbrella of the ITU Gender Task Force.

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

48 per cent of all TSB staff are women. 37 per cent of professional posts are held by women, and women hold 67 per cent of P5 posts in TSB.

Diversity of staff, gender equality and the empowerment of women continue to be among TSB's priorities.

# 10 Academia

### 10.1 ITU Kaleidoscope academic conferences

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

The 10th edition of Kaleidoscope, [Kaleidosope 2018: *Machine Learning for a 5G future*](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2018/Pages/default.aspx), will be held in Santa Fe, Argentina, 26-28 November 2018, hosted by Universidad Tecnológica Nacional.

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

### 10.2 ITU Journal: *ICT Discoveries*

The first issue of the [ITU Journal](http://news.itu.int/discover-the-power-of-artificial-intelligence-to-drive-ict-innovation-in-the-first-issue-of-the-itu-journal/) forecasts the impact of Artificial Intelligence on ICT networking. The second will share a strong bond with the first, investigating the data dimensions of modern economies and where innovation can ensure that data proves a force for good.

The [second issue](https://www.itu.int/en/journal/002/Pages/default.aspx) of the ITU Journal, to be published in December 2018, is dedicated to the theme “Data for Good”. It will publish original academic papers investigating the technical, business and policy challenges underlying effective data management and analysis.

### 10.3 World Standards Cooperation and Academia

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

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

The ICES conference and WSC Academic Day 2018 took place Yogyakarta, Indonesia, 3-5 July 2018, hosted by Universitas Islam Indonesia, the national standards body of Indonesia and Diponegoro University. The theme of the ICES conference was “Leveraging Internet-based technologies to teach standardization”. The aim of the WSC Academic Day 2018 was to review the potential of Internet-based technologies to improve teaching, training and education about standardization. Participants recommended that IEC, ISO and ITU consider launching a joint project, with appropriate external partners, to develop an entry-level Massive Open Online Course about standardization.

# 11 Publications

Over 9,500 pages of ITU-T Recommendations and Supplements were published between February and September 2018. Figure 4 illustrates the number of Recommendations (including Supplements) published per year since 2014; note that the 2018 figure is estimated.

All major revisions of ITU-T Recommendations are now also being published for free download in the reflowable ePub format, 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. It is expected that by mid-February 2019, all major revisions approved in the current study period will be available in this new format.

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, timeframe and Study Group, among others, with searches applicable to the title or the full text of the standard.

Figure 4 – Number of Recommendations, amendments and Supplements
published per year since 2014. (\*) estimate

# 12 Media and promotion

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

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

TSB communications are systematically distributed using a variety of social media channels including Twitter, Facebook, LinkedIn, Weibo and YouTube. SlideShare and related promotion in relevant LinkedIn professional communities has proven effective in highlighting expert-oriented content developed by ITU-T standardization experts.

High-priority ITU-T news topics include:

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

Infographics, animations and video form part of coordinated packages of TSB communications. TSB communications incorporate ITU-T expert interviews, event wrap-up videos and videos expressly designed for social media. An [animated video providing an introduction to ITU-T’s work](https://youtu.be/hgP4IyY33iI) sponsored by NTT and KT, released in May 2016, continues to feature among ITU’s most popular videos each year.

Examples of videos include:

* Event wrap-up videos, e.g. [network aspects of IMT-2020](https://www.youtube.com/watch?v=04W1YI0ZxCs&list=PLpoIPNlF8P2NPFldoAGvSmBijxXSaL5ei); [Digital Financial Services](https://www.youtube.com/watch?v=5_jK8NKQBnU&list=PLpoIPNlF8P2NMDChEpow1n0ks9O63DXkg); [Future Networked Car](https://www.youtube.com/watch?v=zly1rf3cY64&list=PLpoIPNlF8P2MVL0biDS1wPgDEFxJ0Hq93).
* Videos expressly designed for social media, e.g [Artificial Intelligence](https://www.facebook.com/ITU/videos/1240008842750586/); [Intelligent Transport Systems](https://www.facebook.com/ITU/videos/1271884246229712/); [QoS at major events](https://youtu.be/AhB-lXg6x0s).
* Video interviews, e.g. Chairmen of ITU-T Study Groups on ['SG at a Glance' webpages](http://www.itu.int/en/ITU-T/studygroups/2017-2020/Pages/default.aspx).

# 13 Services and tools

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

## 13.1 ITU-T Databases

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

* [ITU-T Work Programme](http://www.itu.int/ITU-T/workprog)
* [ITU-T A.4, A.5 and A.6 recognized organizations](https://www.itu.int/en/ITU-T/extcoop/Pages/sdo.aspx)
* [ITU-T AAP](https://www.itu.int/ITU-T/aap/AAPSearch.aspx) & [TAP](https://www.itu.int/net/ITU-T/lists/t-approval.aspx)
* [ITU-T Recommendations](http://www.itu.int/itu-t/recommendations)
* [ITU-T Liaison Statements](http://www.itu.int/net/itu-t/ls/)
* [ITU-T Patents and Software Copyrights](http://www.itu.int/ipr/)
* [ITU Product Conformity Database](http://www.itu.int/net/itu-t/cdb/ConformityDB.aspx)
* [ITU-T Formal descriptions and Object identifiers](http://www.itu.int/ITU-T/formal-language/index.html)
* [ITU-T Test Signals](http://www.itu.int/net/itu-t/sigdb/menu.htm)
* [ITU-T Terms & Definitions](http://www.itu.int/ITU-R/go/terminology-database)
* [International Numbering Resources](http://www.itu.int/ITU-T/inr/index.html) (See section 13.6 for more details)
* ICT standards landscape (from SG17).

## 13.2 ITU-T MyWorkspace

Version 2 of [MyWorkspace](https://www.itu.int/net4/ITU-T/myworkspace/) has been released. MyWorkspace is a personalized webpage restricted to users with an active ITU account. MyWorkspace provides easy access to the information and services most valued by ITU-T delegates, including:

* [ITU-T community](https://www.itu.int/myworkspace/home/index/ITU-T_experts) and [Chat service](https://www.itu.int/myworkspace/home/index/messenger);
* [Meeting documents](https://www.itu.int/myworkspace/home/index/suggested_documents) with a section to retrieve [bookmarked documents](https://www.itu.int/myworkspace/home/index/my_bookmarks);
* [Mailing list subscriptions](https://www.itu.int/myworkspace/home/index/mailling_lists);
* [Calendar of current and future events](https://www.itu.int/myworkspace/home/index/all_events);
* Personalized profile and preferences; and more.

## 13.3 ICT standards landscape

The [ICTs standards landscape](http://www.itu.int/net4/ITU-T/roadmap) platform offers an overview of standardization in a given ICT domain by identifying existing published standards and standards that are currently under development across the various involved SDOs.

The platform is publicly available online. Specifically designated ITU-T contributors with supplementary access rights maintain it as a Wiki. Contributors are ITU-T members, experts in the domain they are responsible for, and are designated by the respective ITU-T Study Groups. Access rights are updated by TSB on demand.

The latest release, which contains improvements based on feedback that was recently received is available at <http://www.itu.int/net4/ITU-T/roadmap>

## 13.4 ITUSearch 2.0

TSB has developed a new [search engine](https://www.itu.int/net4/ITU-T/search/Landing) that facilitates access to ITU resources, and which is permanently enriched with the full collections of ITU documents, publications and web pages.

A new design was developed during the past few months, taking into account newly collected feedback that improves user experience. The engine is currently under final testing and the new design should be released in the coming month.

## 13.5 Machine learning for automatic translation

In the framework of new translation initiatives, TSB is developing an automatic machine translation engine based on neural networks, and which is being trained exclusively on ITU corpus.

A prototype that allows online document translation from English to the five other official languages, and from these languages to English has already been developed. This prototype is scheduled to be tested for the first time at the 4-6 December SG2 regional group meeting for the Arab region.

This service will be incorporated in [MyWorkspace](https://www.itu.int/myworkspace) early 2019.

## 13.6 TSBCloud

TSB has deployed a user-friendly, mobile-friendly storage system that offers a secured file sharing open-source solution.

The solution was restricted during the first phase to internal staff and a few delegates for testing purposes, but given the successful testing results, it will be offered to a wider scope of users in the first quarter of 2019. TSBCloud will provide storage space of up to 10 GB of data to each user.

## 13.7 ITU-T services & tools announcements

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

## 13.8 Document Management System for Rapporteur Groups

The MS SharePoint-based Document Management System for ITU-T Rapporteur Group Meetings (RGMs) has been used extensively by the majority of ITU-T Study Groups, notably Study Groups 2, 3, 9, 11, 13, 15, 16 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 (TIES) account.

## 13.9 International Numbering Resources (INRs)

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

Notifications of national numbering/identification plan 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".

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

Council 2017 approved the new fee structure for UIFN (Universal International Freephone Number) and IIN (Issuer Identifier Number) by approving new Decision 600 ([C17/133](https://www.itu.int/md/S17-CL-C-0133/en)) and 601 ([C17/134](https://www.itu.int/md/S17-CL-C-0134/en)). The improved systems went live on 16 January 2018 following the new fee structure approved in Council Decision 600. It was found that the following RoAs are still not reachable, accounting for a total of 93 UIFNs:

* AES - AES Comunicaciónes Bolivia S.A. (1 UIFN)
* AXICOM - Axicom Communications Group Inc., USA (2 UIFN)
* BSCL - BellSouth Chile (2 UIFN)
* BDEVTP - Cable and Wireless plc, Bermuda (3 UIFN)
* CTE - Compañia de Telecomunicaciones de El Salvador, S.A. de C.V. (1 UIFN)
* NEXTRA - GTS Nextra, a.s., Slovakia (4 UIFN)
* HANSE - HanseNet Telekommunikation GmbH, Germany (1 UIFN)
* ABS - Inclarity PLC, UK (9 UIFN)
* STRADA - Infostrada S.p.A., Italy (2 UIFN)
* IRT - Interoute Belgium NV, Belgium (1 UIFN)
* ITAUT - IT-Austria GmbH, Austria (3 UIFN)
* NETZ - Netzquadrat GmbH, Germany (2 UIFN)
* RSLUK - RSL Communications Ltd, UK (50 UIFN)
* CTS - WorldXchange Communications, USA (10 UIFN)
* DTMS – dtms gmbh, Germany (1 UIFN)

Of the 813 registered IINs, 20 were registered in the reporting period; 168 IINs wereupdated; and 25 IINs were withdrawn. These updates have all been published in ITU Operational Bulletin. 341 IINs are now undergoing review.

The recommendation below was approved by ITU Council at its 2018 session (Annex A to the document [C18/121](https://www.itu.int/md/S18-CL-C-0121/en)). “The Committee recommends that the Council take note of the first proposal in Document [C18/100](https://www.itu.int/md/S18-CL-C-0100/en):

 *National Administrations/regulators are invited to provide a focal point for providing or investigating up-to-date contacts for UIFN service providers (RoAs) and the assignees of IINs.*

The Committee recommends that the Council approve the revised second proposal in Document C18/100:

 *For Entities for which national Administrations/regulators have lost contact and for which no contacts could be found by the end of Council 2019, all records relevant to these entities will be removed from the ITU database based on confirmations/notifications from national Administrations/regulators.*

The Committee recommends that the Council instruct the secretariat, as an interim step, to undertake consultations with national administrations in order to submit a report on the status of those consultations to CWG-FHR.”

TSB has been investigating the contacts of the unreachable UIFN Service Providers and IIN assignees and over 100 national Administrations/regulators have been contacted.

Revisions were proposed to Recommendation ITU-T E.169.1 “Application of Recommendation E.164 numbering plan for universal international freephone numbers for international freephone service” and ITU-T E.118 “The international telecommunication charge card” to reflect Council Decision 600 and 601. The draft revised ITU-T E.169.1 and Amendment1 to E.118 achieved ITU members’ first-stage approval (‘determination’) in July 2018.

WTSA Resolution 91 on “Enhancing access to an electronic repository of information on numbering plans published by the ITU Telecommunication Standardization Sector”, a new Resolution approved by WTSA-16, instructs ITU-T Study Group 2 to study this matter on the basis of contributions received from ITU members and information from TSB and to organize the necessary work to determine the requirements for electronic access to a repository of numbering resources reserved, assigned or allocated to each operator/service provider (to the extentpossible) within every country, including presentation of E.164 national numbering plans on the basis of Recommendation ITU-T E.129, and international numbering resources assigned by the Director of TSB. On the request of ITU-T Study Group 2, TSB has provided and presented the information on the implementation of WTSA Resolution 91 to the meetings of ITU-T Study Group 2 held 29 March - 7 April 2017 ([SG2-TD143](https://www.itu.int/md/T17-SG02-170329-TD-GEN-0143/en)), 27 November - 1 December 2017 ([SG2-TD233-R1](https://www.itu.int/md/T17-SG02-171127-TD-GEN-0233)) and 4-13 July 2018 (SG2-TD419). A prototype of the new repository of national numbering plans is available at: <https://www.itu.int/net4/itu-t/nnp>. 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.

## 13.10 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 is found below:

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

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 (TIES) account. Certain collaboration sites are open to non-members, accessed using non-member ITU User accounts.

## 13.11 Meeting Documents Sync Application

This application enables meeting participants to synchronize documents of ongoing ITU-T Study Group meetings from the ITU server to their local drive. The application is constantly enhanced and updated following feedback and suggestions from users. An improved Windows version and a new Mac version of the sync application for Rapporteur Group Meeting (RGM) documents are also now available.

## 13.12 Electronic meetings

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

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

## 13.13 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 Study Groups in terminology-related matters. SCV guides the adoption of terms and definitions in ITU-T Recommendations in accordance with WTSA Resolution 67.

[Council Resolution 1386](https://www.itu.int/md/S17-CL-C-0127/en) of 26 May 2017 created the ITU Coordination Committee for Terminology (CCT), which is composed of SCV, the ITU-R Coordination Committee for Vocabulary (CCV) and two representatives of ITU-D. SCV has thus met twice in 2018 under the umbrella of CCT in the interest of ensuring the harmonization of terminology across the Union.

TSB continues to collect all new terms and definitions proposed by ITU-T Study Groups, 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, in the reporting period, 10 AAP Recommendations, in accordance with requests received from ITU-T Study Groups and linguistic groups.

## 13.14 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.

Below provides a snapshot of new and evolving features of ITU workshops and symposia.

**Executive summary** – An executive summary is generated for the majority of ITU workshops and symposia to offer a concise summary of an event’s key points of discussion and notable outcomes.

**Automatic audience engagement system** – PigeonHole is a new addition to ITU workshops and symposia. The tool increases audience engagement by capturing questions, and their degree of popularity among the audience, via participants’ PCs and mobile devices.

**CRM Registration** – A new registration system has been implemented for ITU workshops and symposia with the goal of delivering a rapid, user-friendly registration experience.

**Open content** – Speakers’ presentations and biographies are all published on ITU’s website to ensure open access to workshop content.

**Remote participation and webcasts** – The majority of ITU workshops and symposia feature online remote participation and webcasts. Archived recordings are found on ITU’s website to ensure open access to workshop content. For more information on remote participation, see Section 13.9.

The following ITU workshops and symposia, arranged by venue, were organized by TSB since January 2018:

**Geneva, Switzerland:**

* ITU Workshop on "Future of Cable TV", 25-26 January 2018.
* Joint IEEE 802 and ITU-T Study Group 15 workshop “Building Tomorrow’s Networks”, 27 January 2018.
* ITU Workshop on Machine Learning for 5G and beyond, 29 January 2018.
* Symposium on the Future Networked Car, 8 March 2018.
* ITU Workshop on 5G Security, 19 March 2018.
* The role of International Standards and of the Basel Convention in tackling e-waste and achieving a Circular Economy, 23 March 2018.
* AI for Good Global Summit, 15-17 May 2018.
* Third annual ITU IMT-2020/5G Workshop and Demo Day – 2018, 18 July 2018.
* ITU Workshop on Global approaches on combating counterfeiting and stolen ICT devices, 23 July 2018.
* ITU Workshop on Advanced Cybersecurity Attacks and Ransomware , 28 August 2018
* ITU Workshop on "Artificial Intelligence for Health", 25 September 2018.
* ITU Workshop on Telecommunication Service Quality Regulatory Frameworks and Experience Driven Networking, 26 November 2018.

**Europe:**

* 1st ITU Workshop on Data Processing and Management for IoT and Smart Cities & Communities, Brussels, Belgium, 19 February 2018.
* Third meeting of the United for Smart Sustainable Cities Initiative (U4SSC), Malaga, Spain, 26 April 2018.
* IoT Week 2018, Bilbao, Spain, 4-7 June 2018.
* ITU Workshop on "Multimedia applications and the future of digital society", Ljubljana, Slovenia, 9 July 2018.
* ITU Workshop on Telecommunication Service Quality, Istanbul, Turkey, 3-4 September 2018.
* ITU Forum "Towards 5G Enabled Gigabit Society", Athens, Greece, 11-12 October 2018.

**Africa:**

* ITU Regional Standardization Forum on Emerging Economic, Regulatory and Policy Trends in a Fast-Changing Digital World, Kigali, Rwanda, 5 February 2018
* ITU Workshop on Performance, QoS and QoE for Multimedia Services, Dakar, Senegal, 19-20 March 2018.
* Sixth Regional Workshop for Africa on "Standardization of future networks: What opportunities for Africa?", Abidjan, Côte d'Ivoire, 26 – 27 March 2018.
* 8th Green Standards Week, Zanzibar, Tanzania, 9-12 April 2018.
	+ 12th ITU Symposium on ICT, Environment and Climate Change
	+ Forum and Training on With ICTs everywhere – How safe is EMF?
	+ Forum on Artificial Intelligence and Internet of Things in the development of Smart Sustainable Cities.
* 10th TSB Director's CTO Meeting, Durban, South Africa, 9 September 2018.
* ITU Workshop on the Rise of the MVNOs - Leveraging MVNOs in an "everything connected world", Durban, South Africa, 12 September 2018.
* Smart ABC Programme 2018 (Artificial Intelligence, Banking and Cities), Durban, South Africa, 10-13 September 2018.

**Asia and the Pacific:**

* Workshop “Impact of AI on ICT Infrastructures”, Xian, China, 25 April 2018.
* 4th Asia-Pacific Forum on Smart Sustainable Cities and e-Government 2018, Thanh Hoa City, Vietnam, 4-6 July 2018.
* ITU Regional Standardization Forum on Emerging Economic, Regulatory and Policy Trends in a Fast-Changing Digital World, Xi'an, China, 27 August 2018
* International Forum on Intelligent Transport Systems (ITS), Nanjing, China, 6-7 September 2018
* ITU Forum on Artificial Intelligence, Internet of Things and Smart Cities, Wuxi, China, 3 December 2018.

**Arab States**:

* Second ITU-T Study Group 11 Regional Workshop for Africa on “Counterfeit ICT Devices, Conformance and Interoperability Testing Challenges in Africa”, Tunis, Tunisia, 23 April 2018.
* BSG Interactive Workshop on Effectiveness in Standardization, Tunis, Tunisia, 24 April 2018.
* Regional Workshop on Telecom Numbering Planning and Policies for Arab and Africa Region, Tunis, Tunisia, 25 April 2018.
* Forum on Exploring the Potential of Artificial Intelligence and Internet of Things, Cairo, Egypt, 6 May 2018.
* The Bridging the Standardization Gap Session on IoT (Training on IoT), Cairo, Egypt, 6 May 2018.
* Second ITU Workshop on Data Processing and Management for IoT and Smart Cities & Communities, Tunis, Tunisia, 17 September 2018.

**Americas:**

* North-American Chief Technology Officer (CTO) Meeting, California, United States, 9 May 2018.
* 1st Forum on Artificial Intelligence and the Internet of Things in Smart Sustainable Cities in Latin America, Buenos Aires, Argentina, 29-30 May 2018.
* Information Session on “Exploring the Role of Small and Medium Enterprises (SMEs) in Linking AI and IoT in Smart Cities”, Buenos Aires, Argentina, 30 May 2018.
* 2018 HLPF Side Event: "Shaping Smarter and More Sustainable Cities: Striving for Sustainable Development Goals", New York, United States, 12 July 2018.
* ITU Workshop on Standardizing Digital Fiat Currency (DFC) and its Applications, New York, United States, 18-19 July 2018.
* ITU Workshop on "Machine Learning for 5G and beyond", San Jose, United States, 7 August 2018.
* First Workshop on Network 2030, New York, United States, 2 October 2018.
* ITU/SAE Workshop on "How communications will change vehicles and transport", Detroit, United States, 8-9 October 2018.
* ITU Workshop on the future of TV for the Americas, 26 November 2018, Bogotá, Colombia.
* ITU Kaleidoscope conference on Machine learning for a 5G future, Santa Fe, Argentina, 26-28 November 2018.
* World Smart City Forum, Santa Fe, Argentina, 29 November 2018

**CIS:**

* ITU Regional Forum on “Internet of Things, Telecommunication Networks and Big Data as basic infrastructure for Digital Economy”, Saint-Petersburg, Russian Federation, 4-6 June 2018.
* ITU Regional Workshop on Deployment of VoLTE/ViLTE networks based on IMS: from Standardization to Implementation, Samarkand, Republic of Uzbekistan, 2-3 October 2018.

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

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

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

The WTSA-16 Action Plan ([TSAG-TD292](https://www.itu.int/md/T17-TSAG-181210-TD-GEN-0292)) assigns action items to the operational provisions in the Resolutions and also reports information on the progress of the implementation of those action items.

A-series ITU-T Recommendations are available at <http://www.itu.int/ITU-T/recommendations/index.aspx?ser=A>.

Regarding the liaison template in Recommendation ITU-T A.1, TSB noticed that the "For Comment" field of liaison statements should be discontinued, as was agreed by TSAG 2016; however, this change was not brought to WTSA-16 and A.1 is yet to be updated accordingly.

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

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

ITU-T has undertaken a mapping of its activities to the UN Sustainable Development Goals (SDGs), an action highlighting the ITU-T activities most relevant to the SDGs and proposing actions for ITU-T to expand its contribution to the pursuit of the SDGs.

This mapping of ITU-T work to the SDGs will support the WSIS process in its promotion of efforts to leverage ICTs for sustainable development (see the [WSIS-SDG Matrix](https://www.itu.int/net4/wsis/sdg/) linking WSIS Action Lines with the SDGs), highlighting areas where these efforts will receive support from the international standards developed by ITU-T.

This mapping was presented to the February 2016 meeting of TSAG ([TSAG-TD419](http://www.itu.int/md/T13-TSAG-160201-TD-GEN-0419/en)) and led to the development of a mapping tool to map ITU-wide objectives and outputs to SDG goals and targets.

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

In implementing the decision of the July 2016 meeting of TSAG (C.108/TSAG), an ad-hoc group under ITU-T Study Group 13 created in February 2017 is developing guidance for drafting ITU-T Recommendations. This ad-hoc group is led by Wu Tong (China Telecom) and Marco Carugi (NEC, Japan).

[The current draft](https://www.itu.int/md/T17-SG13-180716-TD-GEN-0253/en) “Guidelines and Methodologies for Developing Technical Recommendations” attempts to address all questions likely to be asked by experts contributing to the development of ITU-T Recommendations.

ITU-T Study Group 13 has extended the timeframe for the delivery of the guidelines from July 2018 to March 2019.

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

Note – Corrigenda are not listed here.

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

**ITU-T G.993.2 (revised) “Very high speed digital subscriber line transceivers 2 (VDSL2)”** (under approval) specifies an access technology that exploits the existing infrastructure of copper wires that were originally deployed for POTS services. It can be deployed from central offices, from fibre-fed cabinets located near customer premises, or within buildings. This Recommendation is an enhancement to ITU T G.993.1 that supports asymmetric and symmetric transmission at a bidirectional net data rate up to 200 Mbit/s on twisted pairs using a bandwidth up to 30 MHz.

This version of this Recommendation integrates all the previous amendments and corrigenda with the 2011 version of Recommendation ITU-T G.993.2. This version of Recommendation ITU-T G.993.2 corrects or adds the following functionality:

– Method to address the misestimation of the SNR during MEDLEY (Amendment 2)

– Segmentation of SOC messages for profile 35b (Corrigendum 1)

– Annex D: Long reach VDSL2 (Amendment 3)

– Near-end anomalies for loss-of-power, host-reinit and spontaneous interruptions (Amendment 4)

– Addition of operation per the North American region for profile 35b (Annex Q) (Amendment 4)

– Addition of operation per the China region for profile 35b (Annex Q) (new)

– Addition of Successful SRA counter (new)

– Long reach VDSL2 corrigendum related to MAXNOMATP (new)

– Corrigendum to MAXMASK definition in Table 7 5 (new)

– Corrigendum to use of US0 with 35b profile for the North-America region (new).

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

**ITU-T G.993.2 (2015) Amd.4 “Very high speed digital subscriber line transceivers 2 (VDSL2) - Amendment 4”** addresses the following:

- Addition of a Band plan and Limit PSD masks for profile 35b for the North American region (Annex A).

- Addition of operation per the North American region for profile 35b (Annex Q).

**ITU-T G.993.5 (revised) “Self-FEXT cancellation (vectoring) for use with VDSL2 transceivers”** (under approval) is specifically limited to the self-far-end crosstalk (self-FEXT) cancellation in the downstream and upstream directions. It defines a single method of self-FEXT cancellation, in which FEXT generated by a group of near-end transceivers and interfering with the far-end transceivers of that same group is cancelled. This cancellation takes place between very high-bit-rate digital subscriber line 2 (VDSL2) transceivers, not necessarily of the same profile. This Recommendation is intended to be implemented in conjunction with Recommendation ITU T G.993.2. This version of this Recommendation integrates all of the previous amendments and corrigenda with the 2015 version 2.0 of Recommendation ITU-T G.993.5. This version of Recommendation ITU-T G.993.5 corrects or adds the following functionality:

– Typographical correction in clause 8.2 (Corrigendum 1)

– Generalization of the segmentation of SOC messages in clause 10.4.2.2 for vectoring of profile 35b (Corrigendum 1)

– Transceiver O-DEACTIVATING state (Amendment 1)

– Annex A: Mitigating strong FEXT (Amendment 2)

– Annex B: Vectored Long Reach VDSL2 (Amendment 2)

– Encoding of R-P-VECTOR-2 in LR mode with long loop operation (Annex B) (Corrigendum 2)

– Long reach VDSL2 corrigendum related to MAXNOMATP (new).

**ITU-T G.994.1 (revised) “Handshake procedures for digital subscriber line transceivers”** provides a flexible mechanism for digital subscriber line (DSL) transceivers to exchange capabilities and to select a common mode of operation. It includes parameters relating to service and application requirements as well as parameters pertinent to various DSL transceivers. This Recommendation is currently an integral part of the start-up procedure for Recommendations ITU T G.991.2, ITU-T G.992.1, ITU-T G.992.2, ITU-T G.992.3, ITU-T G.992.4, ITU-T G.992.5, ITU-T G.993.1 and ITU-T G.993.2. It is anticipated that future DSL Recommendations will also be able to make use of this Recommendation. Provisions are also included for exchanging non-standard information. The 2018 edition of this Recommendation integrates ITU-T G.994.1 (2017) and all its amendments and corrigendum. In addition, the 2018 edition includes the following new technical material:

– codepoints for support of US0 of G.993.2 Annex N PSD masks

– codepoints for support of US0 together with profile 35b of G.993.2 Annex A PSD masks

– codepoints for support of G.9701 extended probesequence length.

**ITU-T G.994.1 (2017) Amd.2 “Handshake procedures for digital subscriber line transceivers: Amendment 2”** includes:

- Add codepoint for the support of G.9701 Annex D.

**ITU-T G.996.2 (revised) “Single-ended line testing for digital subscriber lines (DSL)”** specifies line testing for xDSL transceivers in the form of single ended line testing (SELT), dual-ended line testing (DELT) and metallic line testing (MELT). This version of this Recommendation integrates all the previous amendments and corrigenda with the 2009 version of Recommendation ITU-T G.996.2. This version of Recommendation ITU-T G.996.2 corrects or adds the following functionality:

• Amendment 2 provides updates to Annexes E and F, defining revised new measurement parameters for a MELT-PMD and a MELT-P.

• Amendment 3 updates Annex E defining accuracy values for MELT-PMD and MELT-P (new functionality).

• Amendment 4 updates Annex E on the accuracy values for multi-component 4-element resistance and 3-element capacitance parameters in MELT-PMD and on a definition on dealing with the xDSL input capacitance during measurements.

• Amendment 5 provides updates to Annexes A and B, defining SELT operating in conjunction with ITU-T G.9701 transceivers.

• Amendment 6 updates Annexes A, E, and F, defining the following new functionalities: SELT PMD management, MELT PMD management, report of negative capacitance values, pair identification tone with timeout, report of reliability indicator for measurements, report of time stamp, parallelism and polarity of far-end signature detection, and CPE identification capacitive.

• Corrigendum 1 fixes a number of inconsistencies.

**ITU-T G.996.2 (2009) Amd.6 “Single-ended line testing for digital subscriber lines (DSL): Amendment 6”** updates Annexes A, E, and F, defining the following new functionalities:

1) SELT PMD management

2) MELT PMD management

3) Report of negative capacitance values

4) Pair identification tone with timeout

5) Report of reliability indicator for measurements

6) Report of time stamp

7) Parallelism and polarity of far-end signature detection

8) CPE identification capacitive.

**ITU-T G.997.1 (revised) “Physical layer management for digital subscriber line transceivers”** (under approval) specifies the physical layer management for asymmetric digital subscriber line (ADSL) and very high speed digital subscriber line 2 (VDSL2) transmission systems. It specifies means of communication on a transport transmission channel defined in the physical layer Recommendations ITU-T G.992.1, ITU-T G.992.2, ITU-T G.992.3, ITU-T G.992.4, ITU T G.992.5 and ITU-T G.993.2. It specifies network elements (NE) content and syntax for configuration, fault and performance management.

The revision of this Recommendation includes the management information base (MIB) elements for the physical layer management of Recommendation ITU T G.993.2 and additional MIB elements for the physical layer management of Recommendations ITU T G.992.3 and ITU-T G.992.5. The 2018 edition of this Recommendation integrates ITU-T G.997.1 (2016) and all its amendments and corrigenda. It adds the following new technical material:

– Add support for G.993.2 Annex N PSD masks.

– Add support of MAXEFTR and extend the definition of the parameters “error-free bits counter” and “MINEFTR” to apply to line with retransmission inactive.

**ITU-T G.997.1 (2016) Amd.2 “Physical layer management for digital subscriber line transceivers - Amendment 2”** includes:

- Addition of loop diagnostic status parameters

- Freezing of performance and monitoring counters when line is forced in L3 state

- Add support for Band plan and Limit PSD masks of profile 35b for the North American region (Annex A).

**ITU-T G.997.2 (revised) “Physical layer management for G.fast transceivers”** (under approval) specifies the physical layer management for fast access to subscriber terminals (G.fast) transmission systems. It specifies managed objects for configuration, fault, status, inventory and performance management. The 2018 edition of this Recommendation integrates ITU-T G.997.2 (2015) and all its amendments and corrigenda. It adds the following new technical material:

– Correction on loss of power definition for RPF.

– Correction to the special value of SNRps

– Inclusion of managed objects for showtime reconfiguration

– Correction to the range of valid values of LOM\_PERSISTENCYds/us

– Inclusion of managed objects CLASSMASKds/us.

**ITU-T G.997.2 (2015) Amd.5 “Physical layer management for G.fast transceivers: Amendment 5”** includes:

- Freezing of performance and monitoring counters when line is forced in L3 state

- Add support for G.9701 Annex D (cDTA).

**ITU-T G.999.1 (revised) “Interface between the link layer and the physical layer for digital subscriber line (DSL) transceivers”** (under approval) defines a point-to-point interface between the LINK layer device such as a network processor and a PHY device supporting multiple DSL lines, such as VDSL2, ADSL2, and SHDSL.

Corrigendum 1 to Recommendation ITU-T G.999.1 (2009) contains:

• Resolution of an inconsistency with TCI bit mapping relative to IEEE 802.1q

• Clarification of LENGTH field bit mapping

• Editorial corrections and clarifications to various clauses throughout the Recommendation.

Amendment 1 to Recommendation ITU-T G.999.1 (2009) provides the following update:

• Revision to clause 6.3 with extension for flow control on the PHY-to-LINK data stream over gamma reference point.

• Update of clause 7, Table 7-1 Configuration parameters for the encapsulation.

This revision adds support for 2.5 Gbit/s and 10 Gbit/s LINK/PHY physical interfaces.

**ITU-T G.9700 (revised) “Fast access to subscriber terminals (G.fast) – Power spectral density specification”** (under approval) specifies power spectral density (PSD) mask requirements for fast access to subscriber terminals (G.fast), a set of tools to support reduction of the transmit PSD mask, profile control parameters that determine spectral content, including the allowable maximum aggregate transmit power into a specified termination impedance, and a methodology for transmit PSD verification. It complements the physical layer (PHY) specification in Recommendation ITU T G.9701.

Amendment 1 provided support for a new 106 MHz profile with +8 dBm maximum aggregate transmit power.

Amendment 2 aligns the text of clause 6.5 on notching of specific frequency bands with ITU-T G.9701 (2014) and its latest amendments, completes the specification of 212 MHz profiles, adds Annex X ''Adaptation to the coax medium'' in support of Annex X ''Operation without multi-line coordination intended for a crosstalk free environment'' that has been specified in amendment 3 to ITU-T G.9701, and updates the table of International amateur radio frequencies in Appendix I.

**ITU-T G.9701 (revised) “Fast access to subscriber terminals (G.fast) – Physical layer specification”** (under approval) specifies a gigabit broadband access technology that exploits the existing infrastructure of wire-pairs that were originally deployed for plain old telephone service (POTS) services. Equipment implementing this Recommendation can be deployed from fibre-fed distribution points (fibre to the distribution point, FTTdp) located very near the customer premises, or within buildings (fibre to the building, FTTB). This Recommendation supports asymmetric and symmetric transmission at an aggregate net data rate up to 1 Gbit/s on twisted wire-pairs using spectrum up to 106 MHz and specifies all necessary functionality to support far-end crosstalk (FEXT) cancellation between multiple wire-pairs, and facilitates low power operation.

Corrigendum 1 (2015) provides clarifications and corrects various errors in the Recommendation, and in particular includes a change to the definition of DFT output samples.

Corrigendum 2 (2016) increases the number of RFI bands from 16 to 32, and provides clarifying text on alignment between TIGA and SRA/FRA procedures, tone repetition, unavailable seconds, and byte order in SOC and eoc messages.

Amendment 1 (2016) specifies test parameters, some of which had previously been left for further study, and specifies support for low power operation.

Amendment 2 (2016) includes a new annex on cross-layer traffic monitoring functions and link state control to support low power operation. It also includes a new 106 MHz profile with increased maximum transmit power, support for increased bit loading, Hlog reporting in both directions, and Xlog reporting.

Corrigendum 3 (2017) adds several clarifications, and fixes various errors and inconsistencies.

Amendment 3 adds support for new functionality: full specification of the 212 MHz profile, Annex X – Operation without multi-line coordination intended for a crosstalk free environment (e.g., coaxial cable medium) including independent dynamic time assignment (iDTA), Annex T – higher layer control aspects of DTA, and Annex S – software download to NTs.

Amendment 4 supports new functionality for impulse noise monitoring (INM), robust management channel recovery (RMCR), and performance monitoring parameter ANDEFTR.

Corrigendum 5 adds several clarifications, and fixes various errors and inconsistencies.

Amendment 5 adds support for coordinated dynamic time assignment (cDTA).

Corrigendum 6 includes:

1. Correction of Figure 10-25 in §10.4.4 “Cyclic extension and windowing” according to Q4-180423-C29 (Issue 10.71).

2. Revision of the text on §11.2.2.5 “OLR commands and responses” according to Q4-180423-C31R1 (Issue 10.73). Further revised according to WD1018 (Issue 10.79).

3. Revision of the text of §13.2.1.1 “SRA procedures” according to Q4-180423-C20R1 (Issue 10.70). Further revised according to Q4-180423-C32R1 (Issue 10.73). Further revised according to WD1018 (Issue 10.79).

4. Revision of the text of §13.3.1.1.1.1 “FRA time window (fra-time)” according to Q4-180423-C30R1 (Issue 10.72).

5. Replacing BRMC with NRMC in §9.5 according to Q4-180625-C34 (Issue 10.75).

6. Revision of the text of §11.3.1.1 “Near end anomalies” according to Q4-180827-C02R1 (Issue 10.74).

7. Revision of the text of §11.4.4.7.3.3 “INM inter arrival time histogram primitives” according to Q4-180827-C17R1 (Issue 10.78.1).

8. Revision of the text of §11.4.1.2.2 “Signal-to-noise ratio per subcarrier (SNR-ps)” according to Q4-180827-WD02R1 (Issue 10.76.1).

9. Revision of the text of §12.3.4.2.1 “O-MSG 1”, §12.3.4.2.2 “R-MSG 2”, and §11.2.2.11 “Management counter read commands responses” according to WD1015 (Issue 10.77.1.1).

Amendment 6 includes:

1. Addition of new §5.6 “Reconfiguration of the line” according to Q4-180423-WD04R1 (Issue 20.32.76). Further revised according to Q4-180625-C02R1 (Issue 20.32.82). Further revised according to Q4-180827-WD03R2 (Issue 20.32.88).

2. Revision of the text of §10.2.2.1 “Sync symbol encoder” according to Q4-180827-C26R1 (Issue 20.57.2). Further revised according to C1040R1 (Issue 20.57.3).

3. Revision of the text of §10.3.2.5.2 “Time identification control parameters” according to Q4-180827-C26R1 (Issue 20.57.2). Further revised according to C1040R1 (Issue 20.57.3).

4. Revision of the text of §11.1.1 “γ\_MGMT interface” according to Q4-180423-WD04R1 (Issue 20.32.76).

5. Revision of the text of §11.3.1.1 “Near-end anomalies” according to Q4-180423-WD04R1 (Issue 20.32.76). Further revised according to Q4-180625-C02R1 (Issue 20.32.82). Moved to Annex R.5 according to Q4-180827-WD03R2 (Issue 20.32.88).

6. Revision of the text of §12.3.2 “G.994.1 handshake phase” according to Q4-180827-C26R1 (Issue 20.57.2). Further revised according to C1040R1 (Issue 20.57.3). Further revised according to WD0964 (Issue 20.62.1).

7. Revision of the text of §12.3.3.2.1 “O-SIGNATURE” according to C1040R1 (Issue 20.57.3).

8. Revision of the text of §12.3.4.2.1 “O-MSG 1”and §12.3.4.2.2 “R-MSG 2” (Issue 20.32.90).

9. Addition of text for new Annex R “Showtime reconfiguration” according to WD0421 (Issue 20.32.62). Revised according to Q4-180423-WD04R1 (Issue 20.32.76). Further revised according to Q4-180625-C02R1 (Issue 20.32.82). Further revised according to Q4-180827-WD03R2 (Issue 20.32.88). Further revised according to WD0885 (Issue 20.32.89).

10. Addition of text for new Annex V “Targeted generalized vectoring (TGV)” according to Q4-180423-C28R1 (Issue 20.49.9.1). Revised according to Q4-180827-C25R1 (Issue 20.49.13). Revised according to WD1042 (Issue 20.49.14).

Changed DTA to iDTA throughout as appropriate (AMD.5 LC comment resolution).

**ITU-T G.9701 (2014) Amd.5 “Fast access to subscriber terminals (G.fast) - Physical layer specification: Amendment 5”** supports coordinated dynamic time assignment (cDTA).

**ITU-T G Suppl.62 (02/2018) “Gfast certification"** provides information regarding the Gfast certification of equipment implementing ITU-T Recommendations G.9700 and G.9701.

**ITU-T Technical Paper NT software upgrade for one image**: Annex S of [ITU-T G.9701] provides means to upgrade the software of an NT where the executable software can be upgraded with a single vendor-specific image file. This software management process requires the support of two images, however, not all NTs have the capability to store two images. This Technical Paper describes a software upgrade procedure for NTs with one image only.

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

**ITU-T G.984.5 (2014) Amd.1 “Gigabit-capable passive optical networks (G-PON): Enhancement band - Amendment 1”** includes:

1) New Appendix IV describing the examples for a Multi-PON Module

2) Method for CEx isolation and directivity calculations in multi-interferer scenarios in Appendix III and application case in Appendix I

3) New Appendix V providing analysis on coexistence method using a 2:N splitter.

**ITU-T G.988 Amd.1 “ONU management and control interface (OMCI) specification: Amendment 1”** contains various updates to ITU-T G.988 (2017). This amendment contains editorial corrections and clarifications along with the following substantive changes and extensions to PON OMCI related to bonded ONUs, filtering on DHCP for admission control purposes, synchronization alarm support, ONU timezone offset and ONU manufacturing data.

**ITU-T G.989.2 (revised) “40-Gigabit-capable passive optical networks 2 (NG PON2): Physical media dependent (PMD) layer specification”** (under approval) specifies the physical media dependent (PMD) layer requirements for a passive optical network (PON) system with a nominal aggregate capacity of 40 Gbit/s in the downstream direction and 10 Gbit/s in the upstream direction, hereinafter referred to as NG-PON2. NG-PON2 is a flexible optical fibre access network capable of supporting the bandwidth requirements of mobile backhaul, business and residential services. Furthermore, this Recommendation describes optional configurations, to extend beyond this nominal capacity, as the ITU-T G.989 series of Recommendations allows for multiple upstream and downstream line rates.

This Recommendation specifies the characteristics of hybrid time and wavelength division multiplexing (TWDM) channels, referred to as TWDM PON. The characteristics of optional, tunable point-to-point wavelength overlay channels are also described, referred to as point-to-point wavelength division multiplexing (PtP WDM) PON.

The TWDM PON described in this Recommendation represents a further development from the systems described in the ITU-T G.984 and ITU-T G.987 series of Recommendations. To the greatest extent possible, this Recommendation retains the requirements of ITU-T G.984.1 and ITU-T G.987.1 to ensure maximal reuse of existing technology and compatibility with deployed optical access systems and optical fibre infrastructure.

Edition 2.0 continues the maintenance and evolution of physical media dependent (PMD) layer specification.

**ITU-T G.989.3 Amd2 “40-Gigabit-capable passive optical networks (NG PON2): Transmission Convergence (TC) layer specification”** (under approval) continues the evolution of NG-PON2 Transmission Convergence (TC) layer, introducing TWDM channel bonding, making additions and changes to the PLOAM channel, providing DBA enhancements, and performing regular specification maintenance.

**ITU-T G.9807.2 Amd1 “10 Gigabit-capable symmetrical passive optical networks (XG(S)-PON): Reach extension”** contains necessary additional details and clarifications for the Recommendation, and provides regular specification maintenance.

**ITU-T G Suppl. 63 (02/2018) “ITU-T G.989.3 TC layer operating in ITU T G.987.3 or ITU-T G.9807.1 TC layer mode”** describes how a flexible G.989.3 TC layer implementation can be used to support a G.987.3 or G.9807.1 PON.

G.989.3 was largely derived from G.987.3. The G.9807.1 Appendix C TC layer specification was derived from G.989.3, with G.9807.1 Appendix II describing this derivation in detail. G.9807.1 also specifies that a G.9807.1 compliant OLT will interwork with a G.987.3 compliant ONT.

It should be evident from this chain of derivation that a flexible TC layer implementation that supports G.989.3 can support G.9807.1 or G.987.3 operation. This supplement describes the implementation flexibility required.

**ITU-T G Suppl. 64 (02/2018) “PON transmission technologies above 10 Gb/s per wavelength”**: The line rate per wavelength in the existing PON systems, such as GPON, XG(S)-PON, TWDM-PON, is up to 10Gb/s. For High-speed PON, line rate per wavelength will exceed 10Gb/s, in order to provide higher bandwidth capability for growing services’ requirement.

This supplement describes characteristics of optical transmission above 10 Gb/s per wavelength between the optical line termination (OLT) and the optical network unit (ONU). It reviews challenges of transmission above 10 Gb/s in optical access. A set of assumed system requirements is developed as a basis for discussion of candidate technologies. Some aspects considered include signal modulation selection, optical transmitter design, optical receiver design, and wavelength dependency. Coexistence with other optical access systems is also investigated as a key factor of wavelength planning.

**I.1.3 Optical fibres**

**ITU-T G.650.1 (revised) “Definitions and test methods for linear, deterministic attributes of single-mode fibre and cable”** contains definitions of the linear, deterministic parameters of single-mode optical fibres and cables. It also contains both, reference test methods and alternative test methods for characterizing these parameters. These test methods are suitable mainly for factory measurements of the linear, deterministic attributes of single-mode fibres and cables. Some of the test methods may also be used to characterize discrete optical components.

**ITU-T G.651.1 (revised) “Characteristics of a 50/125 µm multimode graded index optical fibre cable for the optical access network”** recommends a quartz multimode fibre to be used for the access network in specific environments. These environments are multi-tenant building sub-networks in which broadband services have to be delivered to individual apartments. The recommended multimode fibre supports the cost-effective use of 1 Gbit/s Ethernet systems over link lengths up to 550 m, usually based upon the use of 850 nm transceivers.

The recommended fibre type is an improved version of the well-known 50/125 µm multimode graded-index fibre as recommended in ITU-T Recommendation G.651. Its cost effective use is very common in datacom systems applied in enterprise buildings throughout the world for quite a number of years.

**ITU-T G.672 (revised) “Characteristics of multi-degree reconfigurable optical add/drop multiplexers”** deals with the classification and the characteristics of multi-degree reconfigurable optical add/drop multiplexers (MD-ROADMs), including two-degree ROADMs. Some examples of MD-ROADM configurations and applications are given in the appendices.

Photonic cross connects (PXC), which are a special category of MD-ROADM characterized by a unique switching matrix (see Figures 7-4, 7-5, 7-6, 7-7, 9-2, I.4 of [ITU-T G.680]) are outside the scope of this Recommendation.

**ITU-T G.698.2 (revised) “Amplified multichannel dense wavelength division multiplexing applications with single channel optical interfaces”** provides optical parameter values for physical layer interfaces of dense wavelength division multiplexing (DWDM) systems primarily intended for metro applications which include optical amplifiers. Applications are defined using optical interface parameters at the single-channel connection points between optical transmitters and the optical multiplexer, as well as between optical receivers and the optical demultiplexer in the DWDM system. This Recommendation uses a methodology which does not specify the details of the optical link, e.g., the maximum fibre length, explicitly. This version of this Recommendation includes unidirectional DWDM applications at 100 Gbit/s with 100 GHz and 50 GHz channel frequency spacing.

**ITU-T G.9803 “Radio over fiber systems”** defines fundamental architecture and requirements for radio over fiber system and specifies radio over fiber transmission systems suitable for access network and radiolocation applications.

**ITU-T L.108 “Optical fibre cable elements for microduct blowing-installation application”** describes characteristics, construction and test methods for microduct fibre units and microduct cables to be used with the blowing installation technique. The cable characteristics required for a cable to perform appropriately are described. Also, a method is described for determining whether or not the cable has the required characteristics. The required conditions may differ according to the installation environment; detailed test conditions must be agreed upon between a user and a manufacturer for the environment in which a cable is to be used.

**ITU-T L.109 (revised) “Construction of optical/metallic hybrid cables”** describes cable construction and provides guidance for the use of this type of cable. Technical requirements may differ according to the installation environment. Environmental issues and test methods for cable characteristics are described in other L-series Recommendations.

**ITU-T L.156 “Air-assisted installation of optical fibre cable”** describes air-assisted methods for installation of optical fibre cables in ducts. These methods can be used to install microcables into microducts, or largercables into ducts or conduits. Installing conditions and equipment required should be different in each case.

**ITU-T L.163 “Criteria for optical fibre cable installation with minimal existing infrastructure”** describes criteria for the installation of optical fibre cables defined in [ITU-T L.110] in remote areas with lack of usual infrastructure for installation including the procedures of cable-route planning, cable selection, cable-installation scheme selection, cable tension and temperature consideration, and the handling, bend protection and river/lake closing of the cable together with pilot tests and training for installation.

This Recommendation also describes how to mitigate the considerable risks and/or issues to which the optical fibre cable may be exposed when infrastructures are minimal during installation, maintenance and operation procedures.

**ITU-T L.207 “Passive node elements with automated ID tag detection”** focuses on hardware aspects on this type of passive node elements and to describe the general features, characterization and performance specifications for node elements with automated ID tag detection, including the environmental conditions, functional requirements, performance requirements, and mechanical and electrical/optical interface requirements. A product characterization checklist is included in the Appendix III.

**ITU-T L.314 (revised) “Optical fibre identification for the maintenance of optical access networks”** deals with important considerations with respect to the requirements for an optical fibre identification technique used for construction and maintenance work in optical access networks by detection of leaky light waves.

**ITU-T L.315 “Water detection in underground closures for the maintenance of optical fibre cable networks with optical monitoring system”** describes the methodology for water detection in splice closures/cabinets, the fundamental requirements for a water sensor and technical considerations as regards the OTDR based water ingress monitoring and location system design.

**ITU-T G Suppl. 59 (02/2018 - revised)** provides guidance regarding the long term reliability of cabled optical fibres. This Supplement uses currently accepted models combined with current experience to describe items that can impact the performance of an optical fibre over time. The document describes ''optical reliability'' for fibres, ''mechanical reliability'' for fibres and describes how optical cables impact these properties.

**ITU-T G.suppl.40 (revised) “Optical fibre and cable Recommendations and standards guideline”** provides information on the background and specifications used in the development of optical fibre and cable ITU-T Recommendations such as Recommendations ITU-T G.651.1, ITU T G.652, ITU-T G.653, ITU-T G.654, ITU-T G.655, ITU T G.656, ITU-T G.657 and L series Recommendations. It also contains information used in the development of test method Recommendations such as Recommendations ITU-T G.650.1, ITU T G.650.2 and ITU-T G.650.3. Moreover, this Supplement maps ITU T documents to optical fibre and cable standards developed under IEC.

**ITU-T G Suppl. 41 (02/2018 - revised)** describes design considerations for repeatered, repeaterless and optically amplified systems supporting SDH and OTN signals in optical submarine cable systems.

**ITU-T G.suppl.42 (revised) “Guide on the use of the ITU-T Recommendations related to optical fibres and systems technology”** contains a functional grouping of the ITU-T Recommendations on optical fibres and systems technology (e.g., optical fibres and cables, physical optical interfaces and optical fibre submarine cable systems).

An introduction to each category with more than one Recommendation outlines the subjects which are common to the category.

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. There are also cross-references to the other Recommendations dealing with related issues.

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.

**ITU-T Technical Paper “ Guide on the use of ITU-T L-series Recommendations related to optical technologies for outside plant”**

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

**ITU-T G.709/Y.1331 (2016) Amd.2 “Interfaces for the optical transport network (OTN): Amendment 2”** adds the OTN mappings for the IEEE 802.3 200Gbit/s and 400Gbit/s Ethernet client signals, adds the eSSM message type for the OSMC, specifies OTSiG-O transport over the FlexO-LR SOTUm interface, and adds reference to two FEC options for OTUk signals. It also provides clarification regarding interfaces where OTUk and OTUCn Section Monitoring overhead is optional, and elaborates on OCh and OTiSA maintenance signals.

**ITU-T G.709.1/Y.1331.1 (revised) “Flexible OTN short-reach interfaces”** specifies a set of flexible interoperable short-reach OTN interface over which an OTUCn (n ≥ 1) is transferred, using bonded interfaces. The Recommendation defines the frame structure for FlexO using the RS(544,514) FEC.

**ITU-T G.709.1/Y.1331.1 Amd.1 “Flexible OTN short-reach interfaces: Amendment 1”** (under approval) contains editorial changes to the second edition (06/2018) of ITU-T Recommendation G.709.1/Y.1331.1, related to the:

- FEC specification enhancements to align to G.709 format

- Replacement of PHY terminology to FlexO instances

- Fixed typos in clause 11.6.1

- Fixed typo in AM value of Table 9-2.

**ITU-T G.709.2 “OTU4 long-reach interface”** specifies functions for an OTU4 long reach interconnect application. The text of this recommendation is intentionally kept separate from the main G.709 text and from other adjoints like the G.709.1 text.

**ITU-T G.709.3 “Flexible OTN long-reach interface”** defines flexible OTN (FlexO) long-reach interfaces that support bonding (i.e. grouping) of multiple of these interfaces such that an OTUCn (n ≥ 1) can be transferred via one or more optical tributary signals (OTSi) over one or more physical interfaces. The Recommendation specifies the frame structure for FlexO long reach interfaces using forward error correction codes with a higher coding gain than used in the FlexO short reach interfaces that are specified in G.709.1.

**ITU-T G.709/Y.1331 (2016) Amd.3 “Interfaces for the optical transport network (OTN): Amendment 3”** contains extensions to the fifth edition (06/2016) of ITU-T Recommendation G.709/Y.1331, related to the:

* Addition of interconnection of Ethernet UNI and FlexE Group UNI in two administrative domains (7.5, Appendix XIV).
* Addition of 50GBASE-R mapping into ODUflex (2, 17.13.3, Annex J).
* Update of FlexE terminology and calendar slot descriptions with FlexE 2.0 IA (2, 17.11, 17.12).
* Redefine the OP overhead bit in bit 1 of JC6 as a RES overhead (20.4, 20.4.3.1, 20.5).
* Replacement of references to IEEE Std. 802.3-2015, 802.3by and 802.3bs by a reference to IEEE Std 802.3-2018 (2, 17.13.1, 17.13.2, Annex J, Annex K).
* Addition of ODU4 and ODUflex(25G/50G/200G/400GBASE-R) rows to Table 7-9 (7.4).
* Addition of 25G, 50G, 200G and 400GBASE-R rows to Table IX.1 (Appendix IX).
* Addition of ODUflex(25G/50GGBASE-R, FC-1600/3200) rows to Table X.1 (Appendix X).

**ITU-T G.798 (2017) Amd.1 “Characteristics of optical transport network hierarchy equipment functional blocks”** contains text modifications and additions:

* moving the ODUkP to Ethernet MAC layer and Ethernet Reconciliation sublayer adaptation functions from ITU-T G.8021 to ITU-T G.798.
* to support adaptation of ODUkP to Ethernet Coding sublayer for 25 Gb/s, 200 Gb/s and 400 Gb/s Ethernet signals.
* to align with ITU-T G.8023.
* replacing Appendix VIII to align with ITU-T G.872 and G.873.1.

**ITU-T G Suppl. 58 (02/2018 - revised) “Optical transport network module framer interfaces”** describes several interoperable component-to-component multilane interfaces (across different vendors) to connect an optical module (with or without digital signal processor (DSP)) to a framer device in a vendor's equipment supporting 40G, 100G or beyond 100G optical transport network (OTN) interfaces.

Only the structure of the 11G, 28G or 56G physical lanes of the different OTN module framer interface (MFI) examples is provided in this Supplement. For their electrical characteristics, the OIF-CEI IA specifications can be used. This Supplement relates to Recommendation ITU-T G.709/Y.1331.

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

**I.1.5 Optical transmission systems**

**ITU-T G.695 (revised) “Optical interfaces for coarse wavelength division multiplexing applications”** provides optical parameter values for physical layer interfaces of coarse wavelength division multiplexing (CWDM) applications with up to 16 channels and up to 50 Gbit/s. Applications are defined using two different methods, one using multichannel interface parameters and the other using single-channel interface parameters. Both unidirectional and bidirectional applications are specified. In this version of this Recommendation, an application code for 4 channel PAM4 50G short-haul black box applications has been added, which is suitable for carrying FOIC2.4 (200G striped across four physical lanes).

**ITU-T G.698.4 “Multichannel bi-directional DWDM applications with port agnostic single-channel optical interfaces”** provides optical parameter values for physical layer interfaces of dense wavelength division multiplexing (DWDM) systems primarily intended for metro applications, where the tail-end transmitters have the capability to automatically adapt their DWDM channel frequency to the optical demultiplexer/optical multiplexer (OD/OM) or optical add-drop multiplexer (OADM) port. Applications are defined using optical interface parameters and values for single-channel and multichannel interfaces of multichannel DWDM optical systems in point-to-point applications. This Recommendation uses a system architecture comprising a head end, connecting to the tail-end equipment (TEE) through a black link. The head end houses a set of transmitters and receivers and an OD/OM. A single bidirectional fibre is used to connect the head end to the black link OD/OM or OADM. The connection between the OD/OM/OADM and the TEE is also bidirectional. The initial version of this Recommendation includes DWDM applications up to 10 Gbit/s with channel frequency spacing of 50 GHz and 100 GHz.

**ITU-T G.709/Y.1331 (2016) Amd.3 “Interfaces for the optical transport network (OTN): Amendment 3”** (under approval) contains extensions to the fifth edition (06/2016) of ITU-T Recommendation G.709/Y.1331, related to the:

- Addition of interconnection of Ethernet UNI and FlexE Group UNI in two administrative domains (7.5, Appendix XIV).

- Addition of 50GBASE-R mapping into ODUflex (2, 17.13.3, Annex J).

- Update of FlexE terminology and calendar slot descriptions with FlexE 2.0 IA (2, 17.11, 17.12).

- Redefine the OP overhead bit in bit 1 of JC6 as a RES overhead (20.4, 20.4.3.1, 20.5).

- Replacement of references to IEEE Std. 802.3-2015, 802.3by and 802.3bs by a reference to IEEE Std 802.3-2018 (2, 17.13.1, 17.13.2, Annex J, Annex K).

- Addition of ODU4 and ODUflex(25G/50G/200G/400GBASE-R) rows to Table 7-9 (7.4).

- Addition of 25G, 50G, 200G and 400GBASE-R rows to Table IX.1 (Appendix IX).

- Addition of ODUflex(25G/50GGBASE-R, FC-1600/3200) rows to Table X.1 (Appendix X).

**ITU-T G.709.1/Y.1331.1 (2018) Amd.1 “Flexible OTN short-reach interfaces: Amendment 1”** (under approval) contains editorial changes to the second edition (06/2018) of ITU-T Recommendation G.709.1/Y.1331.1, related to the:

- FEC specification enhancements to align to G.709 format

- Replacement of PHY terminology to FlexO instances

- Fixed typos in clause 11.6.1

- Fixed typo in AM value of Table 9-2.

**ITU-T G.709.3/Y.1331.3 Amd.1 “Flexible OTN long-reach interfaces: Amendment 1”** (under approval) contains extensions to the first edition (06/2018) of ITU-T Recommendation G.709.3/Y.1331.3, related to the:

- Enhancement of the FEC Block Alignment specification (11.3.1)

- Addition of 200G and 400G FlexO with Concatenated FEC (7, 7.2, 11.3, 11.3.1, 11.3.2, 12, 13, 14, 15, Annex C, Annex D, Appendix I, Appendix II)

- Deletion of m and n and addition of Z conventions (5).

**ITU-T G.959.1 (revised) “Optical transport networks physical layer interfaces”** provides physical layer inter-domain interface (IrDI) specifications for optical networks which may employ wavelength division multiplexing (WDM). The IrDIs within the optical transport network (OTN) are provided by unidirectional, point-to-point, single and multichannel line systems. Their primary purpose is to enable transversely compatible interfaces to span the boundary between two administrative domains. The IrDI specifications include intra-office, short-haul and long-haul applications, without line amplifiers. This version of this Recommendation includes multichannel interfaces suitable for FOIC2.4 (200G striped across four physical lanes) and FOIC4.8 (400G striped across eight physical lanes).

**ITU-T G.808 (2016) Amd.1 “Terms and definitions for network protection and restoration”** provides terms, definitions and abbreviations used in Recommendations that describe network protection and restoration. It contains a list of the definitions and abbreviations introduced in Recommendations associated with network protection and restoration. This Recommendation can be considered to be a companion to Recommendations ITU T G.870/Y.1352, ITU T G.8001/Y.1354, ITU T G.8081/Y.1353 and ITU T G.8101/Y.1355. The goal of this Recommendation is to be a single normative source for terms in this subject area. Amendment 1 to Recommendation ITU-T G.808 clarifies the terms used to describe the time intervals related to protection switching (clause 3.2.9).

**ITU-T G.8251 (revised) The control of jitter and wander within the optical transport network (OTN)”** specifies the maximum network limits of jitter and wander that shall not be exceeded and the minimum equipment tolerance to jitter and wander that shall be provided at any relevant interfaces which are based on the optical transport network (OTN).

The requirements for the jitter and wander 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.

**I.1.6 Transport network control aspects**

**ITU-T G.7701 (2016) Amd.1 “Common control aspects - Amendment 1”** describes concepts that are common to both software defined networking (SDN) controller and automatically switched optical network (ASON) control approaches, including common aspects of the interaction between the control functions, management functions and transport resources.

**ITU-T G.7702 “Architecture for SDN control of transport networks”** describes the reference architecture for Software Defined Networking (SDN) control of transport networks applicable to both connection-oriented circuit and/or packet transport networks. This architecture is described in terms of abstract components and interfaces that represent logical functions (abstract entities versus physical implementations).

**ITU-T G.7711 (revised) “Generic protocol-neutral management Information Model for Transport Resources”** specifies a core information model (IM) of transport resources. The IM is applicable to the management and control of transport networks regardless of whether they utilize traditional operation support system (OSS) management, an automatically switched optical network (ASON) control plane or a software-defined networking (SDN) controller to configure transport connectivity. The model is also applicable regardless of the technology of the underlying transport network. Furthermore, the applicability of the IM is independent of the ultimate protocols that will be used in the management and control interfaces.

The 2016 edition of this Recommendation has changed the document structure, added an «experimental» address structure to the foundation model, changed the name of TopologicalEntity to ForwardingEntity, incorporated ForwardingConstruct (FC) under ForwardingEntity and considers FC as closely related to topology, added the resilience model, added the equipment model and added the Specification model.

The 2018 edition of this Recommendation has enhanced the Forwarding & Termination, Foundation, Topology, Resilence, Equipment, and Specification models, and added the Control, Operations Pattern, Processing Construct, Constraint Domain models, and also updated the model description Appendixes. Appendix IV.6 “Synchronization management model” and IV.7 “Media management model” have been remove from this edition as they are being covered by separate Recommendations.

**ITU-T G.875 (revised) “Optical transport network: Protocol-neutral management information model for the network element view”** (under approval) 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 2012 revision of this Recommendation updated the management information model to support the management of the new transport functions that were introduced in the 2010 revision of Recommendation ITU-T G.798 and also to support the management requirements enhancement introduced in the 2010 revision of Recommendation ITU-T G.874.

Amendment 1 enhanced the model to cover delay measurement (DM), automatic protection switching (APS) configuration, tributary slot configuration, and optical data channel data (ODU) type and rate configuration, and to remove the counting of incoming alignment errors (IAEs) and backward incoming alignment errors (BIAEs).

Amendment 2 added: (1) the use of an organizationally unique identifier (OUI) to the description of the attributes selectedApplicationIdentifier and supportableApplicationIdentifierList; and (2) sub-classes the OTN Current Data and History Data object classes from the ITU-T Q.822 Current Data and History Data object classes.

The 2016 revision of this Recommendation has incorporated Amendment 1 and Amendment 2, and in addition the following updates: (1) changes the UML modeling tool from RSA to open source Papyrus tool; (2) updates the ITU-T G.874.1 information model to align with the ITU-T G.7711 v2.0 Core information model; (3) drops subclassing the TP classes from ITU-T M.3160; and (4) supports the additional management requirements in Recommendation ITU-T G.874.

The 2018 revision of this Recommendation up-versions the UML model tool to Papyrus v3.2.0 and the profile to v0.2.13, updates the object class mapping figures to align with G.798, updates the model for ODU, OTU, FlexO, OTSiG-O, OCh-O, OMS-O, & OTS-O, and adds Annex A for OTN Spec Model.

**ITU-T G.8051/Y.1345 (revised) “Management aspects of the Ethernet Transport (ET) capable network element”** addresses management aspects of the Ethernet transport network element containing transport functions of one or more of the layer networks of the Ethernet transport network. The management of the Ethernet layer networks is separable from that of its client layer networks so that the same means of management can be used regardless of the client. The management functions for fault management, configuration management, performance monitoring, and security management are specified.

The 2009 Revision of this Recommendation has added the management of additional transport functions that have been introduced in the 2009 Revision of Recommendation ITU T G.8021/Y.1341.

The 2013 Revision of this Recommendation has added the management of additional functions, including: CSF; proactive loss measurement using LMM/LMR; proactive delay measurement using DMM/DMR and 1DM; synthetic loss measurement using SLM/SLR and 1SL (proactive and on-demand); PM requirements on PDU generation type, Message period, Measurement interval, Repetition period, Start time, Stop time and Session duration; and PM data collection requirements.

The 2015 Revision of this Recommendation has updated the management information (MI) signals for the ETHx\_FT function in clause 8.5, the MI signals for the ETHx/MCC function in clause 8.6, the one-way synthetic loss measurement (1SL) MI signal for the ETHDe\_FT\_Sk function in clause 8.8, and the on-demand and proactive loss measurement requirements in clause 10.2.The 2018 Revision of this Recommendation has updated the fault cause persistency function at ETH-C function for ring protection, the configuration management for protection switching and connection functions. And, in align with ITU T G.8021/Y.1341, this revision has removed both fault management functions and the management information (MI) signals that are related to ETYn\_TT, ODUkP-X-L/MT\_A, and ETYn/ETH\_A. This revision has also removed theMI signals to activate processes in Adaptation functions (i.e. MI\_Active).

**ITU-T G.8052/Y.1346 (revised) “Protocol-neutral management information model for the Ethernet transport capable network element”** (under approval) contains the protocol neutral UML information model for Ethernet transport network (NE) management. The model is based on the Ethernet equipment functions specified in Recommendation ITU-T G.8021/Y.1341, generic management requirements in Recommendation ITU-T G.7710/Y.1701, and Ethernet specific management requirements in Recommendation ITU T G.8051/Y.1345.

The 2016 revision of this Recommendation changes the UML modelling tool from RSA to open source Papyrus tool, updates the Recommendation ITU-T G.8052/Y.1346 information model to align it with the Recommendation ITU-T G.7711/Y.1702 v2.0 Core information model, drops subclassing of the TP classes from Recommendation ITU-T M.3160, and supports the additional management requirements in Recommendation ITU-T G.8051/Y.1345.

The 2018 revision of this Recommendation up-versions the UML model tool to Papyrus v3.2.0 and the profile to v0.2.13, deletes ODUkP-X-L (from the CsfRdiFdiEnableSink\_Pac, CsfRdiFdiEnableSource\_Pac, and CsfReportSink\_Pac), replace ETY termination points with ETHnull termination points, removes ODUkp/ETH\_A and ODU2P/ETHPP-OS\_A, adds Annex A for the Ethernet Spec model.

**ITU-T G.8151/Y.1374 (revised) “Management aspects of the MPLS-TP network element”** addresses management aspects of the multi-protocol label switching (MPLS) transport profile (MPLS-TP) capable network element containing transport functions of one or more of the layer networks of the MPLS-TP network. The management of the MPLS-TP layer networks is separable from that of its client layer networks so that the same means of management can be used regardless of the client. The management functions for fault management, configuration management, performance monitoring and security management are specified.

This Recommendation aligns with the MPLS-TP architecture and requirements jointly developed by IETF and ITU-T and provides the specification for managing MPLS-TP network elements (NEs) that support the operations, administration, maintenance (OAM) protocol neutral equipment functionality as defined in Recommendation ITU T G.8121/Y.1381, G.8121.1/Y.1381.1, and G.8121.2/Y.1381.2.

**ITU-T G.8152/Y.1375 (revised) “Protocol-neutral management information model for the MPLS-TP network element”** (under approval) contains the protocol neutral unified modelling language (UML) model for multi-protocol label switching – transport profile (MPLS-TP) network element (NE) management.

This Recommendation provides a representation of the MPLS-TP technology using the methodologies that have been used for other transport technologies (e.g., SDH, OTN and Ethernet).

The 2018 revision of this Recommendation up-versions the UML model tool to Papyrus v3.2.0 and the profile to 0.2.13. Updates the model to add the MEP proactive measurement MI, MEP configuration MI, and MIP configuration MI, add the Spec model for MPLS-TP model, replace the G.8152NE and MT\_NE by the MMPLS-TP Constraint Domain, and MT\_SubnetworkProtectionGroup specifies the FcSwitch, and MT\_CrossConnection specifies the ForwardingConstruct.

**I.1.7 Ethernet over transport networks**

**ITU-T G.998.2 (revised) “Ethernet-based multi-pair bonding”** describes a method for bonding of multiple digital subscriber lines (DSL) for Ethernet transport. This Recommendation can support SHDSL, VDSL and ADSL transport as well as future xDSL technologies as they emerge. This Recommendation builds on the IEEE 802.3ah-2004 methods and extends Ethernet transport over other xDSL technologies, including ADSL. The Recommendation does not describe the details of the specific xDSL transport technology. Rather, it focuses on the aspects of the PCS layer modifications required for bonding. This version of the Recommendation integrates all the previous amendments and corrigenda with the 2005 version of Recommendation ITU-T G.998.2. This version of Recommendation ITU-T G.998.2 corrects or adds the following functionality:

• Amendment 1 addresses differential delay for aggregation of ADSL2plus links and of VDSL2 links.

• Amendment 2 includes new functionality for discovery/aggregation and pair management at the bonding layer.

• Amendment 3 includes a new clause 9 defining "intentional temporary shutdown of some bonded lines" (new functionality).

• Amendment 4 includes a new Annex D defining ''Ethernet bonding with DTU encapsulation'' (new functionality).

• Corrigendum 1 fixes an occurrence of inconsistency.

**ITU-T G.998.4 (revised) “Improved impulse noise protection for digital subscriber line (DSL) transceivers”** specifies techniques beyond those defined in the existing ITU-T digital subscriber line (DSL) Recommendations ITU-T G.992.3, ITU-T G.992.5 and ITU T G.993.2 to provide enhanced protection against impulse noise or to increase the efficiency of providing impulse noise protection (INP).

This version of this Recommendation integrates all of the previous amendments and corrigenda with the 2015 version 2.0 of Recommendation ITU-T G.998.4. This version of Recommendation ITU-T G.998.4 corrects or adds the following functionality:

– Valid values for RS FEC (corrigendum);

– Maximum error-free throughput (EFTR\_max) (amendment)

– Minimum/accumulated/maximum NDR reporting with disabled retransmission (amendment).

**ITU-T G.8011/Y.1307 (revised) “Ethernet service characteristics”** describes a framework for defining network-oriented characteristics of Ethernet services based on MEF Forum (MEF) specifications. The framework is supported by the modelling of Ethernet layer networks described by ITU-T and MEF. The service definition, service attributes and operation, administration and maintenance (OAM) introduced in this framework are used to create numerous specific Ethernet services.

**ITU-T G.8013/Y.1731 Amd.1 “Operation, administration and maintenance (OAM) functions and mechanisms for Ethernet-based networks - Amendment 1”** provides:

– Modification to “Frame delay” in clause 8

– Updates to clauses 2 and 3, and to the Bibliography

**ITU-T G.8021/Y.1341 “Characteristics of Ethernet transport network equipment functional blocks”** specifies both the functional components and the methodology that should be used in order to specify the Ethernet transport network functionality of network elements; it does not specify individual Ethernet transport network equipment.

**ITU-T G.8023 “Characteristics of equipment functional blocks supporting Ethernet physical layer and FlexE interfaces”** (under approval) specifies both the functional components and the methodology that should be used in order to specify the Ethernet physical layer and Flex Ethernet interfaces.

**ITU-T G.8031/Y.1342 (2015) Amd.1 “Ethernet linear protection switching- Amendment 1”** describes the specifics of linear protection switching for Ethernet VLAN signals. Included are details pertaining to ETH linear protection characteristics, architectures and the automatic protection switching (APS) protocol. The protection scheme considered in this Recommendation is:

– VLAN-based Ethernet subnetwork connection linear protection with sublayer monitoring.

**I.1.8 MPLS over transport networks**

**ITU-T G.8121/Y.1381 (revised) “Characteristics of MPLS-TP equipment functional blocks”** specifies both the functional components and the methodology that should be used in order to specify multi-protocol label switching – transport profile (MPLS-TP) layer network functionality of network elements; it does not specify individual MPLS-TP network equipment as such.

**ITU-T G.8121.1/Y.1381.1 (revised) “Characteristics of MPLS-TP equipment functional blocks supporting ITU T G.8113.1/Y.1372.1 OAM mechanisms”** specifies both the functional components and the methodology that should be used in order to specify multi-protocol label switching – transport profile (MPLS-TP) layer network functionality of network elements based on the protocol neutral constructs defined in Recommendation ITU-T G.8121 and on the tools defined in Recommendation ITU T G.8113.1/Y.1372.1.

**ITU-T G.8121.2/Y.1381.2 (revised) “Characteristics of MPLS-TP equipment functional blocks supporting ITU T G.8113.2/Y.1372.2 OAM mechanisms”** specifies both the functional components and the methodology that should be used in order to specify multi-protocol label switching – transport profile (MPLS-TP) layer network functionality of network elements based on the protocol neutral constructs defined in Recommendation ITU T G.8121/Y.1381 and on the tools defined in Recommendation ITU T G.8113.2/Y.1372.2.

**ITU-T G.8131 Amd.3 “Linear protection switching for MPLS transport profile - Amendment 3”** provides updates on the following:

– Initialization behaviour,

– State transition modification, and

– Operation related to state transition table lookup.

**I.1.9 Synchronization and timing**

**ITU-T G.7721 (revised) “Management requirement and information model for synchronization”** provides the management requirements and a protocol-neutral management information model for managing network elements and network of synchronization.

**ITU-T G.8260 (2015) Amd.2 “Definitions and terminology for synchronization in packet networks: Amendment 2”** provides the following update:

− Added definition of relative time error in clause 3.1.24

− Addition of clause I.3.1.4 to Appendix I describing packet selection windows

− Modification to clause I.5 to align with terminology in clause I.3.1.4.

**ITU-T G.8262 (revised) “Timing characteristics of synchronous equipment slave clock”** outlines requirements for timing devices used in synchronizing network equipment that uses the physical layer to deliver frequency synchronization. This Recommendation defines the requirements for clocks, e.g., bandwidth, frequency accuracy, holdover and noise generation.

**ITU-T G.8262.1/Y.1362.1 “Timing characteristics of enhanced synchronous equipment slave clock”** (under approval) outlines requirements for timing devices used in synchronizing network equipment that uses the physical layer to deliver frequency synchronization. This Recommendation defines the requirements for clocks, e.g., bandwidth, frequency accuracy, holdover and noise generation.

**ITU-T G.8264/Y.1364 (2017) Amd.1 “Distribution of timing information through packet networks - Amendment 1”** makes changes to incorporate the Enhanced Primary Reference Clock (ePRC) into the tables of SSM codes for Synchronous Ethernet.

**ITU-T G.8266/Y.1376 (2016) Amd.1 “Timing characteristics of telecom grandmaster clocks for frequency synchronization - Amendment 1”** provides the following updates:

- Changes the scope to include the GM with embedded PRTC

- Changes Clause 8.1 to account for the GM with embedded PRTC

- Replaces text and provides additional material to Appendix I.

**ITU-T G.8271 (2017) Amd.1 “Time and phase synchronization aspects of telecommunication networks - Amendment 1”** provides the following update:

− Addition to Appendix IV on network asymmetry.

**ITU-T G.8271 Amd 2 “Time and phase synchronization aspects of packet networks: Amendment 2”** provides the following updates:

− Added abbreviations and acronyms

− Replaced Tables 1 and 2

− Enhanced description of FCS field in Annex A.1.3.2

− Replaced Table A.7

− Added text to clause I.7.2

− Replaced Table II.1

− Replaced Table II.2

− Added references to the Bibliography.

**ITU-T G.8271.1/Y.1366.1 (2017) Amd.1 “Network limits for time synchronization in Packet networks - Amendment 1”** provides the following updates:

− Changes to clause 7 (Network Limits)

− Minor enhancements to Appendix III

− Amendment to Appendix V

− Replacement of Appendix VII

− Replacement of Figure IX.1

− Addition of new Appendix X

− Addition of new Appendix XI

− Addition of a Bibliography.

**ITU-T G.8271.2/Y.1366.2 (2017) Amd.1 “Network limits for time synchronization in packet networks with partial timing support from the network - Amendment 1”** (under approval) provides the following updates:

− Addition of new acronyms

− Addition of note to clause 7

− Revision of sub-clause 7.3

− Addition of sub-clause 7.4

− Revision of Appendix I

− Revision of Appendix II.

**ITU-T G.8271.2 Amd.2 “Network limits for time synchronization in packet networks with partial timing support from the network: Amendment 2”** provides the following updates:

− Replacement of Figure 2

− Addition of text to clauses 7.3.1.1 and 7.3.2.1

− Revision of clauses 7.4.1 and 7.4.2

− Replacement of Figures I.2 and I.4

− Revision of clauses I.3 and I.6

− Addition of new Appendix IV.

**ITU-T G.8272 (revised) “Timing characteristics of primary reference time clocks”** specifies the requirements for primary reference time clocks (PRTCs) suitable for time, phase and frequency synchronization in packet networks. It defines the error allowed at the time output of the PRTC. These requirements apply under the normal environmental conditions specified for the equipment.

**ITU-T G.8273/Y.1368 “Framework of phase and time clocks”** is a framework Recommendation for phase and time clocks for devices used in synchronizing network equipment that operate in the network architecture defined in Recommendations ITU-T G.8271, ITU-T G.8275 and the ITU-T G.8271.x series of Recommendations.

**ITU-T G.8273.2/Y.1368.2 Amd.2 “Timing characteristics of telecom boundary clocks and telecom time slave clocks - Amendment 2”** (under approval) replaces text in the Scope, in clauses 2, 4, 7.1, 7.1.1, 7.1.2, 7.4.1.2, C.2.4.1.2, and in Annex B . It adds Annex D. It replaces text in Appendices I, II, and V. It replaces text, table and figure in Appendix III and VI.

**ITU-T G.8273.3/Y.1368.3 Amd.1 “Timing characteristics of telecom transparent clocks - Amendment 1”** (under approval) changes the notes in clauses 7.1.1, 7.1.2 and 7.13. It also adds Appendix III.

**ITU-T G.8275/Y.1369 Amd.1 “Architecture and requirements for packet-based time and phase distribution: Amendment 1”** provides the following updates:

− Add to Acronyms

− Add to Bibliography

− Update Appendix III, Generic IWF PTP clock

− Add new Appendix V, Deployment Examples and the Use of Partially Aware Clock Types

− Add new Appendix VI, cnPRTC functional architecture.

**ITU-T G.8275.1/Y.1369.1 (2016) Amd.2 “Precision time protocol telecom profile for phase/time synchronization with full timing support from the network: Amendment 2”** provides the following updates:

- Change Annex C to reference G.8275 Annex B

- Correct some settings in Tables V.2 and V.3

- Clarify the requirements on the T-TSC when it is embedded in the end application

- Add an example to Appendix XII.

**ITU-T G.8275.2/Y.1369.2 (2016) Amd.2 “Precision time protocol telecom profile for phase/time synchronization with partial timing support from the network - Amendment 2”** provides the following updates:

- Added new acronym to clause 4: T-BC-A

- Added and replaced text in clause 5 related to addition of T-BC-A

- Added and replaced text in clause 6.2.3 related to T-BC-A addition and reference to “local time reference”, including changes to Table 1

- Changed text in clause 6.6

- Added references to T-BC-A in clauses 6.7.1 and 6.7.4

- Added T-BC-A reference and “local time reference” to clauses 6.7.6 and 6.7.7

- New material and edits to clause 6.8 including T-BC-A references

- Added references to T-BC-A in Appendix I and Appendix III

- Added “local time reference” to Appendix II

- Added and replaced material in Appendix IV

- New material added to Appendix V related to PTSF

- Added new Appendix VIII on PTSF-lossSync.

**ITU-T G.Suppl.sim “Simulations of Transport of Time over Packet Networks”** describes the mathematical modelling and simulation analyses to support the development of ITU-T Recommendations on the transport of time over packet networks. The main purpose of this Supplement is to document this work, as it forms the basis for the requirements in the relevant Recommendations. Both time-domain and frequency domain models and analyses are described.

Since SyncE noise accumulation results are needed as input to the simulation of time error accumulation, models and simulation analyses for SyncE noise generation and accumulation are also described. The modelling and simulation work described here is limited to steady-state behaviour, non-enhanced clocks, full-timing support from the network, and frequency provided by the physical layer by SyncE. Simulation cases that do not have these limitations are for further study.

**I.1.10 Cable**

**ITU-T J.207 (revised) “Specification for integrated broadcast and broadband digital television application control framework”** provides guidance for administrations and entities who intend to provide integrated broadcast-broadband digital television (DTV) services in the development of integrated broadcast-broadband system solutions. This Recommendation also defines high-level application programming interfaces (APIs) needed to implement an application control framework for DTV-enabled devices. This framework is responsible for managing, integrating and controlling the interactive content and applications available through DTV services installed by the end user or embedded by the device manufacturer and providing a unified execution environment for them.

**ITU-T J.297 (revised) “Requirements and functional specification of cable set top box for 4K ultra high definition television”** adds Multiplex method for TLV and channel bonding in functional specification part and new function HDR for 4K ultra high definition service as well as several editorial modifications and updates in Appendix.

**ITU-T J.382 (revised) “Advanced digital downstream transmission systems for television, sound and data services for cable distribution”** provides specifications that should be considered for advanced digital cable downstream transmission technologies to provide high spectral efficiency schemes saving transmission resources for downstream in hybrid fibre coax (HFC) based networks. This Recommendation covers the common definition of framing structure, channel coding and modulation for television, sound and data services including high quality broadcast and multicast services distributed through HFC based networks.

**ITU-T J.1107 “Architecture and specification for Radio over IP transmission systems”** provide a cost-effective adaptable solution for HFC-based cable TV network devices in optic-based cable TV network. The purpose of RoIP system is to transmit Data Over Cable Service Interface Specifications (DOCSIS) based Up Stream (US) RF signal of Cable Modem (CM) to Cable Modem Termination System (CMTS) through IP transmission in optic-based cable TV network.

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

**ITU-T Q.850 (revised) “Usage of cause and location in the Digital Subscriber Signalling System No. 1 and the Signalling System No. 7 ISDN user part”** defines the format, encoding and semantics of cause information elements/parameters and the usage of the location field, in the Digital Subscriber Signalling System No. 1 and the Signalling System No. 7 ISDN User Part.

**ITU-T Q.3405 “IPv6 protocol procedures for broadband services”** identifies the IPv6 protocol procedures which support broadband services with IPv6 transition. The protocol procedures are specified according to three basic IPv6 transition modes, including dual stack, tunnelling and translation.

**ITU-T Q.3641 “IMS references to Release 11 for communication between IMS and NGN Networks in order to support the end-to-end service interoperability”** identifies the IMS IP-Multimedia Subsystem specifications for the "ETSI Release 11" as base for the communication between IMS and NGN Network in order to support end-to-end service interoperability.

**ITU-T Q.3717 “ Signalling requirements for automatic management of IP address pool by SDN technologies on BNG”** describes the signalling requirements for the implementation of automatic management and efficient utilization of IP address resources using software defined networking technologies on broadband network gateways. The signalling is used to automatically implement allocation, monitor and reclaim of IP address resources.

**ITU-T Q.3718 “Signalling requirements of the Sew interface for Virtual Data Center”** focuses on the inter-domain Sew interface which is standardized to allow for multiple control entities within Virtual Data Center (VDC). In VDC, the SDN control entities exchanges the control plane related information with each other through the Sew interface.

**ITU-T X.609.6 “Managed P2P communications: Content distribution signalling requirements"** (under approval) specifies signalling requirements for content distribution services over managed P2P overlay network that is specified in ITU-T X.609. Content distribution over a managed P2P network provides flexible content management over existing overlay networks and also it enables contents providers to control accessing the overlay network. That is, the content provider can update the content to be distributed over an overlay network anytime, and every update will be applied to all peers in the overlay network. This Recommendation lists requirements for the related reference points that are defined in Recommendation ITU-T X.609 for providing content distribution services, and it also describes high-level procedures for content distribution service over managed P2P architecture and roles of the managed P2P components for the service.

**ITU-T X.609.7 “Managed P2P communications: Content distribution peer protocol"** (under approval) specifies a content distribution peer protocol (CDPP) that runs on the interface among entities of managed P2P communications. CDPP is used to distribute one or more contents to a number of peers. Content distribution over traditional P2P communications has incurred various issues such as distribution of illegal content, uncontrollable participation, and synchronized distribution of the updated contents. Different from the content distribution over the traditional P2P communications which is not capable of providing manageability, the content distribution over managed P2P communications can be managed by content provider or service provider. In the content distribution over managed P2P communications, as an example, participation in an overlay network can be controlled so that only predefined peers can join the overlay network and distribute contents each other. In addition, content to be distributed over an overlay network can be updated anytime, and every update will be applied to all peers in the overlay network. The protocol is capable of managing content distribution under control of content provider or service provider. This Recommendation provides protocol operations, and message formats for content distribution over managed P2P network.

**ITU-T Y.2072 “Framework of Energy Sharing and Trading Platform”** provides a framework of energy sharing and trading platform for integrated control and management considering energy production, storage and consumption. After identifying key characteristics and core technologies of the platform, it specifies requirements taking into account the energy value chain comprising various stakeholders. Then, it provides architectural overview specifying related interfaces and functional blocks. Finally mechanisms for energy information exchange to support integrated control and management services on the energy sharing and trading platform are described.

**ITU-T Y.2323 “Requirements and capabilities of orchestration in next generation network evolution”** (under approval) provides the scenarios of the orchestration in NGNe, specifies the general requirements of the orchestration in NGNe, and also introduces its capabilities from the perspective of NGN evolution and the coordination of NGNs and the networks implemented by SDN and NFV technologies.

**ITU-T Y.2242 “Service function chaining in mobile network”** (under approval) specifies a way to coordinate existing and ongoing works on service function chaining in mobile network (specified in [IETF RFC7665][IETF RFC 8300] and [b-ONF TS-027]) by introducing a chain orchestrator as a new entity. The Recommendation also covers the case when relevant network functions are virtualized. The objective of this document is to describe the requirements, architecture, functional entities, reference points and information flows of service function chaining in mobile networks..

**ITU-T Y.2305 “Unified management of Content Delivery Networks”** specifies requirements, mechanisms, security considerations for unified management of multiple Content Delivery Networks (CDNs), in order to support simple and optimized interconnection between different CDNs. This Recommendation provides a technical solution of ‘CDN manager’ with capabilities of content synchronization, user’s request routing, and other related unified management functionalities, to build up a global content delivery network.

**ITU-T Y.2619 “Operation, administration, and maintenance functions and mechanisms for Public packet Telecommunication Data Network (PTDN)”** specifies maintenance entities, OAM functions, and common OAM mechanisms in PTDN. It also defines OAM mechanisms, functions, and encapsulation specific to connectionless mode and connection-oriented mode. In the Annex, some examples of encapsulation for OAM messages in different planes are given.

**ITU-T Y.2323 “Requirements and capabilities of orchestration in next generation network evolution”** (under approval) provides the scenarios of the orchestration in NGNe, specifies the general requirements of the orchestration in NGNe, and also introduces its capabilities from the perspective of NGN evolution and the coordination of NGNs and the networks implemented by SDN and NFV technologies.

**ITU-T Y.2814 “Mobility management framework over reconfigurable networks**” focuses on application-driven mobility management of user devices, related functions and services, to improve user’s quality of experience in the evolving reconfigurable network environment. This Recommendation describes requirements, functional architecture, information flows and service scenarios to specify the target mobility management framework.

**ITU-T Y.2815 “Mobility supporting architecture for mobile Peer to Peer service in heterogeneous wireless networks”** (under approval) specifies the mobility supporting architecture required for mobile P2P services in heterogeneous networks including cellular networks, WiMAX and WLAN. It covers the aspects related to functional requirements, and architecture, high-level information flows and security considerations for mobile P2P users.

**ITU-T Y.Suppl.51 “Device Independent Screen-free service models and scenarios”** describes service models and scenarios for device independent screen-free service based on FMC (Fixed Mobile Convergence). This Supplement uses the features defined on Y.2720 sup.14, Y.sof (Supplementary service scenarios for fixed-mobile convergence).

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

**ITU-T Y.3102 “Framework of the IMT-2020 network”** provides the framework for overall non-radio aspects of the IMT-2020 network. Following an introduction to the key features of the IMT-2020 network, architectural design considerations and framework of the IMT-2020 network are provided.

**ITU-T Y.3103 “Business Role-based Models in IMT-2020”** describes business roles, business role-based models and best practice use cases in IMT-2020 from different relevant perspectives. It can be used as a guideline for further IMT-2020 studies from business point of view as well as for deployment and operation of IMT-2020 networks.

**ITU-T Y.3104 “Architecture of the IMT-2020 network”** (under approval) provides the architecture of the IMT-2020 network from a functional perspective. An architecture reference model of the IMT-2020 network and procedures of the IMT-2020 network basic services [ITU-T Y.3102] are specified.

**ITU-T Y.3105 “Requirements of capability exposure in the IMT-2020 network”** (under approval) identifies requirements of capability exposure in the IMT-2020 network. In particular, it provides at first an overview and general aspects of capability exposure in the IMT-2020 network, and then identifies requirements for the following key network capabilities: network slicing management, edge computing, network data analytics, fixed and mobile convergence, and QoS capabilities. Related scenarios of capability exposure in the IMT-2020 network are provided in Appendix.

**ITU-T Y.3112 (revised) “Framework for the support of Multiple Network Slicing in the IMT-2020 network”** (under approval) describes the concept of network slicing and use cases of multiple network slicing. The multiple network slicing enables a single device to simultaneously connect to different network slices. The use case describes the slice service type for indicating a specific network slice and the slice user group for precisely representing the network slice in terms of performance requirements and business models. This Recommendation also specifies the high-level requirements and high-level architecture for multiple network slicing in IMT-2020 network.

**ITU-T Y.3170 “Requirements of machine learning based QoS assurance for IMT-2020 network”** describes the concept of network slicing and use cases of multiple network slicing in the IMT-2020 network. Multiple network slicing is a type of network slicing to enabling a single device to simultaneously connect to different network slices. The use cases introduce the slice service type for indicating a specific network slice and the slice user group for precisely representing the network slice in terms of performance aspects and business aspects. This Recommendation also specifies high-level requirements and framework for multiple network slicing in the IMT-2020 network.

**ITU-T Y.3324 “Requirements and Architectural Framework for Autonomic Management and Control of IMT-2020 Networks”** (under approval) specifies high-level and functional requirements and architecture of Autonomic Management and Control (AMC) for IMT-2020 networks. It also specifies interworking reference points between AMC and IMT-2020 management and orchestration architecture, and legacy NMS/OSS. In Appendix I, it describes a use case to realize the AMC architecture through ETSI GANA reference model.

**ITU-T Q.5001 “Signalling requirements and architecture of intelligent edge computing”** defines the intelligent edge computing. It is applicable to collect, store, and process data reliably in the intelligent edge computing, especially to support mission critical services. Thus, the main functionality of intelligent edge computing is collecting, processing, analysing the data and providing the values based on intelligent data processing. This Recommendation specifies use cases, signalling requirements and an architecture of intelligent edge computing.

**ITU-T G.sup.5GP “5G Wireless Fronthaul Requirements in a PON Context”** enumerates the various requirements arising from 5G wireless systems, concentrating on the fronthaul portion of the network, and considers how they compare with current and future optical access transport systems. Practical passive optical network solutions to serve the 5G fronthaul application are hypothesized.

**ITU-T Y.Suppl.47 to Y.3070-series “Information-Centric Networking – Overview, Standardization Gaps and Proof-of-Concept”** provides the overview of information-centric networking and describes the fifteen standardization gaps and five proof-of-concept investigated by ITU-T Focus Group on IMT-2020 (FG IMT-2020) during 2015-2016. It is based on the ICN related contents of the two final output documents of FG IMT-2020 [b-FG IMT-2020 Gaps] [b-FG IMT-2020 ICN PoC].

**ITU-T Y.Suppl.48 to Y.3070-series “Proof-of-Concept for Data Service using Information Centric Networking in IMT-2020”** specifies a proof-of-concept for a service that provides named data such as Internet of Things (IoT) named data by information centric networking in IMT-2020. In the Supplement, an enhanced name resolution system is implemented based on distance-constrained containers to resolve from names to addresses more efficiently.

**Technical Report GSTR-TN5G “Transport network support of IMT-2020/5G”** documents a reference model for the IMT 2020/5G transport network and a set of deployment scenarios. It captures requirements on transport networks in order to support IMT 2020/5G networks and provides details on the interfaces between the IMT 2020/5G entities and the transport network. The support of IMT 2020/5G network slicing (data plane and control plane) and Control/Management interfaces are also described.

**ITU-T Technical Report “Transport network support of IMT-2020/5G”** documents a reference model of IMT 2020/5G network and a set of deployment scenarios. It documents requirements on transport networks in order to support IMT 2020/5G networks, particularly at interfaces between IMT 2020/5G entities and transport networks. Aspects of transport network support include network slicing (data plane and control plane), synchronization, and Control/Management.

**I.2.4 Home networking**

**ITU-T G.9958 “Generic architecture of home networks for energy management”** specifies functional definitions of components and networks to provide energy management services in home. It also specifies home network configurations and requirements for these services.

**ITU-T G.9960 (revised) “Unified high-speed wire-line based home networking transceivers - System architecture and physical layer specification”** specifies the system architecture and physical (PHY) layer for wireline-based home networking transceivers which are capable of operating over premises' wiring, including inside telephone wiring, coaxial cable, and power-line wiring. It complements the data link layer (DLL) specification in Recommendation ITU-T G.9961, and the power spectral density (PSD) specification in Recommendation ITU-T G.9964.

**ITU-T G.9961 (revised) “Unified high-speed wireline-based home networking transceivers – Data link layer specification”** specifies the data link layer (DLL) for wireline-based home networking transceivers capable of operating over premises wiring including inside telephone wiring, coaxial cable, and power-line wiring. It complements the system architecture and physical (PHY) layer specification in Recommendation ITU-T G.9960, and the power spectral density (PSD) specification in Recommendation ITU-T G.9964.

**ITU-T G.9961 (2015) Amd.3 “Unified high-speed wire-line based home networking transceivers - Data link layer specification: Amendment 3”** includes the addition of new capabilities to the Layer 2 configuration and management protocol (LCMP) and to the neighbouring domain interference mitigation (NDIM) mechanism. It also provides alignment of this Recommendation to new Recommendation ITU-T G.9978 on secure admission in G.hn-based networks.

**ITU-T G.9961 (2015) Amd.4 “Unified high-speed wire-line based home networking transceivers - Data link layer specification: Amendment 4”** includes a new management message compression mechanism to minimize the length of these messages to reduce overhead. It also includes some additional capabilities for low power modes.

**ITU-T G.9962 (revised) “Unified high-speed wire-line based home networking transceivers – Management specification”** specifies the physical and data link layer management for the ITU T G.996x series home networking transceiver specifications. It defines common management parameters and protocols for all ITU-T G.996x-series Recommendations for the purpose of device configuration, status and performance management, fault monitoring and diagnostics. It also provides management functionalities to coordinate multiple domains. It includes support for LCMP communication through the L1 and L6 interfaces.

**ITU-T G.9963 (revised) “Unified high-speed wireline-based home networking transceivers – Multiple input/multiple output specification”** specifies the additions and modifications to Recommendations ITU T G.9960 and ITU-T G.9961 that are needed for a multiple input multiple output (MIMO) home networking transceiver capable of operating over premises power-line wiring. MIMO transceivers are able to transmit and receive over three power-line conductors (phase, neutral and ground). This Recommendation also specifies the means by which transceivers that comply with ITU-T G.9960, ITU T G.9961 and ITU-T G.9963 interoperate when used on the same wires.

**ITU-T G.9978 (revised) “Secure admission in G.hn network”** specifies the various secure admission methods for a node to enter a G.hn domain, including media access control (MAC) authorization-based secure admission, generic pairing, auto-pairing and passphrase-based secure admission. This latest revision includes new use cases.

**ITU-T G.9979 (revised) “Implementation of the generic mechanism in the IEEE 1905.1a-2014 Standard to include applicable ITU-T Recommendations”** specifies the necessary details for including network transceivers defined in ITU-T Recommendations as supported home networking technologies under the abstraction layer defined by IEEE 1905 technology.

**ITU-T G.9991 “High speed indoor visible light communication transceiver – System architecture, physical layer and data link layer specification”** (under approval) specifies the system architecture, physical (PHY) layer and data link layer (DLL) for high-speed indoor optical wireless communication transceiver using visible light.

**ITU-T G.9992 “Indoor optical camera communication transceiver – System architecture, physical layer and data link layer specification”** (under approval) specifies the system architecture, physical (PHY) layer and data link layer (DLL) for indoor optical camera communication transceiver.

**I.2.5 Smart Grid**

**ITU-T G.9958 (03/2018) “Generic architecture of home networks for energy management”** specifies functional definitions of components and networks to provide energy management services in home. It also specifies home network configurations and requirements for these services.

**I.2.6 Software-defined networking**

**ITU-T Q.3717 “Signalling requirements for automatic management of IP address pool by SDN technologies on BNG”** (under approval) describes the signalling requirements for the implementation of automatic management and efficient utilization of IP address resources using software defined networking technologies on broadband network gateways. The signalling is used to automatically implement allocation, monitor and reclaim of IP address resources.

**ITU-T Q.3718 “Signalling requirements of the Sew interface for Virtual Data Center”** (under approval) focuses on the inter-domain Sew interface which is standardized to allow for multiple control entities within Virtual Data Center (VDC). In VDC, the SDN control entities exchanges the control plane related information with each other through the Sew interface.

**I.2.7 Cloud computing**

**ITU-T Y.3505 “Cloud computing - Overview and functional requirements for data storage federation”** provides overview and functional requirements of data storage federation. Data storage federation provides a single virtual volume from multiple data sources in heterogeneous storages. In this Recommendation, configuration for logical components, and ecosystem of data storage federation as well as cloud computing based data storage federation are introduced for data storage federation. Functional requirements are derived from use cases.

**ITU-T Y.3506 “Cloud computing - Functional requirements for cloud service brokerage”** provides functional requirements of cloud service brokerage. To provide functional requirements for the cloud service brokerage, this Recommendation specifies the overview including service model and configuration of the cloud service brokerage. Various use cases are also identified to derive the functional requirements.

**ITU-T Y.3507 “Cloud computing – Functional requirements of physical machine”** (under approval) provides the introduction of physical machine with physical machine components, physical machine types, virtualizations in physical machine as well as the scalability of components in physical machine. Also, the Recommendation provides functional requirements for physical machine derived from various use cases are described in Appendix. The relationship with other related specifications developed in other SDOs has also been introduced as Appendix.

**ITU-T Y.3517 “Cloud computing - Overview of inter-cloud trust management”** (under approval) provides an overview of inter-cloud trust management by specifying isolation and security management mechanism, inter-cloud trust management model, reputation-based trust management in inter-cloud environment, cloud service evaluation framework and the relationship with cloud computing reference architecture. It also provides requirements for inter-cloud trust management derived from the corresponding use cases.

**ITU-T Y.3518 “Cloud computing - Functional requirements of inter-cloud data management”** (under approval) provides the overview of inter-cloud data management and its functional requirements. It describes the typical use cases and specifies the functional requirements on three aspects, ranging from inter-cloud data policy, inter-cloud data isolation and protection, inter-cloud data management which are derived from the corresponding use cases.

**ITU-T Y.Suppl.49 “ITU-T Y.3500-series – Supplement on Cloud Computing standardization roadmap”** provide the summary of cloud computing related deliverables in ITU-T SGs and other SDOs. For this purpose, it is necessary to collect all the information from ITU and other SDOs including their understanding of cloud computing and relation with cloud computing of their works.

**I.2.8 Big data**

**ITU-T Y.3519 “Cloud computing - Functional architecture of big data as a service”** (under approval)describes the functional architecture for big data as a service (BDaaS). The functional architecture is defined on the basis of the analysis of requirements and activities of cloud computing based big data described in ITU-T Y.3600. Following the methodology of ITU-T Y.3502, the BDaaS functional architecture is described from a set of functional components and cross-cutting aspects. The specified functional components consist of sets of functions that are required to perform the BDaaS activities for the roles and sub-roles described in ITU-T Y.3600.

**ITU-T Y.3601 “Big data - framework and requirements for data exchange”** provides framework to exchange big data. Big data exchange has multiple processes consist of data import and data export within big data ecosystem. Big data exchange is used for exchanging data of multiple types and multiple formats from data source to data target. In this Recommendation, direct and intermediary exchange patters are introduced for big data exchange. Also, for big data exchange, the extended activities of big data ecosystem are provided. Functional requirements are derived from use cases. In addition this Recommendation provides a description of the activities for the support of big data exchange by extending the activities defined in Recommendation ITU-T Y.3600.

**ITU-T Y.3602 “Big data – Functional requirements for data provenance”** (under approval) describes a model and operations for big data provenance. Also, this Recommendation provides the functional requirements for big data service provider (BDSP) to manage big data provenance.

**ITU-T Y.3651 “Big-data-driven networking – mobile network traffic management and planning”** (under approval) specifies some technology aspects related to big-data-driven networking – mobile network traffic management and planning. The research of this Recommendation includes: requirements, framework, reference points, performance aspects and security considerations of big-data-driven networking – mobile network traffic management and planning.

**ITU-T Y.Suppl.50 “Use case and application scenario of big data driven networking”** present a set of use cases and several scenarios supported by big data driven networking including: 1) network management; 2) network active maintenance; 3) network optimization; 4) network operation; 5) network attack prevention; 6) root cause tracking of QoS; 7) QoE improvement; 8) resource management; 9) network planning and design; 10) traffic engineering; 11) cross layer design; 12) content delivery network. 13) NAT devices detection; 14) bDDN in future network; 15) bDDN in data centre network; and 16) bDDN in industrial Internet.

**I.2.9 Network Management**

**ITU-T M.3372 “Requirements for resource management in cloud-aware telecommunication management system”** introduces a functional framework and functional requirements for resource management in cloud-aware telecommunication management system. It provides the composition of the functional framework, and the functions of each component in the framework. In this Recommendation, the general background and the current status of the cloud computing management are also analysed. And the benefit of introducing functional framework and functional requirements of resource management in cloud-aware telecommunication management system is explained.

**ITU-T Y.2814 “Mobility management framework over reconfigurable networks”** focuses on application-driven mobility management of user devices, related functions and services, to improve user’s quality of experience in the evolving reconfigurable network environment. The important issues on this Recommendation include:

* Enhanced management on location, handover and connection over reconfigurable networks;
* Application based mobility management orchestration for automation and optimization;
* Open interface supporting mobility of applications and services deployed on this framework.

This Recommendation describes requirements, functional architecture, information flows and service scenarios to specify the target mobility management framework.

**I.3.1 Video and image coding**

**ITU-T H.222.0 (7th Ed.) “Information technology - Generic coding of moving pictures and associated audio information: Systems”** incorporates the 6th edition, the published Amd.1 "Ultra-low latency and 4k and higher resolution support for transport of JPEG 2000 video", the draft Amd.2 "Carriage of timed metadata for media orchestration (MORE) and sample variants over MPEG-2 TS" and the draft Amd.3 "Carriage of HEVC Tiles over MPEG-2 Systems". With respect to the previous edition, the 7th edition

– fixes interoperability issues in the transport of JPEG 2000 Part 1 (Rec. ITU-T T.800 | ISO/IEC 15444-1),

– adds support for JPEG 2000 Ultra-Low Latency (ULL) encoding and support for higher resolutions (4K or higher) of JPEG 2000 video,

– adds support for the carriage of timed metadata for media orchestration (MORE) as defined in ISO/IEC 23001-13,

– adds support for the transport of sample variants as defined in ISO/IEC 23001-12 (2nd edition),

– adds support for the transport of substreams containing HEVC (Rec. ITU-T H.264 | ISO/IEC 23008-2) Motion Constrained Tile Sets and

– resolves an ambiguity in the specification of the semantics of the HEVC video descriptor.

**ITU-T H.265.1 V3 “Conformance specification for ITU-T H.265 high efficiency video coding”** specifies tests for (non-exhaustive) testing to verify whether bitstreams and decoders meet the normative requirements specified in ITU T H.265 | ISO/IEC 23008-2 high efficiency video coding (HEVC). The bitstreams provided with this document correspond to the 02/2018 (V5) edition of Rec. ITU-T H.265. The V3 edition adds tests for the screen content coding (SCC) extensions and non-intra high throughput profiles.

**ITU-T T.88 Amd.4 “Information technology - Lossy/lossless coding of bi-level images”** commonly known as JBIG2, defines a coding method for bi-level images (e.g. black and white printed matter). These are images consisting of a single rectangular bit plane, with each pixel taking on one of just two possible colours. Multiple colours are to be handled using an appropriate higher level standard such as Recommendation ITU-T T.44 | ISO/IEC 16485. This Recommendation | International Standard has been explicitly prepared for a lossy, lossless, and lossy-to-lossless image compression. This revision includes integration of the previously approved amendments 1 through 3 and the addition of specification of a verification test procedure for JBIG2 encoders and decoders (which was processed in the ISO/IEC approval process as Amendment 4).

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

**ITU-T H.626.3 “Architecture for visual surveillance system interworking”** defines an architecture of visual surveillance system interworking. A visual surveillance system is deployed as a stand-alone and fully autonomous system, and the data and resource cannot be shared between different visual surveillance systems. The visual surveillance system interworking mechanism enables the communication among the different visual surveillance systems, and this interworking mechanism can realize the cross-system sharing of the data and resource. This Recommendation describes the architecture, entities, reference points, service control flows, and deployment models for visual surveillance system interworking.

**ITU-T H.626.4 “Architecture for a point-to-point visual surveillance system”** defines the architecture of a point-to-point (P2P) visual surveillance system, including the functional requirements, functional architecture, entities, service flows and interfaces. The P2P visual surveillance system is a kind of visual surveillance system, which provides a solution for users to access video streams directly from the cameras through network, without transferring video streams by the visual surveillance platform.

**I.3.3 IPTV and digital signage**

**ITU-T H.766 “Lua for IPTV services”** defines Lua as one of standard multimedia application frameworks for IPTV services. Lua is an extension programming language designed to support general procedural programming with data description facilities. Lua is the scripting language for Ginga-NCL [ITU-T H.761]. The Lua engine is distributed as free software under the MIT license. Lua for IPTV services is structured in two sets of application programming interfaces (APIs). Lua IPTV Core API is a basic, mandatory API that conforms with Ginga-NCL [ITU-T H.761]. Lua IPTV Extended API includes enhanced functionality that a Lua implementation is recommended to support. This Recommendation defines Lua IPTV Core API and Lua IPTV Extended API. It includes an Annex with a reference manual for Lua 5.1 as well as an appendix with sample Lua code, which implements a simple health application.

**ITU-T H.782 (V2) (revised) “Digital signage: Metadata”** specifies the data elements and structures of the metadata for digital signage services. The metadata describes information for contents, terminal devices, play logs, playlist schedule, screen layout, etc. The metadata is handled by a digital signage server, a digital signage client, a content deliver server, and a content delivery client. It also specifies general information flows to describe how the metadata are used in the digital signage services. This revision updates the data types of elements/attributes of identifiers. The update aims to widen applicability of the specifications at the price of easy XML validation.

**ITU-T H.783 “Digital signage: Audience measurement services”** specifies functional requirements, configuration and operations, and metadata for audience measurement services in digital signage. The configuration and operations are processed between audience measurement client and audience measurement aggregation. The metadata describes the detail data elements and structures on information used in the configuration and operations.

**ITU-T H.784 “Digital signage: Display device control interface”** (under approval) addresses the display device control interface between the display device and the DS client. The Recommendation introduces an overview of the display device control interface and describes the functions and procedures for controlling and configuring the display device through the interface.

**ITU-T H.785.1 “Digital signage: Service requirements and a reference model on information services in public places via an interoperable service platform”** addresses high-level requirements, a reference model, push-based distribution methods and relevant metadata of DS services in public places via the interoperable service platform. The Recommendation is expected to enhance interoperability for DS services in public places as to efficient and effective system operation.

**I.3.4 Immersive live experience**

**ITU-T H.430.1 “Requirements for immersive live experience (ILE) services”** provides the definition of Immersive Live Experience (ILE) and identifies general requirements and high-level functional requirements for ILE services, in order to clarify ILE services.

**ITU-T H.430.2 “Architectural framework for immersive live experience (ILE) services”** identifies general framework and high-level functional architecture for ILE services, in order to clarify ILE services and general functions of ILE systems. This Recommendation also provides the role model of ILE.

**ITU-T H.430.3 “Service scenario of immersive live experience (ILE)”** provides several service scenarios of ILE and also provides use cases as information, in order to clarify ILE services.

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

**ITU-T G.1070 (revised) “Opinion model for video-telephony applications”** proposes an algorithm that estimates videophone quality for quality of experience (QoE)/quality of service (QoS) planners. This model can be used by QoE/QoS planners to help ensure that users will be satisfied with end-to-end service quality. The model provides estimates of multimedia quality that take interactivity into account and it allows planners to avoid under-engineering. The application of this Recommendation is limited to QoE/QoS planning. Other applications such as quality benchmarking and monitoring are outside the scope of this Recommendation.

**ITU-T P.809 “Subjective Evaluation Methods for Gaming Quality”** presents guidelines for the conduction of subjective experiments for the Quality of Experience (QoE) assessment of gaming services. First, an overview about gaming QoE features covering hedonic and pragmatic quality as well as the player experience is given. Additionally, methods for two test paradigms, passive viewing-and-listening tests and interactive tests, are described including information about the test environment and test setup, participant instructions, selection of game materials and a list of available questionnaires for the assessment of several gaming QoE features such as flow and immersion.

**I.3.6 New services and applications**

**ITU-T F.743.5 “Framework and interfaces for multimedia content delivery network”** identifies the problems when the content delivery network (CDN) technology and its related services are evolving from the traditional dedicated IPTV service to the converged multimedia service in an IP-based network environment. According to the prospect of design goals, this Recommendation defines a functional framework for multimedia CDN composed of four basic functional components with the connection of logical interfaces from the service point of view. As the initiation of multimedia CDN series of Recommendations, this Recommendation aims to define the fundamental components in a general CDN framework by analysing the tendency of development of CDN technology and multimedia services. With such Recommendation, it is beneficial for the CDN service provider and manufacturer to develop their CDN service and products to support more types of multimedia service in a more efficient way.

**ITU-T F.743.6 “Service requirements for next generation content delivery networks”** describes the use cases, service requirements and challenges of the next generation CDN. Based on the existing modes analysis for bringing CDN to the edge described in Appendix I, a new reference architecture named Access CDN which decouples common functions and customized service is proposed. This architecture enlarges the CDN industry space from a closed-loop system to a decoupled open platform, and provides the opportunity for a win-win relationship between CDN service providers and operators.

**ITU-T F.746.7 “Metadata for intelligent question answering service”** to define metadata for intelligent question answering service. This Recommendation defines the metadata to support intelligent question answering service described in [ITU-T F.746.3]. The scope of this Recommendation is focused on describing metadata for different functional components in intelligent question answering (QA) system: natural language processing function, question analysis function, candidate answer generation function, answer inference/generation function, and input and output function. This Recommendation also describes the general information flows to describe how the metadata are used in the intelligent QA service. This Recommendation together with the existing standard “Intelligent question answering service framework” [ITU-T F.746.3] will support the future systems which are expected to be equipped with QA functions for advanced user experiences.

**ITU-T F.746.8 “Requirements for unified status monitoring of networks and services”** describes requirements and functional architecture for a unified status monitoring (USM) system which allows network providers and application service providers to get the status information they need. The USM system, which consists of a USM server and a set of USM agents, collects both static and dynamic status information from network providers and application service providers. It can also parse the status requests from network providers and application service providers, generate the status reports, and send the reports back to them.

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

**ITU-T Y.4003 “Overview of smart manufacturing in the context of the industrial Internet of things”** provides an overview of smart manufacturing in the context of the Industrial Internet of things (IIoT). The Recommendation introduces at first smart manufacturing and IIoT, including the smart manufacturing capabilities with respect to the Internet of things (IoT) reference model [ITU-T Y.4000]. Then, with respect to smart manufacturing in the context of the IIoT, it identifies fundamental system characteristics and high-level requirements, specifies a reference model and provides some use cases.

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

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

**ITU-T Y.4120 “Requirements of Internet of things applications for smart retail stores”** provides requirements of IoT applications for smart retail stores. The usage of the IoT enables “smart retail stores”. The IoT can enable a safe and efficient retail store management system for non-stop operation (24 hours / 365 days): the collection and monitoring in real time of information related to the various kinds of equipment in stores may allow early detection of equipment failure and accurate prediction of equipment problems. For an effective usage of the IoT by retail store operators and store equipment providers, appropriate guidelines for IoT applications for smart retail stores are necessary.

**ITU-T Y.4121 “Requirements of an Internet of Things enabled network for support of applications for global processes of the Earth”** describes key IoT GP features, deployment schemes of IoT GP devices and requirements of the IoT GP network. IoT applications for global processes, such as advanced detection of natural disasters, present demanding requirements for real-time distributed IoT networks. Internet of Things for monitoring and study of Global Processes (IoT GP) is an innovative concept that combines Internet of Things (IoT) devices distributed all over the world and one or more Control and Management Centers (CMCs) for monitoring of global natural and man-made processes. The key idea of IoT GP is consolidation in real-time of sensor data from different parts of the Earth, allowing enhanced disaster preparedness and development of advanced models of global processes. For example, IoT GP can be used to detect areas of possible occurrence of earthquakes, floods, wildfires, heat waves, etc.

**ITU-T Y.4415 “Architecture of web of objects based virtual home network”** describes an architecture of WoO based VHN (WVHN) in accordance with [ITU-T H.622.2] and [ITU-T Y.4452]. The service capabilities and framework of virtual home network (VHN) are identified in the ITU-T Recommendation [ITU-T H.622.2]. [ITU-T Y.4452] identifies the functional framework of Web of Objects (WoO) to deploy Internet of things (IoT) services in the World Wide Web environment.

**ITU-T Y.4416 “Architecture of the Internet of things based on next generation network evolution”** provides a description of the architecture of the Internet of things (IoT) based on next generation network evolution (NGNe), taking account of the IoT reference model specified in Recommendation ITU-T Y.4000/Y.2060, the IoT common requirements specified in Recommendations ITU-T Y.4100/Y.2066, and the IoT functional framework and capabilities specified in Recommendation ITU-T Y.4401/Y.2068. It describes extensions to NGNe functional entities, reference points and NGNe functional components, and enhancement to NGNe capabilities as described in ITU-T Y.2012, and other related Recommendations in order to support the IoT.

**ITU-T Y.4417 “Framework of self-organization network in the IoT environments”** specifies a framework of self-organization networking for IoT in an aspect of communications. ITU-T Y.4417 presents the concepts, characteristics, architectures, requirements, and functionalities of self-organization networking. Self-organization networking is an autonomous networking established by each device, where the device effectively interacts with its peers and performs self-control. In IoT environments, self-organization networking is required when the heterogeneous devices belong to infrastructure-unsupported IoT area networks.

**ITU-T Y.4418 “Functional architecture of gateway for Internet of things applications”** provides the functional architecture of gateway for IoT applications, including the gateway's functional entities, relevant reference points and logical flows.

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

**ITU-T Y.4457 “Architectural framework for transportation safety services”** describes a transportation safety management model and an architectural framework for transportation safety services based on the IoT reference model. Accidents and disasters caused by various means of transportation affect many lives and properties. Transportation safety can be influenced by defective vehicles (e.g., cars, trains, ships), environmental status (e.g., wind, snow, low temperatures), disruption to transportation infrastructures (e.g., bridges, tunnels, roads) and human error. Transportation safety services based on Internet of things (IoT) technologies can reduce the occurrence of accidents and disasters, and save the lives and damage to properties.

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

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

**ITU-T Y.4500.2 “oneM2M - Requirements”** provides an informative functional role model and normative technical requirements for oneM2M.

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

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

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

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

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

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

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

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

• Binding oneM2M Protocol primitive types to HTTP method.

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

• Binding oneM2M RESTful resources to HTTP resources.

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

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

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

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

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

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

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

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

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

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

**ITU-T Y.4500.32 “oneM2M- MAF and MEF Interface Specification** specifies communication between the M2M Authentication Function (MAF) and MAF clients on the reference point Mmaf and between the M2M Enrolment Function (MEF) and MEF clients on the reference point Mmef.

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

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

**ITU-T F.780.1 “Framework for telemedicine systems using ultra-high definition imaging”** describes requirements for using ultra-high definition (UHD) imaging, such as 4K and 8K video, for telemedicine. The purpose of these requirements is to use UHD systems as part of endoscope and/or microsope for medical practices. This document also describes a list of requirements for usng a UHD-based “endosopic video camera” as a medical device. In addition, Annex A describes the requirements on the use of this technology as a medical device.

**ITU-T H.820 “Conformance of ITU-T H.810 personal health system: Conformity assessment test plan”** provides a top-level overview of the test specifications and test profiles used to verify product conformance to the Continua Design Guidelines that are defined in the Recommendations of the ITU-T H.810 sub-series, of which Recommendation ITU-T H.810 (2017) is the base Recommendation. It outlines the scope of the conformance and interoperability tests, test suite structures & test purposes, test case reference list, and the Continua Test Tool, which in turn are specified in details in the Recommendations of the H.820-H.850 series.

**ITU-T H.830.13 “Conformance of ITU-T H.810 personal health system: Services interface Part 13: Capability Exchange: Health & Fitness Service sender”** provides a test suite structure (TSS) and the test procedures (TP) for Capability Exchange through the Health & Fitness Service (HFS) sender in the Services interface, based on the requirements defined in the Recommendations of the ITU-T H.810 sub-series, of which Recommendation ITU-T H.810 (2017) is the base Recommendation. The objective of this test specification is to provide a high probability of interoperability at this interface. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.830.14 “Conformance of ITU-T H.810 personal health system: Services interface Part 14: Capability Exchange: Health & Fitness Service receiver”** provides a test suite structure (TSS) and the test procedures (TP) for Capability Exchange through the Health & Fitness Service (HFS) receiver in the Services interface, based on the requirements defined in the Recommendations of the ITU-T H.810 sub-series, of which Recommendation ITU-T H.810 (2017) is the base Recommendation. The objective of this test specification is to provide a high probability of interoperability at this interface. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.830.15 “Conformance of ITU-T H.810 personal health system: Services interface Part 15: FHIR Observation Upload: Health & Fitness Service sender”** provides a test suite structure (TSS) and the test procedures (TP) for FHIR Observation Upload through the Health & Fitness Service (HFS) sender in the Services interface, based on the requirements defined in the Recommendations of the ITU-T H.810 sub-series, of which Recommendation ITU-T H.810 (2017) is the base Recommendation. The objective of this test specification is to provide a high probability of interoperability at this interface. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

**ITU-T H.830.16 “Conformance of ITU-T H.810 personal health system: Services interface Part 16: FHIR Observation Upload: Health & Fitness Service receiver”** provides a test suite structure (TSS) and the test procedures (TP) for FHIR Observation Upload through the Health & Fitness Service (HFS) receiver in the Services interface, based on the requirements defined in the Recommendations of the ITU-T H.810 sub-series, of which Recommendation ITU-T H.810 (2017) is the base Recommendation. The objective of this test specification is to provide a high probability of interoperability at this interface. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

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

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

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

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

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

**ITU-T H.845.17 “Conformance of ITU-T H.810 personal health system: Personal Health Devices interface Part 5Q: Power status monitor”** provides a test suite structure (TSS) and the test purposes (TP) for the power status monitor of personal health devices in the Personal Health Device (PHD) interface, based on the requirements defined in the Recommendations of the ITU-T H.810 sub-series, of which Recommendation ITU-T H.810 (2017) is the base Recommendation. The objective of this test specification is to provide a high probability of interoperability at this interface. This Recommendation includes an electronic attachment with the protocol implementation conformance statements (PICS) and the protocol implementation extra information for testing (PIXIT) required for the implementation of Annex A.

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

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

**ITU-T H.861.1 “Requirements on establishing brain healthcare quotients”** describes healthcare indices derived from neuroimaging analysis that are called Brain Healthcare Quotients (BHQs), intended to be used for facilitating the communication of information about brain status. It describes the requirements on how such an index is created and also how some concrete BHQs can be defined and calculated. This Recommendation also includes examples of services using BHQs to better monitor the health states for supporting active and alert living. BHQs are linked to various healthcare aspects of human life and can be used to improve life styles. It can give good standardized measurement and indices of brain conditions even for non-specialists.

**ITU-T H.870 “Guidelines for safe listening devices/systems”** describes requirements on safe-listening devices and systems, called personal/portable audio systems, especially those for playing music, to protect people from hearing loss. It also gives a glossary for common understanding as well as the background information on sound, hearing and hearing loss.

**I.5.1 New security standards**

**ITU-T X.894 “Generic applications of ASN.1 Cryptographic Message Syntax”** provides Abstract Syntax Notation One (ASN.1) modules for using cryptographic syntax in ITU-T Recommendations. Cryptographic message syntax (CMS) provides data integrity, confidentiality, origin authenticity, and non-repudiation services needed for reliable information exchange and for strong authentication. It also brings together a set of cryptographic key management techniques to support flexible key establishment mechanisms, such as constructive key management, key agreement, key exchange, and password-based encryption. These techniques can be used to prevent fraud, and to protect personally identifiable and other sensitive information. This Recommendation | International Standard supports digital signature, encryption, and signcryption techniques based on the public-key technology defined in the ITU-T X.500 series | ISO/IEC 9594 multipart standard. All of the standardized encoding rules for ASN.1 are supported.

**ITU-T X.1041 “Security framework for voice-over-long-term-evolution (VoLTE) network operation”** analyses security threats encountered by the VoLTE network and recommends countermeasures for telecommunication operators to ensure the secure operation. It also provides a security reference framework for VoLTE network.

**ITU-T X.1042 “Security services using the software-defined networking”** (under approval) supports the protection of network resources using security services based on software-defined networking (SDN). This Recommendation first classifies the network resources for SDN-based security services. These network resources are SDN application, SDN controller, SDN switch and security manager (SM). This Recommendation then defines security services based on SDN.

**ITU-T X.1080.1 (revised) “e-Health and world-wide telemedicines - Generic telecommunication protocol”** defines the framework for other parts of the ITU-T 1080.x series of Recommendation by providing the overall model for communications aspects of telebiometrics. It provides the basic allocation of object identifiers for uniquely identifying pieces of information during data transfer and it defines a generic telecommunication protocol.

It provides a technique for a formal specification of objects and it specifies a generic protocol that supports interactions between a medical station local to a patient and a remote medical centre providing greater expertise. This protocol is to be used and extended by other parts of the ITU-T X.1080.x series of Recommendations.

**ITU-T X.1093 “Telebiometric access control with smart ID cards”** (under approval) describes the general scheme for logical and/or physical access control using the biometrics-on-card. This Recommendation can be applied to the recent emerging area of requiring secure physical and also logical access control management.

**ITU-T X.1147 “Security requirements and framework for big data analytics in mobile Internet services”** (under approval)mainly analyse the security requirements of big data analytics in mobile Internet services, and provide security framework.

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

* Detection of vulnerabilities in telecommunications/ICT network
* Methodology of security assessment in telecommunications/ICT network.

**ITU-T X.1215 “Use Cases for Structured Threat Information Expression (STIX)”** (under approval) provides various use cases for how the STIX language may be used to support cyber threat intelligence and information sharing. This Recommendation also describes concepts and functionality of Structured Threat Information Expression (STIX). It is targeted to support a range of use cases involved in cyber threat management, including analysing cyber threats, specifying indicator patterns for cyber threats, managing response activities, and sharing cyber threat information. Given this kind of information, a security decision can be made on how to best defend against the threat. It is intended to support both more effective analysis and the continued exchange of cyber threat information. The STIX suite of specifications is maintained under the responsibility of OASIS. See <https://www.oasis-open.org/committees/tc_home.php?wg_abbrev=cti>

**ITU-T X.1249 "Technical framework for countering mobile in-application advertising spam"** (under approval) provides a technical framework for countering mobile in-application advertising spam. Mobile in-application advertising spam is the sending of unsolicited advertisements, which are displayed within a mobile phone application. These unsolicited messages can appear on the display screen of a mobile device as a banner at the top or bottom of the screen, a mobile interstitial, or an overlay. Along with the rapidly increasing development of mobile applications, mobile in-application advertisement has been surging dramatically. Filtering unwanted or malicious advertisements is urgently needed regarding to the user experience and even security. Although many countermeasures have been proposed and implemented, they all suffer from limitations or drawbacks, and users still face a high volume and a high portion of mobile in-application advertising spam. Therefore, it is necessary to establish a practical framework for countering mobile in-application advertising spam, which can reasonably integrate the advantages of all countermeasures.

**ITU-T X.1276 “Authentication Step-Up Protocol and Metadata Version 1.0”:** Electronic Identity Credential Trust Elevation Methods are used to increase assurance in entity identification using authentication events and related entity information for the purpose of risk mitigation when making access control policy decisions. The goals of this Recommendation are:

– To propose simple Trust Elevation architectural patterns demonstrating the use of Trust Elevation in modern Access Control architectures.

– To describe a common metadata set mechanisms and protocol elements for Trust Elevation information exchanges.

– To promote the use of Trust Elevation elements to facilitate standardization among the many technologies and approaches currently in use for credential & authentication risk mitigation.

**ITU-T X.1277 “FIDO Universal Authentication Framework (UAF)”** (under approval) enables online services and websites, whether on the open Internet or within enterprises, to transparently leverage native security features of end-user computing devices for strong user authentication and to reduce the problems associated with creating and remembering many online credentials.

**ITU-T X.1278 “Client To Authenticator Protocol/Universal 2-factor framework”** (under approval) describes an application layer protocol for communication between an external authenticator and another client/platform, as well as bindings of this application protocol to a variety of transport protocols using different physical media.

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

**ITU-T X.1361 "Security framework for the Internet of things based on the gateway model"** describes a security framework for the Internet of things (IoT) using security gateways. This Recommendation analyses security threats and challenges in an IoT environment, and describes capabilities that could address and mitigate these threats and challenges. A framework methodology is provided for determining which security capabilities are required for mitigating and addressing these threats and challenges for the IoT.

**ITU-T X.1450 “Guidelines on hybrid authentication and key management mechanisms in the client-server model”** provides guidelines for hybrid authentication and key exchange mechanisms in client-server model. The underlying mechanism suggests the use of shared secrets and public key techniques for authentication and key exchange. This Recommendation covers service scenarios, and security threats and methods to mitigate such attacks.

**ITU-T X.1500 Amd.12 “Overview of cybersecurity information exchange (CYBEX)”** provides a list of structured cybersecurity information techniques that have been created to be continually updated as these techniques evolve, expand, are newly identified or are replaced. The list follows the outline provided in the body of the Recommendation. This amendment reflects the situation of recommended techniques as of March 2018, including bibliographical references.

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

**ITU-T X.Supp1.13 (revised) Supplement 13 to ITU-T X-series Recommendations - ITU-T X.1051 “Supplement on Users’ guide for information security controls in telecommunications organizations”** provides interpretable guidance for users of Recommendation ITU-T X.1051. This Supplement gives additional explanations and further implementation guidance for each clause and control specified in Recommendation ITU-T X.1051.

**ITU-T X.Suppl.32 “Code of practice for personally identifiable information protection based on ITU-T X.1058 for telecommunications organizations”** aims to complement the information provided in ITU-T X.1058 by providing additional implementation guidance for Personally Identifiable Information (PII) protection, which are not described in ITU-T X.1058, but should further be applicable to telecommunications organizations to address PII protection.

The number of telecommunications organizations processing PII is on the rise. Accordingly, expectations for the protection of PII are also increasing.

The protection of PII is driving the need for a set of additional controls and implementation guidance for PII protection, which are applicable to telecommunications organizations. The guidance presented in this Supplement are additions to those described in ITU-T X.1058.

**ITU-T X.Suppl.33 - Supplement 33 to X-series Recommendations - ITU-T X.1231 “Technical framework for countering telephone service scam”** provides an overall technical framework for countering telephone service scam and related useful practices. In the framework, entity functions and processing procedures are specified. In addition, the useful practices provided in this Supplement cover most of the practices that are able to stop known telephone service scam methods. Besides, this Supplement specifies the characteristics and the source of the telephone service scam, and categorizes the main methods and relevant technical requirements according to the key technologies of the telephone service scam discovering, judgment, and disposition.

**I.5.2 Trust**

**ITU-T Y.3054 “Framework of trust-based media services”** provides a framework for trust-based media services. It identifies inherent risks in existing media services and describes the necessity of trust-based media services. After identifying functional requirements, it describes components and a functional architecture for trust-based media services. Finally, trust-based content consumption and sharing services are introduced along with a trust analysis mechanism for trust-based media services.

**ITU-T Y.3053 “Trustworthy networking deployment architecture and procedure – Amendment 1”** (under approval)

**ITU-T Y.3053 (2018) Amd.1 “Framework of trustworthy networking with trust-centric network domains: Amendment 1 - Trustworthy networking deployment architecture and procedures”** (under approval) contains modifications to add trustworthy networking deployment architecture and procedures for IP networks in the Internet.

**I.6.1 Green ICT standards**

**ITU-T L.1015 “Criteria for evaluation of the environmental impact of mobile phones”** (under approval) Recommendation focuses on the criteria to be used for evaluation of the environmental impact of mobile phones. It considers all life cycle stages of mobile phones such as the design, production, use and end of life management. The Recommendation also defines a minimum level of environmental performance. Within the constraints of technology and affordability, sustainability should be considered for: materials; energy use; durability, upgrade and repair operations; end of life management; packaging, corporate practice; manufacturing and operations.

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

**ITU-T L.1030 “E-waste management framework for countries”** provides a management framework for e-waste to countries. It summarizes the different steps that countries need to adopt in order to put in place an e-waste management system. The different steps of the e-waste management system described in this Recommendation will be further elaborated in future Recommendations. In addition, the Recommendation provides highlights concerning the environmental impact of improper handling of e-waste as well as the economic opportunities that could emerge from the sustainable management of e-waste.

**ITU-T L.1031 “Guideline on Implementing the E-waste Reduction Target of the Connect2020 Agenda”** describes a three-step approach to address the e-waste reduction target of the Connect 2020 Agenda. These steps consist of guidance on developing an e-waste inventory, approaches to design e-waste prevention and reduction programs, and the supportive measures required for successfully implementing the Connect 2020 e-waste target. This Recommendation is intended to be utilized by relevant stakeholders to take their first step in addressing Target 3.2 of the Connect 2020 Agenda, that is to reduce waste by 50% by 2020.

**ITU-T L.1207 “Progressive migration of a telecommunication/information and communication technology site to 400 VDC sources and distribution”** gives explanation, requirements and guidance for boosting the spread of up to 400 V direct current (400 VDC) power systems and distribution to information and communication technology (ICT) equipment. It includes 400 VDC remote powering up to 400 VDC of distributed ICT equipment, the option of interconnection of local renewable energy sources and their connection to DC power nanogrids and other users, extending the resilience capability of the telecommunications network and ICT sites to grid failures and climate change.

**ITU-T L.1221 “Innovative energy storage technology for stationary use - Part 2: Battery”** is the subpart 2, battery of a series of Recommendations on innovative energy storage system for stationary power system of telecom/ICT equipment used in telecom networks, datacenters and CPE. This subpart introduces technologies and methods for evaluating, selecting and testing battery systems for defined applications.

**ITU-T L.1222 “Innovative energy storage technology for stationary use - Part 3: Supercapacitor technology”** contains selection criteria for telecommunication application based on main performance parameters and the methods for proper use. In addition, some use cases and examples are given in an Appendix to help users.

**ITU-T L.1303 “Functional requirements and framework of green data centre energy-saving management system”** describes functional requirements and framework of energy-saving management system for green data centre. Functional requirements of energy-saving management includes requirements for measuring energy consumption and environmental condition, collecting and storing data, reporting data, and conducting energy-saving. The energy-saving management system consists of following functional blocks: data collecting block; data storing block; data process and analysis block; external system interfacing block; user interface block; control block. Operational flow the energy-saving management system is also provided.

**ITU-T L.1351 “Base station site energy efficiency measurement methodology”** describes and establishes requirements for energy efficiency measurements applicable to base station sites. This Recommendation describes:

* Measurement points definitions
* Conditions of measurement
* Instrumentation requirement
* Reporting requirement
* Use of a monitoring system

This Recommendation can be used as a conformity assessment standard for Recommendation ITU T L.1350.

**ITU-T L.1361 “Measurement method for energy efficiency of Network Function Virtualization”** defines common energy efficiency measurement methods for NFV environments, it does not try to cover all different types of VNFs (e.g. firewall, gateway, etc.), but it provides the basis to make extensible definition.

**ITU-T L.1370 “Sustainable and intelligent building services”** sets the minimal requirements for an efficient and sustainable management of the building as a unit. The sustainability of human activities in urban areas cannot be addressed without taking into consideration the building, which is the most basic unit that cities are composed of. This Recommendation also defines the services enabled by the SIB concept, the way it contributes to the aforementioned goals of sustainability, its features, its different possible functioning modes, or its internal architecture and requirements with the IoT node at its core.

Interoperability deserves a special mention among these requirements and specifications, as most of the added-value that the SIB provides comes into action when it interacts with other parts of the building, other buildings, city elements, or the city itself. Protocols, semantics, and normalization are key as a part of this interaction, and the SIB with its IoT node is required to be compliant with all of them.

Extensibility is another key feature for the SIB and the IoT node. The technology behind smart and sustainable cities is currently evolving very quickly, as it is a state-of-the-art technological arena. That is the reason why one of the most important architectural patterns to take into consideration is to design a SIB and an IoT node that support not only upgrading, but also the capacity to accommodate new technologies, protocols, services and applications that may be relevant for the industry in the future.

In addition to these clear advantages for the technical durability of the SIB infrastructure, this will enable as well the creation of an open “smart ecosystem”, with third parties being able to integrate their own developments, expanding the capacities of the SIB, and ultimately contributing to improve the quality of life of citizens.

**ITU-T L.1450 “Methodologies for the assessment of the environmental impact of the information and communication technology sector”** consists of two parts:

* Part I: The methodology for calculating the information and communication technology (ICT) sector footprint with respect to life cycle greenhouse gases (GHG) emissions;
* Part II: The methodology for defining GHG emissions budget for the ICT sector considering a 2 ºC or lower trajectory.

Appendix IV gives an example of a partial ICT sector footprint derived in line with Part I of the Recommendation.

**ITU-T L.1460 “Connect 2020 greenhouse gases emissions – Guidelines”** provides guidelines to address the Connect 2020 GHG emissions target. It is intended to be utilized by relevant stakeholders to address the Connect 2020 ambitions, while considering the SDG 13 goal and the objectives of the Paris Agreement. It also presents examples of actions taken in order to limit the GHG emissions in the ICT sector.

**I.6.2 Electromagnetic fields**

**ITU-T K.20 (revised) “Resistibility of telecommunication equipment installed in a telecommunication centre to overvoltages and overcurrents”** specifies resistibility requirements and test procedures for telecommunication equipment that is attached to or installed within a telecommunication centre.

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

• external Ethernet power contact test;

• test exemption for internal short cables;

• renaming of some test titles for clarity;

• Intermediate Ethernet test level added.

**ITU-T K.21 (revised) “Resistibility of telecommunication equipment installed in customer premises to overvoltages and overcurrents”** specifies resistibility requirements and test procedures for telecommunication equipment that is attached to or installed within a customer's premises.

Changes compared with Recommendation ITU-T K.21 (2017) include:

• external Ethernet power contact test;

• renaming of some test titles for clarity;

• Intermediate Ethernet test level added.

**ITU-T K.44 (revised) “Resistibility tests for telecommunication equipment exposed to overvoltages and overcurrents – Basic Recommendation”** seeks to establish fundamental test methods and criteria for the resistibility of telecommunication equipment to overvoltages and overcurrents.Major changes compared with the 2017 version of this Recommendation include:

– addition of nine new definitions and modifying one old definition;

– clarification of main body text ;

– added external Ethernet port power cross test;

– revision of the test schematics to improve clarity;

– introduced Intra-system ports and an Ethernet intermediate test level;

– adding tolerances for 1.2/50 waveform generation;

– test exemptions for certain cable lengths.

**ITU-T K.45 (revised) “Resistibility of telecommunication equipment installed in the access and trunk networks to overvoltages and overcurrents”** specifies resistibility requirements and test procedures for telecommunication equipment installed between telecommunication centres and between a telecommunication centre and the customer's premises. Changes compared with Recommendation ITU-T K.45 (2017) include:

• external Ethernet port power contact test;

• renaming of some test titles for clarity.

**ITU-T K.90 (revised) “Evaluation techniques and working procedures for compliance with exposure limits of network operator personnel to power-frequency electromagnetic fields”** provides evaluation techniques and guidelines for compliance with safety limits for human exposure to electromagnetic fields (EMFs) of telecommunication network personnel (e.g., outside plant craft) at power frequencies (DC, 50 Hz and 60 Hz). This Recommendation does not set safety limits; it seeks to provide techniques and procedures for determining the need for any precautions at the work site. This Recommendation includes an electronic attachment containing the EMFACDC program.

**ITU-T K.134 “Protection of small-size telecommunication installations with poor earthing conditions”** provides engineering solutions for lightning protection and safety for small-size telecommunication installations under poor earthing conditions. These protection measures are compromised alternatives due to the restriction of circumstance or expense. These protection measures are not common requirements for all kinds of circumstances and have defined conditions for application respectively. The selection of appropriate and feasible solution is helpful to acquire the best technology economy ratio.

**ITU-T K.135 “Technical parameters for residual current operated protective devices with automatic reclosing feature for telecom applications”** gives an overview of the parameters of residual current operated protective devices with automatic-reclosing feature for telecom applications.

**ITU-T K.136 “Electromagnetic Compatibility requirements for radio telecommunication equipment”** specifies the electromagnetic compatibility requirements and the test method for radio telecommunication equipment and associated ancillary equipment..

**ITU-T K.137 “Electromagnetic compatibility requirements and measurement methods for wire-line telecommunication network equipment”** specifies the electromagnetic compatibility common requirements and the test methods for wire-line telecommunication network equipment, used in a public telecommunication networks to provide telecommunications services: voice, data, audio and video to the end-users, using all applicable media and all kinds of wire-line access technologies, such as DSL, POTS, Ethernet, E1, fibre or others.

Test conditions for all kinds of wire-line telecommunication network equipment are described, e.g. access equipment, router and switching equipment, optical transmission equipment, data centre and cloud computing equipment and power supply equipment (including HVDC).

This Recommendation describes the specific testing levels to be applied to wire-line telecommunication in different environments, such as telecommunication centres, customer premises and outside plants.

**ITU-T K.138 “Quality estimation methods and application guidelines for mitigation measures based on particle radiation tests”** describes the reliability estimation methods based on the results of a neutron irradiation test taking into account the severity of the effect caused by soft errors. The soft error rate in the natural environment has to be calculated from the number of soft errors that occur during a neutron irradiation test. The severity of the impact of a soft error on telecommunications systems, such as the impact on the client signal and control system, is analysed from the error logs created during the test. Additional mitigation measures should be applied if the equipment is less reliable than the target level. This Recommendation also provides guidelines for applying these mitigation measures in light of the results of soft error tests.

**ITU-T K.139 “Reliability requirements for telecommunication systems affected by particle radiation”** describes the reliability requirements for telecommunication equipment in relation to the soft errors that are caused by particle radiation. The principles for determination of reliability requirements are described and three types of reliability requirements (alert function reliability, service reliability, and maintenance reliability) are defined. Three reliability classes for each type of requirement are defined based on the acceptable soft error failure rate. Specific values are determined for each type and class of reliability requirement.

**ITU-T K.Suppl.4 (revised) “ITU-T K.91 - Electromagnetic field considerations in smart sustainable cities”** details the EMF considerations in smart sustainable cities. It provides guidance on implementation and promotes efficient deployment of wireless networks in smart sustainable cities. It features a 'Smart sustainability city EMF check-list' designed to provide an easy to use reference for city officials and planners to ensure smart city policies operate most efficiently and comply with EMF exposure standards. It references World Health Organization (WHO) materials, International Commission on Non-Ionizing Radiation Protection (ICNIRP) guidelines, ITU-T Recommendations and IEC Standards. It is not intended to replicate the material in all references.

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

**ITU-T K.Suppl.9 (revised) “5G technology and human exposure to RF EMF”** contains an analysis of the impact of the implementation of 5G mobile systems with respect to the exposure level of electromagnetic fields (EMF) around radiocommunication infrastructure.

**ITU-T K.Suppl.10 (revised) “Analysis of electromagnetic compatibility aspects and definition of requirements for 5G systems”** provides guidance on the EMC compliance assessment considerations for 5G systems. Given the 5G Radio Access Network (RAN) technical standards are still being finalised, the first version of this Supplement focuses on possible emission and immunity requirements for 5G systems.

**ITU-T K.Suppl.14 (revised) “The impact of RF-EMF exposure limits stricter than the ICNIRP or IEEE guidelines on 4G and 5G mobile network deployment”** provides an overview of some of the challenges faced by countries, regions and cities which are about to deploy 4G or 5G infrastructures. This Supplement provides information on a simulation on the impact of RF‑EMF limits that was carried out in Poland as an example of a wider phenomenon, which is applicable to several other countries, which have set limits stricter than those contained in the ICNIRP or IEEE guidelines.

**ITU-T K.Suppl.15 “Internal DC powering interface surge testing factors (K.20, K.21 and K.44)”** analyses these factors to make K.20 and K.21 equipment designers and testers aware of the surge stress levels.

**ITU-T K.Suppl.16 “Electromagnetic field (EMF) compliance assessments for 5G wireless networks”** provides guidance on the RF-EMF compliance assessment considerations for IMT-2020 wireless networks also called as 5G. Given that the 5G technical standards have just been finalised and commercial 5G networks are not due to launch until 2019 – 2020, the first version of this Supplement is addressing mainly the computational assessment options and assessments of trial networks.

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

**Technical Paper HSTP-DIS-UAV “Use cases and scenarios for disaster information service using unmanned aerial vehicles”** describes use cases and scenarios for disaster information service using Unmanned Aerial Vehicles (UAV). UAVs are expected to be applicable to various disaster situations such as drought, fire, flood, landslide, earthquake, volcanic eruption, tsunami, etc. Use cases in all disaster phases are described, including preparedness phase (before disaster), response and relief phase (during disaster), recovery and reconstruction phase (after disaster).

**Supplement 69 to ITU-T Q-series Recommendations “Framework for interconnection between VoLTE-based network and other networks supporting emergency telecommunications service (ETS)”** specifies the framework for interconnection between VoLTE-based network and other networks supporting emergency telecommunications service (ETS).

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

**ITU-T D.198 "Principles for unified format of price/tariffs/rates-lists used for exchanging telephone traffic"** (under approval) recognizes the right of any operator to present price/tariffs/rates charged for telecommunications services in any form deemed convenient for the operator, and recommends that telecommunications companies offering international connections/exchange of traffic make use as far as possible of the same templates/forms/format of data to represent traffic destinations and offered price/tariffs/rates including if required optional clarifying information or quality of service criteria.

**ITU-T D.263 "Costs, Charges and Competition for Mobile Financial Services (MFS)"** (under approval) proposes a possible approach to reduce high retail and wholesale telecommunication charges related to mobile financial service (MFS).

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

**ITU-T D.262 "Collaborative Framework for OTTs"** (under approval) provides a collaborative framework in order to promote competition, consumer protection, consumer benefits, dynamic innovation, sustainable investment and infrastructure development, accessibility and affordability in relation to the global growth of the Over the Top (OTT) applications.

**Technical Report “Digital Financial Service (DFS) - Glossary”** is a compilation of terms commonly used in the area of digital financial services and an explanation of what these terms mean.

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

**ITU-T E.802 Amd.2 “Framework and methodologies for the determination and application of QoS parameters: Amendment 2 - Updates and additional information on the degree of variability function in support of E.802”** adds analysis and information on the degree of variability function defined in Annex A.

**ITU-T E.840 “Statistical framework for end to end network-performance benchmark scoring and ranking”** presents a framework for the statistical analysis underlying the performance benchmarking of networks and services. The framework describes benchmarking scenarios, use cases and procedures and statistical techniques for ranking end to end KPIs/KQIs. The recommendation refers to mobile services and benchmarking campaigns performed using mobile agents (devices) in drive and/or walk tests, as well as fixed agents, respectively devices placed at fixed locations (e.g., within shopping malls, office buildings, stadiums).

**ITU-T J.343 Amd.1 “Hybrid perceptual bitstream models for objective video quality measurements: Amendment 1 - Test vectors for J.343 family of standards”** adds a new Appendix I containing information about test vectors for the ITU-T J.343 family of Recommendations.

**ITU-T P.501 Amd.1 “Test signals for use in telephonometry – Amendment 1: Addition to P.501 – AM-FM test signal for super-wideband and fullband applications”** extends the applicability of the AM-FM test signal to super-wideband and fullband applications.

**ITU-T P.570 “Artificial noise-fields in laboratory conditions”** specifies various artificial noise-field configurations which can be used in connection with objective as well as subjective evaluation of communication equipment. Furthermore, this Recommendation provides guidance on capturing real world noise environments and pre-processing of signals for reproduction of such environments. This Recommendation also describes calibration procedures and assessment methods for artificial noise-field configurations.

**ITU-T P.808 “Subjective evaluation of speech quality with a crowdsourcing approach”** describes a crowdsourcing approach for conducting subjective evaluations of speech quality. In comparison to laboratory tests, tests using a crowdsourcing approach rely on participants which are connected via an online platform, and whose task is to evaluate speech quality in their own environment, using their own devices. The current Recommendation gives guidance on the test material, experimental design, and the procedure for conducting listening tests in the crowd. An Annex describes the details of ACR listening quality tests. The method is to be seen as complementary to laboratory-based evaluations which are described in [ITU-T P.800].

**ITU-T P.863 (revised) “Perceptual objective listening quality prediction”** describes an objective method for predicting overall listening speech quality from narrowband (NB) (300 to 3 400 Hz) to fullband (FB) (20 to 20 000 Hz) telecommunication scenarios as perceived by the user in an ITU-T P.800 or ITU-T P.830 absolute category rating (ACR) listening-only test. Recommendation ITU-T P.863 supports two operational modes, one for narrowband and one for fullband. Super-wideband (50 to 14 000 Hz) experiments can be simulated by band limiting the reference and accordingly the degraded signal. This Recommendation presents a high-level description of the method, advice on how to use it. All essential parts of the model are described in detail, and are provided in separate pdf-files (see Annex B). These files form an integral part of this Recommendation and shall take precedence in case of conflicts between the high-level descriptions included in the main body of this Recommendation and the corresponding detailed description parts. A conformance testing procedure is also specified in Annex A to allow a user to validate that an alternative implementation of the model is correct. This Recommendation includes an electronic attachment containing detailed descriptions in pdf format (see Annex B) and conformance testing data (see Annex A).

**ITU-T P.863 Implementers’ guide “Implementers' guide for P.863”** contains all updates submitted up to and including those at Study Group 12 meeting in May 2018.

**ITU-T Y.1543 (revised) “Measurements in IP networks for inter-domain performance assessment”** specifies a set of IP performance parameters and methods of measurement applicable when assessing the quality of packet transfer on inter-domain paths. The methods anticipate that there will be multiple measurement systems, each conducting measurements of a segment of the customer-to-customer path, and recommend configurations that should produce useful results in this cooperative scenario. The methods rely on existing parameter definitions and encompass both active and passive measurement techniques. The Recommendation specifies Requirements for trustworthy IP QoS monitoring, to ensure that results will have a foundation in scientific method where sources of error are quantified. Thus, meaningful discussions of network quality of service (QoS) between users and service providers are most relevant when based on measurements at measurement points that correspond to the demarcation points of the service agreement.

**ITU-T Y.1546 Amd.1 “Hand-over performance among multiple access networks – Amendment 1 - IP-Based Service Availability Function”** introduces new Annex C on the IP-Based Service Availability Function.

**ITU-T Technical Report “Subjective evaluation of quality of media with a crowdsourcing approach”** introduces the basic concepts of crowdsourcing, its application in quality assessment studies, and describes general principles of a subjective methodology for assessing media quality using micro-task crowdsourcing. Micro-task crowdsourcing offers fast, low cost, and scalable approaches by outsourcing tasks to a large number of participants. In addition, crowdsourcing also provides a large diverse pool of participants, and a real-life environment for quality assessment of multimedia services and applications. Nevertheless, crowdsourcing methods cannot be understood as direct implementations of laboratory testing methods in an Internet-based environment, due to factors they inherit from the nature of crowdsourcing. Therefore, crowdsourcing experiments should be designed differently. The proposed principles for crowdsourcing subjective assessment methods enable experimenters to collect a large number of media quality ratings (video, image, speech, and audio-visual) in a short period of time from a diverse population of participants and in realistic environments.

**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.4060 “The structure of the testing of heterogeneous Internet of Things gateways in a laboratory environment”** describes the testing methodology of the heterogeneous network gateway which is to be used for communication among IoT devices. The tests will include the following, but not limited to:

* Check the gateway to stress load (benchmarking)
* Check the gateway to the possibility of transmission of various types and sizes of frames and (or) packages.
* Verification of the joint conversions from different protocols and multiple interfaces
* Check the gateway operation settings (CPU, RAM, etc.).
* Check the network parameters (delay, data loss, etc.).

**I.9.9 Testing energy efficiency of base stations**

**ITU-T L.1351 (L.BMM) “Base station site energy parameter measurement methodology”** describes and establishes requirements for energy efficiency measurements applicable to base station sites. This Recommendation describes:

* Measurement points definitions
* Conditions of measurement
* Instrumentation requirement
* Reporting requirement
* Use of a monitoring system

This Recommendation can be used as a conformity assessment standard for Recommendation ITU T L.1350.

**I.9.10 Testing cloud computing**

**ITU-T Q.4042.1 “Cloud interoperability testing about web application – part 1: Interoperability testing between CSC and CSP"** (under approval) specifies the cloud interoperability testing items about web application between CSC and CSP as part 1. These testing objects are developed on the basis of cloud computing interoperability testing objectives specified in [ITU-T Q.4040]. The test cases for cloud interoperability testing about web application have also been introduced as appendix.

**I.10 Mainstreaming accessibility in ICTs**

**ITU-T F.791 (revised) “Accessibility terms and definitions”** defines words describing accessibility, disability, and technical terms to be used for improving the writing in relation to standardization, and to facilitate accurately the needs and the mainstreaming of accessibility in standards that will include persons with disabilities (PWDs), older persons with age related disabilities and persons with specific needs. See WTDC Res. 58, WTDC AD and ITU–T F.790, listed in the Bibliography. This revision updates some of the definitions based on feedback received from the user community.

**ITU-T F.921 (revised) “Audio-based indoor and outdoor network navigation system for persons with vision impairment”** explains how audio-based network navigation systems can be designed to ensure that they are inclusive and meet the needs of persons with visual impairments. Recommendation ITU-T F.921 adopts a technology neutral approach by defining and explaining the functional characteristics of the system. The aim is to give designers of audio-based network navigation systems the information that they need at the initial stages of development to anticipate and overcome any restrictions and barriers that prevent users with visual impairments from making full and independent use of the built environment. Recommendation ITU-T F.921 explains how to accommodate users’ experience of audio-based network navigation systems and ensure the interoperability of those systems. This Recommendation recognizes that by meeting the user needs of persons with visual impairments, audio-based network navigation systems may also benefit persons with other disabilities, age-related conditions and specific needs, as well as the general public. This revision provides updates based on feedback received from field use of this Recommendation, as well as other text clarifications and corrections.

**ITU-T F.930 “Multimedia telecommunication relay services”** (under approval) provides an overview of telecommunications relay services. To this end, this Recommendation provides a functional description of four common types of relay services in use today: text relay, video relay, captioned telephone service relay and speech-to-speech relay. Additionally, it lays out specific functional requirements of relay services pertaining to equipment, call setup, call experience, emergency communications, and message retrieval.
The UN Convention on the Rights of Persons with Disabilities (UNCRPD), article 9, made clear the need to include persons with disabilities, older persons with age related disabilities, and persons with specific needs by mainstreaming them into all aspects of modern life. This can only be done by including them in the design of modern technology and information and communication technologies (ICTs) using universal design as defined in the UNCRPD.
Inclusion in telecommunications is a critical part of modern life for persons with disabilities, and in the realm of relay services such inclusion is expressed through the concept of functional equivalency. It states that persons with disabilities must be able to use telecommunications services with a level of functionality and ease of use that is similar to the way people use mainstream voice telecommunications services.

**Technical Paper ITU-T FSTP.ANS-Checklist “Compliance procedure and requirements for audio-based indoor and outdoor network navigation system for persons with vision impairment”** explains test specifications regarding accessible audio-based network navigation systems specified in ITU-T Rec. F.921. The test involves testing both the capabilities and behaviour of an implementation and checking what is observed against the conformance requirements in the Recommendation.

**Technical Paper FSTP-RCSO “Overview of remote captioning services”** describes remote captioning services. It defines reference model, requirements and functionality that facilitate, via an assistive intermediary (i.e., real time captioner or via voice recognition software), to enable the inclusive meeting participation of person either on site or remotely. The aim of this document is to enable meeting organisers to provide attendees located even in different countries to access to real time captioning services and give comparable and equivalent understanding and participation experience. Depending on the type of meeting, it can be a one-to-one meeting, a group meeting of persons in different locations using conferencing tools, a teleconference call or in a physical conference setting. Remote captioning is often displayed on a screen or TV monitor in the meeting room. Participants can also access remote captioning on their laptops, pads or smartphone using URL link provided to them.

**Technical Paper FSTP-CONF-F921 "Compliance procedure and requirements for audio-based indoor and outdoor network navigation system for persons with vision impairment"**was also approved, which allows conformance testing of deployments of compliant ITU-T F.921 systems.

**I.12 Combating Counterfeiting**

**ITU-T Q.5050 “Framework for solution to combat counterfeit ICT devices”** (under approval) aims to describe a reference framework, with high level challenges and requirements, that should be considered when deploying solutions to combat the circulation and use of counterfeit ICT devices.

**I.30 Formal Languages and Identification**

**ITU-T E.217 (revised) “Maritime communications - Ship station identity”** (under approval): For the purposes of International Public Correspondence Telecommunication, the ship station identity is now only relevant for those existing systems that have the ship station identity embedded in the numbering scheme as illustrated in Annexes A and B. For future systems that will not embed the ship station identity in their numbering scheme the ship station identity ceases to have any relevance for public correspondence telecommunication purposes. This revision of E.217 includes relevant text from E.210 as it combines both of those Recommendations into E.217. In addition it reflects changes that have occurred within the existing family of services provided by Inmarsat that impact the provision of Global Maritime Distress and Safety System (GMDSS). For historical accuracy this revised version also reflects details of the provision of Inmarsat services prior to the expansion of the E.164 numbering plan (ITU-T Recommendation E.164 'The international public telecommunication numbering plan') from a maximum of 12 to 15 digits.

**ITU-T X.676 “Object identifier-based resolution framework for IoT grouped services”** specifies an OID-based resolution framework for identifying various services in IoT environments. This draft Recommendation describes the concepts of IoT grouped services, considerations, architectures, and procedures for an OID-based resolution framework for IoT grouped services.

**ITU-T X.680 Amd.1 “Information technology – Abstract Syntax Notation One (ASN.1): Specification of basic notation Amendment 1”** relaxes the IMPORTS clause to allow importation of definitions from new versions of a given module.

**ITU-T Z.100 Annex F1 (revised) “Specification and Description Language - Overview of SDL-2010 - Annex F1: SDL-2010 formal definition: General overview”** (under approval) provides the motivation for and the main objectives of a formal semantics definition for SDL-2010. It gives an overview of the structure of the formal semantics, and it also contains an introduction to the Abstract State Machine (ASM) formalism, which is used to define the SDL‑2010 semantics.

**ITU-T Z.100 Annex F2 (revised) “Specification and Description Language – Overview of SDL 2010 - Annex F2: SDL 2010 formal definition: Static semantics”** (under approval) describes the static semantic constraints of SDL-2010, the mapping to the abstract grammar and the transformations identified by the 'Model' clauses of Recommendations ITU-T Z.101, Z.102, Z.103, Z.104, Z.105 and Z.107, that are included by reference in Recommendation ITU-T Z.100.

**ITU-T Z.100 Annex F3 (revised) “Specification and Description Language – Overview of SDL 2010 - Annex F3: SDL 2010 formal definition: Dynamic semantics”** (under approval)defines the SDL 2010 dynamic semantics.

**ITU-T Z.151 (revised) “User Requirements Notation (URN) - Language definition”** (under approval) defines the User Requirements Notation (URN) intended for the elicitation, analysis, specification and validation of requirements. URN combines modelling concepts and notations for goals (mainly for non-functional requirements and quality attributes) and scenarios (mainly for operational requirements, functional requirements and performance and architectural reasoning). The goal sub-notation is called Goal-oriented Requirements Language (GRL) and the scenario sub‑notation is called Use Case Map (UCM).

**ITU-T Z.161 (revised) “Testing and Test Control Notation version 3: TTCN-3 core language”** (under approval)defines TTCN-3 (Testing and Test Control Notation 3) 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.

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

**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.

**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. TTCN-3 packages are intended to define additional TTCN-3 concepts, which are not mandatory as concepts in the TTCN-3 core language, but which are optional as part of a package which is suited for dedicated applications and/or usages of TTCN-3. While the design of TTCN-3 package has taken into account the consistency of a combined usage of the core language with a number of packages, the concrete usages of and guidelines for this package in combination with other packages is outside the scope of the present document.

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

**ITU-T Z.167 (revised) “Testing and Test Control Notation version 3: Using ASN.1 with TTCN-3”** (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.

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

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

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