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| **Keywords:** | Standardization; Study Groups; activity report; key results; |
| **Abstract:** | This report summarizes progress achieved ITU-T standardization from September to December 2020, as well as measures taken by TSB to enhance the ITU-T standardization platform. |

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**ملخص تنفيذي**

***التقييس في قطاع تقييس الاتصالات بالاتحاد ودعم التعاون***

وافق الاتحاد على أكثر من 120 توصية جديدة ومراجَعة لقطاع تقييس الاتصالات بالاتحاد في الفترة الممتدة من سبتمبر إلى ديسمبر 2020. ويورد التذييل I قائمة بتوصيات القطاع والنصوص المتصلة بها ويوجز مضمونها. ويقدم القسم 1 مجموعة مختارة من النصوص التي تمت الموافقة عليها في الفترة المشمولة بالتقرير. ويمكن الاطلاع على الملخصات التنفيذية لاجتماعات لجان دراسات القطاع في [الصفحات الرئيسية](https://www.itu.int/en/ITU-T/studygroups/Pages/default.aspx) للجان الدراسات.

و[الفريق المتخصص التابع لقطاع تقييس الاتصالات والمعني بالشبكات المستقلة (FG-AN)](https://www.itu.int/en/ITU-T/focusgroups/an/Pages/default.aspx)، الذي أنشئ في 17 ديسمبر 2020، في إطار لجنة الدراسات 13، سيقود إجراء دراسات استكشافية "قبل التقييس" لتحديد كيفية دعم معايير الاتحاد لتنفيذ الشبكات المستقلة وتطورها. و[الفريق المتخصص التابع لقطاع تقييس الاتصالات والمعني بالذكاء الاصطناعي من أجل إدارة الكوارث الطبيعية (FG-AI4ND)](https://www.itu.int/en/ITU-T/focusgroups/ai4ndm/Pages/default.aspx)، الذي أنشئ في 18 ديسمبر في إطار لجنة الدراسات 2، سيدعم الجهود العالمية الرامية إلى تحسين فهمنا للكوارث الطبيعية ونمذجتها من أجل الاستعداد والاستجابة لها بفعالية.

وعقد [فريق المهام الجديد المشترك بين الاتحاد الدولي للاتصالات ومنظمة التوحيد القياسي واللجنة الكهرتقنية الدولية والمعني بالمدن الذكية](https://www.itu.int/en/myitu/News/2020/10/08/13/10/New-smart-city-standards-Joint-Task-Force-established-by-ITU-ISO-and-IEC) اجتماعه الأول في 7 أكتوبر 2020. وعُقدت [قمة الرياض الدولية للمواصفات](https://events.saso.gov.sa/rss/) التي شارك في تنظيمها الاتحاد الدولي للاتصالات ومنظمة التوحيد القياس واللجنة الكهرتقنية الدولية إلى جانب الهيئة السعودية للمواصفات والمقاييس والجودة (SASO) كجزء من أنشطة مجموعة العشرين في 4 أكتوبر، واختتمت القمة [بدعوة إلى العمل](https://www.itu.int/en/myitu/News/2020/11/04/17/32/G20-call-to-action-on-international-standards) لإقرار المعايير الدولية ودعمها واعتمادها لتسريع التحول الرقمي. وجرت احتفالات اليوم العالمي للمعايير لعام 2020 بتنظيم مشترك بين الاتحاد الدولي للاتصالات ومنظمة التوحيد القياسي واللجنة الكهرتقنية الدولية تحت عنوان "[حماية الكوكب بفضل المعايير](https://www.worldstandardscooperation.org/world-standards-day/)".

وتدعم [مذكرة تفاهم (MoU)](https://www.itu.int/en/mediacentre/Pages/pr30-2020-UN-Habitat-partner-accelerate-digital-transformation-cities-communities.aspx) جديدة بين الاتحاد الدولي للاتصالات وبرنامج الأمم المتحدة للمستوطنات البشرية (UN-Habitat) التعاون بين المنظمتين من أجل النهوض بحقوق الإنسان وتعزيز الإدماج الاجتماعي وتحقيق التنمية الحضرية المستدامة. وتدعم مذكرة التفاهم المنظمتين في تشجيع الاستثمار المسؤول وتمويل مشاريع المدن الذكية فضلاً عن الحوار الشامل حول الدعم الذي تقدمه التكنولوجيات الرقمية والمعايير والمبادئ التوجيهية ذات الصلة.

ومكّنت [المسابقة التي نظمها الاتحاد بشأن الذكاء الاصطناعي والتعلم الآلي في شبكات الجيل الخامس](https://www.itu.int/en/ITU-T/AI/challenge/2020/Pages/default.aspx) أكثر من 1 300 مشارك من 62 بلداً من التواصل مع شركاء جدد في الصناعة والأوساط الأكاديمية – واستعمال أدوات وموارد بيانات جديدة – لتحقيق الأهداف المحددة التي ألقت عليها الضوء بيانات المشاكل التي عرضتها الصناعة والأوساط الأكاديمية في البرازيل والصين والهند وأيرلندا واليابان وروسيا وإسبانيا وتركيا والولايات المتحدة. وكانت المسابقة تهدف أيضاً إلى إبراز وإقرار معايير الاتحاد الجديدة لدمج الذكاء الاصطناعي/التعلم الآلي في شبكات الجيل الخامس والشبكات المستقبلية وإتاحة فرص جديدة للصناعة والأوساط الأكاديمية للتأثير على تطور هذه المعايير. وتم تكريم [الفريق الفائز والفريق الحاصل على المركز الثاني](https://www.itu.int/en/myitu/News/2020/12/18/13/45/ITU-AI-ML-machine-learning-5G-grand-challenge-winners) في المسابقة الكبرى في الفترة 17-15 ديسمبر 2020. ويمكن الاطلاع على مزيد من المعلومات بشأن المسابقة في [عدد مخصص من مجلة أخبار الاتحاد](https://www.itu.int/fr/myitu/Publications/2020/12/10/08/43/ITU-News-Magazine-no-5-2020).

ويعرض [العدد الأول](https://www.itu.int/en/myitu/News/2020/12/23/15/03/Be-first-to-read-the-new-ITU-Journal-on-Future-and-Evolving-Technologies) من [مجلة الاتحاد بشأن التكنولوجيات المستقبلية والمتطورة](https://www.itu.int/en/journal/j-fet/Pages/default.aspx) الذي نُشر في 22 ديسمبر 2020، مساهمات فريدة في البحث في مجال معالجة الإشارات والاتصالات في سيناريوهات التنقلية العالية، وإنترنت الأشياء، واتصالات المركبات والتخفيف من وطأة الأوبئة والذكاء الاصطناعي والتعلم الآلي في شبكات الجيل الخامس وما بعدها. ويناقش العدد أيضاً تطور تقاسم البنى التحتية والسبب في أن التقاسم أصبح واقعاً تجارياً في سياق الجيل الخامس. وستتناول [خمسة أعداد خاصة قادمة في 2021](https://www.itu.int/en/myitu/News/2020/12/23/18/27/Contribute-to-special-issues-of-ITU-Journal-on-topics-from-Bio-NanoThings-to-beyond-5G) تكنولوجيا الأشياء الحيوية المتناهية الصغر لأغراض الرعاية الصحية، وإنترنت كل شيء، والاتصالات بالتيراهرتز، والذكاء الاصطناعي والتعلم الآلي في شبكات الجيل الخامس، وأنظمة الاتصالات اللاسلكية التي تتجاوز الجيل الخامس.

وتناول [حدث كاليدوسكوب لعام 2020 بشأن التحول الرقمي الذي تقوده الصناعة](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2020/Pages/default.aspx) في الفترة 11-7 ديسمبر 2020 الفرص الجديدة التي يتيحها الابتكار للصناعة في مجالات مثل الذكاء الاصطناعي (AI) والتعلم الآلي، والأنظمة السيبرانية المادية، والمحاكاة الافتراضية، والتوأمة الرقمية، والواقع المزيد، وشبكات الجيل الخامس وشبكات المستقبل. ويحظى حدث كاليدوسكوب الذي ينظمه الاتحاد برعاية تقنية من معهد مهندسي الكهرباء والإلكترونيات وجمعية الاتصالات لمعهد مهندسي الكهرباء والإلكترونيات. ورحب الحدث هذا العام بجهة داعمة جديدة، جمعية إدارة التكنولوجيا والهندسة لمعهد مهندسي الكهرباء والإلكترونيات. اطلع على المزيد بشأن [الورقة الفائزة والورقتين الحاصلتين على المركز الثاني والثالث في حدث كاليدوسكوب لعام 2020](https://www.itu.int/en/myitu/News/2020/12/24/10/52/Japan-NICT-claims-Kaleidoscope-1st-prize-for-research-in-machine-learning).

***منصة التقييس لقطاع تقييس الاتصالات***

استمر النمو في عضوية قطاع تقييس الاتصالات في عام 2020، حيث رحب القطاع بانضمام 43 عضواً جديداً (9 أعضاء في القطاع و34 منتسباً)، مما أدى إلى زيادة صافية قدرها 22 عضواً في 2020. وبالإضافة إلى ذلك، انضمت 24 هيئة أكاديمية إلى الاتحاد في 2020. وتشارك 19 منظمة بصفة منتسب في إطار هيكل الرسوم المخفضة الجديد للشركات الصغيرة والمتوسطة.

وقد برزت في عام 2020 قيمة بيئة العمل الإلكترونية لقطاع تقييس الاتصالات بالاتحاد. وأصبحت الاجتماعات الافتراضية وأساليب العمل الإلكترونية تشكل منصة أساسية لأعمال التقييس في الاتحاد في إطار التصدي على الصعيد العالمي لفيروس كورونا (COVID-19). ويستخدم أعضاء الاتحاد بصورة مثلى المنصة [[MyWorkspace](https://www.itu.int/net4/ITU-T/myworkspace/)](https://www.itu.int/net4/ITU-T/myworkspace/) الشخصية والخدمات والأدوات المرتبطة بها والتي طورها مكتب تقييس الاتصالات مثل أداة MyMeetings.

وتناقش ورش العمل والندوات التي ينظمها الاتحاد الاتجاهات الناشئة في مجال التقييس وتسلط الضوء على أعمال قطاع تقييس الاتصالات به، وتعزز تعاون القطاع مع هيئات أخرى، وتجذب الأعضاء الجدد للانضمام إليه، وتشجع التعلم من الأقران فيما يتعلق بوضع المعايير الدولية وتنفيذها. ومع عقد جميع ورش العمل والندوات التي ينظمها القطاع بشكل افتراضي، شهدت ورش العمل والندوات زيادة في أعداد المشاركين وتنوعهم.

وفي الفترة الممتدة من سبتمبر حتى منتصف ديسمبر 2020، نُشر أكثر من 5 000 صفحة من توصيات قطاع تقييس الاتصالات وإضافاتها. وتُنشر النسخ الرئيسية من التوصيات والإضافات بالنسق ePub القابل للتكييف (أي يمكن أن تكيف الوثيقة عرضها وفق الجهاز المستعمل)، إلى جانب النسق PDF الاعتيادي. ولا يزال منتج الاتحاد الصادر باسم "توصيات وكتيبات مختارة صادرة عن قطاع تقييس الاتصالات" يُنشر على أساس ربع سنوي في مفتاح USB.

ويواصل مكتب تقييس الاتصالات ترجمة التوصيات التي جرت الموافقة عليها في إطار عملية الموافقة التقليدية (TAP)، فضلاً عن جميع تقارير الفريق الاستشاري لتقييس الاتصالات، بجميع لغات الاتحاد. وترجم المكتب توصيتين جرت الموافقة عليهما في إطار عملية الموافقة البديلة (AAP) في الفترة الممتدة من سبتمبر إلى ديسمبر 2020، وذلك وفقاً للطلبات التي سبق أن تلقّتها لجان الدراسات التابعة للقطاع والمجموعات اللغوية، وفي حدود الميزانية المخصصة للترجمة.

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

# 1 Selection of achievements in ITU-T standardization

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

ITU approved more than 120 new and revised ITU-T Recommendations from September to December 2020. Appendix I lists these ITU-T Recommendations and related texts and summarizes their contents.

**IMT-2020/5G:** New ITU standards describe Information Centric Networking for routing and forwarding (Y.3075), ICN for edge networking (Y.3076); FMC requirements for management and orchestration (Y.3134); FMC session management (Y.3136); network softwarization (Y.3150); and SDN data plane (Y.3155). Three new ITU standards on managed and hybrid peer-to-peer communications were approved (X.609.9, X.609.10 and Q.4100).

**Machine learning for IMT-2020/5G:** New ITU standards address network slicing with AI-assisted analysis (Y.3156), and machine learning marketplace integration (Y.3176).

**Transport, access and home:** New ITU standards address transverse compatible DWDM applications for repeated optical fibre submarine cable systems (G.977.1), telecommunication infrastructure facility management (L.330), and requirements of optical fibre cables for in-home applications (L.111). A new Technical Paper describes the use of G.hn technology for smart grid (GSTP-HNSG).

**Intelligent transport systems:** New ITU standards describe accessibility requirements for smart public transportation services (Y.4211); security requirement and threats to connected vehicles (X.1374); and guidelines for intrusion detection systems (IDSs) on in-vehicle networks (X.1375).

**Quantum information technology:** New ITU standards provide functional architecture (Y.3802), key management (Y.3803) and control and management (Y.3004) for quantum key distribution networks; a security framework for quantum key distribution networks (X.1710), and key combination methods (X.1714).

**Personal data and trust:** A new ITU standard provides a framework for trust-based personal data management (Y.3055); a framework for de-identification processes (X.1148).

**Security:** New ITU standards address SDN/NFV security (X.1046), cybersecurity incident evidence (X.1216); malware analysis in a sandbox environment (X.1218); enhanced authentication using telebiometrics with anti-spoofing detection mechanisms (X.1279); a technical framework for security services provided by operators (X.1452).

**Cloud computing security:** New ITU standards address security aspects for communications as a service application environments (X.1606); requirements for cloud service development and operation management (Y.3525); functional requirements for blockchain as a service (Y.3530), and functional requirements for machine learning as a service (Y.3551).

**Distributed ledger technologies and blockchain:** New ITU standards address terms and definitions (X.1400); security guidelines for using DLT for decentralized identity management (X.1403); security assurance (X.1404); functional requirements for blockchain as a service (Y.3550).

**Electromagnetic fields:** New ITU standards provide a multiservice surge protective device application guide (K.148), passive intermodulation test methods of array antenna systems in mobile communication systems (K.149), and information on semiconductor devices required for the design of telecommunication equipment applying soft error mitigation measures (K.150).

**Environment and circular economy:** New ITU standard provide procurement criteria for sustainable data centres (L.1304), an assessment method for circular scoring (L.1023), a guideline for achieving the e-waste targets of the Connect 2030 Agenda (L.1031), and a scoring tool to assess the sustainability performance of office buildings (L.Suppl.40).

**Energy efficiency:** New ITU standards address energy efficiency metrics and measurement methods for telecommunication equipment (L.1310); an assessment of mobile network energy efficiency (L.1331); and provide guidance to ICT manufacturers on setting 1.5°C aligned targets compliant with Recommendation ITU-T L.1470 (L.Suppl.38).

**Internet of Things security:** New ITU standards address IoT message authentication (X.1366), IoT error logs for IoT incident operations (X.1367)

**Unmanned aerial vehicles:** A new ITU standard defines the requirements and functional architecture of base station inspection services using unmanned aerial vehicles (Y.4559).

**Accessibility**: New ITU standards provide an enhanced user interface framework for IPTV terminal device, gesture control interface (H.704), and accessibility requirements for smart public transportation services (Y.4211).

**e-health**: A new ITU standard evaluates the performance of e-health systems in IoT (Y.4908).

**Quality of service strategies:** New ITU standards provide an application guide for Recommendation ITU-T E.804 (E.804.1) and a QoS operational strategy for improved regulatory supervision on providers of mobile telecommunication services (E.805.1).

Quality Virtual Reality: New ITU standards classify virtual reality services and identify the key QoE factors of VR (G.1035); and a subjective test methodologies for 360º video on head-mounted displays (P.919).

**Emergency telecommunications:** A new ITU standard defines a signalling architecture of the fast deployment emergency telecommunication network to be used in a natural disaster (Q.3060).

**Combating counterfeit and ICT device theft:** A new ITU standard addresses mobile devices with duplicate unique identifier (Q.5052). A new technical report studies the reliability of IMEI.

**Big data:** New ITU standards provide security of big data as a service for Big Data Service Providers (X.1750), security guidelines on big data lifecycle management for telecommunication operators (X.1751); and a Big data reference architecture (Y.3605).

**Telecoms management:** A new ITU standard outlines the requirements and benefits of synergy management for cloud and SDN-based networks, detailing its structure and the composition of the function set (M.3373).

**Video and image coding:** A new twin text with ISO/IEC provides guidance on alternative text for images (T.701.11).

**Protocols:** New ITU standards address a signalling architecture of orchestration in NGNe (Q.3058), a protocol at the interface between two distributed ENUM servers for IMS (Q.3645), a signalling architecture of the fast deployment emergency telecommunication network to be used in a natural disaster (Q.3060), signalling requirements for service function discovery (Q.3059), procedures for vBNG acceleration with programmable acceleration card (Q.3720).

**Test specifications:** New ITU standards provide testing procedures for augmented reality applications (Q.4066), a framework for IoT testing (Q.4062), a framework for the testing of identification systems used in IoT (Q.4063), parameters of virtual broadband network gateway (vBNG) for monitoring (Q.3915), parameters for evaluating bottlenecks in web-browsing service (Q.3961), and vBNG interoperability testing requirements (Q.4064).

# 2 ITU-T Focus Groups

## 2.1 New group on Autonomous Networks

Established 17 December 2020, the [ITU-T Focus Group on Autonomous Networks (FG-AN)](https://www.itu.int/en/ITU-T/focusgroups/an/Pages/default.aspx), reporting to SG13, will lead exploratory ‘pre-standardization’ studies to determine how ITU standards will support the realization and evolution of autonomous networks.

The group will study the ‘creative intelligence’ techniques describes foundational concepts such as ‘exploratory evolution’, ‘emergent behaviour’, and ‘real-time responsive experimentation’. It will study the meaning and characteristics of autonomous networks, providing definitions and terminology to build clarity around the concepts underpinning creativity in autonomous networks. It will propose technical enablers for evolution in autonomous networks to support networks’ dynamic adaptation to future ICT environments and use cases. And it will demonstrate architecture concepts and develop associated guidelines to enable higher levels of autonomy.

1st meeting: 2-4 February 2021.

## 2.2 New group on AI for Natural Disaster Management

Established 18 December 2020, the [ITU-T Focus Group on AI for Natural Disaster Management (FG-AI4ND)](https://www.itu.int/en/ITU-T/focusgroups/ai4ndm/Pages/default.aspx), reporting to SG2, will support global efforts to improve our understanding and modelling of natural disasters in the interests of effective preparation and response. The group’s activities will benefit from close collaboration with the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP).

The group will analyze relevant use cases of AI to deliver technical reports and accompanying educational materials on the use of AI in three key areas: advancing data collection and handling, improving modelling across spatiotemporal scales by extracting complex patterns from a growing volume of geospatial data, and supporting effective emergency communications.

The group’s work will pay particular attention to the needs of vulnerable and resource-constrained regions, making special effort to support the participation of the countries shown to be most acutely impacted by natural disasters, notably Small Island Developing States (SIDS) and Least Developed Countries (LDCs).

1st meeting dates to be confirmed.

## 2.3 Active groups

[Quantum Information Technology for Networks (FG-QIT4N)](https://www.itu.int/en/ITU-T/focusgroups/qit4n/Pages/default.aspx)

* 6th meeting: 26 October - 6 November 2020
* 7th meeting: 25 January - 5 February 2021.

[AI for Health (FG-AI4H)](https://www.itu.int/en/ITU-T/focusgroups/ai4h)

* 10th meeting: 30 September - 2 October 2020
* 11th meeting: 27-29 January 2021.

[Vehicular Multimedia (FG-VM](https://www.itu.int/en/ITU-T/focusgroups/vm/Pages/default.aspx))

* 11th meeting: 10-11 December 2020
* 12th meeting: 12-13 April 2021.

[AI for Autonomous and Assisted Driving (FG-AI4AD)](https://www.itu.int/en/ITU-T/focusgroups/ai4ad)

* 4th meeting: 2-3 December 2020
* 5th meeting: 2-3 March 2021.

[Environmental Efficiency for AI and other Emerging Technologies (FG-AI4EE)](https://www.itu.int/en/ITU-T/focusgroups/ai4ee/Pages/default.aspx)

* 2nd meeting: 9-10 December 2020
* 3rd meeting dates to be confirmed.

# 3 Cooperation and coordination

TSB implements ITU-T Objective T.5 of the Strategic Plan of the Union, "Extend and facilitate cooperation with international, regional and national standardization bodies".

Memoranda of Understanding and Cooperation Agreements are available on the relevant [web page](https://www.itu.int/en/ITU-T/extcoop/Pages/mou.aspx).

## 3.1 World Standards Cooperation

ITU, ISO and IEC cooperate under the banner of the [World Standards Cooperation](https://www.worldstandardscooperation.org/).

Around 10% of ITU's standards are common or aligned texts with [ISO/IEC Joint Technical Committee 1 (Information Technology)](https://jtc1info.org/).Work of common interest benefits from the [ITU-ISO-IEC Standardization Programme Coordination Group](https://www.itu.int/en/ITU-T/extcoop/Documents/tor/ToR_SPCG.pdf) and the new [ITU-ISO-IEC Joint Task Force on Smart Cities](https://www.itu.int/en/myitu/News/2020/10/08/13/10/New-smart-city-standards-Joint-Task-Force-established-by-ITU-ISO-and-IEC), which held its first meeting on 7 October 2020.

**Riyadh International Standards Summit:** Organized by ITU, ISO and IEC together with the Saudi Standards, Metrology and Quality Organization (SASO) as part of G20 activities, 4 October 2020, the [summit](https://events.saso.gov.sa/rss/) concluded with a [Call to Action](https://www.itu.int/en/myitu/News/2020/11/04/17/32/G20-call-to-action-on-international-standards) to recognize, support, and adopt international standards to accelerate digital transformation.

**World Standards Day:** ITU, ISO and IEC lead the celebration of World Standards Day, 14 October, this year themed [“Protecting the planet with standards”](https://www.worldstandardscooperation.org/world-standards-day/). World Standards Day 2021 will highlight the importance of international standards to the United Nations Sustainable Development Goals.

## 3.2 National and regional standardization organizations

TSB facilitates an ITU-T presence in activities arranged by other standards bodies, with a view to promoting other standards bodies' engagement with ITU-T workings groups, workshops and related ITU-T collaboration initiatives. TSB’s efforts in this regard have strengthened the exchange of information between ITU-T and national and regional standards, supporting closer cooperation and collaboration.

Standardization bodies with which TSB is currently expanding cooperation include the African Regional Organization for Standardisation (ARSO),thePan American Standards Commission (COPANT), the Pacific Area Standards Congress (PASC), and the South Asian Regional Standards Organization (SARSO).

## 3.3 Regional Organizations and ITU Regional and Area Offices

An overview of all WTSA regional preparatory meetings can be found on the relevant [WTSA-20 web page](file:///D:\2020\08_08_2019\WTSA-20%20web%20page).

At the initiative of the TSB Director, TSB organizes conference calls and face-to-face meetings on a regular basis with ITU’s Regional and Area Offices. The activity supports the coordination and efficiency of the operations, events and activities of ITU-T and TSB and also contributes to greater awareness of ITU-T standardization activities.

## 3.4 ITU Sectors

TSAG maintains a close relationship with RAG and TDAG in order to develop synergies with the objective of strengthening coordination and cooperation among the three ITU Sectors on matters of mutual interest.

Three Inter-Sector Rapporteur groups (IRGs) work on items of interest to various ITU-T and ITU-R SGs.

* [IRG-AVA](https://www.itu.int/en/irg/ava): Intersector Rapporteur Group on Audiovisual Media Accessibility, among ITU-T SG9, ITU-T SG16 and ITU-R SG6. A virtual meeting was held on 20 October 2020.
* [IRG-AVQA](https://www.itu.int/en/irg/avqa): Intersector Rapporteur Group on Audiovisual Quality Assessment, among ITU-T SG12 and ITU-R SG6. A virtual meeting was held in December 2020, in conjunction with the Video Quality Expert Group (VQEG).
* [IRG-IBB](https://www.itu.int/en/irg/ibb): Intersector Rapporteur Group on Integrated Broadcast-Broadband, among ITU-T SG9, ITU-T SG16 and ITU-R WP 6B.

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

# 4 Collaboration initiatives

## 4.1 Artificial intelligence and machine learning

**AI and machine learning in 5G:** The [ITU Challenge on AI/ML in 5G](https://www.itu.int/en/ITU-T/AI/challenge/2020/Pages/default.aspx) enabled over 1300 participants from 62 countries to connect with new partners in industry and academia — and new tools and data resources — to achieve goals set out by problem statements contributed by industry and academia in Brazil, China, India, Ireland, Japan, Russia, Spain, Turkey and the United States. The Challenge also aimed to demonstrate and validate new ITU standards for AI/ML integration in 5G and future networks and create new opportunities for industry and academia to influence the evolution of these standards. The Challenge was organized with the support of promotion partners [LF AI & Data](https://lfaidata.foundation/), [NGMN](https://www.ngmn.org/) and [SGInnovate](https://www.sginnovate.com/); Gold sponsor the [Telecommunications Regulatory Authority of the United Arab Emirates](https://www.tra.gov.ae/en/home.aspx); and Bronze sponsors [Cisco](https://www.cisco.com/) and [ZTE](https://www.zte.com.cn/global/).

The [winning and runner-up teams](https://www.itu.int/en/myitu/News/2020/12/18/13/45/ITU-AI-ML-machine-learning-5G-grand-challenge-winners) were recognized at a Grand Finale, 15-17 December 2020. Read more about the Challenge in a [dedicated issue of the ITU News Magazine](https://www.itu.int/fr/myitu/Publications/2020/12/10/08/43/ITU-News-Magazine-no-5-2020). Read more about the Challenge in a [dedicated issue of the ITU News Magazine](https://www.itu.int/fr/myitu/Publications/2020/12/10/08/43/ITU-News-Magazine-no-5-2020).

**AI for Good:** The [AI for Good Global Summit](https://aiforgood.itu.int/programme-2020/) series identifies practical applications of AI with the potential to accelerate progress towards the SDGs. Close to 40 UN partners support the summit. AI for Good ['Breakthrough Days'](https://aiforgood.itu.int/breakthrough-days/), 21-30 September 2020, represented the culmination of this year's actions to generate AI for Good projects capable of advancing gender equality and food security and contending with pandemics such as COVID-19. The AI for Good series features weekly programming all year, arranged into three streams (Build, Learn, Experience) with the following service offerings:

Build:

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

Learn:

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

Experience:

* AI for Good Artistic Intelligence
* AI for Good Demos

**AI and Data Commons:** The [Global Initiative on 'AI and Data Commons'](https://www.itu.int/en/ITU-T/extcoop/ai-data-commons/Pages/default.aspx) aims to support AI for Good projects in achieving global scale. The Initiative will offer assemblies of resources to launch new AI projects aligned with the SDGs, and scale them up fast.

## 4.2 Digital financial inclusion

The[Financial Inclusion Global Initiative (FIGI)](https://www.itu.int/en/ITU-T/extcoop/figisymposium/Pages/default.aspx) is a three-year programme of collective action led by ITU, the World Bank Group and the Committee on Payments and Market Infrastructures, with support from the Bill & Melinda Gates Foundation. FIGI is designed to advance research in digital finance and accelerate digital financial inclusion in developing countries. ITU leads the FIGI Security, Infrastructure and Trust Working Group as well as the organization of FIGI symposia. The third FIGI Symposium will be held virtually over six weeks from 18 May to 24 June 2021.

The new [Digital Currency Global Initiative](https://www.itu.int/en/ITU-T/extcoop/dcgi/Pages/default.aspx) is a collaboration between ITU and Stanford University. The Initiative is an open platform for dialogue and research on pilot implementations of digital currency, their use cases, applications and developing specifications for technical standards that will foster adoption, universal access, and ultimately financial inclusion. Its various working groups and work streams held some 20 virtual meeting in the reporting period.

The [Insights on DFS webinar series](https://www.itu.int/en/ITU-T/webinars/Pages/dfs.aspx) offered two webinars from September and December 2020, episode #11 on tracking digital financial crimes and fraud (part 2), 2 September 2020, and episode #12 on mitigating infrastructure vulnerabilities for digital finance, 10 November 2020.

TSB represented ITU at a high-level panel on “Digital Finance - a Building Block for Digital Cooperation” convened by UNDP, 15 September 2020. The panel welcomed the [UN Secretary-General’s Roadmap for Digital Cooperation](https://www.un.org/en/content/digital-cooperation-roadmap/) and the [UN Secretary General’s Task Force on Digital Financing of the SDGs](https://www.un.org/en/digital-financing-taskforce).

## 4.3 Smart cities and communities

A new [Memorandum of Understanding (MoU)](https://www.itu.int/en/mediacentre/Pages/pr30-2020-UN-Habitat-partner-accelerate-digital-transformation-cities-communities.aspx) between ITU and the United Nations Human Settlements Programme (UN-Habitat) supports their collaboration to advance human rights, promote social inclusion and achieve sustainable urban development. It supports the organizations in encouraging responsible investment and financing for smart city projects as well as inclusive dialogue around the support offered by digital technologies and related standards and guidelines. The leadership of ITU and UN-Habitat welcomed the new MoU at a [Virtual Forum on the Digital Transformation of Cities and Communities](https://www.itu.int/en/ITU-T/climatechange/Pages/20201207.aspx), co-organized by ITU and UN-Habitat on 7 December 2020.

The [United for Smart Sustainable Cities (U4SSC)](http://www.itu.int/en/ITU-T/ssc/united/Pages/default.aspx) initiative is supported by 17 UN bodies with the aim of achieving SDG11: ‘Make cities and human settlements inclusive, safe, resilient and sustainable’. U4SSC held its 5th annual meeting on 9 October 2020, co-organized by ITU, UNECE and UN-Habitat, and hosted by UNECE.

Cities worldwide are evaluating their progress towards smart city objectives and the SDGs using [U4SSC Key Performance Indicators for Smart Sustainable Cities](https://www.itu.int/en/ITU-T/ssc/united/Pages/publication-U4SSC-KPIs.aspx) based on ITU standards. The results of the KPI evaluations are shared by [city snapshots, factsheets and verification reports](https://www.itu.int/en/ITU-T/ssc/united/Pages/publication-U4SSC-KPIs.aspx).

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

U4SSC is developing expert guidance on topics including:

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

TSB represented ITU at the [2nd OECD Roundtable on Smart Cities and Inclusive Growth](http://www.oecd.org/cfe/cities/oecd-roundtable-on-smart-cities-and-inclusive-growth.htm), 3 December 2020.

# 5 Academia

## 5.1 ITU Journal

The [first issue](https://www.itu.int/en/myitu/News/2020/12/23/15/03/Be-first-to-read-the-new-ITU-Journal-on-Future-and-Evolving-Technologies) of the [ITU Journal on Future and Evolving Technologies](https://www.itu.int/en/journal/j-fet/Pages/default.aspx), published 22 December 2020, shares unique contributions to research in signal processing and communications in high-mobility scenarios, the Internet of Things, vehicular communications, pandemic mitigation, and AI and machine learning for 5G and beyond. It also discusses the evolution of infrastructure sharing and why sharing has become a commercial reality in the 5G context. [Five upcoming special issues in 2021](https://www.itu.int/en/myitu/News/2020/12/23/18/27/Contribute-to-special-issues-of-ITU-Journal-on-topics-from-Bio-NanoThings-to-beyond-5G) will address Bio-NanoThings for healthcare, Internet of Everything, Terahertz communications, AI and machine learning for 5G, and wireless communication systems beyond 5G.

In line with the co-publishing agreement signed between ITU and Tsinghua University Press Ltd. in 2019, the joint ITU-Tsinghua University Press journal on [Intelligent and Converged Networks](http://icn.tsinghuajournals.com/) is preparing a [Series on Data Driven Intelligence, Sustainability, and Systems](http://icn.tsinghuajournals.com/EN/column/item1649.shtml) and a [special Issue on Artificial Intelligence Aided 6G Communications](http://icn.tsinghuajournals.com/EN/column/item1647.shtml).

## 5.2 ITU Kaleidoscope academic conferences

The ITU Kaleidoscope series of peer-reviewed academic conferences – technically co-sponsored by the IEEE and the IEEE Communications Society (IEEE ComSoc) – calls for original research on topics of growing strategic relevance to ITU membership.

The twelfth edition of the ITU Kaleidoscope conference, initially planned to take place in Ha Noi, Vietnam, in conjunction with ITU Digital World 2020, was held fully online from 7 to 11 December 2020.

This year Kaleidoscope welcomed a new supporter alongside technical co-sponsors, the IEEE Technology and Engineering Management Society (IEEE TEMS).

[Kaleidoscope 2020: Industry-driven transformation](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2020/Pages/default.aspx) looked at new opportunities for industry introduced by innovation in fields such as artificial intelligence (AI) and machine learning, cyber-physical systems, virtual simulation, digital twins, augmented reality, and 5G and future networks.

See the [Programme](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2020/Pages/programme.aspx) for presentations of 21 research papers (published in [Conference Proceedings](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2020/Documents/Conference%20Proceedings/20-00062-kaleidoscope.pdf)) as well as keynote speeches and invited papers, and a special panel on ["the role of ICT for future pandemics](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2020/Pages/special-panel-pandemics.aspx)" in collaboration with PAHO/WHO). The online event also offered a [Networking opportunities programme](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2020/Pages/networking-opportunities.aspx) that will continue into 2021.

Learn more about the [winning and runner-up papers at Kaleidoscope 2020](https://www.itu.int/en/myitu/News/2020/12/24/10/52/Japan-NICT-claims-Kaleidoscope-1st-prize-for-research-in-machine-learning).

# 6 Membership

ITU-T membership maintained growth in 2020, welcoming 43 new members (9 Sector Members and 34 Associates, resulting in a net increase of 22 members in 2020. In addition, 24 new Academia members joined ITU in 2020. 19 organizations are participating as Associates within the new SME reduced fee structure.

## 6.1 Evolution of ITU-T membership

**New Sector Members in 2020:**

IBM; Zhejiang Dahua Technology Co. Ltd.; Cox Communications; Huawei Technologies Switzerland AG; Asiainfo Technologies (China), Inc.; InterDigital Canada Ltee; Rakuten Mobile, Inc; Global Esports Federation; Five 9 Inc.

**New Associates in 2020:**

Tampnet AS (SG2); Telna (Singapore) Pte. Ltd. (SG2); Afinna One Srl (SG2); Flo Live Limited (SG2); Banktel Kommunikációs Zrt. (SG2); State Grid Information & Telecommunication Group Co., Ltd. (SG2); Telecom Italia Sparkle S.p.A. (SG2); Mytelnet (Pty) Ltd. (SG2); Globalgig Limited (SG2); Podsystem Ltd. (SG2); Inspur Tianyuan Communication Information System Co., Ltd.(SG2); Halys SA (SG2); Wavecontrol, S.L. (SG5); Sky Group (SG9); Vaulto Communication Technologies Ltd. (SG11); Speedchecker Ltd. (SG12), TEOCO Corporation (SG12); Tutela (SG12); Wuhan Rayton Network Technology Co., Ltd (SG13); Jiangsu Zhongtian Technology Co., Ltd. (SG15); Idea Electronic Systems (SG15); AEPONYX inc (SG15); China Electric Power Research Institute (SG15); Onchain Solutions (Shanghai Distributed Technology Co., Ltd.) (SG16); Hangzhou Qulian Technology Co., Ltd. (SG16); Beijing Zhongdun Security Technology Development Co. (SG16); PwC UK (SG16); Shenzhen Transsion Holdings Co. Limited (SG16); ePaiLive Auction (Beijing) Co., Ltd. (SG16); Multiledgers (SG16); Zennous SA (SG20); Innov-Alliance-Tech (SG20); ITRI International Inc. (SG20); BigchainDB GmbH (SG20).

**New Academia in 2020:**

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

**Total ITU-T Sector Members, Associates and Academia (31 December 2009 – 11 December 2020):**

The following table and figure illustrate the evolution of ITU-T membership from 31 December 2009 to 11 December 2020 (noting that the Academia membership category opened in 2011).

**Table 1: Evolution of ITU-T membership from 31 December 2009 to 11 December 2020**

|  | **2009** | **2010** | **2011** | **2012** | **2013** | **2014** | **2015** | **2016** | **2017** | **2018** | **2019** | **2020** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Sector Members | 290 | 261 | 263 | 267 | 274 | 272 | 266 | 253 | 257 | 257 | 266 | 268 |
| Associates | 101 | 111 | 119 | 128 | 130 | 132 | 132 | 128 | 137 | 157 | 182 | 202 |
| Academia | ‑ | ‑ | 23 | 40 | 58 | 73 | 95 | 107 | 124 | 153 | 159 | 163 |
| TOTAL | 391 | 372 | 405 | 435 | 462 | 477 | 493 | 488 | 518 | 567 | 607 | 633 |

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

**Figure 1 – Evolution of ITU-T membership from 31 December 2009 to 11 December 2020**

NOTE – The Academia category was created in 2011.

## 6.2 Reduced Associate fee structure for SMEs

19 organizations are participating as Associates within the new SME reduced fee structure:

| **Organization** | **Study Group** | **Area of Interest** |
| --- | --- | --- |
| Flo Live Limited | SG2 | International numbering resources |
| Banktel Kommunikációs Zrt. | SG2 | International numbering resources |
| Mytelnet (Pty) Ltd. | SG2 | International numbering resources |
| Halys SA | SG2 | International numbering resources |
| Globalgig Limited | SG2 | International numbering resources |
| Wavecontrol, S.L. | SG5 | EMF monitoring procedures |
| Vaulto Communication Technologies | SG11 | Abuse of SS7 vulnerabilities to commit financial fraud |
| Speedchecker | SG12 | Crowdsourcing approach for the assessment of end-to-end quality of service in fixed and mobile broadband networks |
| Focus Infocom Ges. F. Informatik u. Telekomm. mbH | SG12 | Operational aspects of telecommunication network service quality |
| OPTICOM Dipl.-Ing. M. Keyhl GmbH | SG12 | Next-Generation Mobile voice quality testing |
| Opensignal | SG12 | Crowdsourcing approach for the assessment of end-to-end quality of service in fixed and mobile broadband networks |
| Tutela | SG12 | Crowdsourced network quality measurement |
| AEPONYX inc | SG15 | Next-generation PON systems to enable a higher data transmission capacity through multiple frequency channels |
| Hangzhou Qulian Technology Co., Ltd. | SG16 | Distributed ledger technologies and e-services |
| Onchain Solutions (Shanghai Distributed Technology Co., Ltd.) | SG16 | Distributed ledger technologies and e-services |
| Multiledgers | SG16 | Distributed ledger technologies and e-services |
| Innov-Alliance-Tech | SG20 | Sensors, management and monitoring software |
| BigchainDB GmbH | SG20 | General interest with a focus on AI related work items |
| Zennous SA | SG20 | Next Generation Urban Measurement Methodology |

# 7 Virtual meetings

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

MyMeetings is the main platform for ITU-T statutory meetings. MyMeetings is also used to host Rapporteur Group Meetings and non-statutory events, such as webinars. MyMeetings features important elements found in ITU-T physical meetings, including participants’ list and affiliation, multilingual support, moderated floor request and captioning. Several layers of access control ensure that only registered participants gain access to statutory meetings.

Other electronic meeting tools, such as Zoom, are also provided by TSB for hosting fully online (virtual) and any on-demand ad-hoc meetings.

Statistics on e-meetings for the 2018, 2019 and 2020 are shown below.

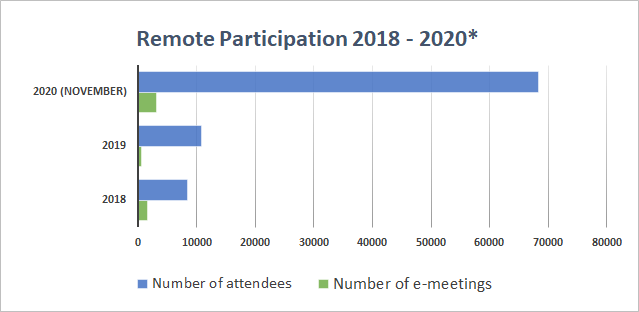


Figure 5 – Remote participation and e-meetings

## 7.1 Statutory meetings

Statutory meetings from September 2020 to TSAG, 11-18 January 2021:

| **Place, Dates** | **Meeting** | **Remarks** |
| --- | --- | --- |
| Virtual, 7-8 September 2020 | ITU-T SG2 | English only, with captioning for all sessions. |
| Virtual, 7-11 September 2020 | ITU-T SG12 | Closing e-plenary in English only. |
| Virtual, 7-18 September 2020 | ITU-T SG15 | Closing e-plenary in English only. |
| Virtual, 18 September 2020 | Interregional meeting for preparation of WTSA | Interpretation in all official ITU languages on MyMeetings, with captioning. |
| Virtual, 21-25 September 2020 | TSAG | Interpretation in all official ITU languages on MyMeetings, with captioning for all sessions. |
| Virtual, 29-30 September 2020 | ITU-T SG5RG-AP | In English only. |
| Virtual, 13-14 October 2020 | ITU-T SG20RG-LATAM | In Spanish only with no interpretation. |
| Virtual, 19-23 October 2020 | ITU-T SG5 | Closing e-plenary in English only. |
| Virtual, 6 November 2020 | ITU-T WP1/20 | In English only with no interpretation. |
| Virtual, 10 November 2020 | ITU-T SG5-RG-LATAM | In Spanish only. |
| Virtual, 19 November 2020 | ITU-T WP1/11 | Planned. In English only with no interpretation. |
| Virtual, 25 November 2020 | ITU-T WP2/9 | Planned. In English only without interpretation. |
| Virtual, 4 December 2020 | ITU-T WP3/11 | Planned. In English only without interpretation. |
| Virtual, 7 December 2020 | ITU-T SG13 | In English only without interpretation. |
| Virtual, 16 December 2020 | ITU-T SG20 | Planned. In English only without interpretation. |
| Virtual, 17 December 2020 | ITU-T SG13 | In English only without interpretation. |
| Virtual, 18 December 2020 | ITU-T SG2 | Planned. In English only without interpretation, with captioning for all sessions. |
| Virtual, 18 December 2020 | ITU-T SG11 | Planned. Interpretation on request. |
| Virtual, 6-7 January 2021 | ITU-T SG12 | Planned. In English only without interpretation. |
| Virtual, 7 January 2021 | ITU-T SG17 | Planned. In English only without interpretation. |
| Virtual, 8 January 2021 | IRM - Interregional meeting for preparation of WTSA | Interpretation in all official ITU languages on MyMeetings, with captioning for all sessions. |
| Virtual, 11-18 January 2021 | TSAG | Interpretation in all official ITU languages on MyMeetings, with captioning for all sessions. |

## 7.2 Workshops and symposia

Participation in ITU workshops and symposia has increased considerably in 2020. With all ITU-T workshops and symposia held virtually with MyMeetings, ITU-T is welcoming a greater number and diversity of participants.

Workshops and symposia, September to December 2020:

* [AI for Good Global Summit](https://aiforgood.itu.int/), weekly programming year-round.
* [DLT Meet-ups Episode #2: Working together for DLT Interoperability](https://www.itu.int/en/ITU-T/webinars/20200902/Pages/default.aspx), 2 September 2020.
* [Webinar on "Tracking Digital Financial Crimes and Fraud – Part 2"](https://www.itu.int/en/ITU-T/webinars/20200901/Pages/default.aspx), 2 September 2020.
* [Webinar on "5G in action – how does it perform in the wild?"](https://www.itu.int/en/ITU-T/webinars/20200903/Pages/default.aspx), 3 September 2020.
* [ITU Workshop on "Autonomous Driving safety data and metrics - what do we really need?"](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/20200916/Pages/default.aspx), 16 September 2020.
* [2020 IEEE / ITU International Conference on Artificial Intelligence for Good](https://2020.ai4g.ieee-tems.org/#about_section), 21 September 2020.
* [Webinar on "Achieving the sustainable development goals (SDGs) through the ITU Smart Incubator",](https://www.itu.int/en/ITU-T/webinars/20201008/Pages/default.aspx) 8 October 2020.
* [DLT Meet-up Episode #3: Telecom Use cases](https://www.itu.int/en/ITU-T/webinars/20201014/Pages/default.aspx), 14 October 2020.
* [FGAI4H Workshop of the Working Group on Clinical Evaluation](https://www.itu.int/en/ITU-T/focusgroups/ai4h/Pages/ws/2010.aspx), 14 October 2020.
* [Session on “Using international standards to build smart sustainable cities and tackle climate change, e-waste and nature loss”](https://www.itu.int/en/ITU-T/climatechange/Pages/20201015.aspx), 15 October 2020.
* [European Impact Summit 2020](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/20201019/Pages/default.aspx), 19-21 October 2020.
* [ISO-IEC-ITU-T-UNECE MoU/MG Webinar on “Traceability within the context of eBusiness Standards”](http://www.unece.org/index.php?id=55139), 22 October 2020.
* [ITU Webinar on “Towards A Truly Autonomous Network”](https://www.itu.int/en/ITU-T/webinars/20201103/Pages/default.aspx), 3 November 2020.
* [DLT Meet-up Episode #4: Creating a public infrastructure of the internet of value](https://www.itu.int/en/ITU-T/webinars/20201104/Pages/default.aspx), 4 November 2020.
* [Riyadh International Standards Summit 2020](https://events.saso.gov.sa/rss/),4 November 2020.
* [Webinar on "Mitigating infrastructure vulnerabilities for digital finance"](https://www.itu.int/en/ITU-T/webinars/20201110/Pages/default.aspx), 10 November 2020.
* [ITU Workshop on "Autonomous Driving safety data and metrics - what do we really need?"](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/20201202/Pages/default.aspx), 2 December 2020.
* [DLT Meet-up Episode #5: DLT standardization: ITU-T standards and the way forward](https://www.itu.int/en/ITU-T/webinars/20201202/Pages/default.aspx), 2 December 2020.
* [Virtual forum on “Digital Transformation of Cities and Communities”](https://www.itu.int/en/ITU-T/climatechange/Pages/20201207.aspx), 7 December 2020.
* [Webinar on "Smart sustainable cities and frontier technologies in Latin America"](https://www.itu.int/en/ITU-T/climatechange/Pages/202012.aspx), 8 December 2020, **co-organized and supported by the R**egional Center for Studies on the Development of the Information Society of the Brazilian Network Information Centre,
* [ITU Workshop on Artificial Intelligence and Environmental Efficiency and Second Meeting of ITU-T Focus Group on Environmental Efficiency for Artificial Intelligence and other Emerging Technologies (FG-AI4EE)](https://www.itu.int/en/ITU-T/climatechange/Pages/20201209.aspx), 9-10 December 2020.
* [ITU Workshop on Vehicular Multimedia Implementation](https://www.itu.int/en/ITU-T/Workshops-and-Seminars/20201210/Pages/default.aspx), 10 December 2020.

[Kaleidoscope 2020 – Industry-driven Digital Transformation](https://www.itu.int/en/ITU-T/academia/kaleidoscope/2020/Pages/default.aspx), 7-11 December 2020.

# 8 Publications

## 8.1 Recommendations and Supplements

Over 5,000 pages of ITU-T Recommendations and Supplements were published between September and mid-December 2020. Figure 4 illustrates the number of Recommendations (including Supplements) published per year since 2016, noting that 2020 covers only until end mid-December.

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

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

The ITU product "ITU-T Recommendations and selected Handbooks" continues to be distributed on a quarterly basis as a USB key. This product represents a tool of great value to standards developers and implementers as a consolidated archive of the over 4,000 ITU-T standards in force. The USB key incorporates advanced search tools, including detailed search-by-content capabilities. Search parameters can be defined by keywords, time frame and SG, among others, with searches applicable to the title or the full text of the standard.

**Figure 4 – Number of Recommendations, amendments and Supplements**   
**published per year since 2016**

## 8.2 Official languages of the Union on an equal footing

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

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

As requested by WTSA Resolution 67, TSB continues to translate all Recommendations approved under the Traditional Approval Process (TAP) as well as all TSAG reports.

TSB also translated two AAP Recommendations between September and December 2020, in accordance with requests received from ITU-T SGs and linguistic groups, and within the available budget.

# 9 Services and tools

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

## 9.1 ITU-T databases

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

* [ITU-T Work Programme](http://www.itu.int/ITU-T/workprog)
* [ITU-T A.4, A.5 and A.6 recognized organizations](https://www.itu.int/en/ITU-T/extcoop/Pages/sdo.aspx)
* [ITU-T AAP](https://www.itu.int/ITU-T/aap/AAPSearch.aspx) & [TAP](https://www.itu.int/net/ITU-T/lists/t-approval.aspx)
* [ITU-T Recommendations](http://www.itu.int/itu-t/recommendations)
* [ITU-T Liaison Statements](http://www.itu.int/net/itu-t/ls/)
* [ITU-T Patents and Software Copyrights](http://www.itu.int/ipr/)
* [ITU Product Conformity Database](http://www.itu.int/net/itu-t/cdb/ConformityDB.aspx)
* [ITU-T Formal Descriptions and Object Identifiers](http://www.itu.int/ITU-T/formal-language/index.html)
* [ITU-T Test Signals](http://www.itu.int/net/itu-t/sigdb/menu.htm)
* [ITU-T Terms & Definitions](http://www.itu.int/ITU-R/go/terminology-database)
* [International Numbering Resources](http://www.itu.int/ITU-T/inr/index.html) (See section 14.6 for more details) ICT standards landscape:
  + Access Network Transport Standards
  + Cloud Computing
  + Home Network Transport Standards
  + ICT Security Standards
  + IMT-2020
  + IoT & Smart Sustainable Cities Standards
  + ITS Communication Standards

## 9.2 MyWorkspace

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

The following applications and services are available in MyWorkspace:

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

## 9.3 ITUSearch

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

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

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

## 9.4 ITU-T services & tools

A [webpage](https://www.itu.int/en/ITU-T/ewm/Pages/default.aspx) for Electronic Working Methods (EWM) keeps the ITU-T community up to date with the latest tools available and services enhancements provided.

## 9.5 Document Management System for Rapporteur Groups

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

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

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

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

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

## 9.6 International Numbering Resources (INRs)

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

Notifications of national numbering/identification plan 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".

## 9.7 ITU-T SharePoint collaboration sites

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

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

A selection of notable collaboration sites is listed below:

* ITU-T SGs (Study Period 2017-2020) (<https://extranet.itu.int/sites/itu-t/studygroups/2017-2020>)
* United for Smart Sustainable Cities (U4SSC) (<https://extranet.itu.int/sites/itu-t/initiatives/U4SSC/>)
* Security, Infrastructure and Trust Working Group (SIT WG) (<https://extranet.itu.int/sites/itu-t/initiatives/sitwg/>)
* FG-AI4H - ITU-T Focus Group on AI for Health (<https://extranet.itu.int/sites/itu-t/focusgroups/ai4h/>)
* FG-VM - ITU-T Focus Group on Vehicular Multimedia  
  (<https://extranet.itu.int/sites/itu-t/focusgroups/vm/>)
* FG-AI4EE - Focus Group on Environmental Efficiency for AI and other Emerging Technologies  
  (<https://extranet.itu.int/sites/itu-t/focusgroups/ai4ee/>)
* FG QIT4N – ITU-T Focus Group on Quantum Information Technology for Networks (<https://extranet.itu.int/sites/itu-t/focusgroups/qit4n>)
* FG-AI4AD – ITU-T Focus Group on Autonomous and Assisted Driving (<https://extranet.itu.int/sites/itu-t/focusgroups/ai4ad>)
* JVDS - ITU-T SG16 & ISO TC22/SC31/WG8 Joint Project Team on Vehicle Domain Service (<https://extranet.itu.int/sites/itu-t/jointgroups/jvds/>)
* IRG-AVA - Intersector Rapporteur Group on Audiovisual Media Accessibility (<https://extranet.itu.int/sites/irg/ava/>)
* CASC - ITU-T Conformity Assessment Steering Committee  
  (<https://extranet.itu.int/sites/itu-t/studygroups/2017-2020/sg11/casc/>)
* Pathway #1: Circular Design (<https://extranet.itu.int/sites/itu-t/initiatives/circulardesign>)
* Digital Currency Global Initiative (<https://extranet.itu.int/sites/itu-t/initiatives/dcgi>)
* Project on E-waste (<https://extranet.itu.int/sites/itu-t/initiatives/E-waste>)
* Focal points and coordinators for WTSA-20 from regional organizations (<https://extranet.itu.int/sites/itu-t/wtsa-20/prepmeet/Lists/ContactSheet/DefViewContacts.aspx>)
* [Numbering Applications Monitor](https://extranet.itu.int/sites/itu-t/studygroups/2017-2020/sg2/SitePages/Numbering%20Applications%20Monitor.aspx)

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

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

## 9.8 Meeting Documents Sync Application

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

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

NOTE – Corrigenda are not listed here.

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

**ITU-T G.994.1 Amd.2 “Handshake procedures for digital subscriber line transceivers - Amendment 2” (under approval)** fully integrates the Amendment 1 to Recommendation ITU-T G.994.1 (2018) and includes the following new technical material:

- A new annex with a collision control protocol for point-to-multipoint operation

- Modify the mandatory carrier set for G.9701 Annex X with operation over coax

- A new annex M with managed objects in a new format compatible with a YANG model

- Add codepoints for the support of G.9711.

[**ITU-T G.997.2 Amd.2 “Physical layer management for G.fast transceivers - Amendment 2”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14523) integrates the Amendment 1 of ITU-T Rec. G.997.2 and includes the following new material:

- Extend the range of minimal Mds with cDTA to 5

In addition, it corrects the following items:

- Aligned the valid ranges of frequencies of MIBPSDMASK with G.9701.

- Explicit the “empty array” in the valid values of configuration parameters.

- Explicit the constraint of G.9701 on the configuration of RMCR\_LOR\_TRIGGER and LOR\_PERSISTENCY.

- Correct the frequency range of one IAR

- Update the reference RFC6020 to RFC7950

- Update the reference RFC7223 to RFC8343

- Incorrect references to G.9701.

The changes relative to corrected items are with the following change bars.

The changes relative to new material are with the following change bars.

**ITU-T G.997.3 “Physical layer management for MGfast transceivers” (under approval)** specifies the physical layer management for Multi-gigabit fast access to subscriber terminals (MGfast) transmission systems. It specifies managed objects for configuration, fault, status, inventory and performance management.

**ITU-T G.9701 (2020) Amd.3 “Fast access to subscriber terminals (G.fast) - Physical layer specification: Amendment 3” (under approval)** includes support to decrease the minimum value of Mds to 5 with cDTA.

**ITU-T G.9711 “Multi-gigabit fast access to subscriber terminals (MGfast) - Physical layer specification (New)” (under approval)** specifies a multi-gigabit broadband access technology that exploits the existing infrastructure of wire-pairs and coaxial cable that were originally deployed for plain old telephone service (POTS) or TV 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 10 Gbit/s on metallic wires using spectrum up to 424 MHz and specifies all necessary functionality to support far-end crosstalk (FEXT) cancellation between multiple wire-pairs.

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

[**ITU-T G.984.5 (2014) Amd.2 (revised) “Gigabit-capable passive optical networks (G-PON): Enhancement band - Amendment 2”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14490) defines wavelength ranges reserved for additional service signals to be overlaid via wavelength division multiplexing (WDM) in future passive optical networks (PON) for maximizing the value of optical distribution networks (ODNs). This amendment 2 includes Updates of general reference diagram of coexistence element, Isolation and Directivity requirements for GPON and XG(S)-PON pairing of a generic 2-port coexistence CEx, Updates of methods for calculating required isolation for WDM/CE/CEM devices, filter considerations for HSP and XG(S)-PON OLT, and optical interface parameters for GPON/XG(S)-PON MPM supporting Class D OPL.

[**ITU-T G.987.2 (2016) Amd.2 “10-Gigabit-capable passive optical networks (XG-PON): Physical media dependent (PMD) layer specification - Amendment 2”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14491) continues the maintenance and evolution of physical media dependent (PMD) layer specifications for XG-PON as defined in this Recommendation. It includes technical updates and corrections for changing references to XG-PON1 to XG-PON, replacing the mask of the eye diagram for ONU transmitter, updating the DD40 downstream specification, correcting the X/S tolerance mask for ONU and updating the X/S tolerance mask for OLT.

**ITU-T G.989.2 Amd.1 “40-Gigabit-capable passive optical networks 2 (NG-PON2): Physical media dependent (PMD) layer specification - Amendment 1” (under approval)** updates the Annex D on power spectral density (PSD) values, to reflect the more recent changes in the PMD spec.

[**ITU-T G.9807.1 (2016) Amd.2 “10-Gigabit-capable symmetric passive optical network (XGS-PON)”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14530) continues the maintenance and evolution of ITU-T G.9807 (2016), and provides additional details regarding 40km operation, E2 budget class, OLT X/S tolerance mask definition, low latency traffic identification and other minor specification adjustments.

[**ITU-T G-series Supplement 66 “5G Wireless Fronthaul Requirements in a PON Context”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?rec=14546) 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 (PON) solutions to serve the 5G fronthaul application are hypothesized.

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”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14536) 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.

The fifth version of Recommendation ITU-T G.650.1 revised third alternative test method “Spectral attenuation modelling” (clause 6.4.4) to cover the applicability of fewer predictor wavelengths for the modelling of much narrower wavelength range. In Appendix III "Example of a matrix model", existing example matrix for G.652 fibre was replaced with new matrix using four predictor wavelengths, and added a new matrix for G.654.E fibre using three predictor wavelengths. Wavelength dependence of modelling error as a function of the number of predictor wavelengths was explained.

[**ITU-T G.672 (revised) “Characteristics of multi-degree reconfigurable optical add/drop multiplexers”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14497) provides a description of the relevant characteristics of multi-degree reconfigurable optical add/drop multiplexer (MD-ROADM) network elements. The MD-ROADM is intended to be used in optical networks based on dense wavelength division multiplexing (DWDM), to enhance network scalability and to support enhanced service provisioning and resilience features. This Recommendation also provides classification criteria and a list of optical transfer parameters for MD-ROADMs appropriate for both fixed and flexible DWDM grid applications. In this version of this Recommendation, additional optical transfer parameters have been specified.

[**ITU-T G.694.1 (revised) “Spectral grids for WDM applications: DWDM frequency grid”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14498) provides a frequency grid for dense wavelength division multiplexing (DWDM) applications. The frequency grid, anchored to 193.1 THz, supports a variety of channel spacings ranging from 12.5 GHz to 100 GHz and wider. Edition 3.0 of this Recommendation also includes a flexible DWDM grid and definitions for “frequency slot” and “slot width” that can be applied also in fixed grid applications.

[**ITU-T G.971 (revised) “General features of optical submarine cable systems”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14501) applies to optical fibre submarine cable systems. The purpose of this Recommendation is to identify the main features of optical fibre submarine cable systems, and to provide generic information on relevant Recommendations in the field of optical fibre submarine cable systems. A common implementation relevant to all the optical fibre submarine cable systems is described in Annex A. Specific information relevant to each optical fibre submarine cable systems is included in annexes of other Recommendations. The updated data on cable ships and submersible equipment of various countries are also described in Appendix I. In this latest version, the diagram of interoperable optical fibre submarine cable systems and boundaries are described in Fig.1 (b).

[**ITU-T G.972 (revised) “Definition of terms relevant to optical fibre submarine cable systems”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14502) applies to optical fibre submarine cable systems. The purpose of this Recommendation is to provide definitions of terms relevant to optical fibre submarine cable systems, including terms relevant to system configuration, system aspects, terminal equipment, optical submarine repeaters and branching units, optical fibre submarine cable, manufacturing and installation, and the maintenance of the submarine portion. Appendix I is the alphabetical list of terms defined in this Recommendation.

[**ITU-T G.977.1 “Transverse compatible DWDM applications for repeatered optical fibre submarine cable systems”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14511) provides physical layer specifications for dense wavelength division multiplexing (DWDM) applications on dispersion-unmanaged repeatered optical fibre submarine cable systems. Transverse compatible applications for DWDM applications for repeatered optical fibre submarine cable systems are described for point-to-point, multichannel line systems with optically pumped amplifiers. The primary purpose is to enable multiple vendors to design DWDM transmission equipment for submarine fibre links that are compliant with this Recommendation.

[**ITU-T G.9806 Amd.1 “Higher speed bidirectional, single fibre, point-to-point optical access system (HS-PtP)- Amendment 1”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14494) describes a higher speed bidirectional single fibre point-to-point optical access system than the data rate in existing ITU-T point-to-point access systems. It supports 10 Gbit/s and 25 Gbit/s for the optical access services including the optical distribution network (ODN) specification, the physical layer specification, services requirements and the operation, administration and maintenance (OAM) specification.

[**ITU-T L.151 (revised) “Installation of Optical Fibre Ground Wire (OPGW) cable”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14510) refers to Optical Ground Wire (OPGW) Cable installation. It deals with the factors that should be considered in determining the characteristics of this type of cable, the apparatus that should be used, the precautions that should be taken in handling the reels and the method that should be used to string the cable and joint it.

[**ITU-T L.Sup.39 to ITU-T L.100-series Recommendations “Optical fibre cable Recommendations and standardization guideline”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?rec=14547) provides information on the guideline used in the development of optical fibre cable Recommendations. The guideline also helps for readers to understand organization of L.100-series cable Recommendations.

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

I.1.5 Optical transmission systems

**ITU-T G.709/Y.1331 Amd.1 (revised) “Interfaces for the optical transport network (OTN) - Amendment 1” (under approval)** defines the requirements for the optical transport network (OTN) interface signals of the optical transport network, in terms of:

– OTN hierarchy

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

– frame structures

– bit rates

– formats for mapping client signals.

Edition 6.1 of this Recommendation includes the addition of tables with GCC bit rates, enhancements to the description of OTUCn-M behaviour, addition of an appendix that describes the implications on fault management for the case that the OTSiG (de)modulator process and associated OTSiG-O|OCh-O\_TT function are located in adjacent equipment, and several typographical/editorial corrections.

**ITU-T G.709.1/Y.1331.1 (2018) Amd.2 “Flexible OTN short-reach interfaces - Amendment 2” (under approval)** restructures the definition of a FlexO-x frame and its overhead, adds payload type and reserved client specific overhead. In additional, FlexOsec encryption OH and functions are added.

**ITU-T G.709.3/Y.1331.3 (revied) “Flexible OTN long-reach interfaces” (under approval)** defines the flexible optical transport network (OTN), known as FlexO, long-reach interfaces that support bonding (i.e. grouping) of multiple of these interfaces such that one or more client signals (e.g. one or more 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 Recommendation ITU-T G.709.1/Y.1331.1 and multiplexing of OTUCn client signals into the payload of a FlexO group.

Edition 2 contains the following extensions to Edition 1.1:

– Addition of 100G, 200G and 400G FlexO with OFEC (16, Annexes D, E, G, appendices III, IV, V, bibliography)

– Addition of 100G FlexO with concatenated FEC (15.4.1, 15.5.4)

– Addition of multiplexing of OTUCn client signals into the payload of a FlexO group (Annex F).

**ITU-T G.798 Amd.3 “Characteristics of optical transport network hierarchy equipment functional blocks - Amendment 3” (under approval)** contains text modifications and additions for:

– supporting 25 Gb/s and 50 Gb/s OTN interfaces.

– supporting 200 Gb/s and 400 Gb/s FlexO interfaces.

– supporting the adaptation of ODUkP to Ethernet Coding sublayer for 50 Gb/s Ethernet signals.

– supporting the adaptation of ODUkP to SDI/1.5G SDI signals.

– alignment with ITU-T G.709.1 and ITU-T G.709.3.

**ITU-T G.807 Amd.1 “Generic functional architecture of the optical media network - Amendment 1” (under approval)** describes the generic functional architecture of the optical media network that supports the propagation of signals in the context of a transport network. This description is independent of the client CI that is being carried by a signal in the media network.

**ITU-T G.872 Amd.1 “Architecture of the optical transport network - Amendment 1” (under approval)** describes the functional architecture of the optical transport network (OTN) using the modelling methodology described in Recommendations ITU T G.800, ITU T G.805 and ITU T G.807. The OTN functionality is described from a network level viewpoint, taking into account, the characteristic information of clients of OTN, client/server layer associations, networking topology, layer network functionality and optical media network structure, which provide multiplexing, routing and supervision of digital clients. The digital layers of the OTN use the frame formats defined in ITU T G.709. The media portion of the network is described in terms of media constructs, media elements and optical signal maintenance entities.

[**ITU-T G.874 (revised) “Management aspects of optical transport network elements”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14500) addresses management aspects of optical transport network (OTN) elements containing transport functions of one or more of the layer networks of the OTN. The management of the optical layer networks is separable from that of its client layer networks so that the same means of management can be used regardless of the client. The management functions for fault management, configuration management and performance monitoring are specified. Recommendation ITU-T G.874 (2020) aligns with the updates in ITU-T G.709 and ITU-T G.798, and harmonizes with ITU-T G.7710 clauses 8 and 10 on the generic requirements.

[**ITU-T G.Suppl.49 (revised) “Rogue optical network unit (ONU) considerations”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?rec=14545) 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 (PON) solutions to serve the 5G fronthaul application are hypothesized.

[**ITU-T G.Suppl.58 (revised) “Optical transport network module framer interfaces”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?rec=14231) describes several interoperable component to component multilane interfaces (across different vendors) to connect an optical module (with or without digital signal processor (DSP)) to a framer device in a vendor's equipment supporting 25G, 40G, 50G, 100G or beyond 100G optical transport network (OTN) interfaces. Only the structure of the 11G, 28G, 56G, or 112G physical lanes of the different OTN module framer interface (MFI) examples is provided in this Supplement. Electrical parameters for these interfaces can use specifications provided in the relevant clauses of OIF-CEI implementation agreement (IA) specifications. For their electrical characteristics, the OIF-CEI IA specifications can be used. This Supplement relates to ITU-T Recommendation ITU-T G.709/Y.1331.

[**ITU-T G.Supp.70 “Sub 1Gbit/s Services Transport over OTN”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?rec=14551) describes existing and an SDH-based method to support the transport of Sub-1G signals through the OTN. A Sub-1G signal is a digital signal whose bit rate is included in a range from nominally 2 Mbit/s to less than nominally 1 Gbit/s.

I.1.6 Transport network control aspects

**ITU-T G.7701 Amd.2 “Common control aspects - Amendment 2” (under approval)** 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.7710/Y.1701 (revised) “Common equipment management function requirements”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14503) addresses the equipment management functions (EMFs) inside a transport network element that are common to multiple technologies. For example, common applications are described for date and time, fault management, configuration management, account management, performance management and security management. These applications result in the specification of common EMF functions and their requirements. The 2020 revision of this Recommendation has incorporated the following major updates

- Update Clauses 6 and 7 to harmonize with G.874, G.8051, and G.8151

- Replace the term EMS with MCS

- Update Figure 3 to use ODUk and packet-based connections for inter-site communications additionally

- Update Figure 4 for hybrid NE of management network that supports both a media layer and digital layers

- Update Figures 7 and 62 for replacing cZZZ-value with MI\_cZZZ

- Update Figure 22 and Clause 8.8 for replacing XXX\_Reported with ZZZ\_Reported to align with G.806.

[**ITU-T G.7718 (revised) “Framework for the management of MC components and functions”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14542) contains the framework for ASON management. It places ASON management within the TMN context and specifies how the TMN principles may be applied. A management view of the ASON control plane is developed. This view provides the bases for the ASON management requirements specified in this Recommendation. Identifier spaces needed in ASON management are specified. Examples of management system structures and ASON related management applications are contained in the appendices. The 2020 Edition of the Recommendation extends the scope from ASON management to management of MC (management and control) components and functions.

**ITU-T G.8310 “Functional architecture for metro transport network” (under approval)** describes the functional architecture of the metro transport network (MTN) using the modelling methodology described in [ITU T G.800], and [ITU T G.805]. MTN is primarily intended to support transport of D RAN and C RAN traffic. The MTN functionality is described from a network level viewpoint, taking into account the client characteristic information, client/server layer associations, networking topology, and layer network functionality that provide multiplexing, routing and supervision of the digital clients. MTN consists of two non recursive layers, the MTN Path layer, and the MTN Section layer. The MTN Path layer uses the MTN Section layer as its server layer. The MTN Path layer provides configurable connection-oriented connectivity. The server layer for the MTN section layer is provided by 50GBASE R, 100GBASE R, 200GBASE R, 400GBASE R Ethernet interfaces.

**ITU-T G.8312 “Interfaces for a metro transport network” (under approval)** describes a transport technology targeted for metro transport networks, including transport of distributed radio access network (D RAN) and centralized radio access network (C RAN) traffic. This technology leverages existing and emerging pluggable Ethernet modules and reuses FlexE implementation logic.

[**ITU-T G.Suppl.69 “Migration of pre-standard implementations and networks to G.mtn”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?rec=14550) describes considerations for migration of networks using pre-standard SPN to using MTN technology.

[**ITU-T L.330 “Telecommunication Infrastructure facility management”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14515): Extensive outside telecommunication infrastructure facilities that support information technology continue to deteriorate from aging. For providing telecommunication services continuously and maintaining infrastructure safety, it is important to maintain their functions based on appropriate facility management as a series of maintenance tasks that includes inspection, diagnosis and repair. Demand is dramatically increasing for cost-effective technologies that can improve maintenance productivity for various types of infrastructures. The purpose of this Recommendation is to identify facilities, items, typical frequency and criteria to be inspected by operators along with fundamentals of telecommunication infrastructure facility management. It is intended for users not only operators that have needs for improving life-cycle management but also developers that consider applying technologies which are rapidly progressing.

I.1.7 Ethernet over transport networks

[**ITU-T G.8001 Imp (revised) “Implementers' guide for Recommendation ITU-T G.8001/Y.1354 (2020)”**](https://www.itu.int/rec/T-REC-G.Imp8001-202002-I) is an Implementers' Guide for Recommendation ITU-T G.8001/Y.1354 (2016-04). This version contains all updates submitted up to and including those at Study Group 15 meeting in January/February 2020. This document was approved by ITU-T Study Group 15 on 18 September 2020.

[**ITU-T G.8011/Y.1307 (revised) “Ethernet service characteristics”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14504) 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. This Recommendation supersedes Recommendation ITU-T G.8011/Y.1307.1 (2018).

[**ITU-T G.8051/Y.1345 (revised) “Management aspects of the Ethernet Transport (ET) capable network element”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=13546) addresses management aspects of the Ethernet transport (ET) capable 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 2020 revision of this Recommendation has updated clause 6 to clause 8 by referring to Recommendation ITU T G.7710; the fault cause persistency function and the provisioning and reporting for adaptation functions for FlexE related functions as defined in Recommendation ITU T G.8023; transferring ODU related adaptation functions in some tables to Recommendation ITU T G.874.

**ITU-T G.8052.1/Y.1346.1 “Transport OAM Management Information/Data Models for Ethernet Transport Network Element" (under approval)** specifies the management information model and data models for Ethernet Transport Network Element (NE) to support specific interface protocols and specific Management Control (MC) functions. The information model is interface protocol neutral and specified using the Unified Modelling Language (UML). The information model of this Recommendation is derived through pruning and refactoring from the Recommendation [ITU-T G.7711/Y.1702] core information model and Recommendation [ITU-T G.8052/Y.1346] foundation Ethernet Transport NE information model. The data models are interface protocol specific and translated from the information model with the assistance of automated translation tooling. The specific data models considered in this Recommendation include, but not limited to, YANG data models. The specific MC functions covered by this Recommendation are the ITU-T defined Ethernet Operation, Administration, and Maintenance (OAM) functions, with the set of op codes assigned to the ITU-T and the corresponding OAM Protocol Data Units (PDU) and behaviours being specified in Recommendation [ITU-T G.8013/Y.1731] and the equipment characteristics in [ITU-T G.8021/Y.1341]. These OAM functions complement the IEEE 802.1 defined Connectivity Fault Management (CFM) functions; and the YANG module defined in this Recommendation augments the IEEE 802.1Q CFM YANG module.

I.1.8 MPLS over transport networks

[**ITU-T G.8110.1 Amd.1 “Architecture of the Multi-Protocol Label Switching transport profile layer network - Amendment 1”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14525) updates references, removes items formerly considered for further study and incorporates terms formerly defined in ITU-T Recommendations G.8101/Y.1355 (2016).

[**ITU-T G.8112/Y.1371 (revised) “Interfaces for the MPLS transport profile layer network”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14541) specifies the interfaces for the multi-protocol label switching transport profile (MPLS-TP) layer network. The interfaces for the MPLS-TP layer network use various server layer networks, like the plesiochronous digital hierarchy (PDH), synchronous digital hierarchy (SDH), optical transport hierarchy (OTH) and the Ethernet MAC layer network (ETH).

[**ITU-T G.8151/Y.1374 (revised) “Management aspects of the MPLS-TP network element”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14506) 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 Recommendations ITU T G.8121/Y.1381, G.8121.1/Y.1381.1 and G.8121.2/Y.1381.2.

**ITU-T G.8152.1/Y.1375.1 “AM Information/Data Models for MPLS-TP Network Element” (under approval)** specifies the OAM information model and data models for MPLS-TP transport Network Element (NE) to support specific interface protocols and specific management and control functions. The information model is interface protocol neutral and derived from pruning and refactoring the G.7711/Y.1702 core information model and G.8152/Y.1375 foundation MPLS-TP NE information model. The data models are interface protocol specific and translated from the information model with the assistance of automated translation tool. The specific data models considered in this Recommendation include, but not limited to, YANG data models. The specific management and control functions covered by this Recommendation are the G.8113.1/Y.1372.1 specific OAM functions. The YANG modules of this Recommendation are aimed to be compatible with the relevant base generic YANG modules from the IETF for the G.8113.1/Y.1372.1 OAM functionality.

**ITU-T G.8152.2/Y.1375.2 “Resilience Information/Data Models for MPLS-TP Network Element” (under approval)** specifies the resilience management information model and data models for MPLS-TP Network Element (NE) as defined in [ITU-T G.8131] and [ITU-T G.8132]. The information model is interface protocol neutral and specified using the Unified Modelling Language (UML). The information model of this Recommendation is derived through pruning and refactoring from the Recommendation [ITU-T G.7711/Y.1702] core information model and Recommendation [ITU-T G.8152/Y.1375] foundation MPLS-TP NE information model. The data models are interface protocol specific and translated from the information model with the assistance of automated translation tooling. The specific data models considered in this Recommendation include, but not limited to, YANG data models.

I.1.9 Synchronization and timing

[**ITU-T G.8261/Y.1361 Amd.2 “Timing and synchronization aspects in packet networks - Amendment 2”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14526) provides the following update:

− Addition of new MTIE mask for short chains of clocks (clause 9.2.1.4.2).

[**ITU-T G.8271.1/Y.1366.1 Amd.1 “Network limits for time synchronization in Packet networks with full timing support from the network - Amendment 1”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14527) provides the following update:

− Addition of new clause 7.5

− New version of Figure II.6, and addition of text to Appendix II

− Clarifications to Appendix V

− Addition of clause XII.5 and XII.6.

[**ITU-T G.8273.2/Y.1368.2 (revised) “Timing characteristics of telecom boundary clocks and telecom time slave clocks for use with full timing support from the network”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14507) specifies minimum requirements for time and phase for telecom boundary clocks and telecom time slave clocks used in synchronization network equipment that operates in the network architecture as defined in Recommendations ITU-T G.8271, ITU-T G.8271.1, ITU-T G.8275 and ITU-T G.8275.1. It supports time and/or phase synchronization distribution for packet-based networks. This version of the Recommendation only applies to full timing support from the network. These requirements apply under the normal environmental conditions specified for the equipment.

[**ITU-T G.8273.3/Y.1368.3 (revised) “Timing characteristics of telecom transparent clocks for use with full timing support from the network”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14508) defines the minimum requirements for telecom transparent clocks (T-TCs). These requirements apply under normal environmental conditions specified for the equipment. This Recommendation includes: clock accuracy, noise generation, noise tolerance, noise transfer, and transient response for T-TCs.

[**ITU-T G.8275/Y.1369 (revised) “Architecture and requirements for packet-based time and phase delivery”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14509) provides the following updates:

− Common Annex and Appendix material to G.8275.1 and G.8275.2 added as Annex C, Annex D, and Appendix VIII.

[**ITU-T G.8275.1/Y.1369.1 Amd.1 “Precision time protocol telecom profile for phase/time synchronization with full timing support from the network - Amendment 1”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14543) provides the following updates:

- Annex B, Annex E, and Appendix V, common to G.8275.1 and G.8275.2, moved to G.8275.

- Add Packet timing signal fail support.

[**ITU-T G.8275.2/Y.1369.2 Amd.1 “Precision time protocol telecom profile for phase/time synchronization with partial timing support from the network - Amendment 1”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14544) provides the following updates:

− Annex B, Annex E, and Appendix IV, common to G.8275.1 and G.8275.2, moved to G.8275.

− Updated “for further study” references to refer to G.8273.4.

− New material added to clause 6.7.11 Packet timing signal fail.

− New members “portDS.syncReceiptTimeout” and “portDS.delayRespReceiptTimeout” added to Table A.5 portDS data set member specifications.

I.1.10 Cable

**ITU-T J.208 “Harmonization of Integrated Broadcast-Broadband DTV application control framework” (under approval):** Recommendations ITU-T J.207 and ITU-R BT.2075 provide guidance information for Integrated Broadcast-Broadband (IBB) service providers to select IBB systems for their use. In general, IBB systems comprise of various hardware and software components, and tailoring them for the specific IBB system leads to extensive development by manufacturers. On the other hand, in order to deploy the services in a wider area, IBB service providers need to develop their IBB applications for each IBB system if the operators or broadcasters on which the service providers intend to deploy their services use a different IBB system from the system on which the services are originally deployed. Thus, it is beneficial for both IBB service providers and manufacturers of IBB capable reception devices such as STBs to harmonize IBB systems. It should also be considered that the use of companion devices is already a part of IBB services. In addition, information on IBB application environment to implement an IBB application software for other IBB systems is useful to deploy the same service on different IBB systems. Based on the ideas above, this Recommendation is intended to define methods for harmonization of IBB systems and/or their application environment by identifying commonalities across IBB systems and maximizing portability of IBB applications.

**ITU-T J.1301 “The specification of cloud-based converged media service to support IP and Broadcast Cable TV – Requirements” (under approval)** describes functional requirement of the Cloud-Based Converged Media Service to support IP and Broadcast Cable TV. With the cloud-native technology development, cloud-based converged media service can be quickly deployed by cable television operators. This recommendation specifies functional requirements, architecture requirements, interface requirements and security requirements for the cloud-based converged media service to support IP and Broadcast Cable TV.

**ITU-T J.1611 “Functional requirements for Smart Home Gateway” (under approval):** In a smart home solution, a smart home gateway is incorporated to connect various smart home appliances. In addition, an IoT-based connection management platform is required to enable various applications. These applicable solutions include home health, entertainment, security, and home automation, which promotes a safer, happier, and more comfortable and convenient lifestyle. This Recommendation aims to define the functional requirements for a smart home gateway from both hardware and software point of view to ensure secure interoperability among consumers, businesses and industries by delivering a standardized communications platform and allowing devices to communicate cross operating system, service provider, transport technology or ecosystem.

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

[**ITU-T Q.3058 “Signalling architecture of orchestration in NGNe”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14411)**:** The orchestration in NGNe is of great significance for next generation network evolution, because it takes the coexistence and corporation of traditional network such as NGN and SDN/NFV enabled network into consideration. This Recommendation specifies the mapping of reference points to interfaces in the signalling architecture of orchestration in NGNe, and provides the signalling requirements of the interfaces and defines the protocols used for interfaces. The descriptions of the requirements, the functional architecture and the reference points of orchestration in NGNe are aligned with [ITU-T Y.2323] and [ITU-T Y.2324].

[**ITU-T Q.3059 “Signalling requirements for service function discovery”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14412) specifies the signalling requirements for service function discovery based on its functional architecture. The signalling is for service function path controller to discover and select the service function.

[**ITU-T Q.3060 “Signalling architecture of the fast deployment emergency telecommunication network to be used in a natural disaster”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14413): In the last decade, climate change and natural disasters affected most of the countries all over the globe. The consequence such as tropical storms, floods and droughts directly affect social and various industrial sectors including ICT. In this regard, the deployment of special emergency telecommunication network becomes a first and important aid for civilians afflicted by natural disasters. The rapid deployment of such networks is fundamental. Currently, the emergency systems, which are used in a natural disaster cases, are based on the existing technologies such as space-based networks (e.g. Iridium, etc.). However, in forthcoming 5G and IoT era, there are some technologies which may play an important role in helping to provide wide number of ICT services from simple voice/video communication up to telemetry exchange, to name a few. All these services which are rapidly deployed in harmed country may sufficiently change the situation and help to save life of victims of natural hazard events.

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

[**ITU-T Q.3645 “Protocol at interface between two distributed ENUM servers for IMS”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14414) defines protocol at the interface between two Distributed ENUM Servers (DES) of distributed ENUM system in support of IMS interconnection. Based on the functions and signalling requirements defined in [ITU T Q.3643], this Recommendation provides the reference model, procedures, protocol, and message specification for the interface between two DES.

[**ITU-T Q.3720 “Procedures for vBNG acceleration with programmable acceleration card”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14415) specifies the framework, working modes, and procedures for vBNG acceleration with programmable acceleration card.

[**ITU-T Q.3915 “Set of parameters of vBNG for monitoring”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14416): Virtual Broadband Network Gateway has been developed as an entry point for telecommunication providers to introduce network function virtualization (NFV). This draft Recommendation focuses on monitoring of virtual Broadband Network Gateway (vBNG) in NFV. This Recommendation provides the set of parameters that indicate the state and event of vBNG.

[**ITU-T Q.3961 “Parameters for evaluating bottleneck of web-browsing service”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14417): If the QoS of web-browsing service drops, ISPs and ICPs hope to be able to immediately find the reasons, fix the faults and improve web-browsing service. To achieve the above aims, this Recommendation specifies parameters for evaluating bottleneck of the web-browsing service. These parameters can be divided into four groups: parameters in the application layer, parameters in the transportation layer, parameters in the network layer and the characteristic parameters. The relationship between these parameters is also introduced in this Recommendation.

[**ITU-T Q.4064 “Interoperability testing requirements of virtual Broadband Network Gateway”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14418) aims to specify virtual BNG (vBNG) interoperability testing requirements. Firstly, as a basic background, this Recommendation introduces the overview of vBNG and interoperability testing of vBNG, which includes but not limited to the definition, characteristics, general capabilities of vBNG as well as the overview of interoperability testing of vBNG. The description of use cases of vBNG will be provided as appendix. Base on analysis of involved vBNG capabilities in use cases, the corresponding derived requirements of vBNG’s interoperability testing will be introduced.

[**ITU-T Q.4066 “Testing procedures of Augmented Reality applications”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14419): Augmented reality (AR) is a collection of new technologies that perform the function of displaying digital information to a user through special devices (smartphone, AR glasses, projectors, etc.) allowing data to be displayed in visual (3D objects, video, images, etc.), audio or text format alongside real-world objects. Besides, augmented reality offers the possibility of physical objects and virtual entities, which can make additional delays in the process of data transformation. Because testing procedures for augmented reality are significantly different from traditional applications, this Recommendation defines approaches for testing for various applications of AR.

[**ITU-T Q.4100 “Hybrid peer-to-peer (P2P) communications: Functional architecture”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14420) specifies functional architecture of hybrid peer-to-peer overlay networking architecture. The hybrid P2P network makes use of advantages of tree-based overlay network and mesh-based overlay network. This Recommendation specifies related components with detailed composition of functional entities based on their atomic functionalities. This also specifies the reference points to be used for further protocol specification among those components. In addition, this Recommendation provides high-level information flows for various application services based on hybrid overlay network such as IoT, blockchain and multimedia live streaming.

[**ITU-T Q.5052 “Addressing mobile devices with duplicate unique identifier”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14392): The presence and detection of duplicate unique identifiers on mobile networks and identifying the authenticity of a device are two key problems that stakeholders are looking to find solutions for. The detection mechanisms discussed in this documentation are based on post-processing mobile network data to identify devices for blocking purposes based on criteria defined by individual national regulatory bodies. Through incorporation of one or more of these mechanisms, systems can identify and address the problem that duplicate or cloned devices present to governments, operators, and consumers. A combination of one or more methodologies described in this document can be employed at any given time. The decision regarding the methodology or methodologies to employ will determine the level of effectiveness of a country’s detection mechanism.

[**ITU-T X.609.9 “Managed P2P communications: Overlay content management protocol”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14421) specifies overlay content management protocol that supports of managing overlay content to be distributed over managed peer-to-peer network. This protocol is used between peer and IXS (index server) to manipulate the meta information needs to be shared among peers within a same overlay network. This Recommendation provides protocol message syntax and basic operations with information flows. In addition, this provides extended operations for using this protocol for various application services such as content distribution, multimedia streaming and data streaming.

[**ITU-T X.609.10 “Managed P2P communications: Signalling requirements for data streaming”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14422) defines the signalling requirements for data streaming that runs on the reference points among related entities of the managed P2P communications. Data streaming service is a service that delivers the data which a data source generates continuously or on a specific event. Different from audio or video frames in multimedia streaming service, each data generated by the data source in the data streaming service can be processed independently. This Recommendation also addresses service procedures for providing data streaming services based on managed peer-to-peer networks.

[**ITU-T Y.2245 “Service model of the Agriculture Information based Convergence Service”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14389): Agricultural data is the key foundation for Smart Farm models, in which a wide range of Information and Communication Technology (ICT) such as IoT and Big Data are converged, to be operated and managed. Given the fact that every single stage in Smart Farm models from crop growing to selling requires appropriate data, it is crucial to have a well-established service model for data collection and its provision. This service model should gather and process data before providing it for users to enhance their farm business. By convergence of various data collected from each stage of production, the model should ensure higher quality of service. During the production stage, the convergence services are provided to increase crop quality and yield and reduce farm maintenance costs. This Recommendation provides more details about the service model.

[**ITU-T Technical Report TR-BSG “Use of ITU-T Recommendations by Developing Countries”**](https://www.itu.int/pub/T-TUT-BSG-2020): A standard is defined as a document established by consensus and approved by a recognized body. In the UN, the ITU-T is the recognized body for Telecommunication Standardization whose output Standards are known as ITU-T Recommendations. Countries use standards to maximize compatibility, interoperability, safety, repeatability, and quality among others. The ITU-T standardization process involves its members in the development of the standards, which they later utilize. The development of any standard is motivated by a present need to solve a problem or a future need to solve future problems. The expectation is that all countries on either side of development, to actively participate in both the production and utilization of the standards. There is however a perception that there is less utilization of the ITU-T standards by Developing Countries. This document presents the analysis and interpretation of the results of the questionnaire on use of ITU-T Recommendations in Developing Countries.

[**ITU-T Supplement 66 to Y.3000-series “Network 2030 services: Capabilities, performance and design of new communication services for the Network 2030 applications**](https://www.itu.int/rec/T-REC-Y.Sup66/en)**”** focuses on new network-layer services, "network services" for short, and tries to assess the new network services and capabilities required based on Network 2030 vision. It describes new communication services for Network 2030, provides gap analysis, and specifies performance targets for different types of new services and capabilities.

[**ITU-T Supplement 67 to Y.3000-series “Representative use cases and key network requirements for Network 2030**](https://www.itu.int/rec/T-REC-Y.Sup67/en)**”** depicts seven representative use cases with their potential key network requirements: holographic type communications, tactile Internet for remote operations, intelligent Operation Network, network and computing convergence, digital twin, space-terrestrial integrated network and industrial IoT with cloudification. Five overarching abstract requirement dimensions are proposed.

I.2.3 IMT-2020/5G networks

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

[**ITU-T Y.3075 “Requirements and capabilities of Information Centric Networking routing and forwarding based on control and user plane separation in IMT-2020”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14394) specifies service requirements and functional requirements of ICN routing and forwarding based on control and user plane separation in IMT-2020. In addition, the capabilities of ICN routing and forwarding in control plane and data plane are described with considering different scenarios. Finally, the security consideration is discussed.

[**ITU-T Y.3076 “Architecture of ICN-enabled Edge Network in IMT-2020”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14395) specifies the requirements and architecture about ICN-enabled edge network in IMT-2020. 1) From the service and network operation point of view, it discusses detailed requirements of ICN-enabled Edge network in IMT-2020. 2) It provides architecture of ICN-enabled edge network. 3) It describes the key functions and interfaces to satisfy the requirements of ICN-enabled edge network.

[**ITU-T Y.3134 “IMT-2020 fixed mobile convergence functional requirements for management and orchestration”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14397) gives specification about IMT-2020 FMC functional requirements for management and orchestration in order to realize unified network management and resource orchestration functions in IMT-2020 FMC context. The functional requirements include general aspect, resource aspect, service aspect, user aspect and performance aspect of IMT-2020 FMC functional requirements for management and orchestration. The afore-mentioned functional requirements are beneficial to network operators and service providers to design, deploy and operate network in IMT-2020 FMC context.

[**ITU-T Y.3136 “Session management for fixed mobile convergence in IMT-2020 networks”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14398) describes the scenarios, general requirements and design principles of session management (SM) for fixed mobile convergence (FMC) in IMT-2020 networks. This Recommendation describes the functional architecture and key functions of session management for supporting FMC in IMT-2020 networks. This Recommendation provides information flows of PDU session management and traffic routing management for FMC in IMT-2020 networks.

[**ITU-T Y.3150 (revised) “High-level technical characteristics of network softwarization for IMT-2020”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14399): With the global recognition of the usefulness of network slicing technology, which is the most typical substantiation of the network softwarization approach, this Recommendation describes how network softwarization and network slicing contribute to IMT-2020 systems. It explores network slicing from two viewpoints: vertical and horizontal aspects. The Recommendation further describes network slicing for mobile fronthaul/backhaul, introduction to advanced data-plane programmability, and capability exposure. These technical characteristic descriptions are expected to lead to their detailed study.

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

[**ITU-T Y.3155 “Enhanced SDN Data Plane for IMT-2020”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14400) provides the requirements and high-level architecture of enhanced SDN data plane (ESDP) for IMT-2020 which is aiming to provide improved support for relevant requirements of the network. Based on the high-level architecture, it specifies functional blocks, reference points, and work flow of ESDP.

[**ITU-T Y.3156 “Framework of network slicing with AI-assisted analysis in IMT-2020 networks”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14401): For the future enhanced operation and maintenance management of network slicing with the purpose of satisfying users' service level agreement (SLA) requirements, this Recommendation describes the requirements and functional roles of AI-assisted analysis which supports the lifecycle management and orchestration of network slicing.

[**ITU-T Y.3176 “Machine learning marketplace integration in future networks including IMT-2020”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14402) provides high-level requirements and the architecture for integrating ML marketplaces in future networks including IMT-2020. Based on these requirements, the architecture for the integration of ML marketplaces is described taking into account the architectural framework in [ITU-T Y.3172] as a basis.

I.2.4 Home networking

**ITU-T G.9961 (2015) Amd.3 “Unified high-speed wire-line based home networking transceivers - Data link layer specification: Amendment 3” (under approval)** includes enhancements to simplify routing mechanisms in tree topologies.

**ITU-T G.9963 Amd.1 “Unified high-speed wireline-based home networking transceivers - Multiple input/multiple output specification: Amendment 1” (under approval)** aligns this Recommendation with recommendations [ITU-T G.9960], [ITU-T G.9961] and [ITU-T G.9962].

**ITU-T G.9991 (2019) Amd.2 “High-speed indoor visible light communication transceiver - System architecture, physical layer and data link layer specification - Amendment 2” (under approval)** includes a mechanism to support advanced inter-domain mobility through an external controller.

[**ITU-T L.111 “Optical fibre cables for in-home applications”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14514) aims to provide the requirements of optical fibre cables for in-home applications. Compared to requirements of optical fibre cables in traditional “indoor” applications, the requirements of cables in “in-home” applications have their own specialized characteristics. This Recommendation describes characteristics, cable construction and test methods of optical cables with minimum visibility for in-home applications.

**ITU-T Technical paper “On the use of G.hn technology for smart grid” (under publication)** describes the use of G.hn transceivers over power lines infrastructure for different smart grid use cases. The document is intended to provide guidance to silicon vendors, system vendors and electrical utilities to define, configure and deploy devices using G.hn transceivers in this type of environment. This document does not enter into the details of G.hn technologies as they are already described in the relevant Recommendations. The G.hn family of Recommendations includes G.9960 [1], G.9961 [2], G.9962 [3], G.9963 [4] and G.9964 [5] and is referred to herein as G.996x.

I.2.5 Smart Grid

I.2.6 Software-defined networking

[**ITU-T X.1046 “Framework of software-defined security in software-defined networks/network functions virtualization networks”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14442) specifies a framework of software-defined security in software defined networks (SDN) and the network functions virtualization (NFV) networks. This framework utilizes key advantages of SDN/NFV technologies such as on-demand capacity scale-in/scale-out, dynamic and intelligent security policy control regarding real-time network status, separated deploy of control layer and data forwarding layer, full view of traffic for monitoring and unified security policy setting.

I.2.7 Cloud computing

[**ITU-T X.1606 “Security requirements for communications as a service application environments”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14265) identifies security threats and recommends security requirements for communications as a service (CaaS) application environments. This Recommendation describes scenarios and features of CaaS containing multi-communication capabilities. Then it identifies specific threats arising from unique CaaS features and recommends appropriate CaaS security requirements.

[**ITU-T Y.3525 “Cloud computing - Requirements for cloud service development and operation management”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14403) specifies functional requirements of cloud service development and operation management based on the analysis of corresponding use cases.

[**ITU-T Y.3530 “Cloud computing - Functional requirements for blockchain as a service”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14404): Blockchain as a service (BaaS) is a cloud service category in which the capabilities provided to the cloud service customer are the ability of setting up blockchain platform, and development decentralized application using blockchain technologies. In BaaS, an integrated developing environment (IDE) for CSCs is provided to create, deploy and operate decentralized applications. This Recommendation introduces blockchain and blockchain as a service. This Recommendation also provides functional requirements of blockchain as a service which is derived from use cases.

[**ITU-T Y.3531 “Cloud computing - Functional requirements for machine learning as a service”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14405) provides cloud computing requirements for machine learning as a service (MLaaS), which addresses requirements from use cases. Machine learning as a service is a cloud service category in which the capability provided to the cloud service customer is the provision and use of machine learning framework. Machine learning framework is a set of functionalities for provisioning machine learning data as well as training, deploying, and managing machine learning model.

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

I.2.8 Big data

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

[**ITU-T X.1750 “Guidelines on security of big data as a service for Big Data Service Providers”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14266): Big data as a service (BDaaS) is a cloud service category that provides cloud service customers with capabilities to collect, store, analyse, visualize and manage big data, as specified in ITU-T Y.3600. With remarkable growth of data volumes and rapid development of big data business, big data infrastructure has become the central facility to provide BDaaS. Consequently, significant security issues arise for BDaaS. For example, open source big data software design sometimes fails to take security into consideration from the beginning. New technologies introduced by big data analytics can also result in failure of traditional security protection measures. Recommendation X.GSBDaaS analyses security challenges BDaaS faces, identifies security roles and responsibilities for provision of BDaaS, as well as a security framework for a big data infrastructure. It also specifies security protection measures that should be satisfied for services and components related to BDaaS.

[**ITU-T X.1751 “Security guidelines on big data lifecycle management for telecommunication operators”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14267) analyses security vulnerabilities and provides security guidelines on the big data lifecycle management for telecommunication operators. With rapid development of big data technology, the value of data has substantially increased. Big data bring new opportunities to telecommunication services. Previously, data were siloed and managed independently in different telecommunication service systems. Data aggregation and fusion trends are inevitable with the construction of big data services. In the process of data fusion convergence, data flow on platforms and in service processes. Data face various security vulnerabilities at different stages of its lifecycle. This Recommendation introduces specific characteristics of telecommunication big data services and data categories, analyses security vulnerabilities of big data lifecycle management, specifies security guidelines for telecommunication operators.

[**ITU-T Y.3605 “Big data - Reference architecture”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14406) defines Big Data Reference Architecture (BDRA) that can serve as a fundamental reference point for big data standardization and which provides an overall framework for the basic concepts and principles of big data. The Recommendation provides a description of reference architecture concepts, two distinct viewpoints including user view and functional view, and also cross cutting aspects. Furthermore, the Recommendation addresses layering framework, functional components within framework and detailed functional descriptions for big data.

I.2.9 Network Management

**[ITU-T M.3373 “Requirements for synergy management of cloud and SDN-based networks”](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14428)** introduces the management function set and requirements for synergy management of cloud and SDN-based networks. It describes the synergy management structure and the composition of the function set, explains the functions of each component in the function set. The requirements for the synergy management of cloud and SDN-based networks are also described. In this Recommendation, the general background of the synergy service of cloud and SDN-based networks are also analysed. The benefit of introducing synergy management of cloud and SDN-based networks is explained.

I.3.1 Video and image coding

[**ITU-T T.701.11 “Guidance on audio descriptions (twin text of ISO/IEC TS 20071-11:2019, Information technology - Guidance on alternative text for images - Part 11)”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14358) gives guidance on how to create text alternatives (also known as "alt-text") and what information to put in text alternatives. This Recommendation applies to all still images that are used in any type of electronic document. It also applies to individual images within a slide show. The alternative text guidance provided in this Recommendation is not applicable to moving images (e.g. movies). This Recommendation is a twin text with ISO/IEC 20071-11:2019 "Information technology – User interface component accessibility – Part 11: Guidance on text alternatives for images", prepared by ISO/IEC JTC1 SC35 "User interfaces".

I.3.2 Intelligent, interoperable visual surveillance systems

I.3.3 IPTV and digital signage

I.3.4 Immersive live experience

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

I.3.6 New services and applications

I.4.1 Internet of Things and Smart City

[**ITU-T X.1366 “Aggregate message authentication schemes for Internet of things (IoT)”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14262): The number of Internet of things (IoT) devices is increasing, and in the near future there will be an enormous number of devices connected to the IoT network including 5G. This Recommendation specifies two message authentication schemes. One is an aggregate message authentication (AMA) scheme for IoT as a basic mechanism. The other is an interactive aggregate message authentication (IAMA) scheme with interactive protocol in a lightweight and secure manner. Both aggregate message authentication schemes can be applied for ensuring "entity (identity) authentication" as well as for ensuring "message authentication". These schemes may not be applicable in all use cases for utilizing IoT devices, but they are quite effective and suitable for use cases in the following conditions where:

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

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

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

[**ITU-T X.1367 “Standard format for Internet of things error logs for security incident operations”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14263): There are two issues to handle security incidents from the Internet of things (IoT) ecosystem: The first is the incompatibility of protocols between computer networks using transmission control protocol/Internet protocol (TCP/IP) and IoT edge devices. The second is the lack of compatibility of error codes among edge device manufacturers. Recommendation X.1367 specifies a standardized error log format that can be placed in a protocol payload, such as syslog [b-IETF RFC 5424] to be used for converting an error log information issued by an edge device to the standard error log format. Recommendation X.1367 also specifies a standardized error code table to solve the second issue. As a result, security incidents across computer networks and networks for IoT edge devices can be integrally managed.

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

[**ITU-T Y.4211 “Accessibility requirements for smart public transportation services”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14577)**:** The concept of accessibility in public transportation services has been mainly concerned with eliminating physical barriers such as adopting accessible trains and buses that allows a wheelchair accessibility by mechanical lowering-entrance floors. In smart public transportation services, the use of Internet of Things, when properly designed, may increase accessibility of public transportation services by providing access of information and physical accessibility. The Internet of Things can be used to create tools for persons with many types of disabilities and specific needs, including physical, visual, hearing and cognitive disabilities. In order for the smart transportation services to appropriately provide accessible services, information of accessibility profiles must be agreed upon in advance. Such accessibility profiles should basically include information on accessibility needs while traveling on public transportation services. This Recommendation specifies accessibility requirements for smart public transportation services.

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

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

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

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

**ITU-T Y.4476 “OID-based resolution framework for transaction of distributed ledger assigned to IoT resources” (under approval):** An object identifier (OID) is an identifier to name an object with a hierarchically assigned namespace. In the Internet of Things (IoT), thousands of IoT resources will be intricately provided as fusion types of various services. For the thousands of IoT resources, object identifiers (OIDs) can provide a resolution framework with unlimited scalability. On the other hand, IoT resources need to secure their data, so distributed ledger technology (DLT) can guarantee its integrity. In consequence, convergence of DLT and OIDs provide a good solution for identifying secured data of IoT resources. Therefore, this Recommendation specifies a resolution framework for the transaction of distributed ledger assigned to IoT resources. This Recommendation describes the concepts, functional requirements, architecture and procedures of an OID-based resolution framework by using DLT.

[**ITU-T Y.4559 “Requirements and functional architecture of base station inspection services using unmanned aerial vehicles”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14424): The changes being experienced in weather conditions and the aging of materials may cause damage to base stations, which will affect network service quality and even cause safety incidents. Network operators need to carry out timely and periodic inspection and maintenance operations. Due to the long-term, high-intensity and high-altitude nature of these operations, the base station inspection (BSI) services conducted manually are dangerous, inefficient and costly.

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

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

[**ITU-T Y.4908 “Performance evaluation frameworks of e-health systems in the IoT”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14425): Currently e-health systems are being implemented by governments and stakeholders to increase the effectiveness, efficiency and the quality of health care services. The Internet of things (IoT) as a relatively new technology is transforming e-health systems to further enhance health care services. However, this transformation concomitantly creates a need for effective performance evaluation frameworks of e-health systems in the IoT. This Recommendation addresses this need for effective performance evaluation frameworks of e-health systems in the IoT and includes:

– A classification of e-health services in the IoT

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

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

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

[**ITU-T X.1374 “Security requirements for external device with vehicle access capability”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14446)analyzes security threats to connected vehicles in two parts: threats against interfaces which are used to communicate between a vehicle and its external devices, and threats against external devices which communicate with the vehicle. This Recommendation specifies security requirements for such external interfaces and external devices with vehicle access capability in telecommunication network environments to address identified threats depending on types of access interfaces. Interfaces and external devices with vehicle access capability include remote keyless entry (RKE) system with smart key, diagnostic tool and wireless dongle using on-board diagnostic II (OBD-II) port, telematics control units with wireless communication devices and so on.

[**ITU-T X.1375 “Methodologies for intrusion detection system on in-vehicle system”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14447)provides guidelines for intrusion detection systems (IDSs) on in-vehicle networks. This Recommendation mainly focuses on how to detect intrusion and malicious activities on in-vehicle networks such as those using controller area network (CAN) that cannot be supported by general IDSs currently used in Internet deployments.

This Recommendation includes classifications and analyses of attacks targeting in-vehicle networks. It then recommends methodologies and implementation guidelines for detecting intrusions and malicious activities within CAN-based in-vehicle networks that cannot be supported by general IDSs.

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

I.4.5 Connected health: e-Health

[**ITU-T Y.4908 “Performance evaluation frameworks of e-health systems in the IoT”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14425): Currently e-health systems are being implemented by governments and stakeholders to increase the effectiveness, efficiency and the quality of health care services. The Internet of things (IoT) as a relatively new technology is transforming e-health systems to further enhance health care services. However, this transformation concomitantly creates a need for effective performance evaluation frameworks of e-health systems in the IoT. This Recommendation addresses this need for effective performance evaluation frameworks of e-health systems in the IoT and includes:

– A classification of e-health services in the IoT

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

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

I.5.1 New security standards

[**ITU-T X.1052 (revised) ”Information security management processes for telecommunication organizations”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14044) provides best practices for information security management for telecommunication organizations to support Recommendation ITU-T X.1051. This recommendation is based on a process approach to describe a set of security management areas, which gives guidelines of telecommunication organizations to fulfil the control objectives defined in Recommendation ITU T X.1051. The management areas including asset management, incident management, risk management policy management and map the controls defined by Recommendation ITU-T X.1051 to achieve methodologies.

**ITU-T X.1054 (revised) “Information security, cybersecurity and privacy protection - Governance of information security” (under approval):** Information security is a key issue for organizations, amplified by rapid advances in attack methodologies and technologies, and corresponding increased regulatory pressures. The failure of an organization’s information security controls can have many adverse impacts on an organization and its interested parties including but not limited to the undermining of trust. Governance of information security is the use of resources to ensure effective implementation of information security, and provides assurance that:

• directives concerning information security will be followed; and

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

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

Managers and others working in organizations need to understand:

• the governance requirements that affect their work; and

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

[**ITU-T X.1148 “Framework of de-identification process for telecommunication service providers”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14249): Telecommunication organizations collect, manage, use, and share data about individuals, including personally identifiable information. As a result, they utilize data de-identification techniques to protect individuals’ data. This Recommendation describes a framework of de-identification process with operational steps and specifies data release models and data stages in a de-identification process for telecommunication service providers based on data lifecycle model and roles of stakeholders.

[**ITU-T X.1216 “Requirements for collection and preservation of cybersecurity incident evidence”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14259) describes a general procedure for cybersecurity incident response and investigation, analyses sources of cybersecurity incident evidence and specifies capability requirements for tools used for collection and preservation of such evidence an investigative process. This Recommendation also specifies reliability assurance requirements for these tools as guidelines to developers who design tools for such purpose.

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

[**ITU-T X.1218 “Requirements and guidelines for dynamic malware analysis in a sandbox environment”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14444)**:** Unknown malware is commonly used in advanced attacks, in particular APTs (Advanced Persistent Threat), to avoid being detected. For example, a targeted attack using phishing email weaponized with unknown malwares can easily achieve a successful initial compromise. Thus, for detection of advanced attacks, special attention and defense measurements should be taken to detect unknown malwares. This Recommendation analyzes threats related to unknown malwares and specifies requirements of unknown malware detection based on dynamic behavior analysis.

[**ITU-T X.1254 (revised) “Entity authentication assurance framework”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14260) defines three entity authentication assurance levels (i.e., AAL1 – AAL3), and the criteria and threats for each of the three levels of entity authentication assurance. Additionally, it:

• specifies a framework for managing the assurance levels;

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

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

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

[**ITU-T X.1279 “Framework of enhanced authentication using telebiometrics with anti-spoofing detection mechanisms”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14261) provides an architectural framework of enhanced authentication using telebiometrics with anti-spoofing detection. This Recommendation analyses threats to traditional telebiometric authentication solutions and specifies an architectural framework, authentication process flows and security considerations for enhanced authentication using telebiometrics with anti-spoofing detection mechanisms.

[**ITU-T X.1452 “Technical framework for security services provided by operators”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14451)**:** Due to the growing number of innovations in services in network and telecommunication domains, operators do face the pressing need to explore new services based on their network and services capabilities. In this transformation, operators have not only accumulated new assets and experiences with technologies and services for network and telecommunication, but also the capability of offering security services based on the full extend of their network and infrastructure deployments and operations. The specific nature of this class of services makes them exhibit a number of differences with the more traditional telecommunication services (e.g. phone call, short message, mobile network access). In this context, the portfolio of security services that are currently in production and explored by the operators need a specific integration with the resources and assets of the telecommunication network and infrastructure; the risk level on this portfolio is actually higher should the security service itself be compromised as it is precisely supposed to turn the operator offering it as the 'security provider' for the end market customers. A compromise of the service will result in lost of trust by customers and will span through the whole range of the services offered by the operator and will significantly increase the overall Churn level and customer satisfaction and loyalty. Therefore the security assurance defined as the degree of confidence reached in the security service needs to be studied thoroughly. In order to offer technical reference for the operators and guarantee the security, the guidelines of the security services provided by the operator need to be analyzed and established.

This recommendation aims to classify potential use cases of security services provided by operators, analyze specific requirements for security services thus provides guidelines for operators to safeguard and improve their security services.

**Technical Report “Unified Security Model (USM) - a neutral integrated system approach to Cybersecurity”** **(under publication)** offers a one stop place, as a live document, to regroup all the related work conducted.

I.5.2 Quantum key distribution networks

[**ITU-T Y.3802 “Quantum key distribution networks - Functional architecture”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14407) defines a functional architecture model of quantum key distribution (QKD) networks. In order to realize this model, it specifies detailed functional elements and reference points, architectural configurations and basic operational procedures of QKD networks (QKDN).

[**ITU-T Y.3803 “Quantum key distribution networks – Key management”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14408): Quantum Key Distribution (QKD) protocols provide the means to distribute a symmetric random bit strings as a secure key that can be proven to be secure even against an eavesdropper, who has unbounded computational ability. A basic element of QKD is a pair of QKD modules linked by a QKD link that allows two remote parties to share secure keys. A QKD network consists of two or more QKD links and trusted nodes (QKD nodes), where any pair of two QKD nodes can share secure keys via QKD links and key relay. In the end, these keys are supplied to cryptographic applications in user networks. To implement the QKD network (QKDN) and appropriately integrate with the user network, an overview of the QKD technologies, including network capabilities, conceptual structure, layered model, basic functions and components, and its relation to the user network, is given in Recommendation ITU-T Y.3800.

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

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

[**ITU-T Y.3804 “Quantum Key Distribution Networks - Control and Management”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14409): To realize secure, stable, efficient, and robust operations of and services by a quantum key distribution (QKD) network as well as to manage a QKD network (QKDN) as a whole and support user network management, this Recommendation specifies functions and procedures for QKDN control and management based on the requirements specified in Recommendation ITU-T Y.3801.

[**ITU-T X.1710 “Security framework for quantum key distribution networks"**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14452)specifies a framework including requirements and measures to combat security threats for quantum key distribution networks (QKDNs). It specifies a simplified QKDN structure for analysis of relevant security threats. Security requirements and corresponding security measures are then specified on that basis.

[**ITU-T X.1714 “Key combination and confidential key supply for quantum key distribution networks"**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14453)describes key combination methods for quantum key distribution network (QKDN) and specifies security requirements for both the key combination and the key supply from QKDN to cryptographic applications.

[**Technical Report “Security considerations for quantum key distribution network”**](https://www.itu.int/pub/publications.aspx?lang=en&parent=T-TUT-QKD-2020-1)**:** Facing challenge from quantum computers, quantum safe cryptography is becoming increasingly important. Quantum key distribution (QKD) is a technology using quantum physics to securely exchange symmetric encryption keys. This technology solves the problem of key distribution by allowing the exchange of cryptographic keys between two remote parties with information-theoretic security, guaranteed by the fundamental laws of physics. These keys can then be used securely with conventional cryptographic algorithms. Post-quantum cryptography (PQC) refers to cryptographic algorithms which are resilient to attacks by quantum computers. Some post-quantum cryptographies, such as lattice-, code- or hash-based cryptosystems, are currently believed to be quantum-safe until proven otherwise. These two technologies, i.e., QKD and PQC are two pillars complementary to each other for quantum safe cryptography. QKD can be used as a key establishment alternative and QKD deployment is used to secure operators' backbone communications. PQC is a collection of cryptographic algorithms considered to be secure against quantum computer for end-point security. This Technical Report only studies the perspective of QKD. Although QKD technologies have been developed for several decades, there is a need to develop a QKD framework to satisfy requirements from the telecom network's perspective.

I.5.3 Trust

[**ITU-T Y.3055 “Framework for Trust based Personal Data Management”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14393): Data becomes more important for various industries, and data stakeholders aggregate personal data from various data sources to find new values. To increase benefits from personal data utilization with the balance of privacy protection, it is important to support trust based personal data management that considers the trust in personal data utilization processes. Thus, this Recommendation provides a framework for trust based personal data management. It introduces the necessity of trust based personal data management based on the analysis of personal data management. Then, it identifies various requirements for trust based personal data management. After identifying the requirements, this Recommendation provides a framework architecture specifying related functional blocks and reference points with relevant information flows. Details of prospective technologies for personal data management and a trust evaluation model with a specific use case are described in informative appendices.

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

I.5.4 Distributed Ledger Technology

[**ITU-T X.1400 “Terms and definitions for distributed ledger technology”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14449) contains a baseline set of terms and definitions for distributed ledger technology (DLT). The definition of each term provide a basic characterization of the term, and where appropriate, a note is included to provide additional clarity. It is based on Focus Group Technical Report ITU-T FG DLT D1.1:2019, FG DLT D1.1 Distributed ledger technology terms and definitions.

[**ITU-T X.1403 “Security guidelines for using DLT for decentralized identity management”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14264): Distributed Ledger Technology and its specific implementations such as Blockchain offer a unique opportunity for utilizing a trust infrastructure and a platform that could be useful in enabling trusted federation for exchanging identity attributes and identity information. This Recommendation provides a telecom-specific privacy and security considerations for using DLT data in identity management.

[**ITU-T X.1404 “Security assurance for distributed ledger technology”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14450)defines three levels of security assurance for the distributed ledger technology (DLT) in order to facilitate design and development of security assurance mechanisms. It further defines ten security assurance components encompassing the security assurance and specifies criteria and guidelines for achieving each of the three levels of a security assurance component. Finally, it also provides a mapping between specific threats and security assurance components and a mapping between specific security capabilities and security assurance components. Distributed ledger technology (DLT) is defined as a shared digital ledger, which is a continually updated list of all transactions. The assurance of DLT is defined as the degree of confidence that the process or deliverable meets defined characteristics or objective. An assurance level could be considered as a quantitative expression of assurance agreed among the relevant parties. There is a need for specifying criteria and guidelines for achieving each of three levels of a certain security assurance component: data integrity, data confidentiality, credential management, identity proofing of users, entity authentication, authorization, data obfuscation, consensus mechanism strength, smart contract, PII data protection. To facilitate design and development of security assurance mechanisms, this Recommendation is based on three levels of security assurance.

[**ITU-T Y.3530 “Cloud computing - Functional requirements for blockchain as a service”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14404): Blockchain as a service (BaaS) is a cloud service category in which the capabilities provided to the cloud service customer are the ability of setting up blockchain platform, and development decentralized application using blockchain technologies. In BaaS, an integrated developing environment (IDE) for CSCs is provided to create, deploy and operate decentralized applications. This Recommendation introduces blockchain and blockchain as a service. This Recommendation also provides functional requirements of blockchain as a service which is derived from use cases.

I.6.1 Green ICT standards

[**ITU-T L.1023 “Assessment method for Circular Scoring”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14301) outlines an assessment methodology for circularity scoring of ICT goods. The assessment method consist of three steps:

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

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

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

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

**ITU-T L.1024 “Effect for global ICT of the potential of selling services instead of equipment on the waste creation and environmental impacts” (under approval):** It is expected that currently billions of new ICT goods – smartphones and others - are sold annually and even more are expected in 2025. Business models based on servitization which would - most effectively - improve the circularity of these ICT goods are not well understood, e.g. prolonging the lifetime and/or the e-waste collection rate. The cases in the ICT ecosystem – for which the ICT goods - are better sold as services/subscriptions than products, are not clearly understood from an environmental point of view. This Recommendation utilises information compiled from stakeholders which can provide good insights into the specified potential challenge.

[**ITU-T L.1031 (revised) “Guideline for achieving the e-waste targets of the Connect 2030 Agenda”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14572) describes a three-step approach to achieve the e-waste targets set in the Connect 2030 Agenda. These steps consist of guidance on developing an e-waste inventory, approaches to design e-waste prevention and reduction programmes and the supportive measures required for successfully implementing the Connect 2030 e-waste targets. This Recommendation is intended to be utilized by relevant stakeholders to take their first step in addressing Target 3.2 of the Connect 2030 Agenda that is to increase the global e-waste recycling rate to 30% and Target 3.3 that is to raise the percentage of countries with e-waste legislation to 50%.

[**ITU-T L.1304 “Procurement Criteria for Sustainable Data Centres”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14565) aims to support public authorities in purchasing data centres related products, services and items with reduced environmental impacts through establishing a set of procurement criteria.

[**ITU-T L.1310 (revised) “Energy efficiency metrics and measurement methods for telecommunication equipment”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14302) contains the definition of energy efficiency metrics test procedures, methodologies and measurement profiles required to assess the energy efficiency of telecommunication equipment. Energy efficiency metrics and measurement methods are defined for telecommunication network equipment and small networking equipment. These metrics allow for the comparison of equipment within the same class, e.g., equipment using the same technologies. The comparison of equipment in different classes is out of the scope of this Recommendation.

[**ITU-T L.1331 (revised) “Assessment of mobile network energy efficiency”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14303) aims to provide a better understanding of the energy efficiency of mobile networks. The focus of this Recommendation is on the metrics and methods of assessing energy efficiency in operational networks. The networks considered are those whose size and scale could be defined by topologic, geographic or demographic boundaries. This Recommendation explains how to extrapolate the measurements made on partial networks to the level of the total network. Such a simplified approach is proposed as a way of making approximate energy efficiency evaluations at the level of network elements and cannot therefore be considered sufficient for the entire network operation including, for example, transport.

[**ITU-T L.Suppl.38 to Recommendation ITU-T L.1470 “Guidance to ICT manufacturers on setting 1.5°C aligned targets compliant with Recommendation ITU-T L.1470”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?rec=14582)supports information and communication technology (ICTs) organizations in setting science-based targets for greenhouse gases (GHGs) according to the decarbonisation pathways, described in detail in Recommendation ITU-T L.1470 ‘GHG emissions trajectories for the ICT sector compatible with the UNFCCC (United Nations Framework Convention on Climate Change) Paris Agreement’, aligned to the IPCC Special Report on 1.5°C and is intended to be provided to Science Based Targets Initiative (SBTi) to be used as a sectoral target-setting approach. This supplement focuses exclusively on ICT manufacturers. Guidance for additional sub-sectors, including such as semi-conductor manufacturers and PCB manufacturers, will be covered in future work.

Note: The term ICT manufacturers refers to organisations which have the financial and organisational control of the design and production of ICT goods, also including software providers.

[**ITU-T L.Suppl.40 to Recommendation ITU-T L.1371 “Scoring tool to assess the sustainability performance of office buildings”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?rec=14583) presents the scoring tool that can be used to assess the sustainability performance of office buildings using Recommendation ITU-T L.1371 “A methodology for assessing and scoring the sustainability performance of office buildings”.

I.6.2 Electromagnetic fields

[**ITU-T K.34 (revised) “Classification of electromagnetic environmental conditions for telecommunication equipment - Basic EMC Recommendation”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14566) defines electromagnetic environmental classes for telecommunication equipment covering all relevant electromagnetic environmental parameters. This Recommendation applies to telecommunication equipment installed in telecommunication centres, outdoor locations and customer premises. This is a basic EMC Recommendation for telecommunications.

[**ITU-T K.35 (revised) “Bonding configurations and earthing at remote electronic sites”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14567): Bonding configurations, earthing, and the type of power distribution for equipment located at remote electronic sites are proposed, which are intended to promote harmony of installation and equipment configurations while providing for personnel safety and electromagnetic compatibility.

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

[**ITU-T K.70 (revised) “Mitigation techniques to limit human exposure to EMFs in the vicinity of radiocommunication stations”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14568) defines techniques which may be used by telecommunication operators to evaluate the cumulative (total) exposure ratio in the vicinity of transmitting antennas and to identify the main source of radiation. It offers guidance on mitigation methods which allow reduction of radiation level in order to comply with exposure limits. It also provides guidance on procedures necessary in the environment (on site) in which, in most cases, there is a simultaneous exposure to multiple frequencies from many different sources. Radiating sources may belong to many operators and may represent different radiocommunication services (e.g., cellular systems, trunking systems, broadcasting, radio relays, wireless access, etc.).

This Recommendation includes an electronic attachment with an EMF-estimator software that implements the methodology it describes. Amendment 2 adds Appendix I with distinct 32-bit and 64 bit versions of the EMF estimator software. As Microsoft Access 32-bit and 64-bit versions cannot be served by the same software package, two versions of this software are proposed. More exactly two separate install procedures are required in order to run this software depending on the Microsoft Access version installed on user PC. The "save" procedures were also substantially improved in these versions, and the antenna library was also reorganized and expanded. The new software package is in the attached zipped file.

[**ITU-T K.78 (revised) “High altitude electromagnetic pulse immunity guide for telecommunication centres”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14569) specifies the radiated and conducted immunity requirements against a high altitude electromagnetic pulse (HEMP) for equipment installed in telecommunication centres for functions such as switching, transmission, radiocommunication, and power distribution. The requirements consist of immunity test methods and levels for telecommunication equipment in each installation condition. The telecommunication system can be more robust by applying surge protective devices (SPDs) for surge mitigation and electromagnetic screening to the building and/or equipment enclosures.

[**ITU-T K.91 (revised) “Guidance for assessment, evaluation and monitoring of human exposure to radio frequency electromagnetic fields”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14570): There are many possible methods of exposure assessment and each of them has its own advantages and disadvantages. Recommendation ITU-T K.91 gives guidance on how to assess and monitor human exposure to radio frequency (RF) electromagnetic fields (EMFs) in areas with surrounding radiocommunication installations based on existing exposure and compliance standards in the 9 kHz to 300 GHz range. This includes procedures for evaluating exposure and how to show compliance with exposure limits with reference to existing standards. Recommendation ITU-T K.91 is oriented to the examination of the area accessible to people in the real environment of currently operated services with many different sources of RF EMF, but also gives references to standards and Recommendations related to EMF compliance of products. Recommendation ITU-T K.91 includes an electronic attachment containing an uncertainty calculator and the Watt guard modules.

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

[**ITU-T K.145 (revised) “Assessment and management of compliance with radio frequency electromagnetic field exposure limits for workers at radiocommunication sites and facilities”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14571) includes guidance on the protection of workers against radio frequency electromagnetic fields (RF-EMFs) exposure in their working environments. Radio frequency (RF) workers range from installation engineers and tower climbers to R&D personnel and laboratory testing engineers. All of these RF workers are exposed to stronger RF-EMF fields than the general public. There are also RF informed workers who have been provided with information on RF-EMF safe working practices for a site as well as all other workers who are regarded as members of the public for the purposes of RF-EMF exposure limits. This Recommendation provides minimum general safety guidance for telecommunication RF workers around the world.

[**ITU-T K.148 “Multiservice surge protective device application guide”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14561): A Multiservice Surge Protective Device (MSPD) protects two or more services e.g. mains and telecommunications, and has a common bonding point for the service surge protective devices (SPDs) contained in the MSPD. This Recommendation application guide on MSPDs explains their uses, required performance parameters and usage consequences.

[**ITU-T K.149 “Passive intermodulation test methods of array antenna systems in mobile communication systems”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14562) specifies methods for measuring passive intermodulation level of array antenna systems in mobile communication systems, including test equipment and test procedures. This Recommendation covers the following frequency ranges, but not limited to the following ranges: LTE 700, APT 700, LTE 800, Cellular 850, E-GSM 900, DCS 1800, PCS 1900, AWS 1700/2100, UMTS 2100 and LTE 2600 operating bands.

[**ITU-T K.150 “Information of semiconductor devices required for design of telecommunication equipment applying soft error mitigation measures”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14563) describes characteristic parameters and functions of semiconductor devices that a telecommunication equipment designer needs when implementing soft error mitigation measures. This Recommendation describes kinds of information expected to be supplied from semiconductor device vendors to designers for telecommunication equipment. The definition of expected information and objective to collect it are described firstly. It is described which semiconductor devices are targeted to collect information next. Finally, details of expected information to be collected are described for each target semiconductor devices.

[**ITU-T K.Suppl.21 to Recommendation ITU-T K.21 “Rationale for setting resistibility requirements of telecommunication equipment installed in customer premises against lightning”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?rec=14579) provides technical information (rationale) for setting the resistibility requirements against lightning in Rec. ITU-T K.21. This information should be referred on the case of revision of Recommendation ITU-T K.21, the rationale described in this Supplements mainly quoted from past contributions and other documents discussed in SG5 on the stage of establishment and revision of ITU-T K.21. Also, this supplement intends that rationale for revision of Rec. ITU-T K.21 is added on the case Rec. ITU-T K.21 is revised.

[**ITU-T K.Suppl.22 to Recommendation ITU-T K.45 “Rationale for setting resistibility requirements of telecommunication equipment installed in the access and trunk networks against lightning”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?rec=14580) provides technical information (rationale) for setting the resistibility requirements against lightning in Rec. ITU-T K.45. This information should be referred on the case of revision of Recommendation ITU-T K.45, the rationale described in this Supplement mainly quoted from past contributions and other documents discussed in SG5 on the stage of establishment and revision of Rec. ITU-T K.45. Also, this supplement intends that rationale for revision of Rec. ITU-T K.45 is added on the case Rec. ITU-T K.45 is revised.

[**ITU-T K.Suppl.23 to Recommendation ITU-T K.147 “Ethernet port surge voltages and currents”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?rec=14581) simulates Ethernet port voltages and currents due to magnetic and direct surge coupling. Examples of the resultant equipment port impulse current paths for a Smith termination, capacitance and insulation voltage limiting, are shown and discussed.

I.6.4 Emergency communication & disaster relief

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

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

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

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

I.6.5 Naming, numbering, addressing and identification

ITU-T E.157 (revised) “International calling party number delivery” (under approval) provides guidance for international calling party number delivery across boundaries of countries which is technology neutral.

[ITU-T E.212 (2016) Amd.3 “The international identification plan for public networks and subscriptions - Annex H: Criteria and procedures for the assignment and reclamation of shared ITU-T E.212 mobile country codes (MCC) for regional and other international organizations (ROIO)/standards development organization (SDO)-specified networks and their respective mobile network codes (MNCs)”](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14315) provides criteria for assignment of shared E.212 resources for specific use cases to applicants that are regional and other international organizations (ROIO)/standard development organization (SDO)-specified networks.

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

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

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

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

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

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

[**ITU-T E.804.1 “Application guide for Recommendation ITU-T E.804: Quality of service aspects for popular services in mobile networks”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14427) provides detailed guidance on the application of QoS metrics defined in Recommendation ITU-T E.804 section 7.

**ITU-T E.805.1 “QoS operational strategy for improved regulatory supervision on providers of mobile telecommunication services” (under approval)** provides guidance to telecommunication regulators on how to achieve their regulatory goals for quality of service (QoS) at reduced regulatory effort and improved operational efficiency, thereby providing desired benefits to consumers and providers of mobile telecommunication services. Telecommunication regulators involved in QoS supervision often face challenges on how mobile QoS within their respective jurisdictions can be enforced in a cost-effective manner and over a desired turnaround time, while not compromising reliability in QoS assessment outcomes.

[**ITU-T E.812 Amd.1 “Crowdsourcing approach for the assessment of end-to-end quality of service in fixed and mobile broadband networks - Amendment 1: New Appendix II and Appendix III”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14489) introduces Appendix II (Use cases for the crowdsourcing approach) and Appendix III (Practical approaches to fixed broadband crowdsourcing).

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

[**ITU-T P.381 (revised) “Technical requirements and test methods for the universal wired headset or headphone interface of digital mobile terminals”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14465) specifies critical physical and electrical-acoustical characteristics for the universal headset interface and provides corresponding test methods. Both 3.5 mm and 2.5 mm diameter headset/headphone interfaces have been widely used in digital mobile terminals in recent years. Nowadays, the consumer is free to choose either the headset/headphone originally provided by the terminal manufacturer or others that are offered separately. However, the quality of service (QoS)/quality of experience (QoE) perceived by users is influenced by both the electrical performance of the interface and the compatibility between the terminal and the connected headset/headphone.

[**ITU-T P.382 (revised) “Technical requirements and test methods for multi-microphone wired headset or headphone interfaces of digital wireless terminals”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14466): Headset/headphone interfaces of diameter 3.5 mm and 2.5 mm have been widely used in digital mobile terminals during recent years. Nowadays, the consumer is free to choose either the headset/headphone originally provided by the terminal manufacturer or others that are offered separately. However, the quality of service/quality of experience (QoS/QoE) perceived by users is influenced by both the electrical performance of the interface and the compatibility between the terminal and the connected headset/headphone. Recommendation ITU T P.382 specifies critical physical and electroacoustical characteristics for the universal headset interface with more than four terminals and provides corresponding test methods.

[**ITU-T P.919 “Subjective test methodologies for 360º video on head-mounted displays”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14429) describes subjective assessment methods for evaluating quality of experience of short (between 10 seconds and 30 seconds) 360º video. It also outlines the characteristics of the source sequences to be used, such as duration, kind of content and number of sequences. Details within this recommendation are expected to change, based on experiments into how best to conduct subjective tests with 360º content.

[**ITU-T P.Suppl.28 “Considerations for the development of new QoS and QoE related objective models to be embedded in Recommendations prepared by Study Group 12”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14495) provides guidelines for Recommendations which are to be consented by SG12, when these Recommendations describe or specify tools for the objective estimation of dimensions of QoS and QoE with quality models.

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

I.9 Conformity, interoperability and testing

I.9.3 SIP-IMS conformity assessment and interconnection testing

I.9.8 Testing Internet of things

[**ITU-T Q.4062 “Framework for IoT Testing”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14387): The IoT is one of the global infrastructures for the information society, delivering advanced services by interconnecting things based on, existing and evolving, interoperable information and communication technologies. Such a global infrastructure can be achieved by use of multiple access technologies for different types of communication networks such as BAN, PAN, LAN, WLAN, LPWAN, FAN, MAN, WAN and Cellular networks. Conformance and interoperability tests not only for domains with single access technology but also for the integrated domains with multiple access technologies are required. The main goal of this Recommendation is to specify the testing framework for IoT to accommodate the tests for such integrated domains with multiple access technologies. Conformance and interoperability tests for domains served by single unified access technology have been taken into account by relevant SDOs and therefore are out of scope of this Recommendation. This Recommendation describes the types of the tests for the domains with multiple access technologies and specifies the test procedures and the considerations correspond to the testing types.

[**ITU-T Q.4063 “The framework of testing of identification systems used in IoT”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14391): The concept of the Internet of Things, defined in Recommendation ITU-T Y.4000/Y.2060, nowadays plays an important role for telecommunication and information technologies. According to a forecast, the number of Internet of Things in the foreseeable future will be hundreds of billions pieces, and further it will grow up to trillions. It is essential that most of customers of telecommunication networks will be IoT-based devices in the near future. In other words, all objects which are surround us might become IoT. The IoT, in accordance with the Recommendation ITU-T Y.4050/Y.2069, are things which have a network address and have the ability to integrate it. The penetration of IoT devices is going very fast and therefore, requires the standardization of identification procedures and relevant testing methods.

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

I.9.9 Testing energy efficiency of base stations

I.9.10 Testing cloud computing

I.9.11 Testing SDN

I.10 Mainstreaming accessibility in ICTs

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

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

[**ITU-T Y.4211 “Accessibility requirements for smart public transportation services”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14577)**:** The concept of accessibility in public transportation services has been mainly concerned with eliminating physical barriers such as adopting accessible trains and buses that allows a wheelchair accessibility by mechanical lowering-entrance floors. In smart public transportation services, the use of Internet of Things, when properly designed, may increase accessibility of public transportation services by providing access of information and physical accessibility. The Internet of Things can be used to create tools for persons with many types of disabilities and specific needs, including physical, visual, hearing and cognitive disabilities. In order for the smart transportation services to appropriately provide accessible services, information of accessibility profiles must be agreed upon in advance. Such accessibility profiles should basically include information on accessibility needs while traveling on public transportation services. This Recommendation specifies accessibility requirements for smart public transportation services.

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

[**ITU-T Q.5052 “Addressing mobile devices with duplicate unique identifier”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14392) which identifies challenges and proposes mechanisms to enable the detection of mobile devices with duplicate identifiers present on operator networks as well as recommending mechanisms for validating the legitimacy of such devices.

**ITU-T Q.5053 “Mobile device access list audit interface” (under approval)** defines the methodologies and interfaces between Mobile device access list audit system (MDALAS) and Mobile Network Operators’ Equipment Identity Register (EIR) to audit and reconcile whether the MNOs are complying with the defined Mobile device access list requirements. This document proposes different types of methodologies and interfaces to check and reconcile the Mobile device access list used by the MNOs to comply with the regulations with the Mobile device access list Audit System (MDALAS).

[**Technical Report ITU-T QTR-RLB-IMEI “Reliability of IMEI”**](https://www.itu.int/pub/publications.aspx?lang=en&parent=T-TUT-CCICT-2020) contains a study on the reliability of IMEI, including information about key vulnerabilities to IMEI reprogramming on mobile devices, challenges to make the IMEI non-reprogrammable, effects of IMEI tampering on mobile users, brand owners, manufacturers, service providers, regulators, governments, law enforcement agencies and on national security. It addresses key challenges faced by a range of stakeholders that arise from cloned/tampered IMEIs, including concerns about the misuse of IMEI numbers raised by Member States at ITU Council-17 and ITU Council-18. It also proposes ways to improve IMEI reliability and preventive steps for solving the issues on a national and international level.

I.12 Signalling Protocols

I.13 Formal Languages and Identification

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

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

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

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

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

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

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

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

[**ITU-T Z.161 (revised) “Testing and Test Control Notation version 3: TTCN-3 core language”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14480) defines Testing and Test Control Notation 3 (TTCN-3) intended for specification of test suites that are independent of platforms, test methods, protocol layers and protocols. TTCN-3 can be used for specification of all types of reactive system tests over a variety of communication ports. Typical areas of application are protocol testing (including mobile and Internet protocols), service testing (including supplementary services), module testing, testing of Common Object Request Broker Architecture (CORBA) based platforms and application programming interfaces (APIs). The specification of test suites for physical layer protocols is outside the scope of this Recommendation. This revision of the Recommendation contains amendments, clarifications, corrigenda and editorial corrections.

[**ITU-T Z.161.3 (revised) “Testing and Test Control Notation version 3: TTCN-3 language extensions: Advanced parameterization”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14481) defines the advanced parameterization package of TTCN-3. TTCN 3 can be used for the specification of all types of reactive system tests over a variety of communication ports. Typical areas of application are protocol testing (including mobile and Internet protocols), service testing (including supplementary services), module testing, testing of Common Object Request Broker Architecture (CORBA) based platforms, application programming interfaces (APIs), etc. TTCN-3 is not restricted to conformance testing and can be used for many other kinds of testing including interoperability, robustness, regression, system and integration testing. The specification of test suites for physical layer protocols is outside the scope of this Recommendation.

[**ITU-T Z.161.4 (revised) “Testing and Test Control Notation version 3: TTCN-3 language extensions: Behaviour types”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14482) defines the behaviour types package of TTCN 3. TTCN 3 can be used for the specification of all types of reactive system tests over a variety of communication ports. Typical areas of application are protocol testing (including mobile and Internet protocols), service testing (including supplementary services), module testing, testing of Common Object Request Broker Architecture (CORBA) based platforms, application programming interfaces (APIs), etc. TTCN 3 is not restricted to conformance testing and can be used for many other kinds of testing including interoperability, robustness, regression, system and integration testing. The specification of test suites for physical layer protocols is outside the scope of this Recommendation.

[**ITU-T Z.161.6 (revised) “Testing and Test Control Notation version 3: TTCN-3 language extensions: Advanced Matching”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14483) defines the support of advance matching of TTCN-3. TTCN-3 can be used for the specification of all types of reactive system tests over a variety of communication ports. Typical areas of application are protocol testing (including mobile and Internet protocols), service testing (including supplementary services), module testing, testing of OMG CORBA based platforms, APIs, etc. TTCN-3 is not restricted to conformance testing and can be used for many other kinds of testing including interoperability, robustness, regression, system and integration testing. The specification of test suites for physical layer protocols is outside the scope of the present document.

[**ITU-T Z.161.7 (revised) “Testing and Test Control Notation version 3: TTCN-3 language extensions: Object-Oriented Features”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14484) defines the support for object-oriented features in TTCN-3. TTCN-3 can be used for the specification of all types of reactive system tests over a variety of communication ports. Typical areas of application are protocol testing (including mobile and Internet protocols), service testing (including supplementary services), module testing, testing of OMG CORBA based platforms, APIs, etc. TTCN-3 is not restricted to conformance testing and can be used for many other kinds of testing including interoperability, robustness, regression, system and integration testing. The specification of test suites for physical layer protocols is outside the scope of the present document.

[**ITU-T Z.165.1 (revised) “Testing and Test Control Notation version 3: TTCN-3 language extensions: Extended TRI”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14485) defines the extended TRI package of TTCN 3. TTCN 3 can be used for the specification of all types of reactive system tests over a variety of communication ports. Typical areas of application are protocol testing (including mobile and Internet protocols), service testing (including supplementary services), module testing, testing of CORBA based platforms, APIs, etc. TTCN 3 is not restricted to conformance testing and can be used for many other kinds of testing including interoperability, robustness, regression, system and integration testing. The specification of test suites for physical layer protocols is outside the scope of this Recommendation.

[**ITU-T Z.166 (revised) “Testing and Test Control Notation version 3: TTCN-3 control interface (TCI)”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14486) specifies the control interfaces for Testing and Test Control Notation 3 (TTCN-3) test system implementations. The TTCN-3 control interfaces (TCIs) provide a standardized adaptation for management, test component handling and encoding/decoding of a test system to a particular test platform. This Recommendation defines the interfaces as a set of operations independent of a target language. The interfaces are defined to be compatible with the TTCN-3 standards (see clause 2 of ETSI ES 201 873-6 V4.12.1). The interface definition uses the Common Object Request Broker Architecture (CORBA) Interface Definition Language (IDL) to specify the TCI completely. Clauses 8, 9 and 9.7 of ETSI ES 201 873-6 V4.12.1 present language mappings for this abstract specification to the target languages Java and ANSI C. This revision of the Recommendation contains amendments, clarifications, corrigenda and editorial corrections.

[**ITU-T Z.167 (revised) “Testing and Test Control Notation version 3: Using ASN.1 with TTCN-3”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14487) defines a normative way of using ASN.1 as defined in Recommendations ITU-T X.680, ITU-T X.681, ITU-T X.682 and ITU-T X.683 with TTCN-3. The harmonization of other languages with TTCN-3 is not covered by this Recommendation. This revision of the Recommendation contains amendments, clarifications, corrigenda and editorial corrections.

[**ITU-T Z.169 (revised) “Testing and Test Control Notation version 3: Using XML schema with TTCN-3”**](https://www.itu.int/ITU-T/recommendations/rec.aspx?id=14488) defines the mapping rules for the world wide web consortium (W3C) schema to Testing and Test Control Notation 3 (TTCN-3) to enable testing of XML-based systems, interfaces and protocols. This revision of the Recommendation contains amendments, clarifications, corrigenda and editorial corrections.

I.14 Rules and Procedures, Working Methods

[**Author's guide for drafting ITU-T Recommendations (25 September 2020)**](https://www.itu.int/oth/T0A0F000004)permits uniform, efficient preparation of texts by TSB for publication. It covers the rules for drafting a Recommendation in a standard manner. Its provisions should be applied in all instances where texts (such as draft Recommendations) are being prepared by study group authors for approval and publication. The methods presented in this author's guide are the basis for a template and will remain stable until changes to current publication procedures necessitate their modification. In order to facilitate comparison with other presentation styles, this author's guide has been prepared in accordance with the presentation rules that it mandates. The examples used within the text, such as references, are for illustrative purposes only. Thus, this author's guide constitutes an example of the proposed presentation style. Please note that Recommendation ITU-T A.1500 is a fictitious Recommendation used to illustrate the points given in this guide.

**Technical Paper “Description of the incubation mechanism and ways to improve it” (under publication):** Security (understood as per SG17 mandate) is under a very strong evolution at a much faster pace than a 4 years term cadence. There are many forces in action driving a lot of innovation such as: - Strong arm race between attackers and defenders - The general Digitalization mega-trend driving general innovation (AI, DLT, etc.) - A fundamental singularity moment is approaching called post-quantum - A strong change in the policy and regulatory frameworks at country and regional levels (e.g. GDPR) In this context, SG17 took the initiative to develop a strategy of transformation of security studies through a correspondence group called CG-xss. This correspondence group and the associated special sessions on transformation of security studies delivered a strategy in three steps where the first step was about the creation of an incubation mechanism to deal with innovation at a much more timely manner. Whilst this incubation mechanism proved to be successful in pilot, a lot of the documentation describing it got diluted in too many temporary documents. It was therefore felt the need for a reference live document that can codify this incubation mechanism and fundamentally incrementally answer the question: how to bring innovation in cybersecurity standardisation in Study Group 17 in a timely manner? This document proposes a technical paper whose purpose is precisely to answer this question. As any mechanism can be improved it will as well review and analyse what other SDOs are doing to bring innovation and perhaps it will help SG17 to constantly review and improve this mechanism.

**Technical Paper “Strategic approaches to the transformation of security studies” (under publication):** Study Group 17 is now clearly facing a growth problem in many dimensions and whilst this is a good problem to have, it is still a problem. - In one hand the strong and fast evolution of Security is the result of many external forces leading to a massive innovation and prompting SG17 on considering if it has the right structure for the future - On the other hand, resources not being infinite what shall SG17 consider to offer an efficient structure for the future In many ways, a Study Group is like a company which product is called a 'recommendation' and which needs to understand how to structure its 'portfolio' in the right 'business units' called essentially Working Parties and Questions. Like in a company, the success chances are heavily related to how the organization is setup and how are leaders allocated to this organization. So, it is of the most importance, especially now in the current moment in our history, to pay a particular attention to the future structure of security studies. As wisely, a correspondence group for the transformation of security studies was setup in the course of this study period, a lot of work and thinking was already delivered and documented including methodology, potential models, even examples for new structures and even a story for the study group. Yet this knowledge is very diluted in many TDs and it is necessary now to regroup all of this work into a live document so that we can collectively develop a new approach for SG17. This document proposes a technical paper whose purpose is precisely to address this problem by regrouping our knowledge already produced in a living document and offer a vehicle to help SG17 community with a strategic approach to transformation of security studies.

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