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

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# 1 Introduction

This document contains the clean text of the Questions agreed by Study Group 2 to be submitted to WTSA, which were endorsed at the virtual TSAG meeting, 11-18 January 2021. This set of Questions became effective on 18 January 2021, for the remainder of the study period.

Table 1 lists the Questions endorsed and their relationships to the previously in-force set of Questions.

Table 1 – List of Questions for ITU-T Study Group 2

| New number | Current Question title | Status | Previous number | Previous Question title |
| --- | --- | --- | --- | --- |
| 1/2 | Application of numbering, naming, addressing and identification plans for fixed and mobile telecommunications services | Continued | 1/2 | Application of numbering, naming, addressing and identification plans for fixed and mobile telecommunications services |
| 2/2 | Routing and interworking plan for current and future networks | Continued | 2/2 | Routing and interworking plan for fixed and mobile networks |
| 3/2 | Service and operational aspects of telecommunications, including service definition | Continued | 3/2 | Service and operational aspects of telecommunications, including service definition |
| 5/2 | Requirements, priorities and planning for telecommunication/ICT management and operation, administration and maintenance (OAM) Recommendations | Continued | 5/2 | Requirements, priorities and planning for telecommunication management and operation, administration and maintenance (OAM) Recommendations |
| 6/2 | Management architecture and security | Continued | 6/2 | Management architecture and security |
| 7/2 | Interface specifications and specification methodology | Continued | 7/2 | Interface specifications and specification methodology |

# 2 Wording of Questions

## A Question 1/2 – Application of numbering, naming, addressing and identification plans for fixed and mobile telecommunications services

(Continuation of Question 1/2)

### A.1 Motivation

Continuation of studies regarding naming, numbering, addressing, and identification resources within the remit of Study Group 2. A significant amount of Q1/2 work throughout a study period is the result of future issues presented by Q1/2 Collaborators. These issues typically resulted in numerous future tasks defined and approved during the previous study periods.

Q1/2 will continue to define, study, and resolve future issues through the approval of additional tasks.

### A.2 Question

How can ITU-T Study Group 2 deal with the issues related to the application of numbering, naming, addressing and identification plans for fixed and mobile telecommunications services including, but not limited to, the Tasks detailed below?

### A.3 Tasks

Tasks include, but are not limited to:

1) Maintenance of existing ITU-T E-series numbering related Recommendations

Rationale: This task reviews and revises, where and when appropriate, the existing ITU-T numbering, naming, addressing and identification Recommendations of the ITU-T E-series and F-series, e.g., E.101, E.118, E.129, E.156, E.157,E.164, E.164.1, E.164.2, E.164.3, E.168, E.168.1, E.169, E.169.1, E.169.2, E.169.3, E.190, E.191, E.191.1, E.193, E.195, E.212, E.213, E.214, E.217, E.218, E.370, E.910, E.1100.

This task will ensure that these Recommendations are updated to reflect the current circumstances of the global telecommunications industry and regulatory environment taking into account the requirements of future telecommunication/ICT architectures, capabilities, technologies, applications and services including NGN, IP-based networks or IoT/M2M. As an example, several Recommendations were revised and updated during the last study period. It also includes the development of Recommendations for reporting misuse (Recommendation ITU-T E.156) or providing calling line identity (Recommendation ITU-T E.157). This task also addresses requests for resources described in Recommendations such as ITU-T E.212, E.164 or E.118 resources not covered in any of the tasks below.

2) UIFN/UIPRN/UISCN registrar coordination

Rationale: The Question maintains and considers potential evolutions of the use of the resources specified in Recommendations regarding the administration of Universal International Freephone Numbers (UIFN), Universal International Premium Rate Numbers, Universal International Shared Cost Numbers and ITU-T IND ATM End System Addresses (ITU-T AESAs).

Under this task, the Question will consult on an ongoing basis with the Registrar to resolve issues, relative to the above resources and any future resources created in the future, presented by the industry and the Registrar.

3) Request for numbering resources for future telecommunication/ICT architectures, capabilities, technologies, applications and services

Rationale: When future global or regional telecommunication/ICT architectures, capabilities, technologies, applications and services are developed and proposed for implementation, they often request/require global numbering resources. This task receives and reviews global numbering resource applications whenever necessary as per WTSA Resolution 20.

This Question will receive, study, and resolve such anticipated requests. Current instances of such requests include IoT/M2M, in-car emergency calling, UPT, UIFS, USCS, GMSS, RMSS, etc.

4) Global evolution of naming, numbering, addressing and identification (NNAI) requirements for telecommunications/ICT architectures capabilities, technologies applications and services

Rationale: This task will study the evolution of directly assigned global numbering, naming, addressing and identification schemes to accommodate current and future telecommunication/ICT architectures, capabilities, technologies, applications and services. A global understanding of the future use of these methodologies/schemes and their evolution would be of significant value to telecommunications network operators, service providers, vendors, planners, forums, and standards bodies worldwide.

The task would study and document the evolution of numbering, naming, addressing, and identification schemes including the convergence with current and future IP-based systems/networks that also includes the future of NNAI. Additionally, the task would study and analyse NNAI plans that already exist and that are already widely deployed and used; identify mechanisms that permit convergence between these different plans; identify gaps in plans or convergence that need to be addressed, and where appropriate develop future schemes/methodologies.

Specifically, in relation to the future of NNAI there will be a need to revisit issues of personal and terminal mobility, including the concepts of a single terminal being used by multiple subscribers. The future of NNAI studies would also include future and emerging telecommunication/ICT architectures, capabilities, technologies, applications and services.

With regard to geographic location, it is anticipated that future IP-based services, future mobile and satellite architectures or IoT/M2M may have additional or different requirements for both terminal and subscriber geographic location compared with existing and legacy systems. This could give rise to the requirement for future numbering, addressing, naming and identification resources or the expanded use of the current NNAI resources.

Undertaking studies into the "future of NNAI" including, for example, requirements related to cloud computing future generations of mobile (including satellite) networks or IoT/M2M.

5) Naming, numbering, addressing and identification for convergence between ITU-T E.164 numbering plan-based networks and IP address-based networks

Rationale: Convergence of the existing telecommunication networks, both fixed and wireless, with the current and future IP address-based network requires the continuing development of naming, numbering, addressing and identification mechanisms to support this convergence.

The task identifies requirements and develops solutions relating to NNAI for the convergence between the ITU-T E.164 numbering plan-based networks and current and future IP address‑based networks. A typical example of such interworking is ENUM, which maps E.164 numbers into Internet identifiers. The development of a solution includes, but is not limited to, the identification of the E.164 resource, the determination of how these resources will be used and administered, the determination of the ITU-T E.164 addressing scheme required to support this type of network, and the determination of which, if any, ITU-T E.164 resources will be made available to IP address-based networks.

In addition, this task will continue identification of future NNAI with respect to the longer term goal of convergence of the naming and addressing schemes used in international telecommunication networks.

The objective is a Recommendation(s), as appropriate, containing the results of the above work.

6) Implementation and Activation of ITU-T E.164 Numbering Resources

Rationale: The growth of future and existing telecommunication/ICT architectures, capabilities, technologies, applications and services as well as the quantity of network operators and service providers due to the evolution of competition in the telecommunications industry, has resulted in the introduction of numerous new geographic and non-geographic numbering resources domestically, internationally and globally. In order for these resources to be activated effectively, new methods are required to increase awareness and implementation of the resources.

This task will study potential awareness and implementation methods as appropriate and, as a result of the study, will publish these methods in the E-series of Recommendations. The study will include means of identifying better communication of the newly created country codes, assigned ranges under shared codes or their use, alternatives for making the Operational Bulletin more visible and relevant for the evolving telecoms ecosystem, or improvements to the way the current and potentially future methodologies are used.

7) Guidelines for effective and efficient national numbering resources administration

Rationale: The administration and evolution of national numbering plans involves a diversity of tasks that depends on the approach of the country to its national telecommunications environment (size, geography, regulation, legal framework, structure of the numbering plan, ecosystem of players, etc.). Consideration of such resources to the provision of future telecommunication/ICT architectures, capabilities, technologies, applications and services may benefit from closer cooperation and sharing the experience of the tasks associated with the national environments between the numbering plan administrations.

This task will consider typical elements to be considered for structuring and administering national numbering plans and possibly define good common practices and guidelines for national numbering plan administrators.

8) Number portability

Rationale: Update the existing Number Portability Supplement to include the necessary technical requirement for the introduction of number portability, including with respect to IP address-based networks and current and future IP based technologies.

9) Future applications for Naming, numbering, addressing and identification

Rationale: Over the past few years there has been a growing interest for global resources, including for machine to machine (M2M) services, that are not tied to a particular country but have a global outreach. Such capabilities, applications and services include (but are not limited to) container tracking, embedded SIMs in various vehicles and machines ("xeroxes", vending machines, etc.), extra-territorial use of resources. A number of M2M service providers, however, rely on global resources in general, and MCC 901 in particular, to deploy such services. Additionally, future types of applications may require NNAI resources (e.g., E.212 MCC + MNC and E.164 CC+IC), both on global and national levels. These types of capabilities, applications and services will put future demands on NNAI resources.

The study will continue to evaluate the applications, the associated risks of exhaustion for the NNAI resources along with mitigation measures and provide guidelines to Administrations on the use of national or globally assigned NNAI resources. The study will also consider means of monitoring the use of the global resources to ensure such resources are used according to their assignments. This will include specification of tools to make such resources globally reachable whenever necessary, templates for assignees to report on the use of such resources, including notification of future use cases, as well as templates for publishing national numbering plan information.

10) Definitions

Rationale: This task provides terms and definitions for use in the field of identifiers (e.g., names, numbers, addresses and identifiers (IDs)) for public telecommunication services and networks. Consistent terminology is seen as an important factor in ITU-T Recommendations. For the area covering Identifiers, there are important Recommendations in the E- and F-series, but also in the Q- and X-series. In this task, these terms and definitions have been developed, for the most part, from the practice of the use of IDs in traditional telephone networks such as PSTN, ISDN and PLMN-based networks (e.g., 4G and 5G). These terms will continue to be applicable with their current definitions for future telecommunication/ICT architectures, capabilities, technologies, applications and services that includes NGNs, PLMNs for future generations of mobile (including satellite) and future IP-based networks.

An up-to-date status of work under this Question is contained in the SG2 work programme (<https://www.itu.int/ITU-T/workprog/wp_search.aspx?sg=2>).

Recommendations and Supplements under responsibility of this Question: ITU-T E.101, E.118, E.112, E.129, E.156, E.157, E.164, E.164.1, E.164.2, E.164.3, E.168, E.168.1, E.169, E.169.1, E.169.2, E.169.3, E.190, E.191, E.191.1, E.193, E.195, E.212, E.213, E.214, E.217, E.218, E.370, E.910, E.1100, E.1110.

Texts under development: E.118, E.157, E.164.1, E.A-ENUM, E.A-N/GoC, E.disab, E.ENUMINF, E.IoT-NNAI, E.sup.OTTnum, E.sup.spoofing to E.157, TR.EENM, TR.G4Dir, TR.OTTnum, TR.TRAFGR.

### A.4 Relationships

WSIS Action Lines

– C2, C6, C10.

Sustainable Development Goals

– 9, 10, 11.

Recommendations

– N/A

Questions

– N/A

Study Groups

– N/A

Standardization bodies

– N/A

## B Question 2/2 – Routing and interworking plan for current and future networks

(Continuation of Question 2/2)

### B.1 Motivation

With the rapid evolution of network technologies and the emerging Numbering, Naming, Addressing, and Identification (NNAI) requirements of future telecommunication/ICT architectures, capabilities, technologies, applications and services future including NGN, IP-based networks or IoT/M2M, it is increasingly important to ensure that current networks can route and interwork in all relevant aspects with networks based on current alternative technologies and take into account ongoing and future developments.

In addition to that, the increasing assignment of global NNAI resources for future telecommunication/ICT architectures, capabilities, technologies, applications and services require careful study and analysis of the requirements needed to ensure end-to-end routing and interworking within and between different types of telecommunication/ICT architectures, capabilities, technologies, applications and services.

Such developments include, but are not limited to, Internet of Things (for example, M2M) and the increased usage of Over-the-Top (OTT) applications, and these developments will have to be studied in order to ensure end-to-end routing and interworking within and between different types of current and future telecommunication/ICT architectures, capabilities, technologies, applications and services. Operational aspects relating to the interconnection and interoperability of different types of networks and their usage of global NNAI resources for those type of applications will also be studied.

The study will, based on and following up from Question 1/2's role in the creation and maintenance of criteria for assignment and usage of global NNAI resources, focus on how such global NNAI resources are routed and interworked. The motivation for the study is to ensure seamless end-to-end routing and interworking within and between current and future networks, including all relevant principles ensuring the in-life management of global NNAI resources (for example, number portability and carrier migration) as well as overall governance of the operational processes involved.

### B.2 Question

The question will deal with the issues detailed under Tasks below.

### B.3 Tasks

Tasks include, but are not limited to:

1) Maintenance of existing ITU-T E-series Recommendations

Rationale: It is essential to provide required evolution in existing Recommendations (ITU-T E.170 – E.179; E.350 – E.399; E.164 Supplement 2).

This task will ensure that these Recommendations are updated to reflect the current circumstances of the global telecommunications industry and regulatory environment as well as taking into account the requirements of future architectures, capabilities, technologies, applications and services including NGN, IP-based networks or IoT/M2M. This builds upon the activity of the study group during the past study period that saw an increased amount of applications for and designations of global NNAI resources for future telecommunication/ICT architectures, capabilities, technologies, applications and services that require an equal study from a routing, interworking, number portability and carrier migration perspective to ensure that the principles and operational aspects for an end-to-end seamless service are followed through.

2) Routing for current and future telecommunication/ICT architectures, capabilities, technologies, applications and services

Rationale: Current networks are increasingly engaging and interworking with future and different types of future telecommunication/ICT architectures, capabilities, technologies, applications and services. At the same time, network applications and technologies are being widely extended to include voice, data, video, multimedia, and other services integrated that require routing between themselves or with existing networks. There are also the requirements of future telecommunication/ICT architectures, capabilities, technologies, applications and services emerging that are potentially impacting NNAI and should be considered.

This task will extend the work on the relevant or future ITU-T E-Series Recommendations to identify and recommend the update of existing or the development of future routing principles and operational aspects to study the requirements of future telecommunication/ICT architectures, capabilities, technologies, applications and services including NGN, IP-based networks or IoT/M2M as well as cloud computing within current and future networks. The task will further analyse whether or not supplementary services and features in current networks can exist and interwork in future networks.

This task will further consider networks where topologies are in motion rather than fixed. It is expected that the change in perspective will lead to future routing architectures, protocols, and methods.

3) Routing congestion control

Rationale: State-dependent routing methods that flood link-state and topology information throughout the network are subject to overload and congestive collapse.

This task will study and provide suggestions and/or best practices for routing congestion control methods and will develop Recommendations to address these issues.

4) Availability of routing information

Rationale: It was noted that the lack of information on the overall call routes from the originating entity up to the terminating entity may be a contributing factor of misuse (ref. Resolution 61 (Rev. Dubai, 2012), "Countering and combating misappropriation and misuse of international telecommunication numbering resources").

This task will investigate how to make the routing information available for calls based on global NNAI resources, noting that there may be national issues impacting this (for example, requirements for onward routing following number portability), to the terminating operator to assist in identifying possible instances of fraud, misuse, and security related issues. The task will further study the availability of routing information of global NNAI resources assigned to and in use by providers with a view of proposing solutions to ensure effective end-to-end seamless routing.

5) Interworking

Rationale: The emergence and increased usage of future telecommunication/ICT architectures, capabilities, technologies, applications and services including NGN, IP-based networks or IoT/M2M requires the interworking between current networks and current alternative as well as future networks.

This task will study and review the impact of convergence of current networks with future networks and as the requirements of future telecommunication/ICT architectures, capabilities, technologies, applications and services including NGN, IP-based networks or IoT/M2M on interworking emerge.

6) Number Portability and Carrier migration

Rationale: With the emergence of future telecommunication/ICT architectures, capabilities, technologies, applications and services including NGN, IP-based networks or IoT/M2M utilizing global NNAI resources, it is essential to look as well at the principles and operational capabilities to continue to provide guidelines on number portability and how such guidelines could be considered in relation to carrier migration (i.e., the bulk transfer of global NNAI resources from one provider to another in a business to business to consumer environment).

This task will review and consider the existing supplement to Recommendation ITU-T E.164 on number portability with a view of evolving the principles and operational aspects of number portability to consider the requirements of future telecommunication/ICT architectures, capabilities, technologies, applications and services including NGN, current and future IP-based networks or IoT/M2M in the context of carrier migration.

The task will also study and review the principles and requirements of infrastructure ENUM for international IMS interworking and carrier migration.

An up-to-date status of work under this Question is contained in the SG2 work programme (<https://www.itu.int/ITU-T/workprog/wp_search.aspx?sg=2>).

Recommendations and Supplements under responsibility of this Question: ITU-T E.170 – E.179; E.350 – E.399; E.164 Supplement 2.

Text under development: E.164 Supplement 2.

### B.4 Relationships

WSIS Action Lines

– C2.

Sustainable Development Goals

– 9.

Recommendations

– N/A

Questions

– All Questions dealing with the definition and characteristics of telecommunication services for which routing technologies will be utilized, and to also include Questions focusing on a) numbering and addressing plans (e.g., Q1/2); b) network management and performance (e.g., Q6/2).

Study Groups

– ITU-T SG3

– ITU-T SG11

– ITU-T SG13

– ITU-T SG15

– ITU-T SG16

– ITU-T SG17

– ITU-T SG20

– ITU-T JCA-IoT and SC&C

– ITU-T FG NET-2030

Standardization bodies

– N/A

Other groups

– Broadband Forum

– ETSI

– IETF

– Relevant international forums/organizations.

## C Question 3/2 – Service and operational aspects of telecommunications, including service definition

(Continuation of Question 3/2)

### C.1 Motivation

With the emergence of the requirements of future telecommunication/ICT architectures, capabilities, technologies, applications and services and the continued development of future IP-based networks, providing constancy for users of various voice-based and non-voice-based services, particularly on the PSTN, ISDN and mobile networks, to be able to communicate with other users on other networks remains essential. Interworking of existing and future telecommunication/ICT architectures, capabilities, technologies, applications and services and capabilities will remain important to satisfy customers' future and/or changing requirements (e.g., QoS, terminal/personal mobility).

In addition, increased awareness of customers' needs by administrations and ROAs, and the continued application of competition to future telecommunication/ICT architectures, capabilities, technologies, applications and services are likely to increase the pace of future service development. It is especially important that mechanisms, including interworking scenarios, be identified that may be of benefit to developing countries in making the transition from legacy networks and the services that they support to more modern means of telecommunication/ICTs, possibly supported on current and future IP-based networks, or other fixed mobile or satellite networks.

### C.2 Question

The question will deal with the issues detailed under Tasks below.

### C.3 Tasks

Tasks include, but are not limited to:

****1****) Maintenance of all existing service-related Recommendations

This task reviews and revises, where and when appropriate, the existing service-related ITU-T Recommendations, including international telephone, international telecommunication charge card, international freephone, international premium rate, international shared cost services, ISDN, UPT, and mobility services, e.g., ITU-T E.105, E.106, E.116, and F.110, F.111, F.115, F.116, F.85x.

2) Service and operational aspects of numbering and related service definition issues

It is important to ensure that users of various voice-based and non-voice-based services, particularly on the PSTN, ISDN and mobile networks, can communicate with other users on future telecommunication/ICT architectures, capabilities, technologies, applications and services including, but not limited to, current and future IP based networks.

Changes in the provision of telecommunication services, including aspects of international roaming across both terrestrial and satellite based architectures, capabilities, technologies, applications and services may give rise to the need for future service requirements and definitions for numbering, naming, addressing and identification resources.

This task will expand its assessment on the impact of introduction of future IP-based networks and interworking with current IP-based networks (including NGN) to include future developments of future telecommunication/ICT architectures, capabilities, technologies, applications and services requirements to determine what future services, service features, and service principles for interworking need to be defined to take advantage of technology developments.

3) Service and Operational Aspects for emergency service provision

Further develop service requirements for the provision of emergency services to warn and inform the public over future telecommunication/ICT architectures, capabilities, technologies, applications and services. The task will evolve current emergency related recommendations to ensure that future telecommunication/ICT architectures, capabilities, technologies, applications and services are able to be used whatever medium is used. The task will study the provision of emergency service messaging, supporting emergency telecommunications provision over different current and future telecommunication/ICT architectures, capabilities, technologies, applications and service areas and across national boundaries. The focus should be to facilitate multi-language warnings, cross-border roaming, and to prevent spam.

4) ****Service and operational aspects of interworking issues****

To study the service and operational impacts of future telecommunication/ICT architectures, capabilities, technologies, applications and services that would emerge from interworking with existing telecommunication/ICT architectures, capabilities, technologies, applications and services. This would include continuing to study what characteristics of traffic can be identified that would enable traffic to be deemed as impermissible as well as initiating studies of future architectures, capabilities, technologies, applications and services to assess the exact nature of any impact upon services that may emerge with their implementation and provide guidance to Administrations and operators.

Q3/2 will continue to define, study, and resolve future issues through the approval of additional tasks.

An up-to-date status of work under this Question is contained in the SG2 work programme (<https://www.itu.int/ITU-T/workprog/wp_search.aspx?sg=2>).

Recommendations and Supplements under responsibility of this Question: ITU-T E.105, E.106, E.108, E.116, E.119, ITU-T E.Suppl.1; ITU-T F.110, F.111, F.115, F.116, F.85x.

Texts under development: E.112, E.370, E.ACP, E.dit, TR.DOTT, TR.INCCBS.

### C.4 Relationships

WSIS Action Lines

– C2, C6.

Sustainable Development Goals

– 9, 13.

Recommendations

– N/A

Questions

– N/A

Study Groups

– ITU-T SG3 on tariff and accounting principles, telecommunication economic and policy issues

– ITU-T SG11 on signalling requirements and protocols

– ITU-T SG12 on Quality of Service aspects

– ITU-T SG13 on future networks including mobile and NGN

– ITU-T SG17 on Identity Management, security, languages and telecommunications software

– ITU-T FG NET-2030

– ITU-D SG 2.

Standardization bodies

– N/A

Other groups

– ETSI

– IETF

– 3GPP

– 3GPP2

– GSMA

– ISO

– Relevant international forums/organizations.

## D Question 5/2 – Requirements, priorities and planning for telecommunication/ICT management and operation, administration and maintenance (OAM) Recommendations

(Continuation of Question 5/2)

### D.1 Motivation

Study Group 2 is the lead study group for Telecommunication Management. Telecommunication management includes the management and operations of networks and services, by means of principles, frameworks, architectures, functional requirements, information models, and management interfaces.

In the fast evolving world of Telecoms, modern Telecom Operators, performing Service Provider (SP) and/or Network Operator (NO) roles, need to be able to evolve their management activities, processes and management systems to:

– Support the management of future telecommunication/ICT, architectures, technologies, capabilities and applications;

– Support cloud related management (including cloud-network synergy management) and its service delivering;

– Improve understanding of the management requirements of customers, as well as the future telecommunication/ICT architectures, capabilities, technologies, applications and services (including cloud) required to support these services;

– Enhance the customer/user experience by applying future telecommunication/ICT architectures, capabilities, technologies, applications and services in network management and operation;

– Support modern management activities to optimize the business processes and data usage, by developing smarter OAM schemes.

This Question is responsible for identifying telecom network operators' and service providers' priorities for the development of network and service management & operation Recommendations and for developing a programme or roadmap to meet these priorities.

This Question is also responsible for the coordination of management standardization work inside ITU-T.

Close cooperation is required with other SDOs and forums.

### D.2 Question

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

1) What are the network operators and service providers' requirements and priorities for the development of management Recommendations?

2) What enhancements are required to ITU-T M.3070 series to support cloud computing and cloud service management (including synergy management of cloud and networks)?

3) What aspects of telecommunication management and OAM are under development or need to be assigned to what Questions for timely development?​

4) What future telecommunication/ICT architectures, capabilities, technologies, applications and services, will be used to enhance the current TMN architecture and functionalities? What future telecommunication/ICT architectures, capabilities, technologies, applications and services will be managed?

### D.3 Tasks

Tasks include, but are not limited to:

1) Gain an understanding of the network operator and service provider's requirements, priorities and roadmap for the development of telecom management technology and Recommendations through workshops and joint events with other forums and SDOs.

2) Develop enhanced telecom management requirements and priorities to support modern ecosystem of future telecommunication/ICT architectures, capabilities, technologies, applications and services.

3) Establish an ongoing mechanism (e.g., by organizing a series of workshops and/or a establish permanent advisory group) to agree the priorities of network operator and service providers' priorities in order to influence the future direction of telecom management including the strategy and commit, infrastructure lifecycle management, product lifecycle management, operations support and readiness, fulfilment, assurance and billing process areas as they relate to market product and customer management, service management, resource management and supplier/partner management (ITU-T M.3050 Business Processes).

4) Identification of development directions, missing work areas and those that are overlapping, or potentially so, between multiple study groups, Questions and Recommendations.

5) Manage the responsibility associated with the lead study group on telecommunication management.

6) Establish and maintain an active liaison and agree priorities with key SDOs and forums.

7) Develop, maintain, and regularly distribute a task overview/work plan that documents the work and time schedules of all telecommunications management and OAM activities within ITU-T.

An up-to-date status of work under this Question is contained in the SG 2 work programme (<https://www.itu.int/ITU-T/workprog/wp_search.aspx?sg=2>).

Recommendations and Supplements under responsibility of this Question: ITU-T M.3362, M.3363, M.3364, M.3372.

Texts under development: M.rcsnsm, M.resm-AI, M.rmacbe, M.rmbs, M.rrsp, M.rvqms, M.rwop-AI.

### D.4 Relationships

WSIS Action Lines

– N/A

Sustainable Development Goals

– N/A

Recommendations

– ITU-T M.3362, M.3363, M.3364, M.3372.

Questions

– N/A

Study Groups

– ITU-T SG9, SG12, SG13, SG15, SG16, SG17, SG20

– FG NET-2030

Standardization bodies

– 3GPP, 3GPP2, ATIS, DMTF, ETSI, IEEE, IETF, MEF, OASIS, TM Forum.

Other groups

– TM Forum.

## E Question 6/2 – Management architecture and security

(Continuation of Question 6/2)

### E.1 Motivation

The standardization of management interfaces cannot be pursued fruitfully without a characterization and specification of the systems and functions which communicate via these interfaces. For this purpose, TMN was specified by Recommendation ITU-T M.3010. Recommendation ITU-T M.3060 builds on ITU-T M.3010 and specifies the framework and the architectures needed to support the management of the NGN. Ongoing developments in telecommunications network and technologies, architectures and services, e.g., related to cloud computing, energy saving, future telecommunication/ICT architectures, capabilities, technologies, applications and services, require that the management framework and architecture evolve with them. Evolve management framework and architecture to support smart maintenance, and AI/ML-enhanced management.

A very important aspect of the management infrastructure is security. Undisturbed operation of telecommunications networks has become a cornerstone of society. In order to withstand actions that are aimed at disturbing this operation, the management plane must be very well secured. Therefore, it is needed that the security of management is considered and included in each step in the study and specification of management frameworks, architecture and interfaces.

### E.2 Question

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

1) How should the management architectures evolve in order to support evolving and future telecommunication network technologies, architectures and services, e.g., cloud computing, energy saving, future telecommunication/ICT architectures, capabilities, technologies, applications and services?

2) How to use future technologies (e.g., using cloud, smart maintenance and AI/ML) to improve the management system architectures?

3) Which extensions to existing Recommendations, or which new Recommendations, are needed in response to the results of the study under 1 and 2)?

4) What is the impact of evolution in network technologies and architectures on the security of the management plane?

5) Which extensions to ITU-T M.3016 series, or which new Recommendations, are needed in response to the results of the study under 4)?

### E.3 Tasks

Tasks include, but are not limited to:

1) Develop/enhance management architectures to support cloud computing, energy saving, and future telecommunication/ICT architectures, capabilities, technologies, applications and services, if needed.

2) Develop smart operation management and maintenance architectures.

3) Develop AI/ML enhanced management architectures, which support new services, such as auto-driving.

4) Maintain management architecture Recommendations, including the ITU-T M.3010, M.3050 series, M.3060 series, M.3040 series and M.3070 series.

5) Maintain security of management and management of security Recommendations, including the ITU-T M.3016 series, M.3210.1, Q.813, Q.815, Q.817, and M.3410 Recommendations.

An up-to-date status of work under this Question is contained in the SG2 work programme (<https://www.itu.int/ITU-T/workprog/wp_search.aspx?sg=2>).

Recommendations and Supplements under responsibility of this Question: ITU-T M.3040, M.3071.

Texts under development: M.AI-tom.

### E.4 Relationships

WSIS Action Lines

– C2, C5.

Sustainable Development Goals

– 9.

Recommendations

– ITU-T M.3040, M.3071.

Questions

– N/A

Study Groups

– ITU-T SG5, SG12, SG13, SG15, SG17.

– ITU-T FG NET-2030.

Standardization bodies

– N/A

Other groups

– TM Forum.

## F Question 7/2 – Interface specifications and specification methodology

(Continuation of Question 7/2)

### F.1 Motivation

There are several interfaces between network management systems, including both intra-domain and inter-domain interfaces. The intra-domain interfaces are essential for the interoperability between management systems within one organization. The inter-domain interfaces ensure the exchange of management information between systems from different organizations, which can be business to business (B2B), custom to business (C2B) or business to government (B2G) interfaces. Standardized interface specifications can bring prompt, reasonable cost, automated, time effective communication processes to business enterprises, customers and government. This Question is responsible for the specification of the management requirements, both the protocol-neutral and protocol-specific versions of information models for both intra-domain and inter-domain interfaces.

The Question is further responsible for the generic information models (e.g., the ITU-T M.3100 series Recommendations) and the common management services (e.g., the ITU-T M.3700 series). The management information models may need to be extended to address the required enhancements to support future telecommunication/ICT architectures, capabilities, technologies, applications and services.

Besides the generic management information models and management functionalities, the Question is also responsible for the management interface specifications for specific network technologies, including transport (e.g., Ethernet), access (e.g., PON), and core network (e.g., signalling and packet switching network elements), NGN (including Telecommunications for Disaster Relief, TDR), SDN (Software Defined Network) / NFV (Network Function Virtualization), DLT (Distributed Ledger Technology), smart maintenance, and other areas or technologies as specified in the work of Question 5/2.

The essence of management standardization is in the specification of management functionality and associated management information for communication across management interfaces. The specification of a management interface is composed of interface requirements in the form of management functionality, the analysis and identification of the information to be communicated independent of the implementation means (termed an information model), and the transformation of the protocol-neutral information into a protocol-specific format (termed a data model). This process is generally referred to as requirements, analysis, and design (RAD).

The RAD process defines a methodology which provides a unified approach for all work on management interface specifications, including requirements capture, information analysis and design. Central to the methodology is protocol-neutral modelling.

This Question is responsible for the definition and maintenance of the management interface methodology (Recommendation ITU-T M.3020) and the frameworks specifying the use of management technologies, including UML, CORBA, XML-based Web-services, and REST/HTTP, and collaborating with other SDOs and forums to harmonize interface methodologies and where possible produce common management interface methodology. This Question is broadly responsible for the generation of any methodologies concerning the communication of management information within, between, and outside of management networks (such as for human-machine interfaces).

This Question is also responsible for management protocol profiles. With the application of future telecommunication/ICT architectures, capabilities, technologies, applications and services in network management, it is required to provide protocol support for exchanging management information, especially for Web services and XML technologies.

### F.2 Question

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

1) What enhancements and extensions are needed for the Requirements, Analysis and Design (RAD) methodology defined in Recommendation ITU-T M.3020, including support for service-oriented architecture concepts? What additional frameworks are needed for timely support of future management technologies, such as REST/HTTP, including methodologies for definition of representations and concepts and the mappings between them?

2) What collaboration inside and outside ITU-T is required to support the generation of both generic and specialized information models?

3) What general protocol-neutral and protocol-specific information models (including the common management services) are required to support further development of management interfaces (e.g., Q, B2B/B2C)?

4) What enhancements are required to ITU-T M.1400 series and M.3100 series Recommendations to support future technologies?

5) What enhancements and extensions to the generic and specialized information models are required to support cloud computing, energy saving, future telecommunication/ICT architectures, capabilities, technologies, applications and services identified by Question 5/2?

6) What enhancements to the information model definition are required if AI/ML is applied in network management.

7) What protocol support is required to exchange information for REST/HTTP based management?

8) What maintenance of existing Recommendations is required?

### F.3 Tasks

Tasks include, but are not limited to:

1) Enhancements to ITU-T M.3020 (jointly with 3GPP) based on future requirements.

2) Enhancements to ITU-T M.3020 for design phase, including support protocol-specific information modelling (especially for REST/HTTP based designs), by collaborating with other SDOs.

3) Development of additional frameworks and guidelines to support future management technologies, especially for the REST/HTTP based management technology.

4) Enhancements to Recommendations ITU-T M.1400 series and M.3100 series to support future network technologies.

5) Development of the information models to support the management of cloud computing, energy saving, future telecommunication/ICT architectures, capabilities, technologies, applications and services.

6) Extend Recommendations ITU-T Q.811 and Q.812 to support REST/HTTP based management.

7) Maintenance of Recommendations ITU-T G.850 Series, M.1400 series, M.1520, M.1530, M.1532, M.1535, M.1537, M.1539, M.3020, M.3100 series, M.3320, M.3340 series, M.3350 series, M.3600 series, M.3700 series, Q.751, Q.816 series, Q.820 series, Q.830 series, Q.840 series, X.160, X.161, X.162, X.163, X.170 and X.171, X.700, X.701, X.702, X.720 Series, X.730 Series, X.740 Series, X.750 Series, X.780 series and X.790 Series; X.710, X.711, Q.811 and Q.812.

An up-to-date status of work under this Question is contained in the SG2 work programme (<https://www.itu.int/ITU-T/workprog/wp_search.aspx?sg=2>).

Recommendations and Supplements under responsibility of this Question: ITU-T G.850 Series, G.8010, G.8011, M.1400 series, M.1520, M.1530, M.1532, M.1535, M.1537, M.1539, M.3020, M.3100 series, M.3320, M.3340 series, M.3350 series, M.3600 series, M.3700 series, ITU-T Q.751, Q.811, Q.812, Q.816 series, Q.818, Q.820 series, Q.830 series, Q.840 series, ITU-T X.160, X.161, X.162, X.163, X.170 and X.171, X.700, X.701, X.702, X.710, X.711, X.720 Series, X.730 Series, X.740 Series, X.750 Series, X.760, X.780 series and X.790 Series.

Texts under development: M.immbs, Q.rest, X.rest, X.rest-ics.

### F.4 Relationships

WSIS Action Lines

– C2, C6.

Sustainable Development Goals

– 9.

Recommendations

– ITU-T M.3020.

Questions

– N/A

Study Groups

– ITU-T SG5, SG13, SG15, SG17, SG20.

– ITU-T FG NET-2030.

Standardization bodies

– 3GPP, 3GPP2, TM Forum, ATIS, DMTF, ETSI, IETF, OASIS, MEF, IEEE, W3C.

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