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| ITU‑T Study Group 2 | | |
| Operational aspects of service provision and telecommunication management | | |
| Report of ITU-T SG2 to the World Telecommunication Standardization Assembly (WTSA-20), Part I: GENERAL | | |

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| **Abstract:** | This contribution contains the report of ITU-T Study Group 2 to WTSA-20 concerning its activities during the 2017-2021 study period. | |
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Note by the TSB:

The report of Study Group 2 to the WTSA-20 is presented in the following documents:

Part I: **Document 1** – General

Part II: **Document 2** – Questions proposed for study during the study period 2022-2024

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1 Introduction

## 1.1 Responsibilities of Study Group 2

Study Group 2 was entrusted by the World Telecommunications Standardization Assembly (Hammamet, 2016) with the study of six Questions in the area of numbering, naming, addressing and identification, routing and interworking, service and operational aspects of telecommunications, telecommunication management and operation, administration and maintenance, management architecture and security, and interface specifications and specification methodology.

Annex A to WTSA-16 Resolution 2 states the following mandate for Study Group 2, Operational aspects of service provision and telecommunication management:

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

*• numbering, naming, addressing and identification requirements and resource assignment, including criteria and procedures for reservation, assignment and reclamation;*

*• routing and interworking requirements;*

*• principles of service provision, definition and operational requirements;*

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

*• operational aspects of interworking between traditional telecommunication networks and evolving networks;*

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

*• management of telecommunication services, networks and equipment via management systems, including support for next-generation networks (NGN), cloud computing, future networks (FN), software‑defined networking (SDN), IMT-2020, and the application and evolution of the telecommunication management network (TMN) framework;*

*• ensuring the consistency of the format and structure of identity management (IdM) identifiers;*

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

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

Annex A to WTSA-16 Resolution 2 states the following lead study group responsibilities for Study Group 2, Operational aspects of service provision and telecommunication management:

*• Lead study group on numbering, naming, addressing, identification and routing*

*• Lead study group on service definition*

*• Lead study group on telecommunications for disaster relief/early warning, network resilience and recovery*

*• Lead study group on telecommunication management.*

Annex B to WTSA-16 Resolution 2 defines the following responsibilities of SG2:

*ITU T Study Group 2 is the lead study group for numbering, naming, addressing and identification (NNAI), routing and service definition (including future services or mobile services). It is responsible for creating principles of service and operational requirements, including billing and operational quality of service/network performance. Service principles and operational requirements must be developed for current and evolving technologies.*

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

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

*Study Group 2 is responsible for studying, developing and recommending general principles of NNAI and routing for all types of network.*

*The chairman of Study Group 2 (or, if necessary, the chairman's delegated representative), in consultation with Study Group 2 participants, should provide technical advice to the Director of TSB concerning general principles for NNAI and routing and the effect on allocation of international codes.*

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

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

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

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

*• for transmission interfaces between network elements.*

*In support of market-acceptable FCAPS interface solutions, Study Group 2 studies will identify service-provider and network-operator requirements and priorities for telecommunication management, continue the evolution of the telecommunication management framework currently based on telecommunication management network (TMN), next-generation network (NGN), software-defined networking (SDN) concepts, and address the management of NGN, cloud computing, future networks (FN), SDN and IMT 2020.*

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

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

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

*Study Group 2 will hold meetings back-to-back with those of Study Group 3.*

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

Annex C to WTSA-16 Resolution 2 defines the list of Recommendations under the responsibility of Study Group 2 in the 2017-2020 study period:

*• ITU T E series, except those in conjunction with Study Group 17 or under the responsibility of Study Groups 3, 12 and 16*

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

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

*• ITU T G.850-series*

*• ITU T M-series*

*• ITU T O.220-series*

*• ITU T Q.513, ITU T Q.800  ITU T Q.849, ITU T Q.940-series*

*• Maintenance of the ITU T S-series*

*• ITU T V.51/M.729*

*• ITU T X.160-, ITU T X.170-, ITU T X.700-series*

*• ITU T Z.300-series.*

## 1.2 Management team and meetings held by Study Group 2

Study Group 2 met seven times in Plenary in the course of the study period (see Table 1) under the chairmanship of Mr Philip RUSHTON (United Kingdom) assisted by Vice-Chairmen Mr Abdullah AL-MUBADAL (Saudi Arabia), Mr Ahmed Tajelsir ATYA MOHAMMED (Sudan, Republic of the), Mr Saif BIN GHELAITA (United Arab Emirates), Mr Edgardo Guillermo CLEMENTE (Argentina), Mr Philippe FOUQUART (Orange, France), Ms Aysel KANDEMIR (Turkey) (until 27 November 2017), Mr Hossam ABD EL MAOULA SAKAR (Egypt), Ms Yanchuan WANG (China, P.R.), and Mr Ramazan YILMAZ (Turkey) (since 27 November 2017).

**TABLE 1  
Meetings of Study Group 2 and its working parties**

| **Meetings** | **Place, date** | **Reports** |
| --- | --- | --- |
| Study Group 2 | Geneva, 29 March – 7 April 2017 | SG2 – R 1 to R 3 |
| Study Group 2 | Geneva, 27 November – 1 December 2017 | SG2 – R 4 to R 7 |
| Study Group 2 | Geneva, 4 – 13 July 2018 | SG2 – R 8 to R 11 |
| Study Group 2 | Geneva, 19 – 28 February 2019 | SG2 – R 12 to R 15 |
| Study Group 2 | Geneva, 10 – 14 December 2019 | SG2 – R 16 to R 23 |
| Study Group 2 | Virtual, 27 May – 5 June 2020 | SG2 – R 24 to R 27 |
| Study Group 2 | Virtual e-plenary, 7-8 September 2020 | SG2 – R 28 |
| Study Group 2 | Virtual e-plenary, 18 December 2020 | SG2 – R 29 – R 30 |
| Study Group 2 | Virtual, 31 May - 11 June 2021 | SG2 – R 31 to R 33 |
| Study Group 2 | Virtual, 8-19 November 2021 | SG2 – R 34 to R 36 |

In addition many Rapporteurs group meetings took place during the study period, see Table 1-bis.

TABLE 1-bis **Rapporteur meetings organized under Study Group 2 during the study period**

| **Dates** | **Place/Host** | **Question(s)** | **Event name** |
| --- | --- | --- | --- |
| 11 October 2016 | E-meeting | Q7/2 | Q7/2 interim meeting on methodology harmonization with 3GPP |
| 1 November 2016 | E-meeting | Q7/2 | Q7/2 interim meeting on X.mfsiwt |
| 24 January 2017 | E-meeting | Q7/2 | Q7/2 interim meeting on methodology harmonization with 3GPP |
| 7 – 8 February 2017 | Geneva, Switzerland/ITU | Q1/2 | Q1/2 Rapporteur Group meeting |
| 5 May 2017 | E-meeting | Q7/2 | Q7/2 Rapporteur group meeting |
| 11-12 July 2017 | Geneva, Switzerland/ITU | Q1/2 | Q1/2 Rapporteur Group meeting |
| 17-18 October 2017 | E-meeting | Q5/2 | Q5/2 Rapporteur group meeting |
| 25 October 2017 | E-meeting | Q6/2 | Q6/2 Rapporteur group meeting |
| 9 November 2017 | E-meeting | Q7/2 | Joint Q7/2 and 3GPP SA5 meeting |
| 26 January 2018 | E-meeting | Q7/2 | Joint Q7/2 and 3GPP meeting |
| 15-16 May 2018 | E-meeting | Q5/2 | Q5/2 Rapporteur group meeting |
| 22 May 2018 | E-meeting | Q6/2 | Q6/2 Rapporteur group meeting |
| 23 May 2018 | E-meeting | Q7/2 | Joint Q7/2 and 3GPP SA5 meeting |
| 26 September 2018 | E-meeting | Q7/2 | Q7/2 RGM: Progression on methodology harmonization with 3GPP (M.3020) |
| 6 November 2018 | E-meeting | Q7/2 | Q7/2 RGM: Progression on draft M.tsm-gim |
| 19-20 December 2018 | E-meeting | Q5/2 | Q5/2 RGM: proression on M.RTAFM, MRDM, M.rtsmf, M.rvqms |
| 10 January 2019 | E-meeting | Q6/2 | Q6/2 RGM: Progression on M.tsm and M.somm |
| 25 April 2019 | E-meeting | Q7/2 | Q7/2 Emeeting on interface specification methodology (M.3020) harmonization and REST interfaces with 3GPP SA5. |
| 8 May 2019 | E-meeting | Q1/2 | Q1/2 rapporteur group meeting on progress work on E.156 |
| 13 May 2019 | E-meeting | Q1/2 | Q1/2 rapporteur group meeting on progress work on E.157 |
| 30 May 2019 | E-meeting | Q1/2 | Q1/2 rapporteur group meeting on progress work on E.157 |
| 3 June 2019 | E-meeting | Q1/2 | Q1/2 rapporteur group meeting on progress work on E.156 |
| 21 – 23 August 2019 | Beijing/China (P.R.) | Q5/2, Q6/2, Q7/2 | Q5,6,7/2 Joint Rapporteurs group meeting |
| 30 September – 1 October 2019 | Geneva, Switzerland/ITU | Q3/2 | Q3/2 Rapporteurs group meeting |
| 2 – 4 October 2019 | Geneva, Switzerland/ITU | Q1/2 | Q1/2 Rapporteurs group meeting |
| 27 November 2019 | E-meeting | Q7/2 | Q7/2 Rapporteur group meeting on Interface Methodology harmonization between ITU-T SG2 and 3GPP SA5 |
| 24 February 2020 | Biel/Bienne, Switzerland | Q3/2 | Q3/2 Rapporteurs group meeting |
| 25-27 February 2020 | Biel/Bienne, Switzerland | Q1/2 | Q1/2 Rapporteurs group meeting |
| 16 March 2020 | E-meeting | Q6/2 | Progress work on M.AI-tom |
| 18 March 2020 | E-meeting | Q5/2 | Progress work on M.rvqms, M.rcsnsm, M.rmbs, M.rmacbe, M.rrsp, M.resm-AI |
| 31 March 2020 | E-meeting | Q1/2 | Progress on ITU-T E.IoT-NNAI, "Internet of Things Naming Numbering Addressing and Identifiers" |
| 7 May 2020 | E-meeting | Q7/2 | Progress work on M.tsm-gim, X.rest, Q.rest |
| 4 March, 1 April, 15 April, 6 May, 21 May 2020 | E-meeting | Qall/2 | Series of e-meetings on ITU-T SG2 preparations for WTSA-20 and the new Study Period (2021-2024) |
| 1 and 17 July, 5 August 2020 | E-meeting | Q1/2 | Series of Q1/2 e-meeting on E.157 |
| 3 August 2020 | E-meeting | Qall/2 | SG2 e-meeting on streamlining Resolutions |
| 6 August 2020 | E-meeting | Q1/2 | Q1/2 e-meeting on ITU-T E.212 Annex H |
| 11 August 2020 | E-meeting | Q1/2 | Q1/2 e-meeting on Humanitarian Country Code (+888) and all related matters |
| 17 August 2020 | E-meeting | Q6/2 | Q6/2 e-meeting to progress: M.AI-tom |
| 18 August 2020 | E-meeting | Q5/2 | Q5/2 e-meeting to progress: M.rcsnsm, M.rvqms, M.rmbs, M.rrsp, M.resm-AI |
| 20 August 2020 | E-meeting | Q1/2 | Q1/2 e-meeting on TR.EENM |
| 31 August 2020 | E-meeting | Q1/2 | Q1/2 e-meeting on ITU-T TR.OTTnum |
| 2 September 2020 | E-Meeting | Q7/2 | Q7/2 e-meeting to progress: Methodology harmonization with 3GPP (M.3020) |
| 12 October 2020 | E-Meeting | Q1/2 | Q1/2: Editor's ad-hoc e-meeting on E.157 |
| 12 October 2020 | E-Meeting | Q6/2 | Q6/2: Editor's ad-hoc e-meeting on M.AI-tom |
| 14 October 2020 | E-Meeting | Qall/2 | ITU-T SG2: TAP comment resolution e-meeting on E.212 (2016) Amd.3 |
| 15 October 2020 | E-Meeting | Q1/2 | Q1/2: Editor's ad-hoc e-meeting on TR.EENM |
| 16 October 2020 | E-Meeting | Qall/2 | ITU-T SG2 ad-hoc e-meeting on Streamlining Resolutions |
| 20 October 2020 | E-Meeting | Q5/2 | Q5/2: Editor s ad-hoc e-meeting on M.resm-AI, M.rvqms |
| 21 October 2020 | E-Meeting | Q1/2 | Q1/2: Editor s ad-hoc e-meeting on E.118 |
| 22 October 2020 | E-Meeting | Q7/2 | Q7/2: Editor s ad-hoc e-meeting on X.rest, Q.rest, X.rest-ics |
| 16-18 November 2020 | E-Meeting | Q1/2 | Q1/2: RGM on +888/Humanitarian, and checkpoint from editor s ad-hoc meetings |
| 16 November 2020 | E-Meeting | Q6/2 | Q6/2: Editor s ad-hoc e-meeting on M.AI-tom |
| 19 November 2020 | E-Meeting | Q7/2 | Q7/2: Editor s ad-hoc e-meeting on X.rest, Q.rest, X.rest-ics |
| 16 December 2020 | E-Meeting | Q7/2 | Q7/2: Methodology harmonization with 3GPP (M.3020) |
| 8-10 March 2021 | E-Meeting | Q1/2 | RGM e-meeting to progress the work of Q1/2 |
| 18 March 2021 | E-Meeting | Q5/2 | Q5/2: Editor s ad-hoc e-meeting on M.rvqms, M.rwop-AI, M.rmbs, M.rmacbe, M.rrsp, M.resm-AI |
| 22 March 2021 | E-Meeting | Q6/2 | Q6/2: Editor s ad-hoc e-meeting to progress the work of Q6/2 |
| 7 April 2021 | E-Meeting | Q7/2 | Q7/2: Methodology harmonization with 3GPP (M.3020) |
| 27 April 2021 | E-Meeting | Q7/2 | Q7/2: Editor s ad-hoc e-meeting on X.rest, Q.rest, X.rest-ics, others |
| 23 June 2021 | E-Meeting | Q7/2 | Q7/2: Methodology harmonization with 3GPP (M.3020 and REST) |
| 28 July 2021 | E-Meeting | Q1/2 | Q1/2 ad hoc on STIR/SHAKEN |
| 11 August 2021 | E-Meeting | Q1/2 | Q1/2 ad hoc on STIR/SHAKEN |
| 18 August 2021 | E-Meeting | Q5/2 | Q5/2 Editor s ad hoc |
| 6-10 September 2021 | E-Meeting | Q1/2 | Q1/2, Q2/2, Q3/2 RGM |
| 13 September 2021 | E-Meeting | Q6/2 | Q6/2 Editor s ad hoc |
| 5 October 2021 | E-Meeting | Q1/2 | Q1/2 Editor ad hoc on E.156 follow up |
| 20 October 2021 | E-Meeting | Q5/2 | Q5/2 Editor s ad hoc |
| 11 November 2021 | E-Meeting | Q7/2 | Q7/2 Editor s ad hoc |
| 16 February 2022 | E-Meeting | Q6/2 | Q6/2: Progression of M.il-AITOM |
| 22 February 2022 | E-Meeting | Q5/2 | Q5/2: Discussion on potential new work items |
| 16 March 2022 | E-Meeting | Q5/2 | Q5/2: Progression of M.rmnoc-AI |

The NCT met 48 times, which resulted in advice to the Director to assign 24 ITU-T E.212 shared MCC and MNCs, 19 ITU-T E.164 shared CC and ICs, and 2 ITU-T E.218 IINs.

2 Organization of work

## 2.1 Organization of studies and allocation of work

**2.1.1** At its first meeting of the study period, Study Group 2 decided to establish two Working Parties.

**2.1.2** Table 2 shows the number and title of each Working Party, together with the number of Questions assigned to it and the name of its Chairman.

**2.1.3** Table 3 lists other groups created by Study Group 2 during the study period.

**2.1.4** In line with Resolution 54 (rev., Hammamet, 2016), the ITU-T Study Group 2 Regional Group for Africa (SG2RG-AFR) was created, and ITU-T Study Group 2 Regional Group for the East Africa (SG2RG-EA) concluded in July 2018.

**TABLE 2  
Organization of Study Group 2**

| **Designation** | **Questions to be studied** | **Title of the Working Party** | **Chairman and Vice-Chairmen** |
| --- | --- | --- | --- |
| WP 1/2 | Q1/2, Q2/2, Q3/2 | Numbering, naming, addressing, routing and service provision | Mr Einar BOHLIN (United States)(\*)  Mr Dmitry CHERKESOV (Russian Federation)(#) |
| WP 2/2 | Q5/2, Q6/2, Q7/2 | Telecommunication management and network and service operations | Mr Zhili WANG (BUPT, China, P.R.)(\*)  Ms Yanchuan WANG (China Telecommunications Corporation, China P.R.)(#) |

(\*): Chairman

(#): Vice Chairman

**TABLE 3  
Other Groups (if any)**

| **Title of the Group** | **Chairman** | **Vice-Chairmen** |
| --- | --- | --- |
| Numbering Coordination Team (NCT) | Mr Philip RUSHTON (United Kingdom) |  |
| Joint Rapporteur Group Cloud Computing Management (JRG-CCM) (concluded March/April 2017) | Co-Rapporteur: Mr Emil KOWALCZYK (Orange, Poland) (from SG13)  Co-Rapporteur: Ms Yanchuan WANG (China Telecom) (from SG2) |  |
| Ad-hoc group (AHG) on WTSA-16 Resolution 64 ”Internet protocol address allocation and facilitating the transition to and deployment of IPv6” | Mr Saif BIN GHELAITA (United Arab Emirates) | Mr Einar BOHLIN (United States) |
| Ad-hoc group on numbering misuse and Ad-hoc on calling party number delivery | Mr Richard HILL (VisionNG) |  |
| Ad-hoc group on developing country issues | Mr Ahmed Tajelsir ATYA MOHAMMED (Sudan, Republic of the) |  |
| Ad-hoc group on vocabulary and definitions | Mr Dmitry CHERKESOV (Russian Federation) |  |
| ITU-T Study Group 2 Regional Group for Africa (SG2RG‑AFR)(\*) | Ms Susan NAKANWAGI (Uganda) | Mr Ahmed Tajelsir ATYA MOHAMMED (Sudan, Republic of the);  Mr Frank BOAMAH BAAFI (Ghana);  Mr Wilson EMERY BOKATOLA (Congo, Rep. of the);  Mr Anthony IKEMEFUNA (Nigeria);  Ms Adzowavi MASSAN GNOGNO (Togo) |
| ITU-T Study Group 2 Regional Group for the Americas (SG2RG-AMR) | Mr Edgardo Guillermo CLEMENTE (Argentina) | Mr Fernando HERNÁNDEZ SÁNCHEZ (Uruguay);  Mr Kirk SOOKRAM (Trinidad and Tobago) |
| ITU-T Study Group 2 Regional Group for the Arab Region (SG2RG-ARB) | Mr Saif BIN GHELAITA (United Arab Emirates) | Mr Abdullah AL-MUBADAL (Saudi Arabia);  Mr Ahmed Tajelsir ATYA MOHAMMED (Sudan, Republic of the);  Mr Ahmed JIDOU (Mauritania);  Mr Hossam SAKAR (Egypt) |
| ITU-T Study Group 2 Regional Group for the East Africa (SG2RG-EA)(\*\*) | Ms Susan NAKANWAGI (Uganda) | Mr Peter NYONGESA (Kenya) |

(\*): established 1 December 2017.

(\*\*): concluded July 2018.

## 2.2 Questions and Rapporteurs

**2.2.1** WTSA-16 assigned to Study Group 2 the six Questions listed in Table 4.

**2.2.2** The Questions listed in Table 5 were endorsed at the Telecommunication Standardization Advisory Group (TSAG) meeting held from 11 to 18 January 2021. The endorsed Questions contained in [TSAG-R12](https://www.itu.int/md/T17-TSAG-R-0012/en) became effective on 18 January 2021 for the remainder of the study period. The proposed Question texts in Part II of this report are unchanged relative to those endorsed by TSAG.

**2.2.3** The Questions listed in Table 6 have been deleted during this period.

**TABLE 4  
Study Group 2 – Questions assigned by WTSA-16 and Rapporteurs**

| **Questions** | **Title of the Questions** | **WP** | **Rapporteur** |
| --- | --- | --- | --- |
| 1/2 | Application of numbering, naming, addressing and identification plans for fixed and mobile telecommunications services | 1/2 | Mr Philippe FOUQUART (Orange, France);  Ms Ena DEKANIC (United States)(\*) (#) |
| 2/2 | Routing and interworking plan for fixed and mobile networks | 1/2 | Ms Yana YANKOVA (Voxbone SA, from May 2020) ; Ms Anne-Valérie HEUSCHEN (Voxbone SA, until May 2020);  Mr Saif BIN GHELAITA (United Arab Emirates)(\*) |
| 3/2 | Service and operational aspects of telecommunications, including service definition | 1/2 | Mr Hossam SAKAR (Egypt);  Ms Yasmina ALAA (Egypt)(\*) (&);  Mr Ping ZHAO (China Telecom Corp., China. P.R.)(\*) (%) |
| 5/2 | Requirements, priorities and planning for telecommunication management and operation, administration and maintenance (OAM) Recommendations | 2/2 | Mr Ping ZHAO (China Telecom Corp., China. P.R.);  Mr Dmitry CHERKESOV (Russian Federation)(\*) |
| 6/2 | Management architecture and security | 2/2 | Ms Yanchuan WANG (China Telecom Corp., China. P.R.));  Mr Francis Olivier CUBAHIRO (Burundi)(\*) (%) |
| 7/2 | Interface specifications and specification methodology | 2/2 | Mr Zhili WANG (BUPT, China P.R.) |

(\*): Associate Rapporteur

(#): since 10 December 2019.

(%): since 1 December 2017.

(&): since 13 July 2018.

**TABLE 5  
Study Group 2 – New Questions adopted and Rapporteurs**

| **Questions** | **Title of the Questions** | **WP** | **Rapporteur** |
| --- | --- | --- | --- |
| 1/2 | Application of numbering, naming, addressing and identification plans for fixed and mobile telecommunications services | 1/2 | Mr Philippe FOUQUART (Orange, France);  Ms Ena DEKANIC (United States)(\*) |
| 2/2 | Routing and interworking plan for current and future networks | 1/2 | Ms Yana YANKOVA (Voxbone SA);  Mr Saif BIN GHELAITA (United Arab Emirates)(\*) |
| 3/2 | Service and operational aspects of telecommunications, including service definition | 1/2 | Mr Hossam SAKAR (Egypt);  Ms Yasmina ALAA (Egypt)(\*);  Mr Ping ZHAO (China Telecom Corp., China. P.R.)(\*) |
| 5/2 | Requirements, priorities and planning for telecommunication/ICT management and operation, administration and maintenance (OAM) Recommendations | 2/2 | Mr Ping ZHAO (China Telecom Corp., China. P.R.);  Mr Dmitry CHERKESOV (Russian Federation)(\*) |
| 6/2 | Management architecture and security | 2/2 | Ms Yanchuan WANG (China Telecom Corp., China. P.R.));  Mr Francis Olivier CUBAHIRO (Burundi)(\*) |
| 7/2 | Interface specifications and specification methodology | 2/2 | Mr Zhili WANG (BUPT, China P.R.) |

(\*): Associate Rapporteur

**TABLE 6  
Study Group 2 – Questions deleted**

| **Questions** | **Title of Questions** | **Rapporteurs** | **Results** |
| --- | --- | --- | --- |
| None. |  |  |  |

3 Results of the work accomplished during the 2017-2020 study period

## 3.1 General

During the study period, Study Group 2 examined mmm contributions and generated a large number of TDs and liaison statements. It also:

– drew up 15 new Recommendations;

– amended/revised 8 existing Recommendations;

– developed three new Supplements;

– produced one technical report.

## 3.2 Highlights of achievements

The main results achieved on the various Questions assigned to Study Group 2 are briefly summarized below (see Table 6a). Formal replies to the Questions are given in a synoptic table in Annex 1 of this report.

**Table 6a – Summary of achievements in this study period**

| **Question** | **Recommen­dations** | | **Amend­ments** | **Corri­genda** | **Supplements** | | **Other public­cations** | **Draft Recommendation consented/ determined at the last meeting**  **(see Table 8)** |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **New** | **Rev­ised** | **New** | **Rev­ised** |
| **1/2** |  | 5\* | 6\* |  | 1 |  | 3 |  |
| **2/2** |  |  |  |  | 1 |  |  |  |
| **3/2** | 2 |  |  |  | 1 |  | 1 |  |
| **5/2** | 6 |  |  |  |  |  |  | 1 |
| **6/2** | 4 |  |  |  |  |  |  |  |
| **7/2** | 3 | 1 | 4 |  |  |  |  | 2 |

Notes:

\* Q1/2 Recommendations were Approved under TAP, all other Recommendations were Approved under AAP.

Study Group 2 continued assignments of international shared numbering resources: 24 ITU-T E.212 shared MCC and MNCs were assigned, 19 ITU-T E.164 shared CC and ICs were assigned, and 2 ITU-T E.218 IIN assigned.

**ITU-T E.212 shared MCC and MNCs were assigned:**

1. iBasis Netherlands B.V.
2. Eseye Ltd.
3. Flo Live Limited
4. Airnity
5. Nokia
6. Halys SAS (MCC + Trial-MNC)
7. Telecom Italia Sparkle S.p.A.
8. MFA
9. Bouygues Telecom
10. Orange (MCC + Trial-MNC)
11. Telefonica Moviles España, S.A. Unipersonal (TME)
12. Telefónica Germany GmbH & Co.
13. Podsystem Ltd.
14. A1 Telekom Austria AG
15. Etisalat
16. Tele2 IoT (Tele2 Sverige Aktiebolag)
17. Cubic Telecom Limited
18. Tampnet AS
19. Clementvale Baltic OÜ
20. Legos
21. 1NCE GmbH
22. Maersk Line A/S
23. Plintron Global Technology Solutions Private Limited
24. Limitless Mobile, LLC
25. GloTell B.V.
26. Syniverse Technologies, LLC
27. Twilio Inc.
28. MTN Management Services
29. OneWeb
30. MessageBird B.V.
31. BICS SA
32. SAP SE (now SINCH)
33. European Telecommunications Standards Institute (ETSI)
34. Beezz Communication Solutions Ltd.
35. Teleena Holding B.V. (now Tata Communications (UK) Limited)

**ITU-T E.164 shared CC and ICs were assigned:**

1. Airnity
2. Eseye Ltd.
3. A1 Telekom Austria AG
4. Nokia
5. Telecom Italia Sparkle S.p.A.
6. Afinna One Srl
7. Telefonica Moviles España, S.A. Unipersonal (TME)
8. Telefónica Germany GmbH & Co.
9. Podsystem Ltd.
10. Tele2 IoT (Tele2 Sverige Aktiebolag)
11. Cubic Telecom Limited
12. Clementvale Baltic OÜ
13. Legos
14. Phonegroup SA
15. 1NCE GmbH
16. DIDWW
17. Plintron Global Technology Solutions Private Limited
18. Limitless Mobile, LLC
19. World's Global Telecom (E.164 Trial Identification Code 991 001 – reclaimed 15 January 2021)
20. GloTell B.V.
21. Twilio Inc.
22. MessageBird B.V.
23. BICS SA
24. SAP SE (now SINCH)
25. Telecom26 AG
26. Beezz Communication Solutions Ltd.
27. Monaco Telecom

**ITU-T E.218 IIN assigned:**

1. European Parliament
2. Vattenfall Vindkraft A/S

**ITU-T E.118 (IIN) were assigned:**

1. Podsystem Ltd.
2. Airnity
3. Nokia
4. Telecom Italia Sparkle S.p.A.

**a) Q1/2, Application of numbering, naming, addressing and identification plans for fixed and mobile telecommunications services**

Question 1/2 studies naming, numbering, addressing, and identification resources within the remit of Study Group 2. Tasks of Q1/2 include:

˗ maintenance of existing E-series numbering related Recommendations,

˗ registrar coordination and administration of Universal International Freephone Numbers (UIFN), Universal International Premium Rate Numbers, Universal International Shared Cost Numbers, Network IC codes and ITU-T IND ATM End System Addresses (ITU-T AESAs),

˗ review of global numbering resource applications for new telecommunications services whenever necessary as per Resolution 20 (rev. Hammamet, 2016),

˗ study of global evolution of naming, numbering, addressing and identification (NNAI) requirements for telecommunications services,

˗ implementation and activation of E.164 numbering resources,

˗ updating the existing Number Portability Supplement,

˗ new applications for E.212 MCC + MNC

˗ provision of further guidance to requests for assignment of global resources, referred by the Numbering Coordination Team (NCT)

˗ continued revision of applicability of assigned global resources, e.g., +882/883 for ITS (eCall).

In this study period, Q1/2 has developed four revised Recommendations, six Amendments to Recommendations, and one Supplement:

**˗** [**Amendment 1 to Recommendation ITU-T E.118 (2006)**](https://www.itu.int/rec/T-REC-E.118) revises the registration form for a single Issuer Identifier Number for the international telecommunication charge card.

**˗** [**New Appendix IV to Recommendation ITU-T E.156**](https://www.itu.int/rec/T-REC-E.156) reproduces verbatim the attachment to WTSA Resolution 61 (Rev. Dubai, 2012) on "Suggested guidelines for regulators, administrations and operating agencies authorized by Member States for dealing with number misappropriation" .

**˗** [**Revised Recommendation ITU-T E.156**](https://www.itu.int/rec/T-REC-E.156) outlines the procedures for reporting and taking action regarding alleged misuse of numbers. It also outlines the procedures that the TSB Director should undertake upon receipt of reports of alleged misuse from members, including methods to address and counter any alleged misuse when such reports are brought to his/her attention.

**˗** [**Revised Recommendation ITU-T E.164.2**](https://www.itu.int/rec/T-REC-E.164.2) contains the criteria and procedures for an applicant to be temporarily assigned a three-digit identification code within the shared ITU‑T E.164 country code 991 for the purpose of conducting an international non-commercial trial. The purpose of the trial will be to determine the viability of a proposed new international public correspondence service.

**˗** [**Revised Recommendation ITU-T E.169.1**](https://www.itu.int/rec/T-REC-E.169.1) details the application of Recommendation ITU‑T E.164 Numbering Plan for the Universal International Freephone Numbers (UIFN) in the provisioning of International Freephone Service (IFS) as defined in Recommendation ITU-T E.152. It has been amended and refined in the light of experience gained by service providers and the UIFN Registrar since the inauguration of the UIFN in early 1997. This Recommendation was previously numbered E.169. It has been renumbered as E.169.1, and forms part of the 169.x-series Recommendations describing the numbering plans and assignment procedures for various international services.

**˗** [**Amendment 1 to Recommendation ITU-T E.212 (2016)**](https://www.itu.int/rec/T-REC-E.212) introduces a new Appendix III on shared ITU-T E.212 mobile country code (MCC) 999 for internal use within a private network.

**˗** [**New Annex G to Recommendation ITU-T E.212**](https://www.itu.int/rec/T-REC-E.212) contains the criteria and procedures for an applicant to be temporarily assigned a two digit mobile network code (MNC) within the shared E.212 mobile country code 991 for the purpose of conducting an international non-commercial trial.

**˗** [**New Annex H to Recommendation ITU-T E.212**](https://www.itu.int/rec/T-REC-E.212) contains the criteria and procedures for the assignment and reclamation of shared ITU-T E.212 mobile country codes (MCC) for regional and other international organizations (ROIO)/standards development organization (SDO)-specified networks and their respective mobile network codes (MNCs).

**˗** [**Revised Recommendation ITU-T E.217**](https://www.itu.int/rec/T-REC-E.217): For the purposes of International Public Correspondence Telecommunication, the ship station identity is now only relevant for those existing systems that have the ship station identity embedded in the numbering scheme as illustrated in Annexes A and B. For future systems that will not embed the ship station identity in their numbering scheme the ship station identity ceases to have any relevance for public correspondence telecommunication purposes. This revision of ITU-T E.217 includes relevant text from ITU-T E.210 as it combines both of those Recommendations into ITU-T E.217. In addition, it reflects changes that have occurred within the existing family of services provided by Inmarsat that impact the provision of Global Maritime Distress and Safety System (GMDSS). For historical accuracy, this revised version also reflects details of the provision of Inmarsat services prior to the expansion of the E.164 numbering plan (ITU-T Recommendation E.164 'The international public telecommunication numbering plan') from a maximum of 12 to 15 digits.

**˗** [**New Annex B to Recommendation ITU-T E.218**](https://www.itu.int/rec/T-REC-E.218) specifies the administration of global terrestrial trunk radio access mobile network codes by the ITU-T by detailing the scope of the resource covered by the annex. The annex also specifies the principles used for assignment, the criteria for assignment (against which applications for assignment of a global terrestrial trunk radio access mobile network codes will be assessed), the process for considering the application, and the circumstances under which a terrestrial trunk radio access mobile network code would be reclaimed.

**˗** [**Revised Recommendation ITU-T E.157**](https://www.itu.int/rec/T-REC-E.157) provides guidance for international calling party number delivery across boundaries of countries, which is technology neutral. This updated Recommendation ensures that originating operators shall be able to identify the calling party number that originated an international call; that originating and transit operators shall ensure the provision of the CPN over international networks, unless the calling party requests restriction; and that if the CPN is missing or incorrect, it may be replaced at the discretion of the national regulatory authority by a special allocated number.

**˗** [**Supplement 11 to ITU-T E-series of Recommendations**](https://www.itu.int/rec/T-REC-E.Sup11/en) defines criteria for assigning E.164 identification codes and E.212 Mobile Network Codes under shared MCCs for M2M/IoT services.

**˗** [Technical Report on g**uidelines for effective and efficient national E.164 numbering plan administration**](https://www.itu.int/pub/publications.aspx?lang=en&parent=T-TUT-TLCMGT-2021).

**˗** [**Technical Report on analysis of F.930**](https://www.itu.int/pub/publications.aspx?lang=en&parent=T-TUT-FSTP-2020-TRAFGR)analyses the question of whether Recommendation ITU-T F.930 "Multimedia telecommunication relay services" has enough detail for the purposes required by ITU-T Study Group 2 to assign global resources for these text relay services or whether a new Recommendation is required.

**˗** [Technical Report on **countering spoofing**](https://www.itu.int/pub/publications.aspx?lang=en&parent=T-TUT-TRUST-2021)provides information that could assist in implementing measures to counter spoofing, bearing in mind that calling party number authentication mechanisms are not a global solution against fraud or spoofing.

**b) Q2/2, Routing and interworking plan for fixed and mobile networks**

Question 2/2 is tasked to study routing for new network applications and technologies, dynamic routing for mobile networks, routing congestion control, and availability of routing information as well as updating the existing Number Portability Supplement.

Q2/2 when it met during the study period did so jointly with Q1/2 when justified by contributions.

In this study period, Q2/2 has developed one Supplement:

˗ [**Supplement 2 to Recommendation ITU-T E.164**](https://www.itu.int/rec/T-REC-E.164-202006-I!Sup2) defines standard terminology for a common understanding of the different aspects of number portability within an ITU-T E.164 numbering scheme. It identifies numbering and addressing formats, call flows, network architectures and routing approaches that will provide alternative methods of implementation. It also proposes some examples of the administrative and operational processes required for the successful implementation of number portability.

**c) Q3/2, Service and operational aspects of telecommunications, including service definition**

Question 3/2 is tasked to study service and operational aspects of numbering and related service definition issues, and service and operational aspects for mobile services (terrestrial cellular radio).

In this study period, Q3/2 has developed two new Recommendations, one Supplement, and one Technical Report:

**˗** [**New Recommendation ITU-T E.102**](https://www.itu.int/rec/T-REC-E.102) applies to disaster relief systems, network resilience and recovery. This Recommendation provides definitions of terms relevant to disaster relief systems, network resilience and recovery, including terms relevant to network architecture, functional elements and interfaces, application level aspects and power supply. Appendix I contains excerpts of the terminology defined by the United Nations International Strategy for Disaster Reduction (UNISDR). Appendix II shows the category classification of terms defined in this Recommendation.

**˗** [**New Recommendation ITU-T E.119**](https://www.itu.int/rec/T-REC-E.119) describes the requirements for safety confirmation and broadcast messaging for disaster relief, which can realize public organizations' business continuity plans (BCP) and can, to the best of their ability, help protect lives and property during a disaster. In the event of a disaster, it is very important that public organizations, such as telecommunication companies, electric power companies, hospitals, fire departments and local governments continue to operate and help save the lives of victims. Confirmation of the safety of officials or company staff is important in order to continue operating their necessary tasks. In addition, to be effective, broadcast message systems should automatically confirm the status of officials or staff.

**˗** [**New Supplement 1 to ITU-T E.100 series Recommendations**](https://www.itu.int/rec/T-REC-E.100SerSup1/en): Information and communication technologies (ICT) provide crucial services and systems for our daily lives as well as in emergency and disaster situations. Disaster relief systems that are used during and after disasters provide people with timely and useful information that is used for rescue, evacuation, safety confirmation and even for life sustainability. This Supplement provides the high-level category of disaster relief (DR) systems including early warning systems, identifies the services and systems that need common specifications or requirements. Also, this Supplements describes new study area of disaster relief systems, which includes newly produced ITU-T Recommendations, and its requirements.

**˗** [**New Technical Report on Identify call location for emergency service**](https://www.itu.int/pub/T-TUT-DIS-2020) provides an overview of technical solution for identifying the call location for the emergency services.

**d) Q5/2, Requirements, priorities and planning for telecommunication management and operation, administration and maintenance (OAM) Recommendations**

Question 5/2 is responsible for identifying 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.

In this study period, Q5/2 has developed four new Recommendations:

˗ [**New Recommendation ITU-T M.3362**](https://www.itu.int/rec/T-REC-M.3362) describes the requirements for telecommunication anti-fraud management in the telecommunication management network (TMN), the functional framework for combating telecommunication fraud management and the functional description. The requirements for telecommunication anti-fraud management include fraud detection management, fraud monitoring management, fraud mitigation management and fraud information sharing management. This Recommendation also describes telecommunication fraud scenarios including nuisance calls and spoofing calls.

˗ [**New Recommendation ITU-T M.3363**](https://www.itu.int/rec/T-REC-M.3363) describes the requirements for Data Management in the TMN, the functional framework for data management and the functional description. The data refers to the different categories of telecommunication data in BSS and OSS. The requirements for Data Management include metadata management, data lifecycle management, data quality management, data security management, data configuration management, data service management.

˗ [**New Recommendation ITU-T M.3364**](https://www.itu.int/rec/T-REC-M.3364) introduces requirements for on-site telecommunication smart maintenance management function. In this Recommendation, the requirements for telecommunication smart maintenance function are provided, which include on-site patrol, on-site overhaul, on-site troubleshooting, evaluation of maintenance work, management of maintenance knowledge base, management of service activation function, management of network resource, management of SMAT. This Recommendation also provides use cases of SMAT in TSMS.

˗ [**New Recommendation ITU-T M.3372**](https://www.itu.int/rec/T-REC-M.3372) introduces a functional framework and functional requirements for resource management in cloud-aware telecommunication management systems. It provides the composition of the functional framework, and the functions of each component in the framework. In this Recommendation, the general background and the current status of the cloud computing management are also analysed. And the benefit of introducing functional framework and functional requirements of resource management in cloud-aware telecommunication management system is explained.

˗ [**New Recommendation ITU-T M.3365**](https://www.itu.int/rec/T-REC-M.3365), for video used for surveillance, specifies requirements for quality of experience (QoE) management, including that of resources, indicators, the evaluation activity configuration and evaluation records. Recommendation ITU-T M.3365 provides a scenario for a video quality evaluation system, which is a tool that implements its requirements. Recommendation ITU-T M.3365 also gives examples of video quality evaluation records for reference.

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

˗ [**New Recommendation ITU-T M.3381**](http://www.itu.int/itu-t/workprog/wp_item.aspx?isn=16435) (Consented on 19 November 2021) provides requirements for energy saving management of 5G RAN system with artificial intelligence (AI). The goal of the Recommendation is to explain the requirements of using AI technology to achieve energy saving management for communication units and virtualized hardware resources of 5G RAN system, via EMS and open interfaces provided by vendors, from the OSS level. In addition, this Recommendation includes process recommendations for sending intelligent energy saving strategies from OSS to EMS and then to wireless equipment.

**e) Q6/2, Management architecture and security**

This Question is tasked to study and develop/enhance management architectures to support cloud computing, energy saving, future networks, SDN and IMT 2020, and to develop cloud-based management system architectures.

In this study period, Q6/2 has developed three new Recommendations:

˗ [**New Recommendation ITU-T M.3040**](https://www.itu.int/rec/T-REC-M.3040) introduces principles for on-site telecommunication smart maintenance (TSM). In this Recommendation, the background and basic concepts of on-site telecommunication smart maintenance are provided. This Recommendation also provides details of TSM architectures, including TSM functional architecture, TSM physical architecture, TSM information architecture, and maintenance processes.

˗ [**New Recommendation ITU-T M.3041**](https://www.itu.int/rec/T-REC-M.3041)introduces a framework of smart operation, management and maintenance (SOMM). In this Recommendation, characteristics, scenarios and the functional architecture of SOMM are provided to support service operation, network management, and infrastructure maintenance for both traditional non-SDN/NFV and SDN/NFV aware networks. This Recommendation also describes the relationship of the functional architecture of SOMM with logical layered architecture (LLA) of telecommunications management network (TMN).

˗ [**New Recommendation ITU-T M.3071**](https://www.itu.int/rec/T-REC-M.3071) introduces a new network management functional architecture with the cloud computing technology. In this Recommendation, the background and basic concept of cloud-based network management are provided. This Recommendation also provides the cloud-based network management functional architecture, including the basic components of the cloud-based network management functional architecture, their functionalities and the relationship between the components.

˗ [**New Recommendation ITU-T M.3080**](https://www.itu.int/rec/T-REC-M.3080) provides a framework of artificial intelligence enhanced telecom operation and management (AITOM). It describes the functional framework of AITOM to support telecom operation management for efficiency improvement, quality assurance, cost management, and security assurance. It also describes artificial intelligence (AI) pipelines that combine some components to enable AI based applications. This Recommendation also describes the relationship of the functional framework of AITOM with smart operations, management and maintenance (SOMM) presented in Recommendation ITU-T M.3041. General requirements of security are also described.

**f) Q7/2, Interface specifications and specification methodology**

Question 7/2 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). Q7/2 is also responsible for management protocol profiles.

In this study period, Q7/2 has developed two new Recommendations, one revised Recommendation, and one amendment:

**˗** [**Amendment 1 to Recommendation ITU-T M.1400 (2015)**](https://www.itu.int/rec/T-REC-M.1400) augments clause 29 of Recommendation ITU-T M.1400 with new function codes for the corresponding Optical Data Units and Optical Transport Units. It also corrects some editorial inconsistencies.

**˗** [**Revised Recommendation ITU-T M.3020**](https://www.itu.int/rec/T-REC-M.3020) describes the management interface specification methodology (MISM). It describes the process to derive interface specifications based on user requirements, analysis and design (RAD). Guidelines are given on RAD using unified modelling language (UML) notation; however, other interface specification techniques are not precluded. The guidelines for using UML are described at a high level in this ITU-T Recommendation.

**˗** [**New Recommendation ITU-T M.3164**](https://www.itu.int/rec/T-REC-M.3164) introduces the generic information model for on-site telecommunication smart maintenance. In this Recommendation, the definition and description of the generic information object classes, attributes and the relationship between object classes are provided. This Recommendation also provides examples of each information object class and a diagram of all the example instances.

**˗** [**New Recommendation ITU-T X.760**](https://www.itu.int/rec/T-REC-X.760) describes the measurement framework for the statistical indicators of website traffic. Websites are among largest traffic sources of telecommunication networks. It is necessary for network operators to understand the characteristics of website traffic and measurement methodology to plan and optimize their networks for providing better quality of service to websites and end users. This Recommendation defines three key statistical indicators (KSIs) including eight sub-indicators of website traffic and describes the measurement framework including measurement environment and measurement procedure for KSIs of website traffic. This Recommendation is aimed at providing network operators with a means to benchmark websites for scaling and optimizing network infrastructures.

**˗** [**Amendment 1 to Recommendation ITU-T Q.834.1 (2004)**](https://www.itu.int/rec/T-REC-Q.834.1) replaces the reference to IEEE 802.1D by IEEE 802.1Q.

**˗** [**Amendment 2 to Recommendation ITU-T Q.834.4 (2003)**](https://www.itu.int/rec/T-REC-Q.834.4) replaces the reference to IEEE 802.1D by IEEE 802.1Q.

**˗** [**Amendment 1 to Recommendation ITU-T Q.838.1 (2004)**](https://www.itu.int/rec/T-REC-Q.838.1) replaces the reference to IEEE 802.1D by IEEE 802.1Q.

**˗** [**New Recommendation ITU-T X.785**](https://www.itu.int/rec/T-REC-X.785) defines a set of guidelines for managed object modelling and a management interface for representational state transfer (REST)-based network management. It is part of a framework for REST based network management interfaces. It specifies how REST-based management interfaces should be defined. It covers the generic accessing methods of REST-based managed objects, accessing methods for specific managed object (Mos), information modelling in REST / hypertext transfer protocol (HTTP) and YAML ain't markup language (YAML) / JavaScript object notation (JSON) schemas. Some HTTP requests/responses and YAML/JSON schemas are provided for defining some basic data types: generic managed object (MO) and generic MO accessing methods.

**˗** [**New Recommendation ITU-T Q.819**](https://www.itu.int/itu-t/workprog/wp_item.aspx?isn=14853) (Consented on 19 November 2021) defines a set of services required to support REST-based interfaces and, along with Recommendation ITU‑T X.785, comprises a framework for REST-based network management interfaces. It specifies protocol requirements, and defines some network management-specific support services, which are notification service, heartbeat service, and containment service. The JSON/YAML interface definitions for the network management-specific support services are also provided.

**˗** [**New Recommendation ITU-T X.786**](https://www.itu.int/itu-t/workprog/wp_item.aspx?isn=16616) (Consented on 19 November 2021) provides guidelines for implementation conformance statement (ICS) proformas for REST-based interface systems. It provides an overview and constructions for the OpenAPI Specification (OAS), and provides several proformas (tables) for each OAS syntax component to be used in REST-based interfaces. Instructions on how to complete the columns in the conformance tables are also provided. Examples of REST-based interface ICSs are provided in appendices.

## 3.3 Report of lead study group activities, JCAs and regional groups

Lead Study Group activities of SG2 have been reported to each TSAG meeting.

### 3.3.1 Lead study group activities on numbering, naming, addressing, identification (NNAI) and routing, on service definition, on telecommunications for disaster relief/early warning, network resilience and recovery, and on telecommunication management

As agreed in WTSA-16 and reflected in WTSA Resolution 2, ITU-T Study Group 2 is the lead ITU‑T Study Group in the following specific areas of study:

˗ Lead study group on numbering, naming, addressing, identification (NNAI) and routing

˗ Lead study group on service definition

˗ Lead study group on telecommunications for disaster relief/early warning, network resilience and recovery

˗ Lead study group on telecommunication management

In its lead role, SG2 responds to the requirements of other study groups on issues related to these areas, as well as continuing to provide guidance to the TSB Director on requests to modify, assign and reclaim Global Numbering Resources, for example the codes behind Shared Country Codes.

1. **Lead study group on numbering, naming, addressing, identification (NNAI) and routing**

As to NNAI, the relevant NNAI experts continue to provide guidance to the TSB Director on requests to modify, assign and reclaim global numbering resources, for example the codes behind shared country codes. These resources are assigned by the Director of the TSB in accordance with the criteria detailed in the relevant ITU-T Recommendations that are under the responsibility of SG2. These criteria are both service based and network based.

Requests to requalify for extension of numbering resources, as well as new requests, in particular requests for M2M/IoT numbers were handled and guidance to the NCT was provided. Further progress was made on a number of other work items related to both NNAI and to telecommunication management. These additional work items included Calling Line Identity, IoT-NNAI (including the development of a technical report), cloud aware telecommunication management system, and data management in TMN. Furthermore discussions are underway to identify possible areas of collaboration with SG13.

SG2 is developing the rules required to access and use the electronic repository of national numbers (see Resolution 91 (Hammamet, 2016)). If Member States seek to use this capability to manage their numbering resources then it should be done on a cost recovery basis by the TSB.

The reports of misuse of numbers has dwindled significantly. The relevant Recommendation, ITU-T E.156, “Guidelines for ITU-T action on reported misuse of E.164 number resources” was revised to better distinguish between the different types of numbering resources that are being misused, specifically between directly assigned resources, so called global numbers, and indirectly assigned resources, numbers that are the responsibility of Member States. The amendments to the Recommendation are intended make the reporting of the indirectly assigned resources more effective through email notification to a pre-determined mailing list of misuse rather than registration of the report of misuse for action by the TSB.

SG2 also actively cooperates with external organizations, for example, CEPT and GSMA, and coordinates with other SDOs, for example, 3GPP, ISO, CITS, eCall, on NNAI activities that are of benefit to consumers and all relevant parties, as well as with ETSI to ensure synergies to meet the requirements of users.

For routing, Q2/2 looked at the integrity of geographic numbers on the matter of the credibility of the calling party number.

1. **Lead study group on service definition**

As part of its responsibilities for NNAI, SG2 seeks to meet the requirements of future telecommunication/ICT services, capabilities and applications in this area. SG2 also cooperates with 3GPP on harmonization of management interface specification methodology.

As part of its responsibilities in relation to the study of the operational impact of telecommunication/ICT services, applications and capabilities, SG2 is considering what is impermissible traffic and what possible activities can be taken by Administrations.

1. **Lead study group on telecommunications for disaster relief/early warning, network resilience and recovery**

As to Service, there was a contribution regarding emergency telecommunications systems and a copy was sent to ITU-D via liaison and Q3/2 had discussions about the limited use of voice with M2M/IoT numbers in regards to emergency services.

At its meeting in December 2020, SG2 established a new [Focus Group on AI for Natural Disaster Management (FG-AI4NDM)](https://www.itu.int/en/ITU-T/focusgroups/ai4ndm/Pages/default.aspx), which seeks to capitalize on the growing interest and novelty of AI in the field of natural disaster management to help lay the groundwork for best practices in the use of AI for: assisting with data collection and handling, improving modelling across spatiotemporal scales, and providing effective communication. The group was initially established for one year, and later extended for a further year at the SG2 meeting in November 2021.

1. **Lead study group on telecommunication management**

In its lead role as Lead Study Group for Telecommunication Management, SG2 has been maintaining and updating the Telecommunication Management and OAM Project Plan, which documents management and OAM standardization activities going on inside SG2, collected from all ITU-T study groups, as well as in the wider ITU-T community. This plan is liaised regularly to relevant ITU-T study groups.

In this study period, SG2 has made progresses on telecom management related work mainly in the following aspects: cloud-based network management, smart operation management and maintenance, data management, anti-fraud management, cloud resource management, synergy management of cloud and network, on-site smart maintenance, REST-based management framework, DLT management, AI-enhanced management, etc.

The SG2 meeting of July 2018 approved the creation of “Joint correspondence group of SG2 and SG13 on IMT-2020 network management issues”. The Questions under both study groups involved on this topic are Q6/2, Q21/13 and Q2/13. The discussion in this joint correspondence group kicked off on 13 April 2018 and ITU-T M.3041(ex M.somm) has been discussed in this group.

SG2’s work on REST-based network management framework has been progressing in three work items: X.785 (ex X.rest) “Guidelines for defining REST-based managed objects and management interfaces” (Approved in July 2021), and Q.819 (ex Q.rest) “REST-based management services” and ex X.786 (ex X.rest-ics) "Guidelines for implementation conformance statement proformas associated with REST-based management systems" (Consented in November 2021), which were developed in collaboration with 3GPP SA5.

Work continues in co-operation with 3GPP on methodology harmonization.

ITU T SG2 continues to work with SG11 (on ENUM and on supplementary services), SG13 (on cloud and SDN management, and ML), and SG20 (on IoT use cases).

### 3.3.2 JCAs

None.

### 3.3.3 Regional groups

SG2 has three regional groups (SG2RG-AFR, SG2RG-AMR, and SG2RG-ARB) for Africa, the Americas, and the Arab region. During this study period, SG2 created the new SG2RG-AFR, while SG2’s Regional Group for the East Africa (SG2RG-EA) concluded its work in July 2018.

SG2RG-AFR and SG2RG-ARB held co-located regional meetings in: Tunis, Tunisia, 26-27 April 2018; in Cairo, Egypt, 4-6 December 2018; and in Dubai, United Arab Emirates, 23-24 October 2019, and held a joint e-meeting on 17 May 2021.

SG2RG-AMR held physical regional meetings in Port of Spain, Trinidad and Tobago, 7 March 2017, and Managua, Nicaragua, 28-29 March 2019. It also held an e-meeting on 7 September 2021.

The reports of SG2’s ad-hoc group meetings on developing countries were noted by SG2 and were sent to the regional group meetings for their information and consideration. The results of the Study Group 2 meetings were disseminated to its regional groups,

### 3.3.4 Other activities

At every SG2 meeting, an ad-hoc session on developing country issues was organzied by Mr Ahmed Tajelsir ATYA MOHAMMED (Sudan, Republic of the) and a report is provided to the study group.  The report is then circulated to the SG2 regional groups for dissemination, discussion and use in development of contributions to the SG2 meetings.  This activity has generated useful contributions to the SG2 work focussing on the common issues related to developing countries and identified work for the study group.

4 Observations concerning future work

**a) Numbering, Naming, Addressing and Identification (NNAI)**

**˗ Continued evolution** of global numbering, naming, addressing and identification requirements and capabilities to accommodate current and future telecommunication/ICT architectures, capabilities, technologies, applications and services, e.g., consideration of new studies related to new IP, digital ledger technologies as well as the continuation of other tasks, such as NNAI for IoT and ITS (including eCall).

**˗ Further development of the application of E.212 resources.** New types of applications continue to be identified by members that require further development of E.212 MCC and MNCs, both on global and national levels. These types of applications put further new demands on E.212 resources. The new applications will be evaluated to see how they can be most appropriately included in the text.

**˗ Ensuring availability of NNAI resources.** Studies will be undertaken to ameliorate the associated risks of exhaustion for NNAI resources, in particular for E.212 MCC and MNC, along with mitigation measures and provide guidance to Administrations on the use of national or globally assigned NNAI resources.

**˗ Guidelines for effective and efficient national numbering resources administration.** This task considers 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 as the basis for closer co-operation, understanding and sharing between Administrations.

**˗ Further development of NNAI** to support to accommodate the development and specification of current and telecommunication/ICT architectures, capabilities, technologies, applications and services, e.g., consideration of new studies related to new IP, digital ledger technologies, etc.

**˗ Calling Party Number Delivery and Misuse.** Development of revisions to the ITU-T Recommendations on calling party number delivery (E.157) and misuse of international telecommunication numbering resources (E.156) will continue.

**˗ Implementation and** **Activation of Numbers:** Communication methods by which Administrations and operators can be notified of the assignment of new numbering ranges in order to increase the awareness of assignment of NNAI to facilitate NNAI implementation.

**b) Principles and operational aspects of routing, interworking, number portability and carrier switching/migration**

˗ **Routing**: The lack of information on the overall call routes from the originating entity up to the terminating entity may be a contributing factor of numbering misuse. Investigations on how to make the routing information available for calls based on international telecommunication numbering, naming, addressing and identification (NNAI) resources should be carried out, 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.

˗ **Interworking**: Convergence of the existing E.164 numbering plan-based telecommunication networks, both fixed and wireless, with alternative IP address-based, next generation and future networks as well as with future telecommunication/ICT telecommunication/ICT architectures, capabilities, technologies, applications and services requires the interworking between such existing networks and those alternative and future networks. Interworking between NNAIs needs to be considered and studied as appropriate.

˗ **Number Portability and Carrier Switching/Migration**. Existing Supplement to Recommendation ITU-T E.164 on number portability will be studied to assess the impact and requirements of future telecommunication/ICT architectures, capabilities, technologies, applications and service, for example IP address-based networks, NGNs and other future networks as well as the requirements of carrier ENUM for international IMS interworking and carrier switching/migration (i.e., the bulk transfer of NNAI resources from one provider to another in a business to business to consumer environment).

˗ **Evolution**. With the evolution of the usage of NNAI resources for future services (e.g., in-car calling, etc.), applications (e.g., OTTs), technologies (e.g., M2M/IoT), capabilities and architectures, the routing requirements between the originating entity and the terminating entity as well the requirements for interworking, number portability and carrier switching/migration should be studied and existing requirements and information should be updated, as necessary.

**c) Operational aspects of future services and related service definition issues**

The operational impact of introduction of future telecommunication/ICT architectures, capabilities, technologies, applications and services (that will interwork with current and future IP and C7-based networks (including NGN, satellite, and other future and emerging architectures) will be studied to determine what future services, capabilities and applications, as well as their features, and principles might be required to take advantage of future telecommunication/ICTs.

**d) Telecommunication/ICT management requirements**

Modern Telecom Operators who perform Service Provider and/or Network Operator roles need to be able to evolve their management activities, processes and management systems to support:

˗ future telecommunication/ICT architectures, capabilities, technologies and applications;

˗ cloud-network synergy management, other cloud related management and its service delivering;

˗ management activities to optimize the business processes and data usage.

Also the need remains to continue to evolve management activities, processes and management systems to improve understanding of the management requirements of customers, new services and the networks required to support these services; to meet the need to enhance the customer/user experience.

**e) Telecommunication/ICT management architecture and security**

Extending developments in, future telecommunication/ICT architectures, capabilities, technologies, applications and services, require that the management framework and architecture evolve with them. The security of management is considered and included in each step in the study and specification of management frameworks, architecture and interfaces. Relevant tasks under telecommunication management architecture and security include:

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

˗ Develop smart operation management and maintenance architectures.

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

˗ Maintain Recommendations on management architecture, including the ITU-T M.3010, M3040 series. M.3050 series, M3060 series and M.3070 series.

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

**f) Management interface specifications and specification methodology**

In addition to maintenance of the existing relevant Recommendations under G series/M series/Q series/ X series, other tasks under management interface specifications and specification methodology include:

˗ Enhancements to ITU-T M.3020 (jointly with 3GPP), based on new requirements.

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

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

˗ Enhancements to Recommendations ITU-T M.1400 series and ITU-T M.3100 series to support new network technologies.

˗ Specifying the requirements and development of the information models to support the management of cloud computing, energy saving, and future telecommunication/ICT architectures, capabilities, technologies, applications and services.

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

5 Updates to the WTSA Resolution 2 for the 2022-2024 study period

Annex 2 contains the updates to WTSA Resolution 2 proposed by Study Group 2 concerning the general areas of study, title, mandate, lead roles and points of guidance in the next study period.

ANNEX 1  
  
List of Recommendations, Supplements and  
other materials produced or deleted during the study period

The list of new and revised Recommendations approved during the study period is found in Table 7.

The list of Recommendations determined/consented at the last meeting of Study Group 2 is found in Table 8.

The list of Recommendations deleted by Study Group 2 during the study period is found in Table 9.

The List of Recommendations submitted by Study Group 2 to WTSA-20 for approval is found in Table 10.

Tables 11 onwards list other publications approved and/or deleted by Study Group 2 during the study period.

**TABLE 7  
Study Group 2 – Recommendations approved during the study period**

| **Recommendation** | **Approval** | **Status** | **TAP/AAP** | **Title** |
| --- | --- | --- | --- | --- |
| [E.102](http://handle.itu.int/11.1002/1000/13875) | 2019-12-13 | In force | TAP | Terms and definitions for disaster relief systems, network resilience and recovery |
| [E.118 (2006) Amd. 1](http://handle.itu.int/11.1002/1000/13735) | 2019-02-28 | In force | TAP | Revised registration form |
| [E.119](http://handle.itu.int/11.1002/1000/13074) | 2017-04-07 | In force | TAP | Requirements for safety confirmation and broadcast message service for disaster relief |
| [E.156](http://handle.itu.int/11.1002/1000/14177) | 2020-06-05 | In force | TAP | Guidelines for ITU-T action on reported misuse of ITU-T E.164 number resources |
| [E.156 (2020) Amd. 1](http://handle.itu.int/11.1002/1000/14312) | 2020-06-05 | In force | Agreement | Suggested guidelines for regulators, administrations and operating agencies authorized by Member States for dealing with number misappropriation |
| E.157 | 2021-06-11 | In force | TAP | International calling party number delivery |
| [E.164.2](http://handle.itu.int/11.1002/1000/14178) | 2020-06-05 | In force | TAP | ITU-T E.164 numbering resources for trials |
| [E.169.1](http://handle.itu.int/11.1002/1000/13736) | 2019-02-28 | In force | TAP | Application of Recommendation ITU-T E.164 numbering plan for universal international freephone numbers for international freephone service |
| [E.212 (2016) Amd. 1](http://handle.itu.int/11.1002/1000/13868) | 2018-07-13 | In force | Agreement | New Appendix on shared E.212 Mobile Country Code (MCC) 999 for internal use within a private network |
| [E.212 (2016) Amd. 2](http://handle.itu.int/11.1002/1000/14179) | 2020-06-05 | In force | TAP | New Annex G - Assignment of shared E.212 mobile country codes (MCC) for trials |
| E.212 (2016) Amd. 3 | 2020-12-18 | In force | TAP | Annex H: Criteria and procedures for the assignment and reclamation of shared ITU-T E.212 mobile country codes (MCC) for regional and other international organizations (ROIO)/standards development organization (SDO)-specified networks and their respective mobile network codes (MNCs) |
| [E.217](http://handle.itu.int/11.1002/1000/13477) | 2019-02-28 | In force | TAP | Maritime communications – Ship station identity |
| [E.218 (2004) Amd. 1](http://handle.itu.int/11.1002/1000/14180) | 2020-06-05 | In force | TAP | New Annex B - Criteria and procedures for the assignment and reclamation of shared ITU T E.218 terrestrial trunk radio access mobile country codes ((T)MCC) for networks and their respective terrestrial trunk radio access mobile network codes ((T)MNCs) |
| [M.1400 (2015) Amd. 1](http://handle.itu.int/11.1002/1000/13478) | 2018-01-13 | In force | AAP | Addition of new function codes for optical networks beyond 100 Gb/s |
| [M.3020](http://handle.itu.int/11.1002/1000/13268) | 2017-07-22 | In force | AAP | Management interface specification methodology |
| [M.3040](http://handle.itu.int/11.1002/1000/13877) | 2019-04-13 | In force | AAP | Principles for on-site telecommunication smart maintenance |
| [M.3041](http://handle.itu.int/11.1002/1000/14181) | 2020-02-13 | In force | AAP | Framework of smart operation, management and maintenance |
| [M.3071](http://handle.itu.int/11.1002/1000/13479) | 2018-01-13 | In force | AAP | Cloud-based network management functional architecture |
| [M.3164](http://handle.itu.int/11.1002/1000/14319) | 2020-07-14 | In force | AAP | Generic information model for on-site telecommunication smart maintenance |
| [M.3362](http://handle.itu.int/11.1002/1000/14197) | 2020-06-05 | In force | TAP | Requirements for telecommunication anti-fraud management in the telecommunication management network |
| [M.3363](http://handle.itu.int/11.1002/1000/14182) | 2020-02-13 | In force | AAP | Requirements for data management in the telecommunication management network |
| [M.3364](http://handle.itu.int/11.1002/1000/14183) | 2020-02-13 | In force | AAP | Requirements for on-site telecommunication smart maintenance management function |
| M.3365 | 2021-10-07 | In force | AAP | Requirements for quality of experience management of video used for surveillance |
| [M.3372](http://handle.itu.int/11.1002/1000/13687) | 2018-08-29 | In force | AAP | Requirements for resource management in cloud-aware telecommunication management systems |
| M.3373 | 2020-10-29 | In force | AAP | Requirements for synergy management of cloud and SDN-based networks |
| M.3080 | 2021-02-13 | In force | AAP | Framework of artificial intelligence enhanced telecom operation and management (AITOM) |
| Q.834.1 (2004) Amd. 1 | 2021-07-14 | In force | AAP | ATM-PON requirements and managed entities for the network and network element views: Amendment 1 - Replacement of reference to IEEE 802.1D with IEEE 802.1Q |
| Q.834.4 (2003) Amd. 2 | 2021-07-14 | In force | AAP | A CORBA interface specification for Broadband Passive Optical Networks based on UML interface requirements: Amendment 2 - Replace the reference to IEEE 802.1D by IEEE 802.1Q |
| Q.838.1 (2004) Amd. 1 | 2021-07-14 | In force | AAP | Requirements and analysis for the management interface of Ethernet Passive Optical Networks (EPON): Amendment 1 - Replace the reference to IEEE 802.1D by IEEE 802.1Q |
| [X.760](http://handle.itu.int/11.1002/1000/13480) | 2018-01-13 | In force | AAP | The measurement framework for the statistical indicators of website traffic |
| X.785 | 2021-07-29 | In force | AAP | Guidelines for defining REST-based managed objects and management interfaces |

**TABLE 8  
Study Group 2 – Recommendations consented/determined at the last meeting**

| **Recommendation** | **Consent/Determination** | **TAP/AAP** | **Title** |
| --- | --- | --- | --- |
| M.3381 | 2021-11-19 | AAP | Requirements for energy saving management of 5G RAN system with AI |
| Q.819 | 2021-11-19 | AAP | REST-based Management Services |
| X.786 | 2021-11-19 | AAP | Guidelines for implementation conformance statement proformas associated with REST-based management systems |

**TABLE 9  
Study Group 2 – Recommendations deleted during study period**

| **Recommendation** | **Last version** | **Withdrawal date** | **Title** |
| --- | --- | --- | --- |
| ITU-T E.210/F.120 | 11/1988 | 2019-12-13 | Ship station identification for VHF/UHF and maritime mobile-satellite services |
| ITU-T E.1110 | 01/2013 | 2022-02-22 (anticipated) | Allocation and assignment of ITU-T E.164 country code 888 |

**TABLE 10  
Study Group 2 – Recommendations submitted to WTSA-20**

| **Recommendation** | **Proposal** | **Title** | **Reference** |
| --- | --- | --- | --- |
| None. |  |  |  |

TABLE 11 **Study Group 2 – Supplements**

| **Recommendation** | **Date** | **Status** | **Title** |
| --- | --- | --- | --- |
| E Suppl.11 | 2020-06-05 | New | Criteria for M2M/IoT-related assignments under Recommendation ITU-T E.164.1 and Recommendation ITU-T E.212 Annex A |
| E-100 series Suppl.1 | 2019-02-28 | New | ITU-T E.100 series – Framework of disaster management for disaster relief system |
| E.164 Suppl.2 | 2020-06-05 | New | Number Portability |

TABLE 12 **Study Group 2 – Technical Papers**

| **Recommendation** | **Date** | **Status** | **Title** |
| --- | --- | --- | --- |
| None |  | New/ Revised/ Deleted |  |

TABLE 13 **Study Group 2 – Technical Reports**

| **Recommendation** | **Date** | **Status** | **Title** |
| --- | --- | --- | --- |
| TR.CLE | 2020-06-05 | New | Identify call location for emergency service |
| TR.TRAFGR | 2020-12-18 | New | Technical Report on analysis of F.930 |

TABLE 14 **Study Group 2 – Other publications**

| **Recommendation** | **Date** | **Status** | **Title** |
| --- | --- | --- | --- |
| None. |  | New/ Revised/ Deleted |  |

ANNEX 2  
  
Proposed updates to the Study Group 2 mandate and Lead Study Group roles

**(WTSA Resolution 2)**

The following are the proposed changes to the Study Group 2 mandate and Lead Study Group roles agreed at the last Study Group 2 meeting in this study period, based on the relevant portions of [WTSA-16 Resolution 2](https://www.itu.int/pub/publications.aspx?lang=en&parent=T-RES-T.2-2016http://www.itu.int/dms_pub/itu-t/opb/res/T-RES-T.2-2008-MSW-E.doc).

Part 1 ‑ General areas of study

**ITU‑T Study Group 2**

**Operational aspects of service provision and telecommunication management**

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

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

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

• principles of administering global NNAI resources;

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

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

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

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

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

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

• evolution of the management interface specification methodology;

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

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

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

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

**Annex B**(to Resolution 2) **Points of guidance to ITU-T study groups for the development  
of the post-2020 work programme**

**ITU‑T Study Group 2**

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

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

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

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

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

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

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

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

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

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

• for transmission interfaces between network elements.

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

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

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

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

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

**Annex C**(to WTSA Resolution 2) **List of Recommendations under the responsibility of the respective   
ITU-T study groups and TSAG in the 2017-2020 study period**

**ITU‑T Study Group 2**

ITU‑T E‑series, except those in conjunction with Study Group 17 or under the responsibility of Study Groups 3, 12 and 16

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

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

ITU‑T G.850-series

ITU‑T M-series

ITU‑T O.220-series

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

Maintenance of the ITU‑T S-series

ITU‑T V.51/M.729

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

ITU‑T Z.300-series

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