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| Title: ITU logo | INTERNATIONAL TELECOMMUNICATION UNION**TELECOMMUNICATION STANDARDIZATION SECTOR**STUDY PERIOD 2022-2024 | TSAG-TD593 |
| TSAG |
| **Original: English** |
| **Question(s):** | N/A | Geneva, 29 July - 2 August 2024 |
| **TD(Ref.:** [SG13-LS192](http://handle.itu.int/11.1002/ls/sp17-sg13-oLS-00192.docx)**)** |
| **Source:** | ITU-T Study Group 13 |
| **Title:** | LS/i on revised text of SG13 Questions and updated SG13 text of Resolution 2 [from ITU-T SG13] |
| **LIAISON STATEMENT** |
| **For action to:** | - |
| **For information to:** | TSAG |
| **Approval:** | ITU-T Study Group 13 meeting (Geneva, 26 July 2024) |
| **Deadline:** | N/A |
| **Contact:** | Kazunori TanikawaNICTJapan | E-mail: kazu.tanikawa@nigt.go.jp |

A new liaison statement has been received from SG13.

This liaison statement follows and the original file can be downloaded from the ITU ftp server at <http://handle.itu.int/11.1002/ls/sp17-sg13-oLS-00192.docx>.

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|  | INTERNATIONAL TELECOMMUNICATION UNION**TELECOMMUNICATIONSTANDARDIZATION SECTOR**STUDY PERIOD 2022-2024 | **SG13-LS192** |
| **STUDY GROUP 13** |
| **Original: English** |
| **Question(s):** | All/13 | Geneva, 15 - 26 July 2024 |
| **Ref.: SG13-TD335/PLEN** |
| **Source:** | ITU-T Study Group 13 |
| **Title:** | LS on revised text of SG13 Questions and updated SG13 text of Resolution 2  |
| **LIAISON STATEMENT** |
| **For action to:** | - |
| **For information to:** | TSAG |
| **Approval:** | **ITU-T Study Group 13 meeting (Geneva, 26 July 2024)** |
| **Deadline:** | N/A |
| **Contact:** | Kazunori TanikawaNICTJapan | E-mail: kazu.tanikawa@nigt.go.jp |

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| **Abstract:** | This Liaison Statement replies the TSAG-LS34 and informs about the results of SG13 preparations for WTSA-24. |

This document informs TSAG, per its request [TSAG-LS34], about the results of the SG13 preparatory activities for the next study period.

At its meeting of 15 - 26 July 2024 in Geneva Study Group 13 agreed to propose to WTSA-24
the set of Questions for study in the next study period as found in Annex B.

Study Group 13 also agreed the update to the text of Study Group 13 parts of Resolution 2
(Annex A).

Annex A: Proposed SG13 text part of Resolution 2

Annex B: Set of revised Question texts proposed for WTA-24

**Annex A**

SG13 report to WTSA-24:

Updates to the current title, mandate, lead roles and points of guidance (WTSA Resolution 2)

#### Title of Study Group 13 (No change)

Future networks and emerging network technologies

#### Mandate and leading roles of Study Group 13 in Annex A of WTSA Resolution 2

#### PART 1 – General area of study

ITU T Study Group 13 is responsible for studies relating to the requirements, architectures, capabilities and application programming interfaces (APIs), softwarization, orchestration, and the application using AI including machine learning of future networks (FN). It develops standards related to information-centric networking (ICN). Regarding the IMT systems including IMT-2030, it particularly focuses on non-radio related parts. Study Group 13’s responsibility also includes project coordination on FNs across all ITU-T study groups, and release planning. Moreover, it includes the study on integration of computing and networking from the viewpoint of FN.

Study Group 13 is also responsible for studies relating to future computing, including cloud computing and data handling in telecommunication networks. This covers capabilities and technologies from the network side to support data utilization, exchange, sharing, and data quality assessment g, as well as end-to-end awareness, control and management of future computing, including cloud, cloud security and data handling.

Study Group 13 studies aspects relating to fixed, mobile and satellite convergence for multi-access networks, including various kind of their management, and enhancements to existing ITU T Recommendations on mobile communications, including the energy-saving aspects.

Study Group 13 develops standards for Quantum networks and their related technologies including networking aspects of quantum key distribution networks (QKDN).

Study Group13 further studies 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. In this context, digital asset treatment over FNs is a study target as well.

#### PART 2 – Lead ITU-T Study Group in specific area of study

SG13 Lead study group on future networks such as IMT systems including IMT-2030 networks (non-radio related parts)
Lead study group on fixed-mobile and satellite convergence
Lead study group on computing including cloud computing and data handling ~~infrastructure including cloud~~
Lead study group on artificial intelligence including machine learning for future networks

#### Points of guidance to Study Group 13 in Annex B of WTSA Resolution 2

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

• IMT-2030 network aspects: Studies on the requirements and capabilities for the non-radio part of networks based on the service scenarios of IMT-2030. 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, IMT-2020, etc.

• Application of artificial intelligence technology including machine learning aspects for future networks: Studies on how to incorporate network intelligence into IMT-2030. Development of Recommendations on overall requirements, functional architecture and application support capabilities for networks, which include artificial intelligence (AI) and machine learning mechanisms,.

• Software‑defined networking (SDN), network slicing and orchestration, computing and networking integration aspects: Studies on SDN and 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, and on the integration of computing and networking over variety types of future networks. 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) aspects: Studies ted to analysis of ICN applicability to IMT-2030 networks. Development of new Recommendations on the requirements, functional architecture and mechanisms of ICN networking and use‑case specific mechanisms and architectures, including deployment of corresponding identifiers. Development of Recommendations on the enhancement of ICN for incorporating emerging technologies.

• 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/machine learning., 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 including digital asset treatment. • Quantum networks and relevant technologies: Studies related to quantum networks including networking aspect of quantum key distribution networks (QKDN). Furthermore, development of new Recommendations related to user networks interacting with quantum 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 the network side 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-2030 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 provided 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.

#### List of Recommendations under the responsibility of Study Group 13 in Annex C of WTSA Res.2 (No change)

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

**Annex B**

SG13 report to WTSA-24:

Updated Questions for the 2025-2028 study period

#### List of proposed Questions

| Question number | Question title | Status |
| --- | --- | --- |
| A/13 | IMT Networks and Quantum Communications | Continuation of Q6/13 |
| B/13  | IMT networks and artificial intelligence/machine learning: Requirements and architecture | Continuation of Q20/13 |
| C/13 | Network softwarization | Continuation of Q21/13 |
| D/13 | Enhanced information-centric networking and emerging network | Continuation of Q22/13 |
| E/13 | Fixed, mobile and satellite convergence | Continuation of Q2313 |
| F/13 | Network awareness and network intelligence including big data driven networking and human-like networking | Continuation of Q7/13 |
| G/13 | Requirements and capabilities for computing including cloud computing and data handling | Continuation of Q17/13 |
| H/13 | Functional architecture for computing including cloud computing and data handling | Continuation of Q18/13 |
| I/13 | End-to-end management, governance, and security for computing including cloud computing and data handling | Continuation of Q19/13 |
| J/13 | Innovative convergence service including service model, scenarios, technical aspects in future network | Continuation of Q1/13 |
| K/13 | Next-generation network (NGN) evolution by adoption of emerging network technologies | Continuation of Q2/13 |
| L/13 | Applying Future Networks and innovation in developing countries | Continuation of Q5/13  |
| M/13 | Quantum Enhanced Networks | Continuation of part of Q16/13 |
| N/13 | Trusted ICT infrastructure for Web 3.0 | Continuation of part of Q16/13 |

NOTE – UK, US and Canada did not support the creation of Question N/13 and proposed to transfer a study topic on “trust” to SG17. The Member States also requested the deletion of texts regarding “trust” from SG13 mandate and points of guidance.

**Wording of Questions**

1. DRAFT QUESTION A/13 **International mobile telecommunications (IMT) networks and quantum communications:** **Quality of service (QoS) mechanisms**

(Continuation of Question 6/13)

#### A.1 Motivation

A key characteristic of existing and emerging networks includes its softwarization/virtualization/ intelligence/autonomics/trustworthiness for supporting applications and services with varied QoS/QoE requirements, all of which must be supported by these networks. Appropriate mechanisms are needed to achieve the required levels of QoS/QoE, especially for applications that are latency- and loss-sensitive. Some applications may also require a large amount of bandwidth and strict quality assurance, which makes the support for QoS/QoE challenging, in particular under a softwarized/virtualised/intelligence/autonomous/trustworthy network environment.

To enble QoS/QoE to support above networks characteristics, considerations need to be given to the following:

– end-to-end QoS/QoE assurance and application specific QoS requirements

– use of varied types of networking technology in the core network, in the access network, in endpoints and multiple administrative domains in an end-to-end path

– network resource optimization and orchestration for QoS/QoE enablement

– application and QoS/QoE mapping and its automation

– QoS assurance mechanisms for vertical sector applications

– QoS assurance mechanisms for QKDN and its extensions including Quantum Communications

– QoS assurance mechanisms for deterministic networking

– QoS assurance mechanisms using ai/machine learning mechanisms

 – QoS support of AI for networking for IMT networks

– QoS support of non-terrestrial network (NTN) for IMT networks

– QoS support for providing energy savings

The following major Recommendations, in force at the time of approval of this Question, fall under its responsibility:

* ITU-T Y.3106, Y.3107, Y.3109, Y.3117, Y.3121, Y.3122, Y.3124, Y.3125, Y.3126, Y.3170, Y.3175, Y.3811, Y.3812, Y.3816, Y.3817

#### A.2 Question

Study items to be considered include, but are not limited to:

* What new Recommendations or enhancements to existing Recommendations are needed to enable QoS/QoE support in the softwarized/virtualized/intelligent/autonomic/trustworthy networks, especially for performance-sensitive and/or bandwidth-demanding applications/services?
* What new Recommendations or enhancements to existing Recommendations are needed to enable QoS/QoE support in IMT networks and Quantum communications?
* What new Recommendations are needed to provide optimal resource control and management for achieving end-to-end QoS in a heterogeneous environment involving different QoS mechanisms, network orchestrations, and multiple provider domains?
* What new Recommendations or enhancements to existing Recommendations are needed to support QoS assurance for vertical sector applications of IMT networks and Quantum Communications?
* What new Recommendations or enhancements to existing Recommendations are needed to support QoS assurance for QKDN and its extensions including Quantum communications?
* What new Recommendations or enhancement to existing Recommendations are needed for deterministic networking QoS/QoE assurance mechanisms?
* What new Recommendations or enhancement to existing Recommendations are needed for AI/machine learning based QoS/QoE assurance mechanisms?
* What new Recommendations or enhancement to existing Recommendations are needed for QoS/QoE assurance mechanisms for NTN for IMT networks?
* What new Recommendations or enhancement to existing Recommendations are needed for QoS/QoE support for providing energy savings?
* What guidance is needed for ensuring that QoS/QoE matters raised by other Questions in Study Group 13 are addressed satisfactorily?

NOTE − Question will not overlap with existing works in SG12, SG16, SG20 and other SDO's (e.g. IETF and 3GPP)

#### A.3 Tasks

Tasks include, but are not limited to:

* Maintenance and update of the Recommendations on QoS/QoE in SG13.
* Development of new Recommendations or enhancement to existing Recommendations on QoS/QoE support for resource control and management for softwarized/virtualized/
* intelligent/autonomic/trustworthy networks.
* Development of new Recommendations or enhancement to existing Recommendations on QoS/QoE support in networks including IMT networks and Quantum Communications.
* Development of new Recommendations or enhancement to provide the optimal resource control and management for achieving end-to-end QoS in a heterogeneous environment involving different QoS mechanisms, network orchestrations, and multiple provider domains.
* Development of new Recommendations or enhancement to existing Recommendations on additional QoS parameters measurement and monitoring.
* Development of new Recommendations or enhancements to existing Recommendations which are needed to support QoS/QoE assurance for vertical sector applications of IMT networks with quantum enablement.
* Development of new Recommendations or enhancement to existing Recommendations on QoS/QoE assurance mechanisms in QKDN and extensions including Quantum Communications.
* Development of new Recommendations or enhancement to existing Recommendations on deterministic networking QoS/QoE assurance mechanisms.
* Development of new Recommendations or enhancement to existing Recommendations on AI/machine learning based QoS/QoE assurance mechanisms.
* Development of new Recommendations or enhancement to existing Recommendations on QoS/QoE assurance mechanisms for NTN for IMT networks.
* Development of new Recommendations or enhancement to existing Recommendations on QoS/QoE support for providing energy savings.
* Guidance and collaboration to/with other Questions on QoS/QoE matters, especially to a potential new Question(s).

An up-to-date status of work under this Question is contained in the SG13 work programme: https://www.itu.int/ITU-T/workprog/wp\_search.aspx?sp=17&q=6/13.

#### A.4 Relationships

Recommendations:

* Y-series Recommendations in SG13
* G-series Recommendations in SG12

**Questions:**

* All Questions involved with networks including IMT networks and Quantum communications

**Study groups:**

* All Study Groups involved with networks including IMT networks and Quantum communications

**Other bodies:**

* The 3rd Generation Partnership Project (3GPP)
* Alliance for Telecommunications Industry Solutions (ATIS) Cloud Service Forum (CSF), IPTV Interoperable Fourm (IIF), Packet Technologies and Systems Committee (PTSC) and Performance, Reliability, and Quality Committee (PRQC)
* Broadband Forum
* European Telecommunications Standards Institute (ETSI) Industry Specification Group for Network Functions Virtualization (NFV ISG)
* ETSI INT Automatic Future Internet (AFI)
* ETSI ISG Quantum Key Distribution (QKD)
* Institute of Electrical and Electronics Engineers (IEEE) 802 Local and Metropolitan Area Networks (LAN/MAN)
* IEEE 802.1 Time Sensitive Networking Task Group (TSN TG)
* Internet Engineering Taks Force (IETF)
* Open Door Logistics (ODL)

**WSIS Action Lines**

– C2

**Sustainable Development Goals**

– 9

1. DRAFT QUESTION B/13
**International mobile telecommunications (IMT) networks and artificial intelligence/machine learning: Requirements and architecture**

(Continuation of Question 20/13)

#### B.1 Motivation

The objective of this question is to study the requirements, architecture and use of emerging technologies including artificial intelligence (AI)/machine learning (ML) to realize IMT-2030 networks and networks beyond IMT-2020, in order to address the anticipated needs of network, applications and services in the upcoming years.

Network requirements and architecture for IMT-2020 networks have been baselined and successful deployments have been reported since the early 2010s. Considering that the next generation of IMT networks (the IMT-2030 networks, following the IMT-2020 networks) is expected to be deployed around 2030, it is important to initiate the study and standardization of the requirements and architecture of IMT-2030 networks, while continuing as necessary and appropriate the studies on network requirements and architecture for networks beyond IMT2020. To meet the requirements, including those of emerging service scenarios, and derive necessary architecture enhancements, consideration should be given to key aspects of IMT-2030 networks and networks beyond IMT-2020.

The study should address the integration of emerging network capabilities in IMT-2030 networks and networks beyond IMT-2020, in particular how to take benefit of capabilities enabled by emerging technologies such as AI/ML, coordination of networking and computing (CNC), autonomous networking, semantic-aware networking, digital twin and integrated sensing and communication. Also, the energy efficiency perspective of the network architecture needs consideration.

The further integration of AI/ML capabilities is in particular regarded as one of the key architectural aspects to consider for IMT-2030 networks and networks beyond IMT-2020. A comprehensive study of the impact, KPIs and evaluation of AI/ML, including generative AI network capabilities, is a must for the design of network architecture. The study should also include test methodologies and deployment guidelines for AI/ML capabilities in the networks.

Consideration should be also given to the utilization of open source software activities, and the utilization and guidance for industry implementations and Proof of Concepts (PoCs) related to IMT-2030 networks and networks beyond IMT-2020, and AI/ML.

The following major Recommendations, in force at the time of approval of this Question, fall under its responsibility:

* [Y.3061](https://www.itu.int/ITU-T/workprog/wp_item.aspx?isn=18587), Y.3100, Y.3101, Y.3102, Y.3104, Y.3119, Y.3123, Y.3127, Y.3128, Y.3142, Y.3172, Y.3173, Y.3174, Y.3176, Y.3177, Y.3179, Y.3181, Y.3182, Y.3183, Y.3186, Y.3187, [Y.3400](https://www.itu.int/ITU-T/workprog/wp_item.aspx?isn=18152), Y.3401,Y.3144

#### B.2 Question

Study items to be considered include, but are not limited to:

* What are the key requirements and capabilities of IMT-2030 networks and networks beyond IMT-2020 including AI/ML based on the emerging service scenarios?
* What framework and architecture are required to realize IMT-2030 networks and networks beyond IMT-2020 including AI/ML based on the identified requirements and capabilities?
* What key technologies related to IMT-2030 networks and networks beyond IMT-2020 including AI/ML are required to realize the networks?
* How to incorporate network intelligence from AI/ML into IMT-2030 networks and networks beyond IMT-2020?
* How to enable AI/ML support to the integration of other technologies into IMT-2030 networks and networks beyond IMT-2020?
* How to integrate emerging capabilities in IMT-2030 networks and networks beyond IMT-2020 and particularly how to take benefit of capabilities enabled by emerging technologies?
* How to build and/or guide the ecosystem on IMT-2030 networks and networks beyond IMT-2020 including AI/ML taking into account business models and use cases?
* How to utilize open source software activities, as well as utilize and provide guidance for industry implementations and PoCs related to IMT-2030 networks and networks beyond IMT-2020, and AI/ML to meet the requirements of the networks?

#### B.3 Tasks

Tasks include, but are not limited to:

* Development of Recommendations on the requirements and capabilities for IMT-2030 networks and networks beyond IMT-2020 including AI/ML based on the emerging service scenarios.
* Development of Recommendations on the framework and architecture design of IMT-2030 networks and networks beyond IMT-2020 including AI/ML, based on, among others, the requirements, capabilities and gap analysis identified by network relevant Focus Groups including Focus Group on Autonomous Networks.
* Development of Recommendations and other relevant documents on overall requirements and functional architecture of IMT-2030 networks and networks beyond IMT-2020 including AI/ML.
* Development of Recommendations on the interworking of IMT-2030 networks and networks beyond IMT-2020 with current networks including IMT-2020 networks.
* Study of potential utilization of open source software activities, as well as potential utilization and guidance for industry implementations and PoCs in IMT-2030 networks and networks beyond IMT-2020 and AI/ML.
* Development of Recommendations on ecosystem aspects taking into account business models and use cases.

An up-to-date status of work under this Question is contained in the SG13 work programme: [https://www.itu.int/ITU-T/workprog/wp\_search.aspx?sp=22&q=20/13](https://www.itu.int/ITU-T/workprog/wp_search.aspx?sp=22&q=23/13).

#### B.4 Relationships

Recommendations:

* Y-series Recommendations in SG13
* Q-series Recommendations in SG11

Questions:

* All ITU-T SG13 related Questions, including Q6/13, Q16/13, Q21/13, Q22/13, Q23/13

Study Groups:

* ITU-T Study Groups involved with studies on IMT-2030 networks and networks beyond IMT-2020
* ITU-T SG5

Other bodies:

* ITU Radiocommunication Sector (ITU-R)
* The 3rd Generation Partnership Project (3GPP)
* Next Generation Mobile Networks Alliance (NGMN)
* Internet Engineering Taks Force (IETF)
* International Organization for Standardization (ISO)/ International Electrotechnical Commission (IEC) Joint Technical Committee (JTC)1/ Subcommittee (SC)42
* Asia-Pacific Telecommunity Standardization Program (ASTAP), Alliance for Telecommunications Industry Solutions (ATIS), European Telecommunications Standards Institute (ETSI)
* Open Source organizations

WSIS Action Lines

* C2

Sustainable Development Goals

* 9
1. DRAFT QUESTION C/13
 **Network softwarization**

(Continuation of Question 21/13)

#### C.1 Motivation

The recent continuous change of digital technologies in networking closely influences on various aspects of human life (e.g., industrial control, self-automated driving, time-critical and high-reliability communications, and cloud-based services). New types of networks are emerging or become closer to practical usage with the trend of the times.

Network softwarization is based on an overall approach for the design, deployment, control, management and orchestration of network components by software to provide diversified services to users, exploiting flexibility, dynamicity, and rapidity of networking. The network can be a "platform" for aggregating related network capabilities and providing services, supporting dynamic scaling of functions, elastic provision of performance, and dynamic matching of service supply and demand. The characteristics of network softwarization have a high affinity with the realization of new scenarios and requirements in various business and social fields.

Key technologies include SDN/NFV and data plane programmability supporting network platformized. Besides, to enhance service-oriented network, extended the field of network services providing, network slicing, edge computing, management and orchestration from the perspective of network operational efficiency, and intelligence of service-based computing and data plane need to be studied in Y.3000, Y.3100 and Y.3300 series.

In addition, to make progress on network softwarization, the importance of software-based approach is increased more and more. DevOps with AI technique, Network-as-a-Service, Software-as-a-Service especially for networking and Communication-as-a-Service are realized and should be taken care for network softwarization.

The Recommendations that specify framework, service scenarios, requirements, and architecture of network softwarization in the networks beyond IMT-2020, and IMT-2030 networks fall under the responsibility of this Question.

The following major Recommendations, in force at the time of approval of this Question, fall under its responsibility:

* ITU-T Y.2242, Y.2305, Y.3110, Y.3111, Y.3112, Y.3150, Y.3151, Y.3152, Y.3153,Y.3154, Y.3156, Y.3157,Y.3158, Y.3160, Y.3324.

#### C.2 Question

Study items to be considered include, but are not limited to:

* What are the requirements and architecture of SDN/NFV and data plane programmability to support functions such as network virtualization and network slicing necessary for exploding and diversifying services taking into account traffic controlling, time sensitivity, scalability, reliability, security and distribution of functions?
* What are the requirements and architecture of management and orchestration, related management-control continuum capability of softwarized networks and network slices, taking into account operational efficiency, energy saving, high efficient resource utilization and others?
* What are the gaps in standardization effort for network softwarization as well as in open source activities?
* What are key technology enablers to enhance network softwarization, supporting network platformized, to enhance DevOps of networking software, and to enhance service-based network, in both public telecommunications including satellite communications and private communication networks specific to vertical industry services or applications?
* How to enhance network softwarization by using AI techniques to support network automation?
* What new business models are available with the advent of digital transformation by using techniques of network softwarization, network management and orchestration?
* How to handle, evaluate and measure network parameters for softwarization including network slice to guarantee a measurable service level over homogeneous or heterogeneous networks?

#### C.3 Tasks

Tasks include, but are not limited to:

* Considering open source activities, development and maintenance of Recommendations on requirements, functional architecture and mechanisms for network softwarization including generic SDN and their profiles for intent-based networking, network virtualization, network slicing, NFV, network platformized, DevOps of networking software, service-based network and virtualized network applications supporting service requests over versatile kinds of networks;
* Development of Recommendations on the management and orchestration of homogenous/heterogeneous types of softwarized infrastructure in both public and private networks;
* Development of Recommendations on the capability in support of network softwarization by using enhanced APIs and AI-assisted functionalities;

An up-to-date status of work under this Question is contained in the SG13 work programme: <https://www.itu.int/ITU-T/workprog/wp_search.aspx?sp=22&q=21/13>.

#### C.4 Relationships

Recommendations

* Y-series Recommendations in SG13
* Q-series Recommendations in SG11 relevant to network softwarization

Questions

* All Questions relating to network softwarization

Study Groups

* ITU-T and ITU-R Study Groups involved in the networks beyond IMT-2020 studies and IMT-2030 networks studies

Standardization bodies

* European Telecommunications Standards Institute (ETSI)
* The 3rd Generation Partnership Project (3GPP)
* Internet Engineering Taks Force (IETF)/Internet Research Task Force (IRTF)
* Institute of Electrical and Electronics Engineers (IEEE)
* TeleManagement Forum (TM Forum)
* Broadband Forum (BBF)
* Global System for Mobile Communication Alliance (GSMA)
* Open-source activities involved in network virtualization, network slicing and orchestration studies

WSIS Action Lines:

* C2

Sustainable Development Goals:

* 9
1. DRAFT QUESTION D/13
**Enhanced information-centric networking (ICN) and emerging network technologies**

(Continuation of Question 22/13)

#### D.1 Motivation

The volume and diversity of data generated by network and application services are continuously increasing in the recent years and the trend will continue in the coming years too. The handling of huge data of diverse nature by networks beyond IMT-2020 imposes requirements on network capabilities such as high data rates, low latency, massive connections, and low energy consumption. Given that these requirements are difficult to be supported using conventional host-centric, location-based and client-server architectural approaches [ITU-T Y.3001], information-centric networking (ICN) appeared to be a promising candidate solution that has been studied in the previous Study Period. Similarly, the trends of leveraging the ICN features of ID- or name-based communication, together with upcoming information and communication technologies such as, distributed ledger technology (DLT) and digital twin network (DTN) for data transmission as well as the network service design, control and management have been embraced in new communication network architecture and service design.

Therefore, this Question focuses on the study of leveraging the ID- or name-based communication and upcoming ICT innovations in the IMT-2030 and beyond network architectures.

The following major Recommendations, in force at the time of approval of this Question, fall under its responsibility:

* ITU-T Y.2623, Y.3071-Y.3080, Y. 3081, Y.3082, Y.3083, and Y.3090

#### D.2 Question

Study items to be considered include, but are not limited to:

* What are the requirements, frameworks, and functional architectures of IMT-2030 and beyond networks incorporating enhanced ICN and emerging technologies such as in-network computing, digital twin of networks, distributed ledger technology, self-controlled identity, and deterministic, low latency, and energy efficient communications?
* What are the emerging technologies of networks for industrial Internet, digital assets transmission, and metaverse?
* What extensions or enhancements are required in ICN to incorporate in-network computing, big data analysis, distributed ledger technology/blockchain, artificial intelligence and machine learning (AI /ML) for satisfying requirements of high throughput, low latency, energy efficiency, security, scalability, and high network efficiency? How enhanced ICN functions can be configured and deployed by applying software-defined networking, network function virtualization, service function chaining, network slicing and orchestration?

#### D.3 Tasks

Tasks include, but are not limited to:

* Development of documents of Recommendations, Supplements and Technical Report on scenarios, use cases, requirements, framework and functional architecture of IMT-2030 and beyond networks incorporating enhanced ICN and emerging technologies such as in-network computing, digital twin of networks, distributed ledger technology, self-controlled identity, and deterministic, low latency, and energy efficient communications.
* Development of documents on the emerging technologies of networks for industrial Internet, digital assets transmission, and metaverse.
* Development of documents on the extensions or enhancement of ICN with the component technologies of in-network computing, big data analysis, DLT/blockchain, AI /ML.
* Development of documents on deployment and configuration of ICN and network functions by applying software-defined networking, network function virtualization, service function chaining, network slicing and orchestration.
* Development of documents on ICN deployment-oriented functional architecture and component technologies including data object naming, name resolution, information discovery, transport, routing, mobility, caching, and security.
* Development of documents on ICN use-case specific mechanisms and bridging technologies for applying ICN in IMT-2030 and beyond networks.
* Study and standardization of other relevant emerging network technologies of the study period 2025-2028.

An up-to-date status of work under this Question is contained in the SG13 work programme: https://www.itu.int/ITU-T/workprog/wp\_search.aspx?sp=17&q=22/13.

#### D.4 Relationships and Recommendations

* ICN and emerging technologies related Recommendations: ITU-T Y.3071, Y.3072, Y.3073, Y.3074, Y.3075, Y.3076, Y.2623, Y.3077, Y.3078, Y.3079, Y.3080, Y. 3081, Y.3082, Y.3083, Y.3084, Y.3085. Y.3086 and Y.3090
* IMT-2030 and beyond networks related Recommendations

**Questions**

* IMT-2030 and beyond networks related Questions

**Study Groups**

* ITU-T Study Groups involved with IMT-2030 and beyond networks

**Other bodies**

* International Organization for Standardization (ISO)/ International Electrotechnical Commission (IEC) Joint Technical Committee (JTC)1 Subcommittee (SC) 6
* Internet Engineering Taks Force (IETF)
* European Telecommunications Standards Institute (ETSI) relevant ISGs
* TeleManagement Forum (TM Forum)
* Linux Foundation relevant open-source projects

**WSIS Action Lines**

* C2

**Sustainable Development Goals**

* 9
1. DRAFT QUESTION E/13
**Fixed, mobile and satellite convergence**

(Continuation of Question 23/13)

#### E.1 Motivation

The usages of different access technologies provide users with different user experiences, such as high bandwidth, low latency, massive connections, high reliability, and high security. Fixed, mobile and satellite convergence (FMSC) is the capability that provides services and applications to end users regardless of the fixed, mobile or satellite access technologies being used. The main purpose of FMSC for multi-access network is to utilize all means of access technologies including fixed, mobile and satellite accesses, providing users with the capability to access the network ubiquitously and enjoy the best service experience. Users and operators benefit from FMSC in the aspects of seamless connection, mobility enhancements, communications reliability, service continuity, network robustness, network efficiency, energy efficiency, etc.

Fixed, mobile and satellite convergence is envisioned as a major direction of evolution for non-radio aspects of IMT-2020 and IMT-2030 networks. In FMSC network, the land-based or satellite-based core network connects to the fixed access network, mobile access network, and satellite access network; and includes the core network functionalities and FMSC functionalities. This Question focuses on the standardization of requirements, framework, network capabilities, enabling technologies, network function enhancements, and service enhancements to support FMSC in the context of non-radio aspects of IMT-2020 and IMT-2030 networks, ensuring a consistent user experience for the target of ubiquitous connectivity for various types of user equipment. The subjects on fixed mobile convergence (FMC) in IMT-2020 and IMT-2030 networks without satellite access are also in the scope of this Question. The following major Recommendations, in force at the time of approval of this Question, fall under its responsibility:

* ITU-T Y.3200, Y.3201, Y.3202, Y.3203, Y.3204, Y.3205, Y.3206, Y.3207, Y.3130, Y.3131, Y.3132, Y.3133, Y.3134, Y.3135, Y.3136, Y.3137, Y.3138, Y.3139, Y.3140

#### E.2 Question

Study items to be considered include, but are not limited to:

– What service requirements and network capability requirements are needed to support FMSC in IMT-2020 and IMT-2030 networks?

– What new use cases will be available with the development of FMSC in IMT-2020 and IMT-2030 networks?

– What new capabilities can be exposed with the development of FMSC?

– How to achieve seamless connection, mobility enhancements, communications reliability, service continuity and network robustness in IMT-2020 and IMT-2030 networks with the support of FMSC?

– How to design the framework of FMSC on the basis of general framework of IMT-2020 and IMT-2030 networks?

– What are the impacts and enhancements of FMSC on network functions, interfaces and procedures for IMT-2020 and IMT-2030 networks?

– What enabling technologies are required for FMSC in IMT-2020 and IMT-2030 networks?

– How to apply innovative information and communications technologies to enhance FMSC?

– How to enhance the FMSC network from the perspective of network efficiency and energy efficiency?

– What are needed to achieve ubiquitous connectivity for various types of user equipment?

#### E.3 Tasks

Tasks include, but are not limited to:

– Development of Recommendations on requirements and framework of FMSC in IMT-2020 and IMT-2030 networks.

– Development of Recommendations on network capabilities to support FMSC in IMT-2020 and IMT-2030 networks, focusing on mobility management, session management, connection management, policy control, capability exposure, service continuity, network sharing, etc.

– Development of Recommendations on the application of enabling technologies for FMSC in IMT-2020 and IMT-2030 networks, such as network slicing, multi-access edge computing (MEC), artificial intelligence (AI) / machine learning (ML), distributed ledger technology (DLT), quantum information technology (QIT), etc.

– Study the network function enhancements and service enhancements in support of FMSC in IMT-2020 and IMT-2030 networks.

– Study the enhanced interfaces and procedures in support of FMSC in IMT-2020 and IMT-2030 networks, focusing on the reference points related to the converged core network.

– Study the new use cases, services and exposed capabilities with the development of FMSC in IMT-2020 and IMT-2030 networks.

– Study the ubiquitous connectivity for various types of user equipment supported by FMSC.

An up-to-date status of work under this Question is contained in the SG13 work programme: <https://www.itu.int/ITU-T/workprog/wp_search.aspx?sp=22&q=23/13>.

#### E.4 Relationships

Recommendations

* Y-series Recommendations in SG13
* Q-series Recommendations in SG11

Questions

* All Questions involved with IMT-2020 and IMT-2030 networks

Study Groups

* All Study Groups involved with IMT-2020 and IMT-2030 networks studies

Standardization bodies

* ITU Radiocommunication Sector (ITU-R)
* The 3rd Generation Partnership Project (3GPP)
* European Telecommunications Standards Institute (ETSI)
* Broadband Forum (BBF)
* Institute of Electrical and Electronics Engineers (IEEE)
* Internet Engineering Taks Force (IETF)
* WSIS Action Lines
* C2

Sustainable Development Goals

* 9
1. DRAFT QUESTION F/13
**Network awareness and network intelligence including big data driven networking and human-like networking**

(Continuation of Question 7/13)

#### F.1 Motivation

Network awareness includes network service/application awareness, network traffic awareness , network situation awareness , network requirements awareness, network resource awareness and so on. Among them, deep packet inspection (DPI) is a main application/service awaress technology that is beneficial to network operators in many areas such as quality of service (QoS) assurance, network management and so on.

In order to provide better service and make full use of the network resources, network operators and service providers need to sense the network timely and accurately. It is the task of network awareness technologies to sense the network timely and accurately.

By combination with big data, artificial intelligence and machine learning related technologies, network awareness can be further enhanced to intelligent network-awareness.

Based on intelligent network-awareness, operators can improve QoS and quality of experience (QoE) of the network, they can also make efficient use of network resource, reduce costs and capital investment.

Intelligent network-awareness can also be the generic core technologies and common building blocks for some application technologies which are network intelligence enhanced and dependent on intelligent network awareness tightly.. The aforementioned application technologies include big data driven networking (bDDN), human-like networking (HLN) and so on. Network Intelligence encompasses the data, technology, algorithms, and techniques used to collect, analyse and visualise network information.

It should be emphasized that studies on big data and machine learning related technologies are out of scope for this Question.

The following major Recommendations, in force at the time of approval of this Question, fall under its responsibility:

* ITU-T Y.2770, Y.2771, Y.2772, Y.2773, Y.2774, Y.2775;
* ITU-T Y.3650, Y.3651, Y.3652, Y.3653, Y.3654, Y.3655, Y.3656.
* ITU-T Y.3180, Y.3184, Y.3680.

#### F.2 Question

Study items to be considered including, but are not limited to:

* What enhancements to existing Recommendations are needed to enable services/applications identification/awareness/visibility, to enable traffic and resource optimization based on deep packet inspection in future networks?
* What new Recommendations are needed to provide new mechanism, architecture for deep packet inspection in future networks from the perspective of emerging application context?
* What new Recommendations are needed to support functional requirements, functional architecture, mechanism and application scenarios of intelligent network-awareness in future networks from the perspective of emerging application context?
* What new Recommendations are needed to provide new mechanism for big data driven networking?
* What new Recommendations are needed to provide requirements, architecture and mechanism for human-like networking?
* What new Recommendations are needed for other application technologies based on intelligent network-awareness?

#### F.3 Tasks

Tasks include, but are not limited to:

* Enhancements of ITU-T Y.2770, Y.2771, Y.2772, Y.2773, Y.2774, Y.2775 in future networks.
* Development of new Recommendations on new DPI requirements, architecture, mechanism and methods for future networks in the emerging application context.
* Development of new Recommendations on requirements, architecture, mechanism and methods related to intelligent network-awareness for future networks.
* Development of new Recommendations on requirements, architecture, mechanism and method related to intelligent network-awareness in the emerging application context.
* Development of new Recommendations on new mechanisms of big data driven networking.
* Development of new Recommendations on architecture, requirements and mechanism of human-like networking.
* Development of new Recommendations on other application technologies based on intelligent network-awareness.

An up-to-date status of work under this Question is contained in the SG13 work programme: [https://www.itu.int/ITU-T/workprog/wp\_search.aspx?sp=22&q=7/13.](https://www.itu.int/ITU-T/workprog/wp_search.aspx?sp=17&q=7/13)

#### F.4 Relationships

**Questions:**

* All big data related Questions.
* All artificial intelligent and machine learning related Questions.
* All future networks related Questions.
* All SDN related Questions
* All OAM related Questions

**Study groups:**

* All big data related study groups.
* All artificial intelligence and machine learning related study groups
* All future networks related study groups.
* All OAM related study groups

**Other bodies:**

* Internet Engineering Taks Force (IETF)
* International Organization for Standardization (ISO)
* The 3rd Generation Partnership Project (3GPP)
* European Telecommunications Standards Institute (ETSI) Network Function Virtualization (NFV)
* International Electrotechnical Commission (IEC)
* Institute of Electrical and Electronics Engineers (IEEE)

**WSIS Action Lines**

* C2, C3

**Sustainable Development Goals**

* 9
1. DRAFT QUESTION G/13
**Requirements and capabilities for computing including cloud computing and data handling**

(Continuation of Question 17/13)

#### G.1 Motivation

Digital transformation is the strategic adoption of new, fast and frequently changing technology to improve process and productivity, manage risk, reduce cost, etc. The competitiveness of digital transformation depends on evolving technology, that is, its ability to quickly adapt to future computing technologies. In particular, cloud computing and data handling are driving digital transformation. In addition, future computing technologies take into account artificial intelligence including machine learning, distributed computing, edge computing, data-centric computing, memory-centric computing, quantum cloud computing and etc. Therefore, the telecommunication industry has an important role to play in the fields of future computing and the integration and development of future computing technologies in Future Networks will drive a rapid move towards a digital transformation.

Cloud computing is a model for enabling service user's ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services), that can be rapidly provisioned and released with minimal management effort or service provider interaction.

Data is of high value to building applications and services based on future computing. For this reason, not only the big data capabilities but also technologies and standards to support data usage, processing, analysing, exchanging, sharing, data quality assessment, data privacy and security, data management and data governance (as defined as a term in [ITU-T Y.4602]) are essential in terms of data handling.

The primary focus of this Question is to provide the necessary overview, definitions, and ecosystems including requirements, and capabilities related to the integration or support of future computing including cloud computing and data handling in the telecommunication ecosystem.

This Question is intended to develop new Recommendations for:

* definitions, overview, ecosystem, and use cases for future computing (including cloud computing and data handling);
* requirements, capabilities and application programming interfaces (APIs) for future computing;
* interoperability, data portability, and exchange information in future computing including data schema;
* application of future computing in vertical domains;
* relationship among future computing technologies.

The following major Recommendations and Supplements, in force at the time of approval of this Question, fall under its responsibility:

* ITU-T Y.3500, Y.3501, Y.3503, Y.3504, Y.3505, Y.3506, Y.3507, Y.3508, Y.3530, Y.3531, Y.3532, Y.3535, Y.3537, and Y.3540;
* ITU-T Y.3600, Y.3601, Y.3602, and Y.3603 Y.3510, Y3533;
* ITU-T Y Suppl. 40, Y Suppl. 49, and Y Suppl. 72

#### G.2 Question

Study items to be considered include, but are not limited to:

* What new Recommendations should be developed for future computing (including cloud computing and data handling) definitions, ecosystem, use cases, and capabilities from telecommunication perspectives?
* What new Recommendations should be developed for requirements, capabilities and application programming interfaces?
* What new Recommendations should be developed for requirements for future computing interoperability and data portability between service providers that are appropriate and achievable for use cases?
* What new Recommendations should be developed for future computing 'as a Service'?
* What new Recommendations should be developed for the application of future computing in vertical domains?
* What collaboration is necessary to minimize duplication of efforts with other SDOs?

#### G.3 Tasks

Tasks include, but are not limited to:

* Developing Recommendations for future computing (including cloud computing and data handling) definitions, overview, ecosystem, use cases, business roles and benefits from telecommunication perspectives;
* Developing Recommendations for future computing requirements, capabilities and application programming interfaces;
* Developing Recommendations for future computing interoperability and data portability as well as the applications of future computing in vertical domains;
* Providing the necessary collaboration for the work in Question with relevant SDOs, consortia and fora;
* Maintenance and enhancement of the Recommendations for which the Question is responsible.

An up-to-date status of work under this Question is contained in the SG13 work programme: <https://www.itu.int/ITU-T/workprog/wp_search.aspx?sg=13&q=17> .

#### G.4 Relationships

Recommendations

* Other relevant Y-series Recommendations, in particular in Y.3500- and Y.3600-series
* Y-series and Cloud computing and data handling-related Recommendations in the M-, Q- and X-series Recommendations

Questions

* Cloud computing and data handling-related Questions
* Other relevant Questions with networking aspects

Study Groups

* ITU-T Study Groups and ITU-D Study Groups involved in cloud computing and data handling-related studies

Other bodies

* International Organization for Standardization (ISO)/International Electrotechnical Commission (IEC) Joint Technical Committee (JTC) 1/ Subcommittee (SC) 27, 32, SC38 and SC42
* ISO/Technical Committee (TC) 69
* National Institutes of Standards and Technology (NIST)
* Distributed Management Task Force (DMTF)
* Storage Networking Industry Association (SNIA)
* Cloud Security Alliance (CSA)
* European Telecommunications Standards Institute (ETSI) Industry Specification Group on Network Function Virtualization (ISG NFV)
* Open Computing Project (OCP)
* Linux Foundation projects
* Organization for the Advancement of Structured Information Standard (OASIS)
* World Wide Web Consortium (W3C)
* Data Mining Group (DMG)
* TeleManagement Forum (TM Forum)

WSIS Action Lines:

* C2, C3, C10

Sustainable Development Goals:

* 9
1. DRAFT QUESTION H/13
**Functional architecture for computing including cloud computing and data handling**

(Continuation of Question 18/13)

#### H.1 Motivation

Digital transformation is the strategic adoption of new, fast and frequently changing technology to improve process and productivity, manage risk, reduce cost, etc. The competitiveness of digital transformation depends on evolving technology, that is, its ability to quickly adapt to future computing technologies. In particular, cloud computing and data handling are driving digital transformation. In addition, future computing technologies take into account artificial intelligence including machine learning, distributed computing, edge computing, data-centric computing, memory-centric computing, quantum cloud computing and etc. Therefore, the telecommunication industry has an important role to play in the fields of future computing and the integration and development of future computing technologies in Future Networks will drive a rapid move towards a digital transformation.

Cloud computing is a model for enabling service user's ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services), that can be rapidly provisioned and released with minimal management effort or service provider interaction.

Data is of high value to building applications and services based on future computing. For this reason, not only the big data capabilities but also technologies and standards to support data usage, processing, analysing, exchanging, sharing, data quality assessment, data privacy and security, data management and data governance (as defined as a term in [ITU-T Y.4052]) are essential in terms of data handling.

The primary focus of this Question is to provide the architectures, infrastructures and networking views related to the integration and support of the future computing (including cloud computing and data handling) in telecommunication ecosystems.

This Question is intended to develop new Recommendations for:

* functional architectures in support of future computing based services and applications, future computing functional architectures supporting interworking requirements;
* distributed computing, edge computing and other emerging forms of computing; future computing infrastructures including networking aspects (e.g. for the support of network slicing);
* future computing functional architectures of in support and applied in vertical domains; data handling functional architectures including data handling interworking functional architecture and future computing based data handling architecture;
* functional architectures and mechanisms supporting the integration and convergence of future computing technologies in networking.

The following major Recommendations, in force at the time of approval of this Question, fall under its responsibility:

* ITU-T Y.3502, Y.3509, Y.3510, Y.3511, Y.3512, Y.3513, Y.3515, Y.3516, Y.3519, and Y.3536
* ITU-T Y.3605, and Y.3607

#### H.2 Question

Study items to be considered include, but are not limited to:

* What new Recommendations should be developed regarding the future computing functional architectures, including the specification of corresponding functions, functional components, and their inter relations, interaction procedures, and application programming interfaces(APIs)?
* What new Recommendations should be developed regarding the infrastructures and networking aspects of future computing?
* What new Recommendations should be developed for the data handling architectures, including data exchange and interoperation functional architectures?
* What new Recommendations should be developed for the functional architectures of future computing in support of vertical domains?

What collaboration is necessary to minimize duplication of efforts with other SDOs?

#### H.3 Tasks

Tasks include, but are not limited to:

* Developing Recommendations for future computing functional architectures (including interworking), covering the identification of architectural functions, functional components, and, their inter-relations, interaction procedures, and application programming interfaces required to provide future computing based services;
* Developing Recommendations for future computing infrastructures and networking aspects, covering the identification of functions, functional components, and interfaces for computing, storage and networking relevant to cloud computing, and data handling;
* Developing Recommendations for future computing based data handling functional architecture, data exchange and interoperation functional architecture;
* Developing Recommendations for the functional architectures of future computing in vertical domains;
* Providing the necessary collaboration with external SDOs, consortia and forums;
* Maintenance and enhancement of the Recommendations for which the Question is responsible.

An up-to-date status of work under this Question is contained in the SG13 work programme: <https://www.itu.int/ITU-T/workprog/wp_search.aspx?sg=13&q=18>.

#### H.4 Relationships

Recommendations:

* Other relevant Y-series Recommendations, in particular in Y.3500 and Y.3600 series
* Y-series and Cloud computing and data handling related Recommendations in the M-, Q- and X-series Recommendations.

Questions:

* Cloud computing and data handling related Questions
* Other relevant Questions dealing with networking aspects

Study Groups:

* ITU-T Study Groups and ITU-D Study Groups involved in cloud computing and data handling related studies

Other bodies:

* International Organization for Standardization (ISO)/ International Electrotechnical Commission (IEC) Joint Technical Committee (JTC) 1/ Subcommittee (SC) 38 and SC42
* ISO TC307
* Internet Engineering Taks Force (IETF)
* Institute of Electrical and Electronics Engineers (IEEE)
* European Telecommunications Standards Institute (ETSI) including Industry Specification Group on Multi-access Edge Computing (ISG MEC) and Industry Specification Group on Network Function Virtualization (ISG NFV)
* Open Computing Project (OCP)
* Linux Foundation projects
* Cloud Native Computing Foundation
* Global System for Mobile Communication Association (GSMA)
* Organization for the Advancement of Structured Information Standard (OASIS)
* World Wide Web Consortium (W3C)
* Metro Ethernet Forum (MEF)
* Distributed Management Task Force (DMTF)
* Storage Networking Industry Association (SNIA)
* National Institute of Standards and Technology (NIST)

WSIS Action Lines:

* C2, C3, C10

Sustainable Development Goals:

* 9
1. DRAFT QUESTION I/13
**End-to-end management, governance, and security for computing including cloud computing and data handling**

(Continuation of Question 19/13)

#### I.1 Motivation

Digital transformation is the strategic adoption of new, fast and frequently changing technology to improve process and productivity, manage risk, reduce cost, etc. The competitiveness of digital transformation depends on evolving technology, that is, its ability to quickly adapt to future computing technologies. In particular, cloud computing and data handling are driving digital transformation. In addition, future computing technologies take into account artificial intelligence including machine learning, distributed computing, edge computing, data-centric computing, memory-centric computing, quantum cloud computing and etc. Therefore, the telecommunication industry has an important role to play in the fields of future computing and the integration and development of future computing technologies in Future Networks will drive a rapid move towards a digital transformation.

Cloud computing is a model for enabling service user's ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services), that can be rapidly provisioned and released with minimal management effort or service provider interaction.

Data is of high value to building applications and services based on future computing. For this reason, not only the big data capabilities but also technologies and standards to support data usage, processing, analysing, exchanging, sharing, data quality assessment, data privacy and security, data management and data governance (as defined as a term in [ITU-T Y.4052]) are essential in terms of data handling.

The primary focus of this Question is to develop standards on end-to-end management, governance, security, and production operation for future computing including cloud computing and data handling from the perspective of telecommunication. The novel methods based on artificial intelligence and machine learning are essential to handle complexity of future computing management and optimally orchestrate its operation and lifecycle management.

This Question aims to provide new Recommendations in the following areas:

* End-to-end service management, orchestration, governance (e.g. microservices governance), and production operation of future computing (including cloud computing and data handling);
* End-to-end resource (including software infrastructure) management and orchestration of future computing;
* Data management and governance of future computing;
* Security mechanisms and methods of future computing.

It should be noted that the term "end-to-end" is used here in information technology context, and does not refer to the management of endpoints or user devices, as it would have otherwise been implied if the telecommunication technology context were used. The term end-to-end refers to multi-layer, multi-component and multi-domain in future computing for telecommunications environment, which is in the scope of this Question.

The following major Recommendations, in force at the time of approval of this Question, fall under its responsibility:

* ITU-T Y.3514, Y.3517, Y.3518, Y.3520, Y.3521, Y.3522, Y.3523, Y.3524, Y.3525, Y.3526, Y.3527, Y.3528, Y.3529, Y.3538, and Y.3539
* ITU-T Y.3604

#### I.2 Question

Study items to be considered include, but are not limited to:

* What new Recommendation should be developed for end-to-end service management, orchestration, governance, and production operation of future computing, including but not limited to distributed/edge computing, inter-cloud computing, multi-cloud computing and cloud native related computing, on the aspects of maintenance, monitoring, measurement, scheduling, Development and Operation (DevOps) and continuous integration / continuous delivery (CI/CD), etc?
* What new Recommendation should be developed for end-to-end resource (including software infrastructure) management and orchestration of future computing?
* What new Recommendation should be developed for data management and governance of future computing including but not limited to data analysis, data management, data preservation, data mobility management as well as lifecycle management of data?
* What new Recommendation should be developed for specific identity, access and security mechanisms that enable effortless trusted access to future computing?
* What collaboration is necessary to minimize duplication of efforts with other SDOs?

#### I.3 Tasks

Tasks include, but are not limited to:

* Developing Recommendations for overview, framework, high level and functional requirements and capabilities, data models, and application programming interfaces for end-to-end service management, orchestration, governance, and production operation of future computing, including but not limited to distributed/edge computing, inter-cloud computing, multi-cloud computingand cloud native related computing, on the aspects of maintenance, monitoring, measurement, scheduling, Development and Operation (DevOps) and continuous integration / continuous delivery (CI/CD), etc;
* Developing Recommendations for overview, framework, high level and functional requirements and capabilities, data models for end-to-end resource (including software infrastructure) management and orchestration of future computing;
* Developing Recommendations for data management and governance of future computing including but not limited to data analysis, data management, data preservation, data mobility management as well as lifecycle management of data;
* Developing Recommendations for specific identity, access and security mechanisms that enable effortless trusted access to future computing;
* Providing the necessary collaboration with external SDOs, consortia and forums working on future computing to minimize duplication of efforts;
* Maintaining and enhancing of the Recommendations for which the Question is responsible.

An up-to-date status of work under this Question is contained in the SG13 work programme: <https://www.itu.int/ITU-T/workprog/wp_search.aspx?sg=13&q=19>.

#### I.4 Relationships

Recommendations

* Other relevant Y-series Recommendations, in particular in Y.3500- and Y.3600-series;
* Y-series and Cloud computing and data handling related Recommendations in the M-, Q- and X-series Recommendations.

Questions

* Cloud computing and data handling related Questions
* Artificial intelligence and machine learning (AI/ML) related Questions and Focus Group

Study Groups

* ITU-T Study Groups and ITU-D Study Groups involved in cloud computing and data handling related studies

Other bodies

* Institute of Electrical and Electronics Engineers (IEEE)
* Internet Engineering Taks Force (IETF)
* International Organization for Standardization (ISO)/ International Electrotechnical Commission (IEC) Joint Technical Committee (JTC) 1/ Subcommittee (SC) 27, SC38, SC40 and SC42
* Distributed Management Task Force (DMTF)
* Linux Foundation projects
* Metro Ethernet Forum (MEF)
* Storage Networking Industry Association (SNIA)
* TeleManagement Forum (TM Forum)
* Organization for the Advancement of Structured Information Standard (OASIS)
* The 3rd Generation Partnership Project (3GPP)
* European Telecommunications Standards Institute (ETSI) including Industry Specification Group on Network Function Vertualization (ISG NFV), Industry Specification Group on Zero Touch Networks & Service Management (ISG ZSM), Industry Specification Group on Experienced Networked Intelligence (ISG ENI) and Industry Specification Group on Multi-access Edge Computing (ISG MEC)
* Cloud Security Alliance (CSA)
* World Wide Web Consortium (W3C)
* National Institutes of Standards and Technology (NIST)
* Open Computing Project (OCP)
* OpenInfra Foundation

WSIS Action Lines:

* C2, C3, C5

Sustainable Development Goals:

* 9
1. DRAFT QUESTION J/13
**Innovative convergence service including service model, scenarios, technical aspects in future network**

(Continuation of Q1/13)

#### J.1 Motivation

Innovative service scenarios with support of information technologies are preparing opportunities for new services to be created in various environments demanding ICT support. For example, risk mitigation service features related to the effects of the climate on the environment form nowadays services scenarios of quickly increasing importance.

Convergence service technology refers to the requirements and functional structure of future response services and business models by combining industries and ICT that can improve productivity as well as economy and accessibility by applying advanced technology, and the main contents are as like as global market trends and emerging technologies such as a service model of IoT, ML/AI, blockchain/DLT, digital twin, data acquisition and utilization, data platforms, autonomous driving equipment, and robots.

Service models address the various needs of different businesses or organizations. It is important to consider not only the potential application services (described by use cases) that may be developed, but also the anticipated operating service scenarios and the implementations of service models . These considerations can be applied to assist the application service planning and may possibly even accelerate the availability and automation of application services in future Networks. Service deployment models based on future network technologies can be designed to enable the implementation of the service models and the service providers’ business innovation.

The use cases should be initiated from the user perspective and the service deployment models should take into account the service providers’ perspective.

In the context of these studies, this Question will also consider environmental and technical aspects with the objective to minimize the environmental impact

Recommendations under responsibility of this Question include:

* ITU-T Y.2241, Y.2243, Y.2244, Y.2245, Y.2246, Y.2247, Y.2248, Y.2249, Y.2250

#### J.2 Question

Study items to be considered include, but are not limited to:

* Service scenarios for innovative convergence services in Future Networks;
* Service models based on the requirements, framework, architecture, functional capabilities, and application layer interfaces for innovative convergence service in Future Networks
* Service deployment models for innovative convergence services in Future Networks;
* How to apply energy saving and other environmental aspects in the context of innovative convergence services in Future Networks;
* How to apply network technology as a technical aspect in the context of innovative convergence application services in Future Networks.

####  J.3 Tasks

Tasks include, but are not limited to, the development of documents as appropriate for:

* Service scenarios and service models for innovative application services in Future Networks to support smart farming, smart learning, smart industries, smart energy control, smart logistics, UAV (Unmanned Aerial Vehicle) based services;
* Development of Recommendations on the environmental aspects for energy consumption reduction and energy efficiency management in the context of innovative convergence services in Future Networks;
* Development of Recommendations on the technical aspects in the context of innovative convergence services in Future Networks ;
* Interoperability and architectural tasks of innovative convergence service models to define the functional models.;

#### J.4 Relationships

**WSIS Action Lines**

* C2, C7 e-environment

**Sustainable Development Goals**

* 8, 9, 12, 13

**Recommendations**

* Y-series Recommendations

**Questions**

* All Questions of SG13

**Study groups**

* ITU-T Study Groups 5, 11, 16, 17, 20
* ITU-D Study Groups 1 and 2

**Other bodies**

* International Organization for Standardization (ISO), International Electrotechnical Commission (IEC), American National Standards Institute (ANSI), European Telecommunications Standards Institute (ETSI), The 3rd Generation Partnership Project (3GPP)
* Institute of Electrical and Electronics Engineers (IEEE), Internet Engineering Taks Force (IETF), Open Mobile Alliance (OMA), World Wide Web Consortium (W3C)
* Asia-Pacific Telecommunity (APT), Food and Agriculture Organization of the United Nations (FAO)
1. DRAFT QUESTION K/13
**Next-generation network (NGN) evolution by adoption of emerging network technologies**

(Continuation of Q2/13)

#### K.1 Motivation

With the ever-increasing number of new services and applications, demand has been continuously increasing for enhancing the capabilities of the next generation networks and evolving their infrastructure. The following aspects need to be considered with the next generation network evolution: Ultra-high bandwidth which is able to support bandwidth intensive data transmission; Ultra-low latency guarantee; Lossless transmission for industrial applications; Network intelligence, which makes future evolved next generation networks to be high automatic.

Considering the above aspects and the evolution path of NGNs, the increasing possibilities of adoption of communication technologies( including but not limited to SDN, NFV, distributed ledger technologies and computing power network related technologies) with advanced information technologies are paving the way for evolution of NGNs, and are making available a large set of advanced capabilities for the support of innovative and promising services, applications and technologies in the various business domains and social communities.

Meanwhile, to satisfy the requirements and overcome potential challenges raised by NGNs evolution, it is appropriate to consider how to adopt emerging network technologies in order to provide the network with flexibility, agility and programmability and other advanced characteristics.

Furthermore, as NGN has established its position as an existing underlying network infrastructure for a large number of services and applications, it is critical to study how innovative services and applications meeting the industry demands can be realized by incremental enhancements of the capabilities of NGNs and evolved versions of NGNs such as network intelligence capability enhancement (NICE).

Last but not the least, the study of requirements and architecture for these realizations of innovative services, applications and technologies for NGNe requires that relevant NGNe specifications be maintained and updated.

#### K.2 Question

The Question addresses the support of emerging services and applications in NGNs evolving in a phased evolution approach. Based on the use cases and related ecosystem aspects,

* This Question will study the requirements and capabilities imposed on evolving NGNs.
* This Question will study architectures for NGNs evolving in a phased network evolution approach.
* This Question will focus on the adoption of emerging network technologies.in NGN evolution.

#### K.3 Tasks

Tasks include, but are not limited to:

* Development of Recommendations on the requirements and architectures for NGNs evolving in a phased network evolution approach by adoption of emerging network technologies including, but not limited to SDN, NFV, distributed ledger technologies and computing power network related technologies.
* Development of Recommendations on the specific capability sets for NGNs in a phased network evolution approach for the support of given emerging service features and the adoption of emerging network technologies.
* Maintenance and update of existing Recommendations on NGN and NGNe including development of new Recommendations with emerging network technologies on these subjects as appropriate.

An up-to-date status of work under this Question is contained in the SG13 work programme: https://www.itu.int/ITU-T/workprog/wp\_search.aspx?sp=24&q=2/13.

#### K.4 Relationships

**Recommendations**

– Y-series Recommendations

**Questions**

– Relevant Questions of SG13 on network evolution aspects

**Study Groups**

– Other ITU-T Study Groups as appropriate, ITU-R Study Groups as appropriate

**Standardization bodies**

* Internet Engineering Taks Force (IETF)
* Open Mobile Alliance (OMA)
* Institute of Electrical and Electronics Engineers (IEEE)
* Alliance for Telecommunications Industry Solutions (ATIS)
* European Telecommunications Standards Institute (ETSI)
* International Organization for Standardization (ISO)/ International Electrotechnical Commission (IEC) Subcommittee (SC) 27
* The 3rd Generation Partnership Project (3GPP)
* those involved in network evolution matters

**WSIS action lines:**

* C2

**Sustainable Development Goals:**

* 9
1. DRAFT QUESTION L/13
**Applying future networks and innovation in developing countries**

(Continuation of Question 5/13)

#### L.1 Motivation

The importance of future networks and emerging network technologies for developing countries will continue to grow for the foreseeable future. New technologies are of critical importance to developing countries as they continue to make networks more accessible, more efficient, more cost effective, more adaptive and more versatile.

This question will aim at reducing the standardization gap in the scope of SG13 activities by being the channel through which developing countries can follow, contribute and implement international standards as appropriate to their context.

The activities of this question will mainly focus on producing Technical Papers and Supplements, which study the needs of the eco-system as a whole of developing countries in terms of applying future networks and emerging communication network technologies in accordance with the mandate of SG13.

This Question will address work items of specific interest to developing countries with the aim of producing corresponding specific Recommendations of specific interest to developing countries.

This Question provides a highly useful forum for developing countries to describe their infrastructure circumstances, their requirements, and thus form a basis for work in other SG13 Questions as well as in relevant ITU groups and external organizations toward meeting their needs.

It has been sensed that there is a desire from the least developed countries to be more involved and to help steer the work towards better meeting their needs, but that it is difficult for them to find a suitable home for such inputs.

This Question could be promoted and exploited as an easier and automatic entry in SG13 work, for developing countries new to SG13.

This work should be conducted in close cooperation with relevant ITU groups and external organizations.

#### L.2 Question

Study items to be considered include, but are not limited to:

* What scenarios and requirements in terms of services and deployments are needed for applying future networks and emerging network technologies in Developing Countries telecom networks?
* What are the standardization requirements of developing countries, in relation with SG13's hot topics and what challenges that could be addressed with standards;
* What enhancements to existing Recommendations are required to ensure energy savings directly or indirectly in Information and Communication Technologies (ICTs) and services or in other industries?

#### L.3 Tasks

Tasks include, but are not limited to:

* Prepare gap analysis on the current status and trends of future networks and emerging network technologies, from a viewpoint of developing countries telecom networks.
* Develop requirements and use cases in terms of services and deployments for applying future networks and emerging network technologies in Developing Countries telecom networks.
* Produce Supplements and Technical Papers on how best developing countries can implement emerging technologies or migrate to emerging technologies.
* Study of the impact of the implementation of ITU recommendations in developing countries.
* Produce and promote work items for study by SG13 Questions, relevant to the specific needs of developing countries.
* Develop recommendations of specific interest to the needs of developing countries.

An up-to-date status of work under this Question is contained in the SG13 work programme: <https://www.itu.int/ITU-T/workprog/wp_search.aspx?sp=17&q=5/13>.

#### L.4 Relationships

Recommendations

* Y-series ITU-T Recommendations

Questions

* All Questions of SG13

Study Groups:

* All ITU-T related study groups
* ITU-D Study Groups 1 and 2
* ITU-R WP 5D

Other bodies

* The 3rd Generation Partnership Project (3GPP)
* African Telecommunications Union (ATU), Asia-Pacific Telecommunity (APT), European Conference of Postal and Telecommunications Administrations (CEPT) , Inter America Telecommunication Commission (CITEL), Regional Commonwealth in the field of Communications (RCC) , League of Arab States (LAS)
* Institute of Electrical and Electronics Engineers (IEEE)
* Internet Engineering Taks Force (IETF)

WSIS Action Lines

* C2

Sustainable Development Goals

* 9
1. DAFT QUESTION M/13
**Quantum enhanced networks**

(Continuation of part of Question 16/13)

#### M.1 Motivation

This Question will continue to develop key solutions for quantum key distribution networks (QKDN) and consider quantum enhanced networks covering a broad range of quantum information technologies (QITs).

This Question will include activities related to quantum enhanced networks with QITs (e.g., networking for QKD, quantum entangled, distributed quantum computers/sensors, etc.), and their services and applications.

Recommendations and Supplements under responsibility of this Question include:

* Y.3800, Y.3801, Y.3802, Y.3803, Y.3804, Y.3805, Y.3806, Y.3807, Y.3808, Y.3809, Y.3810, Y.3811, Y.3812, Y.3813, Y.3814, Y.3815, Y.3816, Y.3817, Y.3818, Y.3819, Y.3820, and Y.3821
* ITU-T Y Suppl. 70, Y Suppl. 74, Y Suppl. 74, Y Suppl. 79, and Y Suppl. 80

#### M.2 Question

Study items to be considered include, but are not limited to:

* What new Recommendations should be developed for QKD networks?
* What new Recommendations should be developed for the integration of QKD networks with user networks?
* What new Recommendations should be developed for quantum networks?
* What new Recommendations should be developed for quantum networking with QIT and their services and applications?
* What collaboration is necessary to minimize duplication of efforts with other SDOs?

#### M.3 Tasks

Tasks include but are not limited to, development of new documents related to:

* new Recommendations related to quantum enhanced networks with QIT (e.g., networking for quantum key distribution (QKD), quantum entangled, distributed quantum computers/sensors, etc.);
* new Recommendations related to user networks interacting with quantum enhanced networks;
* Development of new Recommendations and other types of informative documents related to implementation guidelines, scenarios of the above networks and services;
* Providing the necessary collaboration for the works in Question with relevant SDOs, consortia, and fora including JCA-QKDN.
* Maintenance and enhancement of the Recommendations for which the Questions is responsible.

An up-to-date status of work under this Question is contained in the SG13 work programme: <https://www.itu.int/ITU-T/workprog/wp_search.aspx?sp=17&q=16/13>.

#### M.4 Relationships

Recommendations

* Q-, X- and Y-series Recommendations

Questions

* All quantum enhanced networks related Questions

Study Groups

* All quantum enhanced networks related study groups

Other bodies

* International Organization for Standardization (ISO)/ International Electrotechnical Commission (IEC) Joint Technical Committee (JTC) 1/ Subcommittee (SC) 6, SC 27, SC 39 and Ad hoc Group (AG) 4
* ISO/IEC JTC3
* Internet Engineering Taks Force (IETF)/ Internet Research Taks Force (IRTF)
* European Telecommunications Standards Institute (ETSI)
* ETSI Industy Specification Group on Quantum Key Distribution (ISG-QKD)
* ETSI Technical Committee (TC) Cyber
* Institute of Electrical and Electronics Engineers (IEEE)- Standard Association (SA)

WSIS Action Lines

* C2, C5, C7, C11

Sustainable Development Goals

* 9, 11
1. DRAFT QUESTION N/13
**Trusted information and communication technologies (ICT) infrastructures and their applications including Web 3.0**

(Continuation of part of Question 16/13)

#### N.1 Motivation

When considering future ICT infrastructures and services, trust becomes important and essential. In order to support the necessary network intelligence for dealing with complexity and uncertainty/risks in future ICT infrastructures and their applications, it's necessary to make better use of knowledge about the status of the environments and of trust for creation, dissemination and utilization of knowledge in an open and collaborative manner as well as for considering trustworthy autonomous networking and services.

This Question will explore such importance of trustworthy networking and services and identify requirements and functions to support the building of trusted ICT infrastructures in a decentralized manner with various enabling technologies such as blockchain for enhanced security challenges covering privacy, safety, resilience and reliability. In addition, this Question will continue to develop emerging technical solutions for trusted ICT infrastructures and their applications in a fully open and transparent manner to meet new requirements for revolutions and challenges towards Web 3.0, based on the Web3 adhoc activities conducted in SG13.

In addition, interworking aspects between different networks and services should be studied, and this study should focus on the interworking between other networks whenever the need for interworking is identified.

Thus, the focus of this Question will include activities related to trustworthy networking and services including interworking and activities associated to Web3.0. The work to specify the procedure, requirements, properties, and mechanisms for supporting trusted ICT infrastructures and their applications including Web 3.0 is the responsibility of this Question.

Recommendations under responsibility of this Question include:

* Y.2073, Y.3050, Y.3051, Y.3052, Y.3053, Y.3054, Y.3055, Y.3056, Y.3057, Y.3058, Y.3059, Y.3060 and Y.3062

#### N.2 Question

Study items to be considered include, but are not limited to:

* What new Recommendations should be developed for trustworthy networks, including their ability to support specific applications/services?
* What new Recommendations should be developed to support trustworthy networking and services with enabling technologies (e.g., blockchain, trustworthy AI, etc.)?
* What new Recommendations should be developed for trusted ICT infrastructures and their applications with technical challenges to support emerging ecosystems and stakeholders?
* What new Recommendations should be developed for data modelling of digital assets, overall ICT infrastructure design and procedures, technical requirements and applications for trustworthy digital asset trading considering value evaluation and profit sharing for Web 3.0?
* What enhancements to the existing Recommendations should be made to enable interworking between other networks including end user networks (e.g., customer premises networks)?
* What collaboration is necessary to minimize duplication of efforts with other SDOs?

#### N.3 Tasks

Tasks include but are not limited to:

* Development of new Recommendations related to trustworthy networking and services;
* Development of new Recommendations related to enabling technologies for trusted ICT infrastructures with services/applications support;
* Development of new Recommendations related to requirements, functions and mechanisms for emerging ICT ecosystems, stakeholders and their trustworthy interactions taking into account ownership, sharing and trading of value-added data in Web 3.0 scenarios and business models;
* Development of new Recommendations related to interworking between other networks (including specific networks, e.g., networks for vehicular, smart grid and healthcare, etc.) and services considering heterogeneous and constraint networking environments in end user side;
* Development of new Recommendations related to end user networks and their specific applications/services in end users' perspective (e.g., enhancement of home networks, personal area networks, etc.);
* Providing the necessary collaboration for the works in Question with relevant SDOs, consortia, and fora;
* Maintenance and enhancement of the Recommendations for which the Questions is responsible.

An up-to-date status of work under this Question is contained in the SG13 work programme: <https://www.itu.int/ITU-T/workprog/wp_search.aspx?sp=17&q=16/13>.

#### N.4 Relationships

Recommendations

* I-, Q-, X- and Y-series Recommendations

Questions

* All future networks, trusted network infrastructures, home network and quantum enhanced networks related Questions

Study Groups

* All future networks, trusted network infrastructures, home network and quantum enhanced networks related study groups

Other bodies

* International Organization for Standardization (ISO)/ International Electrotechnical Commission (IEC) Joint Technical Committee (JTC) 1/ Subcommittee (SC) 6, SC 27, SC 39 and Ad hoc Group (AG) 4
* Internet Engineering Taks Force (IETF)/ Internet Research Taks Force (IRTF)
* European Telecommunications Standards Institute (ETSI)
* ETSI Technical Committee (TC) Cyber
* Institute of Electrical and Electronics Engineers (IEEE)-Standard Association (SA)
* Online Trust Alliance (OTA)
* Trusted Computing Group (TCG)
* The 3rd Generation Partnership Project (3GPP)
* Broadband Forum
* Open Mobile Alliance (OMA)

WSIS Action Lines

* C1, C2, C3, C5, C7, C10, C11

Sustainable Development Goals

* 9, 11

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