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| **Contact:** | | TSB | | E-mail: [tsbtsag@itu.int](mailto:tsbtsag@itu.int) |

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Annex A  
(to Resolution 2 (Rev. Hyderabad, 2021))

Part 1 – General areas of study

ITU‑T Study Group 2

Operational aspects of service provision and telecommunication management

ITU‑T Study Group 2 is responsible for studies relating to:

• continued deployment of numbering, naming, addressing and identification (NNAI) requirements and resource assignment, including criteria and procedures for reservation, assignment and reclamation;

• evolution of and specification of use of numbering, naming, addressing and identification (NNAI) requirements and resource assignment, including criteria and procedures for reservation, assignment and reclamation for future telecommunication/ICT architectures capabilities, technologies, applications and services;

• principles of administering global NNAI resources;

• principles and operational aspects of routing, interworking, number portability and carrier switching;

• principles of service provision, definition and operational requirements for current and future telecommunication/ICT architectures, capabilities, technologies, applications and services;

• operational and management aspects of networks, including network traffic management, designations and transport-related operations procedures;

• operational aspects of interworking between traditional telecommunication networks and evolving and emerging telecommunication/ICT architectures, capabilities, technologies, applications and services;

• evaluation of feedback from operators, manufacturing companies and users on different aspects of network operation;

• management of future telecommunication/ICT architectures, capabilities, technologies, applications and services;

• evolution of the management interface specification methodology;

• specifying interfaces to management systems to support the communication of identity information within or between organizational domains; and

• the operational impact of the Internet, convergence (services or infrastructure) and future services, such as over-the-top (OTT), on international telecommunication services and networks.

#### Study Group 3

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

ITU T Study Group 3 is responsible, inter alia, for studying international telecommunication/ICT policy and economic issues and tariff and accounting matters (including costing principles and methodologies), with a view to informing the development of enabling regulatory models and frameworks. To this end, Study Group 3 shall in particular foster collaboration among its participants with a view to the establishment of rates at levels as low as possible consistent with an efficient service and taking into account the necessity of maintaining independent financial administration of telecommunications on a sound basis. Additionally, Study Group 3 will study the economic and regulatory impact of the Internet, convergence (services or infrastructure) and new services, such as over-the-top (OTT), on international telecommunication services and networks.

ITU‑T Study Group 5

Environment, climate change and circular economy

ITU‑T Study Group 5 is responsible for the development of standards on the environmental aspects of ICT and digital technologies and the protection of environment including electromagnetic phenomena and climate change.

Study Group 5 will study how the digital transformation can be shaped to ensure it supports transitions towards more sustainable societies.

Study Group 5 will also study issues related to resistibility, human exposure to electromagnetic fields, circular economy, energy efficiency and climate‑change adaptation and mitigation. SG5 will develop international standards, guidelines, technical papers and assessment frameworks that support the sustainable use and deployment of ICTs and digital technologies, and evaluate the environmental performance of digital technologies such as, but not limited to, 5G, artificial intelligence, smart manufacturing, automation, etc.

SG5 is also responsible for studying design methodologies and frameworks to reduce the volume and adverse environmental effects of e-waste and to support the transition towards a circular economy.

SG5 has an extended role in evaluating the impact of ICTs in accelerating climate change adaptation and mitigation actions, particularly in industries (including the ICT sector), cities, rural areas and communities. To this end, SG5 is also working to develop standards and guidelines for building resilient ICT infrastructures in rural areas and communities as well as to develop assessment methodologies for aligning the developmental trajectories of the ICT sector with the United Nations Sustainable Development Agenda 2030 and the Paris Agreement.

In addition to its climate-focused activities, SG5 has five other objectives. The first is to protect ICT (including telecommunication equipment and installations) against damage and malfunction due to electromagnetic phenomena, such as lightning as well as from particle radiations. In this field, SG5 is one of the world's most experienced and respected standardization bodies.

The second is to ensure safety of personnel and users of networks against electrical hazards existing in ICT networks. The third is to avoid health risks from electromagnetic fields (EMFs) produced by telecommunication devices and installations. SG5 will develop standards to give operators, manufacturers and government agencies the tools required to assess EMF levels and to verify compliance with the World Health Organization (WHO) recommended human exposure guidelines and limits. The fourth is to guarantee a good quality of service (QoS), reliability and low latency for high speed networks services by providing requirements on network systems of transportation media. The fifth is EMC which is another key component of SG5’s work by ensuring that the functionality of telecommunication equipment is not compromised by electromagnetic interference related to radiated and conducted disturbances emitted by other electrical or communications systems. EMC is becoming particularly relevant in accounting for the convergence of telecommunication and IT equipment, as well as in ensuring the efficient operation of home networks.

Study Group 5 is responsible for studies on how to use ICTs and digital technologies to tackle in line with the Sustainable Development Goals (SDGs).

ITU-T Study Group 9

Audiovisual content transmission and integrated broadband cable networks

ITU T Study Group 9 is responsible for studies relating to:

– use of telecommunication systems for contribution, primary distribution and secondary distribution of audiovisual content, e.g. television programmes and related data services, including interactive services and applications, providing advanced capabilities, for example ultra-high definition and high-dynamic range, 3D, virtual reality, augmented reality, multiview, etc.;

– use of cable networks, e.g., coaxial cable, optical fiber, hybrid fiber coaxial (HFC), etc., to also provide integrated broadband services. The cable network, primarily designed for audiovisual content delivery to the home, also carries time critical services like voice, gaming, video-on-demand, interactive and multiscreen services, etc., to customer premises equipment (CPE) in the home or enterprise;

– use of cloud computing, artificial intelligence (AI) and other advanced technologies, to enhance audiovisual content contribution and distribution as well as integrated broadband services over the cable networks;

– use of accessibility services (like captioning, audio caption) and new interaction technologies (like haptic, gesture, eye tracking and so on) to enhance accessibility of audiovisual content and related data services for people with different range of abilities.

#### Study Group 11

Signalling requirements, protocols, test specifications and combating counterfeit telecommunication/ICT devices

ITU‑T Study Group 11 has been attributed the responsibility for studies related to signalling-system architecture, signalling requirements and protocols, for all types of networks such as future networks (FN), cloud-computing networks, VoLTE/ViLTE‑based network interconnection, virtual networks, multimedia, next-generation networks (NGN), signalling for legacy network interworking, satellite-terrestrial networks, , software‑defined networking (SDN) technologies, network function virtualization (NFV) technologies, IMT-2020 network and beyond, QKDN and related technologies, augmented reality.

Study Group 11 is also responsible for studies to combat counterfeit telecommunication/ICT devices and mobile device theft.

Study Group 11 will also develop test specifications for testing conformance and interoperability (C&I) for all types of networks, technologies and services, a testing methodology and test suites for standardized network parameters in relation to the framework for Internet-related performance measurement, as well as for existing technologies and emerging technologies.

In addition, Study Group 11 will study a way to implement a testing laboratory recognition procedure and joint ITU/IEC certification schemes in ITU‑T through the work of the ITU‑T Conformity Assessment Steering Committee (CASC).

ITU‑T Study Group 12

Performance, quality of service and quality of experience

ITU‑T Study Group 12 is responsible for Recommendations on performance, quality of service (QoS) and quality of experience (QoE) for the full spectrum of terminals, networks, services and applications ranging from speech over fixed circuit-based networks to multimedia applications over networks that are mobile and packet based. Included in this scope are the operational aspects of performance, QoS and QoE; the end-to-end quality aspects of interoperability, and the development of multimedia quality assessment methodologies, both subjective and objective.

ITU‑T Study Group 13

Future networks and emerging network technologies

ITU‑T Study Group 13 is responsible for studies relating to the requirements, architectures, capabilities and APIs as well as softwarization and orchestration aspects of converged future networks (FN) including the application of machine learning technologies. It develops standards related to information-centric networking (ICN) and content-centric networking (CCN) . Regarding IMT2020 and beyond it particularly focuses on non-radio related parts . SG13 responsibility also includes IMT-2020 and beyond project management coordination across all ITU‑T study groups and release planning.

It is also responsible for studies relating to future computing including cloud computing and data handling in telecommunication networks. This covers capabilities and technologies from network side to support data utilization, exchange, sharing, and data quality assessment and computing-aware networking as well as end to end awareness, control and management of future computing including cloud, cloud security and data handling.

SG13 studies aspects relating to fixed, mobile and satellite convergence for multi access networks, mobility management, and enhancements to existing ITU‑T Recommendations on mobile communications, including the energy-saving aspects. Study Group 13 develops standards for quantum key distribution networks (QKDN) and related technologies. It further studies the concepts and mechanisms to enable trusted ICT, including framework, requirements, capabilities, architectures and implementation scenarios of trusted network infrastructures and trusted cloud solutions in coordination with all study groups concerned.

**ITU‑T Study Group 15**

**Networks, technologies and infrastructures for transport, access and home**

ITU‑T Study Group 15 is responsible in ITU‑T for the development of standards for the optical transport network, access network, home network and power utility network infrastructures, systems, equipment, optical fibres and cables. This includes related installation, maintenance, management, test, instrumentation and measurement techniques, and control plane technologies to enable the evolution toward intelligent transport networks, including the support of smart-grid applications.

**ITU‑T Study Group 16**

**Multimedia and digital services**

ITU‑T Study Group 16 is responsible for studies relating to ubiquitous multimedia applications, multimedia capabilities, digital services and applications for existing and future networks.

This encompasses information and communication technologies for multimedia systems, applications, terminals and delivery platforms; accessibility for digital inclusion; ICTs for active assisted living; human interfaces; distributed ledger technologies; media and signal coding and systems; and digital multimedia services in various verticals (health, culture, mobility, etc.).

ITU‑T Study Group 17

Security

ITU‑T Study Group 17 is responsible for building confidence and security in the use of information and communication technologies (ICT).

Issues related to building confidence and security in the use of ICTs including protecting personally identifiable information (PII) such as technical and operational aspects of data protection with respect to ensuring confidentiality, integrity, and availability of PII. Providing security for ICTs and ensuring security by ICTs remain as major study areas for ITU-T SG17.

To this end, studies for security are included. This also includes studies relating to cybersecurity, managed security services, endpoint detection and response, security management, countering spam and identity management. It also includes security architecture and framework, protection of personally identifiable information, quantum based security, security for distributed ledger technologies, security for intelligent transport system, security aspects related to AI, and security of networks, applications and services such as the Internet of things (IoT) and smart cities, various kinds of networks including IMT2020/5G and beyond, smart grid, industrial control system (ICS), supply chain, smartphone, software‑defined networking (SDN), network function virtualization (NFV), Internet protocol television (IPTV), web services, over-the-top (OTT), social network, cloud computing, big data analytics, digital financial system and telebiometrics.

Study Group 17 is also responsible for the application of open system communications, including directory and object identifiers, and for technical languages, the method for their usage and other issues related to the software aspects of telecommunication systems and test specification languages in support of conformance testing to improve the quality of Recommendations.

**ITU-T Study Group 20**

**Internet of things (IoT) and smart cities and communities**

Study Group 20 is responsible for studies relating to Internet of things (IoT) and its applications, and smart cities and communities (SC&C). This includes studies relating to big data aspects of IoT and SC&C, e-services and smart services for SC&C and digital transformation relevant IoT and SC&C aspects.

Part 2 – Lead ITU‑T study groups in specific areas of study

SG2 Lead study group on numbering, naming, addressing, identification Lead study group on administration of global NNAI resources  
Lead study group on routing and interworking  
Lead study group on number portability and carrier switching  
Lead study group on telecommunications/ICT capability, application  
Lead study group on telecommunication/ICT service definition  
Lead study group on telecommunications for disaster relief/early warning, network resilience and recovery  
Lead study group on telecommunication management

SG3 Lead study group on tariff and accounting principles relating to international telecommunications/ICT  
Lead study group on economic issues relating to international telecommunications/ICT  
Lead study group on policy issues relating to international telecommunications/ICT

SG5 Lead study group on electromagnetic compatibility, resistibility and lightning protection  
Lead study group on soft error caused by particle radiations  
Lead study group on human exposure to electromagnetic fields  
  
Lead study group on circular economy and e‑waste management  
Lead study group on energy efficiency and sustainable digitalization for the climate

SG9 Lead study group on integrated broadband cable networks;  
Lead study group on audiovisual content delivery over cable networks.

SG11 Lead study group on signalling and protocols   
Lead study group on establishing test specifications, conformance and interoperability testing for all types of networks, technologies and services that are the subject of study and standardization by all ITU‑T study groups  
Lead study group on combating counterfeiting of ICT devices  
Lead study group on combating the use of stolen ICT devices

SG12 Lead study group on quality of service and quality of experience  
Lead study group on driver distraction and voice aspects of car communications  
Lead study group on quality assessment of video communications and applications

SG13 Lead study group on future networks such as IMT-2020 networks and beyond (non-radio related parts)   
Lead study group on fixed mobile convergence  
Lead study group on cloud computing   
Lead study group on Machine Learning

SG15 Lead study group on access network transport  
Lead study group on home networking  
Lead study group on optical technology

SG16 Lead study group on multimedia technologies, applications, systems and digital services  
Lead study group on IP-based television services and digital signage  
  
Lead study group on human factors and ICT accessibility for digital inclusion  
Lead study group on automotive related intelligent services  
Lead study group on digital health  
Lead study group on digital culture  
Lead study group on DLT technologies and its applications

SG17 Lead study group on security  
Lead study group on identity management   
Lead study group on languages and description techniques

SG20 Lead study group on Internet of things (IoT) and its applications   
Lead study group on smart cities and communities, including its e-services and smart services   
Lead study group for Internet of things identification

Annex B  
(to Resolution 2 (Rev. Hyderabad, 2021))

Points of guidance to ITU‑T study groups for development  
of the post-2021 work programme

ITU‑T Study Group 2

ITU‑T Study Group 2 is the lead study group for numbering, naming, addressing and identification (NNAI), routing and interworking and service definition (including future telecommunication/ICT architectures, capabilities, technologies, applications and services) and will continue to be responsible for creating principles of service and operational requirements, including NNAI aspects, billing and operational quality of service/network performance. Service principles and operational requirements will also continue to be developed for current and evolving telecommunication/ICTs.

Study Group 2 is responsible for studying, developing and recommending general principles of NNAI as well as routing for all types of future and evolving telecommunication/ICTs architectures, capabilities, technologies, applications and services and operational aspects relating to end-to-end routing for all types of current and future networks.

Study Group 2 is responsible for studying, developing and recommending general principles and operational aspects related to interworking, number portability and carrier switching.

Study Group 2 will study and describe services and capabilities from a user's point of view to facilitate global interconnection and interoperation and, to the extent practicable, ensure compatibility with the International Telecommunication Regulations and related intergovernmental agreements.

Study Group 2 should continue to study service policy aspects, including those that may arise in the operation and provision of transborder, global and/or regional services, taking due account of national sovereignty.

The chairman of Study Group 2 (or, if necessary, the chairman's delegated representative), and the designated advisors through the Numbering co-ordination team (NCT), shall provide technical advice to the Director of TSB concerning general principles for NNAI, assignment, reassignment and/or reclamation of international NNAI directly assigned global resources and routing and the effect on allocation of directly assigned NNAI resources.

Study Group 2 shall provide the Director of TSB with advice on technical, functional and operational aspects in the assignment, reassignment and/or reclamation of international numbering and addressing resources in accordance with the relevant ITU‑T E‑ and F‑series Recommendations, taking into account the results of any ongoing studies, or requests raised by the NCT.

Study Group 2 should recommend measures to be taken to assure operational performance of all networks (including network management) in order to meet the requisite in‑service network performance and quality of service.

As the lead study group on telecommunication management, Study Group 2 is also responsible for the development and maintenance of a consistent ITU‑T work plan, prepared with the cooperation of relevant ITU‑T study groups, on activities associated with telecommunication management and with operations, administration and management (OAM). In particular, this work plan will focus on activities involving two types of interfaces:

• for fault, configuration, accounting, performance and security management (FCAPS) interfaces between network elements and management systems, and between management systems; and

• for transmission interfaces between network elements.

In support of market-acceptable FCAPS interface solutions, Study Group 2 studies will identify service-provider and network-operator requirements and priorities for telecommunication management, continue the evolution of the telecommunication management framework currently based on telecommunication management network (TMN), next-generation network (NGN), software-defined networking (SDN), network function virtualization (NFV) concepts, and address the management of NGN, cloud computing, future networks (including future telecommunication/ICT architectures, capabilities, technologies, applications and services), SDN, NFV and IMT‑2020, Distributed Ledger Technology (DLT).

Study Group 2 will study FCAPS interface solutions that will specify reusable management information definitions via protocol-neutral techniques, continue management information modelling for the major telecommunication technologies, such as optical and IP-based networking, and extend management technology choices consistent with market needs, industry recognized value, and major, emerging technical directions.

Additional studies will also cover network and service operational requirements and procedures, including support for network traffic management, support for the Service and Network Operations (SNO) group, and designations for interconnections among network operators.

To support the generation of such interface solutions, Study Group 2 will strengthen the collaborative relationships with standards development organizations (SDOs), forums, consortia and other experts as appropriate.

Study Group 2 will work on relevant identification aspects in collaboration with Study Group 20 for Internet of things (IoT) and with Study Group 17, as per the mandate of each study group.

ITU‑T Study Group 3

ITU‑T Study Group 3 should study and develop Recommendations, technical reports, handbooks and other publications for members to respond positively and proactively to the development of international telecommunication/ICT markets, in order to ensure that policy and regulatory frameworks remain supportive of innovation, competition, and investment for the benefit of users and the global economy.

In particular, Study Group 3 should ensure that tariffs, economic policies and regulatory frameworks related to international telecommunication/ICT services and networks are forward-looking and serve to encourage take‑up and use, as well as industry innovation and investment. Furthermore, these frameworks need to be adequately flexible to adjust to rapidly evolving markets, technologies, and business models, while ensuring the necessary competitive safeguards and the protection of consumers.

In this context, the work of Study Group 3 should also consider new and emerging technologies and services so its work will help drive new economic opportunities and enhance societal benefits in different areas including healthcare, education, and sustainable development.

Study Group 3 should study and develop appropriate instruments, with a view to creating an enabling policy environment for the transformation of markets and industries, through the promotion of open, innovation-driven, and accountable institutions.

All study groups shall notify Study Group 3 at the earliest opportunity of any development that may have an impact on tariff and accounting principles and international telecommunication/ICT economic and policy issues.

ITU‑T Study Group 5

ITU‑T Study Group 5 will develop Recommendations, supplements and other publications to:

• study the environmental performance of ICTs and digital technologies and their effects on climate change;

• accelerate climate change adaptation and mitigation actions through the use of ICTs and other digital technologies;

* study the environmental aspects of ICT and digital technologies, including issues related to electromagnetic fields, electromagnetic compatibility, energy feeding and efficiency, and resistibility;
* play an active role in reducing the volume of e-waste and facilitate its management, in order to enhance the transition to a circular economy;

• study lifecycle and rare-metal recycling approaches for ICT equipment to minimize the environmental and health impact of e‑waste;

• achieve energy efficiency and sustainable clean energy use in ICTs and digital technologies, including, but not limited to, labelling, procurement practices, standardized power supplies/connectors, eco-rating schemes etc.;

* build resilient and sustainable ICT infrastructures in urban and rural areas as well as in cities and communities;

• study the role of ICTs and digital technologies in climate change adaptation and mitigation;

• reduce the volume of e waste and its environmental impacts (including the environmental impact of counterfeit devices;

• study the transition to a circular economy and implementing circular actions in cities;

• develop methodologies for assessing the environmental impact of ICT and other digital technologies;

• develop standards and guidelines for using ICTs and other digital technologies in an eco-friendly way and enhancing rare-metal recycling and energy efficiency of ICT, including infrastructures/facilities

• develop metrics/KPIs for aligning the environmental performance of the ICT sector and digital technologies with the UN Sustainable Development Agenda 2030 and the Paris Agreement;

• develop energy efficiency/performance metrics/KPIs and related measurement methodologies of ICT and digital technologies including infrastructures and facilities;

• develop tools and guidance on proper, effective and simple communication to reach out the general public on environmental issues including EMF, EMC, resistibility, climate change adaptation and mitigation, etc.;

• study of methodologies for assessing the environmental impact of ICT, both in terms of its own emissions, power usage and the savings created through ICT applications in other industry sectors;

• study of power-feeding methodologies that effectively reduce power consumption and resource usage, increase safety and increase global standardization for economic gains;

•

• set up a low-cost sustainable ICT infrastructure to connect the unconnected;

• study how to use ICTs to help countries and the ICT sector to adapt and build resilience to the effects of environmental challenges, including climate change;

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• assess the sustainability impact of ICT to promote the Sustainable Development Goals;

• study the protection of ICT networks and equipment from interference, lightning and power faults;

• develop standards related to the assessment of human exposure to electromagnetic fields (EMF) produced by ICT installations and devices;

• develop standards related to safety and implementation aspects related to ICT powering and to powering through networks and sites;

• develop standards related to components and application references for protection of ICT equipment and the telecommunication network;

• develop standards related to electromagnetic compatibility (EMC), particle radiation effects, and assessment of human exposure to electromagnetic fields (EMF) produced by ICT installations and devices, including cellular phones, IoT devices and radio base stations;

• develop standards on the reutilization of the existing copper network outside plant and related indoor installations;

• develop standards to guarantee a good quality of service (QoS), reliability and low latency for high speed networks services by providing requirements on network systems of transportation media.

The meetings of Study Group 5 and its working parties/Questions should as far as practicable be collocated with other study groups/working parties/Questions involved in the study of environment, circular economy, energy efficiency and climate change to address the Sustainable Development Goals.

**ITU T Study Group 9**

Within its general area of responsibility, ITU-T Study Group 9 will develop and maintain Recommendations on:

– audiovisual content systems for contribution and distribution, including broadcasting, over cable networks, e.g., coaxial cable, optical fiber, or hybrid fiber coaxial (HFC), etc.;

– procedures for the operation of audiovisual content delivery over cable networks;

– the use of IP or other appropriate protocols, middleware and operating system to provide time critical services, services on demand or interactive services over cable networks;

– AI assisted delivery and transmission systems for audiovisual content and other data services over cable networks;

– cable network terminals and related interfaces (e.g, interfaces to the home network devices such as IoT devices, interfaces to the cloud);

– end-to-end integrated platforms for cable networks;

– advanced, interactive, time-critical and other services and applications over cable networks;

– cloud-based systems for audiovisual content services and control over cable networks;

– secured audiovisual content contribution and distribution, for example conditional access (CA) systems and digital rights management (DRM) over cable networks;

– accessibility applications to access audiovisual content over cable networks;

– common user profile and participation taxonomy for broadband cable TV accessibility.

ITU-T Study Group 9 will develop and maintain implementation guidelines to support deployment of audiovisual content contribution and distribution in developing countries.Study Group 9 is responsible for coordination with the ITU Radiocommunication Sector (ITU-R) on broadcasting matters.

Intersector rapporteur group activities of different Sectors and/or joint rapporteur group activities of different study groups shall be seen as complying with the WTSA expectations for collaboration and coordination.

ITU‑T Study Group 11

ITU‑T Study Group 11 will develop Recommendations on the following subjects:

• network signalling and control architectures in existing and emerging telecommunication environments (e.g. SDN, NFV, FN, cloud computing, VoLTE/ViLTE, IMT-2020 network and beyond, QKDN and related technologies, etc.);

• signalling requirements and protocols for services and applications;

• security of signalling protocols;

• session control and signalling requirements and protocols;

• resource control and signalling requirements and protocols;

• signalling and control requirements and protocols to support attachment in emerging telecommunication environments;

• signalling and control requirements and protocols to support broadband network gateways;

• signalling and control requirements and protocols to support emerging multimedia services;

• signalling and control requirements and protocols to support emergency telecommunication services (ETS);

• signalling requirements for establishing the interconnection of packet-based networks, including VoLTE/ViLTE-based networks, IMT-2020 and beyond;

• test methodologies and test suites as well as monitoring of parameters set for emerging network technologies and their applications, including cloud computing, SDN, NFV, IoT, VoLTE/ViLTE, IMT-2020 technologies, etc., to enhance interoperability;

• conformance, interoperability testing and network/system/service/device testing, including benchmark testing, a testing methodology and testing specification of standardized network parameters in relation to the framework for Internet-related performance measurement, etc.;

• combating counterfeiting of ICT devices;

• combating the use of stolen ICT devices.

Study Group 11 is to lend assistance to developing countries in the preparation of technical reports and guidelines on the deployment of packet-based networks as well as emerging networks.

The development of signalling requirements, protocols and test specifications will be as follows:

• Study and develop signalling requirements;

• Develop protocols to meet the signalling requirements;

• Develop protocols to meet the signalling requirements of new services and technologies;

• Develop protocol profiles for the existing protocols;

• Study existing protocols to determine if they meet the requirements, and work with the relevant standards development organizations (SDOs) to avoid duplication and for necessary enhancements or extensions;

• Study existing open-source codes from open-source communities (OSCs) to support the implementation of ITU‑T Recommendations;

• Develop signalling requirements and relevant test suites for interworking between new signalling protocols and existing ones;

• Develop signalling requirements and relevant test suites for interconnection between packet-based networks (e.g. VoLTE/ViLTE‑based networks, IMT-2020 network and beyond);

• Develop test methodologies and test suites for the relevant signalling protocols.

Study Group 11 is to work on enhancements to existing Recommendations on signalling protocols of legacy networks and emerging networks, in order to guarantee signalling and control security. The objective is to satisfy business needs of member organizations that wish to offer new features and services using networks based on existing Recommendations.

Study Group 11 is to continue coordination of the ITU‑T/IEC certification scheme intended to develop procedures for applying the ITU Testing Laboratories recognition procedure and establishing collaboration with existing conformance assessment programmes.

Study Group 11 is to continue its work on any test specifications for use in benchmarks testing and testing specification for standardized network parameters in relation to the framework for Internet-related measurements.

Study Group 11 is to continue its work with relevant standards organizations and forums on subject areas established by the cooperation agreement.

Study Group 11 is to continue its work on development ITU-T Recommendations, technical reports and guidelines to assist ITU Members on combating counterfeit, tampered, stolen ICT equipment and the adverse impacts they pose.

When meeting in Geneva, Study Group 11 will hold collocated meetings with Study Group 13.

ITU‑T Study Group 12

A particular focus of ITU‑T Study Group 12 is on the end-to-end quality (as perceived by the customer) delivered using a path that, with increasing frequency, involves complex interactions between terminals and network technologies (e.g. mobile terminals, multiplexers, gateway and network signal processing equipment, and IP-based networks).

As the lead study group for quality of service (QoS) and quality of experience (QoE), Study Group 12 coordinates QoS and QoE activities not only within ITU‑T, but also with other standards development organizations (SDOs) and forums, and develops frameworks to improve collaboration.

Study Group 12 is the parent group for the Quality of Service Development Group (QSDG); and the Regional Group of Study Group 12 on QoS for the Africa region (SG12RG-AFR).

Examples of the work Study Group 12 plans to undertake:

• end-to-end QoS planning, focusing on all-packet networks, but also considering hybrid IP/digital circuit-based paths;

• QoS operational aspects and related interworking guidance and resource management to support QoS;

• technology-specific (e.g. IP, Ethernet, MPLS) performance guidance;

• application-specific (e.g. smart grid, IoT, M2M, HN, OTT) performance guidance;

• definition of QoE requirements and performance targets, and associated evaluation methodologies, for multimedia services;

• definition of objective prediction models based on subjective assessment methodologies, data collection via crowdsourcing and customer surveys;

• definition of crowdsourcing-based methodologies for the assessment of QoS and QoE;

• subjective quality assessment methodologies for existing and emerging technologies (e.g. telepresence, virtual reality (VR) and augmented reality (AR));

• quality modelling (psychophysical models, parametric models, intrusive and non-intrusive methods, opinion models) for multimedia and speech (including wideband, superwideband and fullband);

• speech based services in vehicles and aspects of mitigating driver distraction;

• speech terminal characteristics and electro-acoustic measurement methods (including wideband, superwideband and fullband);

• definition of QoS parameters and assessment methods related to artificial intelligence and machine learning;

• development of test specifications for ITU-T Recommendations on performance, QoS and QoE.

ITU‑T Study Group 13

The key areas of competence of ITU‑T Study Group 13 include:

• IMT-2020 and beyond network aspects: Studies on the requirements and capabilities for networks based on the service scenarios of IMT-2020 and beyond. This includes development of Recommendations on the framework and architecture design including also network-related aspects of reliability, quality of service (QoS) and security. Furthermore, it includes interworking with current networks including IMT-Advanced, etc.

• Application of machine learning technologies aspects for future networks: Studies on how to incorporate network intelligence into IMT-2020 and beyond. Development of Recommendations on overall requirements, functional architecture and application support capabilities for the networks which include artificial intelligence and machine learning mechanism, based on but not limited to and the gap analysis identified by FG on Machine Learning for Future Networks including 5G.

• Software‑defined networking (SDN), network slicing and orchestration aspects: Studies on SDN and data plane programmability to support functions such as network virtualization and network slicing necessary for exploding and diversifying services taking into account scalability, security and distribution of functions. Development of Recommendations on the orchestration and related management-control continuum capabilities/policies of network function components, softwarized network and network slices, including enhancement and support of distributed networking capabilities.

• Information-centric networking (ICN) and public packet telecom data network aspects: Studies related to analysis of ICN applicability to IMT-2020 and beyond Development of new Recommendations on ICN general requirements, functional architecture and mechanisms of ICN networking and use‑case specific mechanisms and architectures, including deployment of corresponding identifiers. Development of Recommendations on packet data network based on the study of requirements, frameworks and candidate mechanisms. Development of Recommendations on architecture, network virtualization, resource control and other technical issues of future packet-based network (FPBN), including migration from the conventional IP-based network to FPBN.

• Fixed, mobile and satellite convergence aspects: Studies related to access-agnostic core, which integrates fixed, mobile and satellite, and the application of innovative technologies to enhance such convergence, such as AI/ML., etc. This also includes the development of Recommendations on full connectivity for various types of user equipment

• Knowledge-centric trustworthy networking and services aspects: Studies related to requirements and functions to support the building of trusted ICT infrastructures. Development of Recommendations regarding environmental and socio-economic awareness in order to minimize the environmental impact of future networks, as well as to reduce the barriers to entry for various actors involved in the network ecosystem.

• Quantum enhanced networks: Studies related to quantum key distribution networks (QKDN). Furthermore development of new Recommendations related to user networks interacting with quantum enhanced networks.

• Aspects related to future computing including cloud computing and data handling in telecommunication networks: Studies of the requirements, functional architectures and their capabilities, mechanisms and deployment models of future computing including cloud computing and data handling, covering inter- and intra-cloud scenarios as well as the applications of future computing in vertical domains. Studies include the development of technologies from network aspect to support end to end awareness, control and management of future computing including cloud, cloud security and data handling.

Study Group 13 activities will also cover regulatory implications, including deep packet inspection, and lower energy consumption networks. Furthermore, it includes activities related to innovative service scenarios, deployment models and migration issues based on future networks.

In order to assist countries with economies in transition, developing countries and especially the least developed countries in the application of networks of the future, including IMT-2020 and beyond and other innovative technologies, Study Group 13 maintains a dedicated Question on this topic and its regional group for Africa. Consultations should thereby be enabled with representatives of the ITU Telecommunication Development Sector (ITU-D) with a view to identifying how this assistance might best be done through an appropriate activity conducted in conjunction with ITU‑D.

Joint rapporteur group activities of different study groups shall be seen as complying with the WTSA expectations for collocation.

ITU‑T Study Group 15

ITU‑T Study Group 15 is the focal point in ITU‑T for the development of standards on networks, technologies and infrastructures for transport, access and home. This encompasses the development of related standards for the customer premises, access, metropolitan and long-haul sections of communication networks.

Particular emphasis is given to providing global standards for a high-capacity (terabit) optical transport network (OTN) infrastructure, and for high‑speed (multi‑Mbit/s and Gbit/s) network access and home networking. This includes the related work on modelling for network, system and equipment management, transport network architectures and layer interworking. Special consideration is being given to the changing telecommunication environment, for example, supporting the evolving needs of mobile communication networks.

Access network technologies addressed by the study group include passive optical network (PON), point-to-point optical, and copper-based digital subscriber line technologies, including ADSL, VDSL, HDSL, SHDSL, G.fast, and MGfast. These access technologies find application in their traditional uses as well as in backhaul and fronthaul networks for emerging services such as broadband wireless and data centre interconnect. Home networking technologies include wired broadband, wired narrowband and wireless narrowband, optical fibre, and free-space optical communications. Both access and home networking for smart-grid applications are supported.

Network, system and equipment features covered include: routing, switching, interfaces, multiplexers; secure transport; network synchronization (including frequency, time and phase); cross-connect (including optical cross-connect (OXC)), add/drop multiplexers (including fixed or reconfigurable optical add/drop multiplexers (ROADM)), amplifiers, transceivers, repeaters, regenerators; multilayer network protection switching and restoration; operations, administration and maintenance (OAM); transport resource management and control capabilities to enable increased transport network agility, resource optimization, and scalability (e.g. the application of software-defined networking (SDN) to transport networks together with enabling the use of artificial intelligence (AI)/machine learning (ML) to support the automation of transport network operations). Many of these topics are addressed for various media and transport technologies, such as metallic and terrestrial/submarine optical fibre cables, dense and coarse wavelength division multiplexing (DWDM and CWDM) optical systems for fixed and flex-grid networks, optical transport network (OTN), including the evolution of OTN beyond 400 Gbit/s rates, Ethernet and other packet-based data services.

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In its work, Study Group 15 will take into account related activities in other ITU study groups, standards development organizations (SDOs), forums and consortia, and will collaborate with them to avoid duplication of effort and identify any gaps in the development of global standards.

ITU‑T Study Group 16

ITU‑T Study Group 16 will work on the following items:

* operation of multimedia systems and applications, including interoperability, scalability and interworking over different networks;
* ubiquitous multimedia services and applications;
* multimedia aspects of digital services;
* multimedia systems and services accessibility for digital inclusion;
* development of multimedia end-to-end architectures, including vehicle gateway for intelligent transport system (ITS);
* high-layer protocols and middleware for multimedia systems and applications, including IP-based television services (managed and non-managed networks), Internet-based streaming media services and digital signage;
* media and signal coding;
* multimedia and multimode terminals;
* human-machine interaction;
* signal processing network equipment and terminals, gateway implementations, and characteristics;
* quality of service (QoS), quality of experience (QoE) and end-to-end performance in multimedia systems;
* security of multimedia systems and services;
* distributed ledger technologies and its applications
* digital multimedia services and applications in various vertical industries;
* AI-enabled multimedia applications

In developing its studies, SG16 will take into consideration societal and ethical aspects of intelligent applications.

ITU-T SG16 will work collaboratively with all stakeholders working in the standardization areas under ITU-T SG16, in particular with other ITU SGs, other UN agencies, ISO, IEC, industry forums and consortia, and regional and international standards-development organizations (SDO).

ITU‑T Study Group 17

ITU‑T Study Group 17 is responsible for developing key technical Recommendations in supporting building confidence and security in the use of information and communication technologies (ICT).

To this end this includes studies relating to security, including cybersecurity, countering spam and identity management. It also includes security architecture and framework, security management, and security of networks, applications and services such asthe Internet of things (IoT), intelligent transport system, secure application services, social network, cloud computing, distributed ledger technology,and telebiometrics. Study Group 17 is also responsible for the application of open system communications, including directory and object identifiers, and for technical languages, the method for their usage and other issues related to the software aspects of telecommunication systems, and for conformance testing to improve quality of Recommendations.

ITU-T Study Group 17’s role is to provide technical solutions for addressing security for ICTs and ensuring security by ICTs. Especially, studies on security for new emerging areas, such as security for IMT2020/5G and beyond, Internet of Things (IoT), smart cities, distributed ledger technologies (DLT), Big data analytics, intelligent transport system, security aspects related to AI, and Quantum related technologies, are focused. Its study areas also include the management of personally identifiable information (PII) such as technical and operational aspects of data protection with respect to ensuring confidentiality, integrity, and availability of PII.

In the area of security, Study Group 17 is responsible for developing the core Recommendations on ICT security, such as security architecture and frameworks; the fundamentals related to cybersecurity, including threats, vulnerabilities and risks, incident handling/response and digital forensics; security management, including management of PII such as technical and operational aspects of data protection; and countering spam by technical means.

Study Group 17 provides overall coordination of security work in ITU‑T in its capacity as lead study group on security, on identity management, and on languages and description techniques.

In addition, Study Group 17 is responsible for developing the core Recommendations on security for distributed ledger technologies, security for intelligent transport system, security aspects of applications and services in the areas of IPTV, various kinds of networks including IMT2020/5G and beyond, smart grid, industrial control system (ICS), supply chains, IoT and smart cities, SDN, NFV, social network, cloud computing, big data analytics, smartphone, digital financial system and telebiometrics.

Study Group 17 is also responsible for developing the core Recommendations on a generic identity management model that is independent of network technologies and supports the secure exchange of identity information between entities. This work also includes studying the process for discovery of authoritative sources of identity information; generic mechanisms for the bridging/interoperability of a diverse set of identity information formats; identity management threats; the mechanisms to counter these threats; the protection of personally identifiable information (PII); and the development of mechanisms to ensure that access to PII is only authorized when appropriate.

In the area of open system communication, Study Group 17 is responsible for Recommendations in the following areas:

• directory services and systems, including public key infrastructure (PKI) (ITU‑T F.500- and ITU‑T X.500-series);

• object identifiers (OIDs) and associated registration authorities (ITU‑T X.660/ITU‑T X.670-series);

• open systems interconnection (OSI), including Abstract Syntax Notation One (ASN.1) (ITU‑T F.400-, ITU‑T X.200-, ITU‑T X.400-, ITU‑T X.600-, ITU‑T X.800-series); and

• open distributed processing (ODP) (ITU‑T X.900‑series).

In the area of languages, Study Group 17 is responsible for studies on modelling, specification and description techniques, which includes languages such as ASN.1, SDL, MSC, URN and TTCN-3.

Study Group 17 coordinates security work across all study groups in ITU-T. This work will be developed in line with the requirements of and in cooperation with the relevant study groups such as Study Group 2, Study Group 9, Study Group 11, Study Group 13, Study Group 15, Study Group 16, and Study Group 20.

Study Group 17 will work on relevant identity management aspects in collaboration with Study Group 20 and Study Group 2, as per the mandate of each study group.

ITU‑T Study Group 20

ITU-T Study Group 20 will work on the following items:

* framework and roadmaps for the harmonized and coordinated development of Internet of things (IoT), including machine-to-machine (M2M) communications, ubiquitous sensor networks and smart sustainable cities, in ITU-T and in close cooperation with the ITU Radiocommunication Sector (ITU-R) and ITU Telecommunication Development (ITU-D) study groups and other regional and international standards organizations and industry forums;
* requirements and capabilities for IoT and smart cities and communities (SC&C) including verticals;
* definitions and terminology for IoT and SC&C;
* Solutions provided by emerging digital technologies and their technical impact on IoT and SC&C;
* IoT and SC&C network infrastructure, connectivity and devices, and smart services and applications, including architectures, architecture frameworks for IoT and SC&C;
* Evaluation, assessment as well as service analysis and infrastructure for SC&C regarding the use of emerging digital technologies on the smartness of cities;
* guidelines, methodologies and best practices related to standards to help cities, communities, rural areas and villages deliver services using emerging digital technologies;
* identification aspects of IoT and SC&C in collaboration with other study groups as appropriate;
* protocols and interfaces for IoT and SC&C systems, services and applications;
* Platforms for IoT and SC&C;
* interoperability and interworking of IoT and SC&C systems, services and applications;
* quality of service (QoS) and end-to-end performance for IoT and SC&C in collaboration with SG12, as appropriate;
* security, privacy4 and trustworthiness4 of IoT and SC&C systems, services and applications;
* database maintenance of IoT and SC&C standards;
* big data aspects, including big data ecosystems, of IoT and SC&C;
* e-services and smart services for SC&C;
* IoT and SC&C data processing and management, including data analytics, and AI-enabled applications;
* Technical aspects of data value chain for IoT and SC&C, in collaboration with SG3 as appropriate;
* data sets and semantics based capabilities for IoT and SC&C including verticals.

Annex C  
(to Resolution 2 (Rev. Hyderabad, 2021))

List of Recommendations under the responsibility of the respective   
ITU‑T study groups and TSAG in the 2021-2024 study period

ITU‑T Study Group 2

ITU‑T E‑series, except those in conjunction with Study Group 17 or under the responsibility of Study Groups 12 and 16

ITU‑T F-series, except those under the responsibility of Study Groups 13, 16 and 17

Recommendations of the ITU‑T I.220-, ITU‑T I.230-, ITU‑T I.240-, ITU‑T I.250-series and ITU‑T I.750-series

ITU‑T G.850-series

ITU‑T M-series

ITU‑T O.220-series

ITU‑T Q.513, ITU‑T Q.800 − ITU‑T Q.849, ITU‑T Q.940-series

Maintenance of the ITU‑T S-series

ITU‑T V.51/M.729

ITU‑T X.160-, ITU‑T X.170-, ITU‑T X.700-series

ITU‑T Z.300-series

Study Group 3

ITU‑T D-series

ITU-T D.103/E.231

ITU-T D.104/E.232

ITU-T D.271/X.1261

ITU-T Study Group 5

ITU-T K-series

ITU-T L.1 − ITU-T L.9, ITU-T L.18 − ITU-T L.24, ITU-T L.32, ITU-T L.33, ITU-T L.71, ITU-T L.75, ITU-T L.76, ITU-T L.1000-series

**ITU-T Study Group 9**

ITU T J-series, except those under the responsibility of Study Groups 12 and 15

ITU T N-series

**ITU-T Study Group 11**

*[There are no changes]*

ITU‑T Q-series, except those under the responsibility of Study Groups 2, 13, 15, 16 and 20

Maintenance of the ITU‑T U-series

ITU‑T X.290-series (except ITU‑T X.292) and ITU‑T X.600 − ITU‑T X.609

ITU‑T Z.500-series

ITU‑T Study Group 12

ITU‑T E.420 − ITU‑T E.479, ITU‑T E.800 − ITU‑T E.859

ITU‑T G.100-series, except ITU‑T G.160- and ITU‑T G.180-series

ITU‑T G.1000-series

ITU‑T I.350-series (including ITU‑T G.820/I.351/Y.1501), ITU‑T I.371, ITU‑T I.378, ITU‑T I.381

ITU-T J.140-, ITU-T J.240- and ITU-T J.340-series

ITU‑T P-series

ITU‑T Y.1220-, ITU‑T Y.1530-, ITU‑T Y.1540-, ITU-T Y.1550-, ITU‑T Y.1560-series

ITU‑T Study Group 13

ITU‑T F.600-series

ITU‑T G.801, ITU‑T G.802, ITU‑T G.860-series

ITU‑T I-series, except those under the responsibility of Study Groups 2, 12 and 15, and those having double/triple numbering in other series

ITU‑T Q.933, ITU‑T Q.933*bis*, ITU‑T Q.10xx-series and ITU‑T Q.1700-series

ITU‑T X.1 − ITU‑T X.25, ITU‑T X.28 − ITU‑T X.49, ITU‑T X.60 − ITU‑T X.84, ITU‑T X.90 − ITU‑T X.159, ITU‑T X.180 − ITU‑T X.199, ITU‑T X.272, ITU‑T X.300-series

ITU‑T Y-series, except those under the responsibility of Study Groups 12, 15, 16 and 20

ITU‑T Study Group 15

ITU‑T G-series, except those under the responsibility of Study Groups 2, 12, 13 and 16

ITU‑T I.326, ITU‑T I.414, ITU‑T I.430-series, ITU‑T I.600-series and ITU‑T I.700-series, except ITU‑T I.750-series

ITU-T J.190 and ITU-T J.192

ITU‑T L-series, except those under the responsibility of Study Group 5

ITU‑T O-series (including ITU‑T O.41/ITU‑T P.53), except those under the responsibility of Study Group 2

ITU‑T Q.49/O.22 and ITU‑T Q.500-series, except ITU‑T Q.513

Maintenance of the ITU‑T R-series

ITU‑T X.50-series, ITU‑T X.85/ Y.1321, ITU‑T X.86/ Y.1323, ITU‑T X.87/Y.1324

ITU‑T V.38, ITU‑T V.55/ O.71, ITU‑T V.300

ITU‑T Y.1300 − ITU‑T Y.1309, ITU‑T Y.1320 − ITU‑T Y.1399, ITU‑T Y.1501 and ITU‑T Y.1700-series

ITU-T Study Group 16

(to be provided)

ITU‑T Study Group 17

ITU‑T E.104, ITU‑T E.115, ITU‑T E.409 (in conjunction with Study Group 2)

ITU‑T F.400-series; ITU‑T F.500 − ITU‑T F.549

ITU‑T X-series, except those under the responsibility of Study Groups 2, 11, 13, 15 and 16

ITU‑T Z-series, except ITU‑T Z.300-series and ITU‑T Z.500-series

ITU-T Study Group 20

(to be provided)

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