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SERIES Y: GLOBAL INFORMATION INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS, NEXT-GENERATION NETWORKS, INTERNET OF THINGS AND SMART CITIES

ITU-T Y.3100-series – IMT-2020 standardization roadmap

ITU-T Y-series Recommendations – Supplement 59

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Supplement 59 to ITU-T Y-series Recommendations

ITU-T Y.3100-series – IMT-2020 standardization roadmap

Summary

Supplement 59 to ITU-T Y-series Recommendations represents the snapshot of the current status of standardization activities on IMT-2020. It is based on the IMT-2020 standards roadmap, an online project maintained by the JCA-IMT2020 since its establishment.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
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* To access the Recommendation, type the URL http://handle.itu.int/ in the address field of your web browser, followed by the Recommendation's unique ID. For example, http://handle.itu.int/11.1002/1000/11830-en.

FOREWORD

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The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

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Introduction

This Supplement represents the collection/pointers to the standards and publications of IMT-2020, essential and instrumental for the telecommunication industry showing the full map of activities, technical domains and achievements of ITU, different regional standard development organizations, fora, consortia, and associations operating in the IMT-2020 arena.

Supplement 59 to ITU-T Y-series Recommendations

ITU-T Y.3100-series – IMT-2020 standardization roadmap

1 Scope

This Supplement provides the standardization roadmap for IMT-2020 area in the telecommunication sector. It addresses the following subjects:

- The collection/pointers to the standards and publications of IMT-2020 deliverables in ITU-T study groups (SGs) and other standards development organisations (SDOs);
- Responsible group (owner);
- Status;
- Subject;
- Topics.

2 References

[ITU-T Y.3100] Recommendation ITU-T Y.3100 (2018), *Terms and definitions for IMT-2020 network.*

[ITU-T Y.3101] Recommendation ITU-T Y.3101 (2018), *Requirements of the IMT-2020 network.*

[ITU-T Y.3102] Recommendation ITU-T Y.3102 (2018), *Framework of the IMT-2020 network.*

[ITU-T Y.3104] Recommendation ITU-T Y.3104 (2018), *Architecture of the IMT-2020 network*

[ITU-T Y.3110] Recommendation ITU-T Y.3110 (2017), *IMT-2020 network management and orchestration requirements*.

[ITU-T Y.3111] Recommendation ITU-T Y.3111 (2017), *IMT-2020 network management and orchestration framework.*

3 Terms and definitions

3.1 Terms defined elsewhere

This Supplement uses the following terms defined elsewhere:

3.1.1 backhaul [ITU-T Y.3100]: A network path between base station systems and a core network.

3.1.2 fixed mobile convergence [ITU-T Y.3100]: In the context of IMT-2020, the capabilities that provide services and applications to end users regardless of the fixed or mobile access technologies being used and independently of the users' location.

3.1.3 fronthaul [ITU-T Y.3100]: A network path between centralized radio controllers and remote radio units of a base station function.

3.1.4 functional architecture [b-ITU-T Y.4406]: A set of functional entities used to describe the structure of an NGN. These functional entities are separated by reference points, and thus, they define the distribution of functions. The functional entities can be used to describe a set of reference configurations. These reference configurations identify which reference points are visible at the boundaries of equipment implementations and between administrative domains.

3.1.5 IMT-2020 [ITU-T Y.3100]: (Based on [ITU-R M.2083-0]) Systems, system components, and related technologies that provide far more enhanced capabilities than those described in [b-ITU-R M.1645].

NOTE – [b-ITU-R M.1645] defines the framework and overall objectives of the future development of IMT-2000 and systems beyond IMT-2000 for the radio access network.

3.1.6 management [ITU-T Y.3100]: In the context of IMT-2020, the processes aiming at fulfilment, assurance, and billing of services, network functions, and resources in both physical and virtual infrastructure including compute, storage, and network resources.

3.1.7 network function [ITU-T Y.3100]: In the context of IMT-2020, a processing function in a network.

NOTE 1 – Network functions include but are not limited to network node functionalities, e.g., session management, mobility management and transport functions, whose functional behaviour and interfaces are defined.

NOTE 2 – Network functions can be implemented on a dedicated hardware or as virtualized software functions.

NOTE 3 – Network functions are not regarded as resources, but rather any network functions can be instantiated using the resources.

3.1.8 network slice [ITU-T Y.3100]: A logical network that provides specific network capabilities and network characteristics.

NOTE 1 – Network slices enable the creation of customized networks to provide flexible solutions for different market scenarios which have diverse requirements, with respect to functionalities, performance and resource allocation.

NOTE 2 – A network slice may have the ability to expose its capabilities.

NOTE 3 – The behaviour of a network slice is realized via network slice instance(s).

3.1.9 network slice blueprint [ITU-T Y.3100]: A complete description of the structure, configuration and work flows on how to create and control a network slice instance during its life cycle.

NOTE – A network slice template can be used synonymously with a network slice blueprint.

3.1.10 network slice instance [ITU-T Y.3100]: An instance of network slice, which is created based on a network slice blueprint.

NOTE 1 – A network slice instance is composed of a set of managed run-time network functions, and physical/logical/virtual resources to run these network functions, forming a complete instantiated logical network to meet certain network characteristics required by the service instance(s).

NOTE 2 – A network slice instance may also be shared across multiple service instances provided by the network operator. A network slice instance may be composed of none, one or more sub-network slice instances which may be shared with another network slice instance.

3.1.11 network softwarization [ITU-T Y.3100]: An overall approach for designing, implementing, deploying, managing and maintaining network equipment and/or network components by software programming.

NOTE – Network softwarization exploits the nature of software such as flexibility and rapidity all along the lifecycle of network equipment and/or components, for the sake of creating conditions that enable the re-design of network and services architectures, the optimization of costs and processes, self-management and bring added values in network infrastructures.

3.1.12 network virtualization [ITU-T Y.3011]: A technology that enables the creation of logically isolated network partitions over shared physical networks so that heterogeneous collection of multiple virtual networks can simultaneously coexist over the shared networks. This includes the aggregation of multiple resources in a provider and appearing as a single resource.

3.1.13 orchestration [ITU-T Y.3100]: In the context of IMT-2020, the processes aiming at the automated arrangement, coordination, instantiation and use of network functions and resources for both physical and virtual infrastructures by optimization criteria.

3.1.14 service instance [ITU-T Y.3100]: An instance of a service that is realized within a network slice.

NOTE 1 – A service may be represented by one or more service instances.

NOTE 2 – A service instance may be provided by the network slice operator or a third party.

3.1.15 software-defined networking [ITU-T Y.3300]: A set of techniques that enables to directly program, orchestrate, control and manage network resources, which facilitates the design, delivery and operation of network services in a dynamic and scalable manner.

3.1.16 user plane [b-ITU-T Y.1714]: Refers to the set of traffic forwarding components through which traffic flows.

NOTE – "User plane" is referred to as "transport plane" in other ITU-T Recommendations.

3.1.17 virtualized network function [b-ITU-T Y.3321]: A network function whose functional software is decoupled from hardware, and runs on virtual machine(s).

3.2 Terms defined in this Supplement

None.

4 Abbreviations and acronyms

This Supplement uses the following abbreviations and acronyms:

3GPP	3rd Generation Partnership Project
5GCN	5G Core Network
5GS	5G System
AGF	Aggregator Gateway Function
AMS	Analog/Mixed-Signal
API	Application Programming Interface
BBF	Broadband Forum
BNG	Broadband Network Gateway
CM	Configuration Management
CT	Core network and Terminals
CUPS	Control and User Plane Separation
D2D	Device to Device
E2E	End to End
EE	Energy Efficiency
eMBB	Enhanced Mobile Broadband
EMC	Electromagnetic Compatibility
EMF	Electromagnetic field
ENNI	External Network Network Interface
EPS	Evolved Packet System
ETSI	European Telecommunications Standards Institute
E-UTRAN	Evolved Universal Terrestrial Radio Access Network
EVC	Ethernet Virtual Connection

FlexE	Flexible Ethernet
FM	Fault Management
FMC	Fixed-Mobile Convergence
FMIF	Fixed Mobile Interworking Function
FTTdp	Fibre To The distribution point
GPRS	General Packet Radio Service
ICNIRP	International Commission for Non-Ionizing Radiation Protection
ICT	Information and Communication Technologies
IEEE	Institute of Electrical and Electronics Engineers
IMT	International Mobile Telecommunications
IMT-Advanced	International Mobile Telecommunications-Advanced
IoT	Internet of Things
IP	Intellectual Property
ITS	Intelligent Transportation Systems
KPI	Key Performance Indicator
LAN	Local Area Network
LCM	Life Cycle Management
LCS	Location Services
LR-WPAN	Low-Rate Wireless Personal Area Network
MAC	Medium Access Control
MAN	Metro Area Network
MANO	Management and Orchestration
MEC	Mobile Edge Computing
MEF	Metro Ethernet Forum
MPLS	Multiprotocol Label Switching
MTC	Massive Machine Type Communications
NaaS	Network as a Service
NAS	Non-Access-Stratum
NFV	Network Functions Virtualisation
NFVI	Network Function Virtualization Infrastructure
NGMN	Next Generation Mobile Networks
NGSON	Next Generation Service Overlay Network
NRM	Network Resource Model
NSA	Non-standalone
OTN	Optical Transport Network
PAC	Peer Aware Communication
PHY	Physical Layer

PICS	Protocol Implementation Conformance Statement
PM	Performance Management
PON	Passive Optical Network
QoS	Quality of Service
RAN	Radio Access Network
REST	Representational state transfer
RF-EMF	Radio Frequency Electromagnetic Field
RFID	Radio Frequency Identification
ROOF	Real-time Onsite Operations Facilitation
SA	Standalone
SA	Services and systems Aspects
SAR	Specific Absorption Rate
SDN	Software Defined Networking
SOAM FM IA	Service OAM Fault Management Implementation Agreement
SOAM	Service OAM
SoC	System on Chip
TEDS	Transducer Electronic Data Sheet
TM Forum	TeleManagement Forum
TSG	Technical Specification Groups
UE	User Equipment
ULI	Upper Layer Interface
UML	Unified Modelling Language
URLLC	Ultra-Reliable Low Latency Communications
V2X	Vehicle to Everything
VHDL	VHSIC Hardware Description Language
vNID	Virtual NID
WAVE	Wireless Access in Vehicular Environments
WLAN	Wireless Local Area Network
WPAN	Wireless Personal Area Networks
WRAN	Wireless Regional Area Networks
YANG	Yet Another Next Generation

5 Conventions

None.

6 IMT-2020 network overview

The IMT-2020 network will enable a variety of services, including enhanced mobile broadband (eMBB) services, massive machine type communications (MTC) based services and ultra-reliable

low latency communications (URLLC) based services [ITU-T Y.3101], on an infrastructure of network and computing resources.

Among the numerous features of the IMT-2020 network, the following are specific key features which characterize the IMT-2020 network:

– Distributed architecture based on softwarized network functions,
– Access network agnostic common core network,
– Network slicing.

The following requirements constitute design considerations for the IMT-2020 network architecture:

– Support of network slicing,
– Support of network capability exposure,
– Common interface to support access network agnostic common core network,
– Separation of control plane and user plane,
– Efficient support of different mobility requirements,
– Support of low latency requirements,
– Leveraging existing techniques including NFV/SDN.

7 IMT-2020 standards roadmap

7.1 3GPP

The 3rd Generation Partnership Project (3GPP) unites seven telecommunications standard development organizations (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC), known as "Organizational Partners" and provides their members with a stable environment to produce the Reports and Specifications that define 3GPP technologies.

The project covers cellular telecommunications network technologies, including radio access, the core transport network, and service capabilities – including work on codecs, security, and quality of service – and thus provides complete system specifications. The specifications also provide hooks for non-radio access to the core network (CN), and for interworking with Wi-Fi networks.

There are three Technical Specification Groups (TSG) in 3GPP: Radio Access Networks (RAN), Services and Systems Aspects (SA), and Core Network and Terminals (CT).

The current main focus of 3GPP is specifications for IMT-2020/5G.

Table 7-1 provides a list of 3GPP deliverables associated with IMT-2020 networks.

Table 7-1 – 3GPP deliverables

Name	Responsible group	Status	Subject	Topics
3GPP TS 22.261	3GPP TSG SA	Under change control	Service requirements for the 5G system; Stage 1	IMT-2020
3GPP TS 23.273	3GPP TSG SA	Under change control	5G System (5GS) Location Services (LCS); Stage 2	IMT-2020
3GPP TS 23.278	3GPP TSG CT	Under change control	Customised Applications for Mobile network Enhanced Logic (CAMEL) Phase 4; Stage 2; IM CN Interworking	IMT-2020

Table 7-1 – 3GPP deliverables

Name	Responsible group	Status	Subject	Topics
3GPP TS 23.288	3GPP TSG SA	Under change control	Architecture enhancements for 5G System (5GS) to support network data analytics services	IMT-2020
3GPP TS 23.316	3GPP TSG SA	Under change control	Wireless and wireline convergence access support for the 5G System (5GS)	IMT-2020
3GPP TS 23.401	3GPP TSG SA	Under change control	General Packet Radio Service (GPRS) enhancements for Evolved Universal Terrestrial Radio Access Network (E-UTRAN) access	IMT-2020
3GPP TS 23.501	3GPP TSG SA	Under change control	System Architecture for the 5G System; Stage 2	IMT-2020
3GPP TS 23.502	3GPP TSG SA	Under change control	Procedures for the 5G System (5GS): Stage 2	IMT-2020
3GPP T S 23.503	3GPP TSG SA	Under change control	Policy and Charging Control Framework for the 5G System (5GS); Stage 2	IMT-2020
3GPP TS 24.501	3GPP TSG CT	Under change control	Non-Access-Stratum (NAS) protocol for 5G System (5GS); Stage 3	IMT-2020
3GPP TS 24.502	3GPP TSG CT1	Under change control	Access to the 3GPP 5G Core Network (5GCN) via non-3GPP access networks	IMT-2020
3GPP TS 24.526	3GPP TSG CT	Under change control	User Equipment (UE) policies for 5G System (5GS); Stage 3	IMT-2020
3GPP TS 28.310	3GPP TSG SA	Under change control	Management and orchestration; Energy efficiency (EE) of 5G	IMT-2020
3GPP TS 28.500	3GPP TSG SA	Under change control	Telecommunication management; Management concept, architecture and requirements for mobile networks that include virtualized network functions	IMT-2020
3GPP TS 28.510	3GPP TSG SA	Under change control	Telecommunication management; Configuration Management (CM) for mobile networks that include virtualized network functions; Requirements	IMT-2020

Table 7-1 – 3GPP deliverables

Name	Responsible group	Status	Subject	Topics
3GPP TS 28.511	3GPP TSG SA	Under change control	Telecommunication management; Configuration Management (CM) for mobile networks that include virtualized network functions; Procedures	IMT-2020
3GPP TS 28.515	3GPP TSG SA	Under change control	Telecommunication management; Fault Management (FM) for mobile networks that include virtualized network functions; Requirements	IMT-2020
3GPP TS 28.516	3GPP TSG SA	Under change control	Telecommunication management; Fault Management (FM) for mobile networks that include virtualized network functions; Procedures	IMT-2020
3GPP TS 28.517	3GPP TSG SA	Under change control	Telecommunication management; Fault Management (FM) for mobile networks that include virtualized network functions; Stage 2	IMT-2020
3GPP TS 28.518	3GPP TSG SA	Under change control	Telecommunication management; Fault Management (FM) for mobile networks that include virtualized network functions; Stage 3	IMT-2020
3GPP TS 28.520	3GPP TSG SA	Under change control	Performance Management (PM) for mobile networks that include virtualized network functions; Requirements	IMT-2020
3GPP TS 28.521	3GPP TSG SA	Under change control	Performance Management (PM) for mobile networks that include virtualized network functions; Procedures	IMT-2020
3GPP TS 28.523	3GPP TSG SA5	Under change control	Telecommunication management; Performance Management (PM) for mobile networks that include virtualized network functions; Stage 3	IMT-2020
3GPP TS 28.525	3GPP TSG SA5	Under change control	Telecommunication management; Life Cycle	IMT-2020

Table 7-1 – 3GPP deliverables

Name	Responsible group	Status	Subject	Topics
			Management (LCM) for mobile networks that include virtualized network functions; Requirements	
3GPP TS 28.526	3GPP TSG SA5	Under change control	Telecommunication management; Life Cycle Management (LCM) for mobile networks that include virtualized network functions; Procedures	IMT-2020
3GPP TS 28.527	3GPP TSG SA5	Under change control	Life Cycle Management (LCM) for mobile networks that include virtualized network functions; Stage 2	IMT-2020
3GPP TS 28.528	3GPP TSG SA5	Under change control	Telecommunication management; Life Cycle Management (LCM) for mobile networks that include virtualized network functions; Stage 3	IMT-2020
3GPP TS 28.530	3GPP TSG SA5	Under change control	Management and orchestration; Concepts, use cases and requirements	IMT-2020
3GPP TS 28.531	3GPP TSG SA	Under change control	Management and orchestration; Provisioning	IMT-2020
3GPP TS 28.532	3GPP TSG SA5	Under change control	Management and orchestration; Generic management services	IMT-2020
3GPP TS 28.533	3GPP TSG SA5	Under change control	Management and orchestration; Architecture framework	IMT-2020
3GPP TS 28.541	3GPP TSG SA5	Under change control	Management and orchestration; 5G Network Resource Model (NRM); Stage 2 and stage 3	IMT-2020
3GPP TS 29.500	3GPP TSG CT4	Under change control	5G System; Technical Realization of Service Based Architecture; Stage 3	IMT-2020
3GPP TS 29.501	3GPP TSG CT4	Under change control	5G System; Principles and Guidelines for Services Definition; Stage 3	IMT-2020
3GPP TS 29.502	3GPP TSG CT4	Under change control	5G System; Session Management Services; Stage 3	IMT-2020

Table 7-1 – 3GPP deliverables

Name	Responsible group	Status	Subject	Topics
3GPP TS 29.503	3GPP TSG CT4	Under change control	5G System; Unified Data Management Services; Stage 3	IMT-2020
3GPP TS 29.507	3GPP TSG CT3	Under change control	5G System; Access and Mobility Policy Control Service; Stage 3	IMT-2020
3GPP TS 29.508	3GPP TSG CT3	Under change control	5G System; Session Management Event Exposure Service; Stage 3	IMT-2020
3GPP TS 29.509	3GPP TSG CT4	Under change control	5G System; Authentication Server Services; Stage 3	IMT-2020
3GPP TS 29.510	3GPP TSG CT4	Under change control	5G System; Network function repository services; Stage 3	IMT-2020
3GPP TS 29.511	3GPP TSG CT4	Under change control	5G System; Equipment Identity Register Services; Stage 3	IMT-2020
3GPP TS 29.512	3GPP TSG CT3	Under change control	5G System; Session Management Policy Control Service; Stage 3	IMT-2020
3GPP TS 29.513	3GPP TSG CT3	Under change control	5G System; Policy and Charging Control signalling flows and QoS parameter mapping; Stage 3	IMT-2020
3GPP TS 29.514	3GPP TSG CT3	Under change control	5G System; Policy Authorization Service; Stage 3	IMT-2020
3GPP TS 29.519	3GPP TSG CT3	Under change control	5G System; Usage of the Unified Data Repository Service for Policy Data, Application Data and Structured Data for Exposure; Stage 3	IMT-2020
3GPP TS 29.520	3GPP TSG CT3	Under change control	5G System; Network Data Analytics Services; Stage 3	IMT-2020
3GPP TS 29.531	3GPP TSG CT4	Under change control	5G System; Network Slice Selection Services; Stage 3	IMT-2020
3GPP TS 29.540	3GPP TSG CT4	Under change control	5G System; SMS Services; Stage 3	IMT-2020
3GPP TS 29.561	3GPP TSG CT3	Under change control	5G System; Interworking between 5G Network and external Data Networks; Stage 3	IMT-2020

Table 7-1 – 3GPP deliverables

Name	Responsible group	Status	Subject	Topics
3GPP TS 29.571	3GPP TSG CT4	Under change control	5G System; Common Data Types for Service Based Interfaces; Stage 3	IMT-2020
3GPP TS 32.972	3GPP TSG SA5	Under change control	Telecommunication management; Study on system and functional aspects of energy efficiency in 5G networks	IMT-2020
3GPP TS 33.501	3GPP TSG SA3	Under change control	Security architecture and procedures for 5G System	IMT-2020
3GPP TS.28.522	3GPP TSG SA5	Under change control	Telecommunication management; Performance Management (PM) for mobile networks that include virtualized network functions; Stage 2	IMT-2020
3GPP TS 22.261	3GPP TSG SA	Under change control	Service requirements for the 5G system	IMT-2020
3GPP TS 23.501	3GPP TSG SA2	Under change control	System architecture for the 5G System (5GS)	IMT-2020
3GPP TS 23.502	3GPP TSG SA2	Under change control	Procedures for the 5G System (5GS)	IMT-2020
3GPP TS 23.503	3GPP TSG SA2	Under change control	Policy and charging control framework for the 5G System (5GS); Stage 2	IMT-2020
3GPP TS 24.501	3GPP TSG CT1	Under change control	Non-Access-Stratum (NAS) protocol for 5G System (5GS); Stage 3	IMT-2020
3GPP TS 24.502	3GPP TSG CT1	Under change control	Access to the 3GPP 5G System (5GS) via non-3GPP access networks	IMT-2020
3GPP TS 28.500	3GPP TSG SA5	Under change control	Telecommunication management; Management concept; architecture and requirements for mobile networks that include virtualized network functions	IMT-2020
3GPP TS 28.510	3GPP TSG SA5	Under change control	Telecommunication management; Configuration Management (CM) for mobile networks that include virtualized network functions; Requirements	IMT-2020

Table 7-1 – 3GPP deliverables

Name	Responsible group	Status	Subject	Topics
3GPP TS 28.511	3GPP TSG SA5	Under change control	Telecommunication management; Configuration Management (CM) for mobile networks that include virtualized network functions; Procedures	IMT-2020
3GPP TS 28.512	3GPP TSG SA5	Under change control	Telecommunication management; Configuration Management (CM) for mobile networks that include virtualized network functions; Stage 2	IMT-2020
3GPP TS 28.513	3GPP TSG SA5	Under change control	Telecommunication management; Configuration Management (CM) for mobile networks that include virtualized network functions; Stage 3	IMT-2020
3GPP TS 28.515	3GPP TSG SA5	Under change control	Telecommunication management; Fault Management (FM) for mobile networks that include virtualized network functions; Requirements	IMT-2020
3GPP TS 28.516	3GPP TSG SA5	Under change control	Telecommunication management; Fault Management (FM) for mobile networks that include virtualized network functions; Procedures	IMT-2020
3GPP TS 28.517	3GPP TSG SA5	Under change control	Telecommunication management; Fault Management (FM) for mobile networks that include virtualized network functions; Stage 2	IMT-2020
3GPP TS 28.518	3GPP TSG SA5	Under change control	Telecommunication management; Fault Management (FM) for mobile networks that include virtualized network functions; Stage 3	IMT-2020
3GPP TS 28.520	3GPP TSG SA5	Under change control	Telecommunication management; Performance Management (PM) for mobile networks that include	IMT-2020

Table 7-1 – 3GPP deliverables

Name	Responsible group	Status	Subject	Topics
			virtualized network functions; Requirements	
3GPP TS 28.523	3GPP TSG SA5	Under change control	Telecommunication management; Performance Management (PM) for mobile networks that include virtualized network functions; Stage 3	IMT-2020
3GPP TS 28.525	3GPP TSG SA5	Under change control	Telecommunication management; Life Cycle Management (LCM) for mobile networks that include virtualized network functions; Requirements	IMT-2020
3GPP TS 28.526	3GPP TSG SA5	Under change control	Telecommunication management; Life Cycle Management (LCM) for mobile networks that include virtualized network functions; Procedures	IMT-2020
3GPP TS 28.527	3GPP TSG SA5	Under change control	Telecommunication management; Life Cycle Management (LCM) for mobile networks that include virtualized network functions; Stage 2	IMT-2020
3GPP TS 28.528	3GPP TSG SA5	Under change control	Telecommunication management; Life Cycle Management (LCM) for mobile networks that include virtualized network functions; Stage 3	IMT-2020
3GPP TS 28.530	3GPP TSG SA5	Under change control	Management and orchestration; Concepts, use cases and requirements	IMT-2020
3GPP TS 28.531	3GPP TSG SA5	Under change control	Management and orchestration; Provisioning	IMT-2020
3GPP TS 29.500	3GPP TSG CT4	Under change control	5G System; Technical Realization of Service Based Architecture; Stage 3	IMT-2020
3GPP TS 29.501	3GPP TSG CT4	Under change control	5G System; Principles and Guidelines for Services Definition; Stage 3	IMT-2020
3GPP TS 29.502	3GPP TSG CT4	Under change control	5G System; Session Management Services; Stage 3	IMT-2020

Table 7-1 – 3GPP deliverables

Name	Responsible group	Status	Subject	Topics
3GPP TS 29.503	3GPP TSG CT4	Under change control	5G System; Unified Data Management Services; Stage 3	IMT-2020
3GPP TS 29.507	3GPP TSG CT4	Under change control	5G System; Access and Mobility Policy Control Service; Stage 3	IMT-2020
3GPP TS 29.508	3GPP TSG CT3	Under change control	5G System; Session Management Event Exposure Service; Stage 3	IMT-2020
3GPP TS 29.509	3GPP TSG CT4	Under change control	5G System; Authentication Server Services; Stage 3	IMT-2020
3GPP TS 29.510	3GPP TSG CT4	Under change control	5G System; Network function repository services; Stage 3	IMT-2020
3GPP TS 29.511	3GPP TSG CT4	Under change control	5G System; Equipment Identity Register Services; Stage 3	IMT-2020
3GPP TS 29.512	3GPP TSG CT3	Under change control	5G System; Session Management Policy Control Service; Stage 3	IMT-2020
3GPP TS 29.513	3GPP TSG CT3	Under change control	5G System; Policy and Charging Control signalling flows and QoS parameter mapping; Stage 3	IMT-2020
3GPP TS 29.514	3GPP TSG CT3	Under change control	5G System; Policy Authorization Service; Stage 3	IMT-2020
3GPP TS 29.518	3GPP TSG CT4	Under change control	5G System; Access and Mobility Management Services; Stage 3	IMT-2020
3GPP TS 29.519	3GPP TSG CT3	Under change control	5G System; Usage of the Unified Data Repository Service for Policy Data, Application Data and Structured Data for Exposure; Stage 3	IMT-2020
3GPP TS 29.520	3GPP TSG CT3	Under change control	5G System; Network Data Analytics Services; Stage 3	IMT-2020
3GPP TS 29.531	3GPP TSG CT4	Under change control	5G System; Network Slice Selection Services; Stage 3	IMT-2020
3GPP TS 29.540	3GPP TSG CT4	Under change control	5G System; SMS Services; Stage 3	IMT-2020

Table 7-1 – 3GPP deliverables

Name	Responsible group	Status	Subject	Topics
3GPP TS 29.561	3GPP TSG CT3	Under change control	5G System; Interworking between 5G Network and external Data Networks; Stage 3	IMT-2020
3GPP TS 29.571	3GPP TSG CT4	Under change control	5G System; Common Data Types for Service Based Interfaces; Stage 3	IMT-2020
3GPP TS 33.501	3GPP TSG SA3	Under change control	Security Architecture and Procedures for 5G System	IMT-2020
3GPP TS.28.522	3GPP TSG SA5	Under change control	Telecommunication management; Performance Management (PM) for mobile networks that include virtualized network functions; Stage 2	IMT-2020

7.2 Broadband Forum

The Broadband Forum, a non-profit industry organization, is focused on engineering smarter and faster broadband networks. Their work defines best practices for global networks, enables service and content delivery, establishes technology migration strategies, engineers critical device and service management tools, and is key to redefining broadband. Free technical reports and white papers can be found at broadband-forum.org.

Table 7-2 provides a list of Broadband Forum deliverables associated with IMT-2020 networks.

Table 7-2 – Broadband Forum deliverables

Name	Responsible group	Status	Subject	Topics
BBF TR-293	Broadband Forum	Published	Energy Efficient Mobile Backhaul	IMT-2020
BBF MR-427	Broadband Forum	Published	5G Fixed Mobile Convergence – Marketing Report	IMT-2020
BBF MR-464	Broadband Forum	Published	Migrating Fixed Access to 5G Core	IMT-2020
BBF SD-406	Broadband Forum	Draft	End-to-End Network Slicing	IMT-2020
BBF SD-407	Broadband Forum	Draft	5G Fixed Mobile Convergence	IMT-2020

Table 7-2 – Broadband Forum deliverables

Name	Responsible group	Status	Subject	Topics
BBF WT-521	Broadband Forum	Draft	Study Document for 5G Transport Networks	IMT-2020
BBF SDxFlexEMPLS45G	Broadband Forum	Draft	Flexible Ethernet (FlexE) use with MPLS networks	IMT-2020
BBF TR-355 Amendment 2	Broadband Forum	Published	YANG Modules for FTTdp Management	IMT-2020
BBF TR-383 Amendment 2	Broadband Forum	Published	Common YANG Modules for Access Networks	IMT-2020
BBF TR-221a2	Broadband Forum	Published	Technical Specifications for MPLS in Mobile Backhaul Networks, Amendment 2	IMT-2020
BBF WT-456	Broadband Forum	Draft	AGF Functional Requirements	IMT-2020
BBF WT-458	Broadband Forum	Draft	CUPS for 5G FMC	IMT-2020
BBF MR-459	Broadband Forum	Published	Control and User Plane Separation for a Disaggregated BNG	IMT-2020
BBF WT-460	Broadband Forum	Draft	YANG Modules for Broadband Network Gateways	IMT-2020
BBF WT-521	Broadband Forum	Draft	5G Transport Networks	IMT-2020
WT-457	Broadband Forum	Draft	FMIF Functional Requirements	IMT-2020

7.3 ETSI

The European Telecommunications Standards Institute (ETSI) is an independent, non-profit, standardization organization in the telecommunications industry (equipment makers and network operators) in Europe, headquartered in Sophia-Antipolis, France, with worldwide projection. ETSI produces – standards that are globally applicable for information and communication technologies (ICT), including fixed, mobile, radio, converged, broadcast and internet technologies.

Table 7-3 provides a list of ETSI deliverables associated with IMT-2020 networks.

Table 7-3 – ETSI deliverables

Name	Responsible group	Status	Subject	Topics
ETSI DGS/MEC-0028WlanAPI	ETSI ISG MEC	Draft	Multi-access Edge Computing (MEC); WLAN Information API	IMT-2020
ETSI DGS/NFV-SOL011 (GS)	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 3; Protocols and Data Models; RESTful protocols specification for the Or-Or Reference Point	IMT-2020
ETSI DMI/MEC-DEC34	ETSI ISG MEC	Draft	Multi-access Edge Computing (MEC) MEC Sandbox	IMT-2020
ETSI DMI/NFV-SOL008 (MI)	ETSI ISG NFV	Draft	Network Functions Virtualisation (NFV); Protocol and Data Models; Creation and Management of the OpenAPI Work Programme	IMT-2020
ETSI GS NFV-TST 009	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 3; Testing; Specification of Networking Benchmarks and Measurement Methods for NFVI	IMT-2020
ETSI GR MEC 017	ETSI ISG MEC	Published	Mobile Edge Computing (MEC); Deployment of Mobile Edge Computing in an NFV environment	IMT-2020
ETSI GR MEC 018	ETSI ISG MEC	Published	Mobile Edge Computing (MEC); End to End Mobility Aspects	IMT-2020
ETSI GR MEC 022	ETSI ISG MEC	Published	Multi-access Edge Computing (MEC); Study on MEC Support for V2X Use Cases	IMT-2020
ETSI GR MEC 024	ETSI ISG MEC	Published	Multi-access Edge Computing (MEC); Support for network slicing	IMT-2020

Table 7-3 – ETSI deliverables

Name	Responsible group	Status	Subject	Topics
ETSI GR MEC 027	ETSI ISG MEC	Published	Multi-access Edge Computing (MEC); Study on MEC support for alternative virtualization technologies	IMT-2020
ETSI GR MEC 031	ETSI ISG MEC	Draft	Multi-access Edge Computing (MEC) MEC 5G Integration	IMT-2020
ETSI GR MEC-DEC 023	ETSI ISG MEC	Draft	Multi-access Edge Computing (MEC); Describing ETSI MEC RESTful APIs using the OpenAPI specification	IMT-2020
ETSI GR MEC-DEC 025	ETSI ISG MEC	Published	Multi-access Edge Computing (MEC); MEC Testing Framework	IMT-2020
ETSI GR mWT 012	ETSI ISG mWT	Published	5G Wireless Backhaul/X-Haul	IMT-2020
ETSI GR mWT 016	ETSI ISG mWT	Published	Applications and use cases of Software Defined Networking (SDN) as related to microwave and millimetre wave transmission	IMT-2020
ETSI GR NFV 001	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Use Cases	IMT-2020
ETSI GR NFV-EVE 008	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 3; Charging; Report on Usage Metering and Charging Use Cases and Architectural Study	IMT-2020
ETSI GR NFV-EVE 013	ETSI ISG NFV	Draft	Network Functions Virtualisation (NFV); Connection Based Virtual Services; Report on Connection Based Virtual Services Support with ETSI NFV Architecture Framework	IMT-2020

Table 7-3 – ETSI deliverables

Name	Responsible group	Status	Subject	Topics
ETSI GR NFV-EVE 017	ETSI ISG NFV	Draft	Network Functions Virtualisation (NFV); Management and Orchestration; Report on the support of real-time/ultra-low latency aspects in NFV related to service and network handling	IMT-2020
ETSI GR NFV-IFA 012	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; Report on Os-Ma-Nfvo reference point – application and service management use cases and recommendations	IMT-2020
ETSI GR NFV-IFA 015	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 2; Management and Orchestration; Report on NFV Information Model	IMT-2020
ETSI GR NFV-IFA 016	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 2; Information Modeling; Papyrus Guidelines	IMT-2020
ETSI GR NFV-IFA 017	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 2; Information Modeling; UML Modeling Guidelines	IMT-2020
ETSI GR NFV-IFA 021	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; Report on management of NFV-MANO and automated deployment of EM and other OSS functions	IMT-2020

Table 7-3 – ETSI deliverables

Name	Responsible group	Status	Subject	Topics
ETSI GR NFV-IFA 022	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; Report on Management and Connectivity for Multi-Site Services	IMT-2020
ETSI GR NFV-IFA 023	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Management and Orchestration; Report on Policy Management in MANO; Release 3	IMT-2020
ETSI GR NFV-IFA 024	ETSI ISG NFV	Published	Network Function Virtualisation (NFV) Release 2; Information Modeling; Report on External Touchpoints related to NFV Information Model	IMT-2020
ETSI GR NFV-IFA 028	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; Report on architecture options to support multiple administrative domains	IMT-2020
ETSI GR NFV-IFA 029	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 3; Architecture; Report on the Enhancements of the NFV architecture towards "Cloud-native" and "PaaS"	IMT-2020
ETSI GR NFV-IFA 034	ETSI ISG NFV	Draft	Network Function Virtualization (NFV) Release 3; Management and Orchestration; Report on Architectural enhancement for VNF License Management support and use of VNF licenses	IMT-2020

Table 7-3 – ETSI deliverables

Name	Responsible group	Status	Subject	Topics
ETSI GR NFV-REL 007	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Reliability; Report on the resilience of NFV-MANO critical capabilities	IMT-2020
ETSI GR NFV-REL 008	ETSI ISG NFV	Draft -stopped	Network Functions Virtualisation (NFV); Reliability; Report on Error Handling: Detection, Correlation, Notification	IMT-2020
ETSI GR NFV-REL 010	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 3; Reliability; Report on NFV Resiliency for the Support of Network Slicing	IMT-2020
ETSI GR NFV-SEC 005	ETSI ISG NFV	Published	Network Functions Virtualization (NFV); Trust; Report on Certificate Management	IMT-2020
ETSI GR NFV-SEC 007	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Trust; Report on Attestation Technologies and Practices for Secure Deployments	IMT-2020
ETSI GR NFV-SEC 011	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Security; Report on NFV LI Architecture	IMT-2020
ETSI GR NFV-SEC 016	ETSI ISG NFV	Draft	Network Functions Virtualisation (NFV); Security; Report on location, timestamping of VNFs	IMT-2020
ETSI GR NFV-SEC 017	ETSI ISG NFV	Draft -stopped	Network Functions Virtualisation (NFV); Security; Security Policy Guidelines Report	IMT-2020

Table 7-3 – ETSI deliverables

Name	Responsible group	Status	Subject	Topics
ETSI GR NFV-TST 004	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Testing; Guidelines for Test Plan on Path Implementation through NFVI	IMT-2020
ETSI GR NFV-TST 005	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Continuous Development and Integration; Report on use cases and recommendations for VNF Snapshot	IMT-2020
ETSI GR NFV-TST 006	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Testing; Report on CICD and Devops	IMT-2020
ETSI GR NFV-TST 007	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Testing; Guidelines on Interoperability Testing for MANO	IMT-2020
ETSI GR NFV-TST 011	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Testing; Test Domain and Description Language Recommendations	IMT-2020
ETSI GR NFV-TST 012	ETSI ISG NFV	Draft	Network Function Virtualisation (NFV); Testing; VIM & NFVI Control and Management Performance Evaluation	IMT-2020
ETSI GS MEC 001	ETSI ISG MEC	Published	Multi-access Edge Computing (MEC); Terminology	IMT-2020
ETSI GS MEC 002	ETSI ISG MEC	Published	Multi-access Edge Computing (MEC); Phase 2: Use Cases and Requirements	IMT-2020
ETSI GS MEC 003	ETSI ISG MEC	Published	Multi-access Edge Computing (MEC); Framework and Reference Architecture	IMT-2020

Table 7-3 – ETSI deliverables

Name	Responsible group	Status	Subject	Topics
ETSI GS MEC 009	ETSI ISG MEC	Published	Multi-access Edge Computing (MEC); General principles for MEC Service APIs	IMT-2020
ETSI GS MEC 010-1	ETSI ISG MEC	Published	Mobile Edge Computing (MEC); Mobile Edge Management; Part 1: System, host and platform management	IMT-2020
ETSI GS MEC 010-2	ETSI ISG MEC	Published	Multi-access Edge Computing (MEC); MEC Management; Part 2: Application lifecycle, rules and requirements management	IMT-2020
ETSI GS MEC 011	ETSI ISG MEC	Published	Multi-access Edge Computing (MEC); Edge Platform Application Enablement	IMT-2020
ETSI GS MEC 012	ETSI ISG MEC	Published	Multi-access Edge Computing (MEC); Radio Network Information API	IMT-2020
ETSI GS MEC 013	ETSI ISG MEC	Published	Multi-access Edge Computing (MEC); Location API	IMT-2020
ETSI GS MEC 014	ETSI ISG MEC	Published	Mobile Edge Computing (MEC); UE Identity API	IMT-2020
ETSI GS MEC 015	ETSI ISG MEC	Published	Mobile Edge Computing (MEC); Bandwidth Management API	IMT-2020
ETSI GS MEC 016	ETSI ISG MEC	Published	Multi-access Edge Computing (MEC); UE application interface	IMT-2020
ETSI GS MEC 021	ETSI ISG MEC	Published	Multi-access Edge Computing (MEC); MEC Application Mobility Service API	IMT-2020
ETSI GS MEC 026	ETSI ISG MEC	Published	Multi-access Edge Computing (MEC); Support for regulatory requirements	IMT-2020

Table 7-3 – ETSI deliverables

Name	Responsible group	Status	Subject	Topics
ETSI GS MEC 028	ETSI ISG MEC	Draft	Multi-access Edge Computing (MEC); WLAN Information API	IMT-2020
ETSI GS MEC 029	ETSI ISG MEC	Published	Multi-access Edge Computing (MEC); Fixed Access Information API	IMT-2020
ETSI GS MEC 030	ETSI ISG MEC	Draft	Multi-access Edge Computing (MEC); V2X Information Service API	IMT-2020
ETSI GS MEC 033	ETSI ISG MEC	Draft	Multi-access Edge Computing (MEC) IoT API	IMT-2020
ETSI GS MEC-DEC 032-1	ETSI ISG MEC	Draft	Multi-access Edge Computing (MEC); API Conformance Test Specification Part 1: Test Requirements and Implementation Conformance Statement (ICS)	IMT-2020
ETSI GS MEC-DEC 032-2	ETSI ISG MEC	Draft	Multi-access Edge Computing (MEC); API Conformance Test Specification Part 2: Test Purposes (TP)	IMT-2020
ETSI GS MEC-DEC 032-3	ETSI ISG MEC	Draft	Multi-access Edge Computing (MEC); API Conformance Test Specification; Part 3: Abstract Test Suite (ATS)	IMT-2020
ETSI GS MEC-IEG 004	ETSI ISG MEC	Published	Mobile-Edge Computing (MEC); Service Scenarios	IMT-2020
ETSI GS MEC-IEG 005	ETSI ISG MEC	Published	Mobile-Edge Computing (MEC); Proof of Concept Framework	IMT-2020
ETSI GS MEC-IEG 006	ETSI ISG MEC	Published	Mobile Edge Computing; Market Acceleration; MEC Metrics Best Practice and Guidelines	IMT-2020
ETSI GS NFV 002	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Architectural Framework	IMT-2020

Table 7-3 – ETSI deliverables

Name	Responsible group	Status	Subject	Topics
ETSI GS NFV 003	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Terminology for Main Concepts in NFV	IMT-2020
ETSI GS NFV 004	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Virtualisation Requirements	IMT-2020
ETSI GS NFV-EVE 001	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Virtualisation Technologies; Hypervisor Domain Requirements specification; Release 3	IMT-2020
ETSI GS NFV-EVE 003	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Ecosystem; Report on NFVI Node Physical Architecture Guidelines for Multi-Vendor Environment	IMT-2020
ETSI GS NFV-EVE 004	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Virtualisation Technologies; Report on the application of Different Virtualisation Technologies in the NFV Framework	IMT-2020
ETSI GS NFV-EVE 005	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Ecosystem; Report on SDN Usage in NFV Architectural Framework	IMT-2020
ETSI GS NFV-EVE 007	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 3; NFV Evolution and Ecosystem; Hardware Interoperability Requirements Specification	IMT-2020
ETSI GS NFV-EVE 011	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 3; Virtualised Network Function;	IMT-2020

Table 7-3 – ETSI deliverables

Name	Responsible group	Status	Subject	Topics
			Specification of the Classification of Cloud Native VNF implementations	
ETSI GS NFV-IFA 001	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Acceleration Technologies; Report on Acceleration Technologies & Use Cases	IMT-2020
ETSI GS NFV-IFA 003	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 2; Acceleration Technologies; vSwitch Benchmarking and Acceleration Specification	IMT-2020
ETSI GS NFV-IFA 004	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 2; Acceleration Technologies; Management Aspects Specification	IMT-2020
ETSI GS NFV-IFA 005	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 2; Management and Orchestration; Or-Vi reference point – Interface and Information Model Specification	IMT-2020
ETSI GS NFV-IFA 006	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 2; Management and Orchestration; Vi-Vnfm reference point – Interface and Information Model Specification	IMT-2020
ETSI GS NFV-IFA 007	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 2; Management and Orchestration; Or-Vnfm reference point – Interface and Information Model Specification	IMT-2020
ETSI GS NFV-IFA 008	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV)	IMT-2020

Table 7-3 – ETSI deliverables

Name	Responsible group	Status	Subject	Topics
			Release 2; Management and Orchestration; Ve-Vnfm reference point – Interface and Information Model Specification	
ETSI GS NFV-IFA 009	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Management and Orchestration; Report on Architectural Options	IMT-2020
ETSI GS NFV-IFA 011	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 2; Management and Orchestration; VNF Descriptor and Packaging Specification	IMT-2020
ETSI GS NFV-IFA 013	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 2; Management and Orchestration; Os-Ma-Nfvo reference point – Interface and Information Model Specification	IMT-2020
ETSI GS NFV-IFA 014	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 2; Management and Orchestration; Network Service Templates Specification	IMT-2020
ETSI GS NFV-IFA 018	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Acceleration Technologies; Network Acceleration Interface Specification; Release 3	IMT-2020
ETSI GS NFV-IFA 019	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Acceleration Technologies; Acceleration Resource Management Interface Specification; Release 3	IMT-2020

Table 7-3 – ETSI deliverables

Name	Responsible group	Status	Subject	Topics
ETSI GS NFV-IFA 026	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; Architecture enhancement for Security Management Specification	IMT-2020
ETSI GS NFV-IFA 027	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 2; Management and Orchestration; Performance Measurements Specification	IMT-2020
ETSI GS NFV-IFA 030	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; Multiple Administrative Domain Aspect Interfaces Specification	IMT-2020
ETSI GS NFV-IFA 031	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; Requirements and interfaces specification for management of NFV-MANO	IMT-2020
ETSI GS NFV-IFA 033	ETSI ISG NFV	Draft	Network Functions Virtualization (NFV) Release 4; Management and Orchestration; Sc-Or, Sc-Vnfm, Sc-Vi reference points – Interface and Information Model Specification	IMT-2020
ETSI GS NFV-IFA012	ETSI ISG NFV	Draft	Network Functions Virtualisation (NFV) Release 3; Management and Orchestration; Report on Os-Ma-Nfvo reference point – application and service management interface and information Model Specification	IMT-2020

Table 7-3 – ETSI deliverables

Name	Responsible group	Status	Subject	Topics
ETSI GS NFV-INF 001	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Infrastructure Overview	IMT-2020
ETSI GS NFV-INF 003	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Infrastructure; Compute Domain	IMT-2020
ETSI GS NFV-INF 004	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Infrastructure; Hypervisor Domain	IMT-2020
ETSI GS NFV-INF 005	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Infrastructure; Network Domain	IMT-2020
ETSI GS NFV-INF 007	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Infrastructure; Methodology to describe Interfaces and Abstractions	IMT-2020
ETSI GS NFV-INF 010	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Service Quality Metrics	IMT-2020
ETSI GS NFV-MAN 001	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Management and Orchestration	IMT-2020
ETSI GS NFV-PER 001	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); NFV Performance & Portability Best Practises	IMT-2020
ETSI GS NFV-PER 002	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Proofs of Concept; Framework	IMT-2020
ETSI GS NFV-REL 001	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Resiliency Requirements	IMT-2020
ETSI GS NFV-REL 002	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Reliability; Report on Scalable Architectures for Reliability Management	IMT-2020

Table 7-3 – ETSI deliverables

Name	Responsible group	Status	Subject	Topics
ETSI GS NFV-REL 003	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Reliability; Report on Models and Features for End-to-End Reliability	IMT-2020
ETSI GS NFV-REL 004	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Assurance; Report on Active Monitoring and Failure Detection	IMT-2020
ETSI GS NFV-REL 005	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Accountability; Report on Quality Accountability Framework	IMT-2020
ETSI GS NFV-REL 006	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 3; Reliability; Maintaining Service Availability and Continuity Upon Software Modification	IMT-2020
ETSI GS NFV-SEC 002	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); NFV Security; Cataloguing security features in management software	IMT-2020
ETSI GS NFV-SEC 003	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); NFV Security; Security and Trust Guidance	IMT-2020
ETSI GS NFV-SEC 004 V1.1.1	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); NFV Security; Privacy and Regulation; Report on Lawful Interception Implications	Lawful interception; Network security; Privacy; IMT-2020
ETSI GS NFV-SEC 006 V1.1.1	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Security Guide; Report on Security Aspects and Regulatory Concerns	Security management standards and guidance documents; IMT-2020

Table 7-3 – ETSI deliverables

Name	Responsible group	Status	Subject	Topics
ETSI GS NFV-SEC 009 V1.1.1	NFV ISG NFV	Published	Network Functions Virtualisation (NFV); NFV Security; Report on use cases and technical approaches for multi-layer host administration	Network security; Security Architectures, Models and Frameworks; IMT-2020
ETSI GS NFV-SEC 010 V1.1.1	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); NFV Security; Report on Retained Data problem statement and requirements	Sector-specific security standards; IMT-2020
ETSI GS NFV-SEC 012 V3.1.1	NFV ISG NFV	Published	Network Functions Virtualisation (NFV) Release 3; Security; System architecture specification for execution of sensitive NFV components	Security Architectures, Models and Frameworks; Security mechanisms; IMT-2020
ETSI GS NFV-SEC 013 V3.1.1	NFV ISG NFV	Published	Network Functions Virtualisation (NFV) Release 3; Security; Security Management and Monitoring specification	Security Architectures, Models and Frameworks; Security management standards and guidance documents; IMT-2020
ETSI GS NFV-SEC 014	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 3; NFV Security; Security Specification for MANO Components and Reference points	IMT-2020
ETSI GS NFV-SEC 015	ETSI ISG NFV	Draft -stopped	Network Function Virtualization (NFV) Release 3; NFV Security; Security Specification for other MANO reference points	IMT-2020
ETSI GS NFV-SEC 020	ETSI ISG NFV	Draft	Network Functions Virtualisation (NFV) Release 3; Security; Identity Management and Security Specification	IMT-2020

Table 7-3 – ETSI deliverables

Name	Responsible group	Status	Subject	Topics
ETSI GS NFV-SEC021	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 2; Security; VNF Package Security Specification	IMT-2020
ETSI GS NFV-SOL 002	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 2; Protocols and Data Models; RESTful protocols specification for the Ve-Vnfm Reference Point	IMT-2020
ETSI GS NFV-SOL 003	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 2; Protocols and Data Models; RESTful protocols specification for the Or-Vnfm Reference Point	IMT-2020
ETSI GS NFV-SOL 004	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 2; Protocols and Data Models; VNF Package specification	IMT-2020
ETSI GS NFV-SOL 005	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 2; Protocols and Data Models; RESTful protocols specification for the Os-Ma-nfvo Reference Point	IMT-2020
ETSI GS NFV-SOL 006	ETSI ISG NFV	Draft	Network Functions Virtualisation (NFV) Release 3; Protocols and Data Models; NFV descriptors based on YANG Specification	IMT-2020
ETSI GS NFV-SOL 007	ETSI ISG NFV	Draft	Network Functions Virtualisation (NFV) Release 3; Protocols and Data Models; Network Service Descriptor File Structure Specification	IMT-2020

Table 7-3 – ETSI deliverables

Name	Responsible group	Status	Subject	Topics
ETSI GS NFV-SOL 009	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 3; Protocols and Data Models: RESTful protocols specification for the management of NFV-MANO	IMT-2020
ETSI GS NFV-SOL 010	ETSI ISG NFV	Draft	Network Functions Virtualisation (NFV) Release 3; Protocols and Data Models; VNF Snapshot Package specification	IMT-2020
ETSI GS NFV-SOL 012	ETSI ISG NFV	Draft	Network Functions Virtualisation (NFV) Release 3; Protocols and Data Models; RESTful protocols specification for the Policy Management Interface	IMT-2020
ETSI GS NFV-SOL 013	ETSI ISG NFV	Draft	Network Functions Virtualisation (NFV) Release 3; Protocols and Data Models; Specification of common aspects for RESTful NFV MANO APIs	IMT-2020
ETSI GS NFV-SWA 001	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Virtual Network Functions Architecture	IMT-2020
ETSI GS NFV-TST 001	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Pre-deployment Testing; Report on Validation of NFV Environments and Services	IMT-2020
ETSI GS NFV-TST 002	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); Testing Methodology; Report on NFV Interoperability Testing Methodology	IMT-2020

Table 7-3 – ETSI deliverables

Name	Responsible group	Status	Subject	Topics
ETSI GS NFV-TST 008	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 3; Testing; NFVI Compute and Network Metrics Specification	IMT-2020
ETSI GS NFV-TST 009	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV) Release 3; Testing; Specification of Networking Benchmarks and Measurement Methods for NFVI	IMT-2020
ETSI MI/MEC-DEC23OpenAPI	ETSI ISG MEC	Draft	Multi-access Edge Computing (MEC); Describing ETSI MEC RESTful APIs using the OpenAPI specification	IMT-2020
ETSI White Paper No. 25	ETSI ISG mWT	Published	Microwave and Millimeter-wave for 5G Transport	IMT-2020
GS NFV-SEC 001	ETSI ISG NFV	Published	Network Functions Virtualisation (NFV); NFV Security; Problem Statement	IMT-2020

7.4 IEEE

The Institute of Electrical and Electronics Engineers (IEEE) is the world's largest professional association dedicated to advancing technological innovation and excellence for the benefit of humanity. IEEE and its members inspire a global community through IEEE's highly cited publications, conferences, technology standards, and professional and educational activities.

Table 7-4 provides a list of IEEE deliverables associated with IMT-2020 networks.

Table 7-4 – IEEE deliverables

Name	Responsible group	Status	Subject	Topics
IEEE 1076-2008	IEEE	Published	IEEE Standard VHDL Language Reference Manual	IMT-2020
IEEE 1076.1-2017	IEEE	Published	IEEE Standard VHDL Analog and Mixed-Signal Extensions	IMT-2020

Table 7-4 – IEEE deliverables

Name	Responsible group	Status	Subject	Topics
IEEE 1451.1-1999	IEEE	Published	IEEE Standard for a Smart Transducer Interface for Sensors and Actuators – Network Capable Application Processor Information Model	IMT-2020
IEEE 1451.5-2007	IEEE	Published	IEEE Standard for a Smart Transducer Interface for Sensors and Actuator – Wireless Communication Protocols and Transducer Electronic Data Sheet (TEDS) Formats	IMT-2020
IEEE 1528-2013	IEEE	Published	IEEE Recommended Practice for Determining the Peak Spatial-Average Specific Absorption Rate (SAR) in the Human Head from Wireless Communications Devices: Measurement Techniques	IMT-2020
IEEE 1609.0-2013	IEEE	Published	IEEE Guide for Wireless Access in Vehicular Environments (WAVE) – Architecture	IoT; IMT-2020; IoT & Smart Sustainable Cities Standards; Definitions and Taxonomy
IEEE 1609.11-2010	IEEE	Published	IEEE Standard for Wireless Access in Vehicular Environments (WAVE) – Over-the-Air Electronic Payment Data Exchange Protocol for Intelligent Transportation Systems (ITS)	IoT; IMT-2020; IoT & Smart Sustainable Cities Standards; Short and Mid-Range Devices/Networks; V2I
IEEE 1609.12-2016	IEEE	Published	IEEE Standard for Wireless Access in Vehicular Environments (WAVE) – Identifier Allocations	IMT-2020; Short and Mid-Range Devices/Networks
IEEE 1609.2-2016	IEEE	Published	IEEE Standard for Wireless Access in Vehicular Environments – Security Services for Applications and Management Messages	Wireless; IMT-2020; Cybersecurity (ITS)

Table 7-4 – IEEE deliverables

Name	Responsible group	Status	Subject	Topics
IEEE 1609.2a-2017	IEEE	Published	IEEE Standard for Wireless Access in Vehicular Environments– Security Services for Applications and Management Messages – Amendment 1	IMT-2020
IEEE 1609.3-2016	IEEE	Published	IEEE Standard for Wireless Access in Vehicular Environments (WAVE) – Networking Services	IMT-2020; Short and Mid-Range Devices/Networks
IEEE 1609.4-2016	IEEE	Published	IEEE Standard for Wireless Access in Vehicular Environments (WAVE) – Multi-Channel Operation	Security protocol standards; IMT-2020; Short and Mid-Range Devices/Networks
IEEE 1647-2016	IEEE	Published	IEEE Standard for the Functional Verification Language e	IMT-2020
IEEE 1666-2011	IEEE	Published	IEEE Standard System C(R) Language Reference Manual	IMT-2020
IEEE 1666.1-2016	IEEE	Published	IEEE Standard for for Standard SystemC(R) Analog/Mixed-Signal Extensions Language Reference Manual	IMT-2020
IEEE 1685-2014	IEEE	Published	IEEE Standard for IP-XACT, Standard Structure for Packaging, Integrating, and Reusing IP within Tool Flows	IMT-2020
IEEE 1720-2012	IEEE	Published	IEEE Recommended Practice for Near-Field Antenna Measurements	IMT-2020
IEEE 1734-2011	IEEE	Published	IEEE Standard for Quality of Electronic and Software Intellectual Property Used in System and System on Chip (SoC) Designs	IMT-2020
IEEE 1735-2014	IEEE	Published	IEEE Recommended Practice for Encryption and Management of	IMT-2020

Table 7-4 – IEEE deliverables

Name	Responsible group	Status	Subject	Topics
			Electronic Design Intellectual Property (IP)	
IEEE 1735-2014/Cor 1-2015	IEEE	Published	IEEE Recommended Practice for Encryption and Management of Electronic Design Intellectual Property (IP) – Corrigendum 1: Correction to Rights Digest Description	IMT-2020
IEEE 1785.2-2016	IEEE	Published	IEEE Standard for Rectangular Metallic Waveguides and Their Interfaces for Frequencies of 110 GHz and Above – Part 2: Waveguide Interfaces	Security protocol standards; IMT-2020
IEEE 1800-2017	IEEE	Published	IIEEE Standard for SystemVerilog–Unified Hardware Design, Specification, and Verification Language	IMT-2020
IEEE 1800.2-2017	IEEE	Published	IEEE Standard for Universal Verification Methodology Language Reference Manual	IMT-2020
IEEE 1801-2015	IEEE	Published	IEEE Standard for Design and Verification of Low Power, Energy Aware Electronic Systems	IMT-2020
IEEE 1903-2011	IEEE	Published	IEEE Standard for the Functional Architecture of Next Generation Service Overlay Networks	IMT-2020
IEEE 802.11-2016	IEEE 802	Published	IEEE Standard for Information Technology–Telecommunications and Information Exchange Between Systems Local and Metropolitan Area Networks--Specific Requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications	IMT-2020

Table 7-4 – IEEE deliverables

Name	Responsible group	Status	Subject	Topics
IEEE 802.11ac-2013	IEEE 802	Published	IEEE Standard for Information Technology – Telecommunications and Information Exchange Between Systems – Local and Metropolitan Area Networks – Specific Requirements – Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications	IMT-2020
IEEE 802.11ad-2012	IEEE	Published	(adopted as ISO/IEC/IEEE 8802-11:2012/Amd 3:2014)	IoT; IMT-2020; IoT & Smart Sustainable Cities Standards
IEEE 802.11ah-2016	IEEE 802	Published	IEEE Standard for Information Technology – Telecommunications and Information Exchange Between Systems – Local and Metropolitan Area Networks – Specific Requirements – Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications	IMT-2020
IEEE 802.15.11	IEEE 802.15	Draft	New activity to develop a standard supporting Multi-Gigabit/sec Optical Wireless Communications	IMT-2020
IEEE 802.15.3-2016	IEEE 802.15	Published	IEEE Standard for High Data Rate Wireless Multi-Media Networks	IMT-2020
IEEE 802.15.3e-2017	IEEE 802.15	Published	IEEE Standard for High Data Rate Wireless Multi-Media Networks – Amendment 1: High -Rate Close Proximity Point-to-Point Communications	IMT-2020
IEEE 802.15.4-2015	IEEE	Published	IEEE Standard for Local and metropolitan area networks–Part 15.4: Low-Rate Wireless Personal Area Networks (LR-WPANs)	IoT; IMT-2020; IoT & Smart Sustainable Cities Standards

Table 7-4 – IEEE deliverables

Name	Responsible group	Status	Subject	Topics
IEEE 802.15.7-2011	IEEE	Published	IEEE Standard for Local and Metropolitan Area Networks–Part 15.7: Short-Range Wireless Optical Communication Using Visible Light	IoT; IMT-2020; IoT & Smart Sustainable Cities Standards
IEEE 802.16-2012	IEEE	Published	IEEE Standard for Air Interface for Broadband Wireless Access Systems	IoT; IMT-2020; IoT & Smart Sustainable Cities Standards
IEEE 802.16-Conformance04-2006	IEEE 802.16	Published	Conformance to IEEE 802.16 – Part 4: Protocol Implementation Conformance Statement (PICS) Proforma for Frequencies below 11 GHz.	IMT-2020
IEEE 802.16.1-2012	IEEE 802.16	Published	IEEE Standard for WirelessMAN-Advanced Air Interface for Broadband Wireless Access Systems	IMT-2020
IEEE 802.16.1a-2013	IEEE 802.16	Published	IEEE Standard for WirelessMAN-Advanced Air Interface for Broadband Wireless Access Systems – Amendment 2: Higher Reliability Networks	IMT-2020
IEEE 802.16.1b-2012	IEEE	Published	IEEE Standard for WirelessMAN-Advanced Air Interface for Broadband Wireless Access Systems – Amendment 1: Enhancements to Support Machine-to-Machine Applications	IoT; IMT-2020; IoT & Smart Sustainable Cities Standards
IEEE 802.16.2-2004	IEEE 802.16	Published	IEEE Recommended Practice for Local and Metropolitan Area Networks –Coexistence of Fixed Broadband Wireless Access Systems	IMT-2020

Table 7-4 – IEEE deliverables

Name	Responsible group	Status	Subject	Topics
IEEE 802.16n-2013	IEEE	Published	IEEE Standard for Air Interface for Broadband Wireless Access Systems– Amendment 2: Higher Reliability Networks	IoT; IMT-2020; IoT & Smart Sustainable Cities Standards
IEEE 802.16p-2012	IEEE	Published	IEEE Standard for Air Interface for Broadband Wireless Access Systems Amendment 1: Enhancements to Support Machine-to-Machine Applications	IoT; IMT-2020; IoT & Smart Sustainable Cities Standards
IEEE 802.16q-2015	IEEE 802.16	Published	IEEE Standard for Air Interface for Broadband Wireless Access Systems – Amendment 3: Multi-tier Networks	IMT-2020
IEEE 802.19.1-2014	IEEE 802	Published	IEEE Standard for Information Technology – Telecommunications and Information Exchange Between Systems – Local and Metropolitan Area Networks – Specific Requirements – Part 19: TV White Space Coexistence Methods	IMT-2020
IEEE 802.1CB	IEEE 802.1	Published	IEEE Standard for Local and metropolitan area networks–Frame Replication and Elimination for Reliability	IMT-2020
IEEE 802.1Qbv	IEEE 802.1	Published	IEEE Standard for Local and metropolitan area networks – Bridges and Bridged Networks – Amendment 25: Enhancements for Scheduled Traffic	IMT-2020
IEEE 802.1Qbv Enhancements for Scheduled Traffic	IEEE 802.1	Published	This standard specifies Media Access Control (MAC) Bridges that interconnect individual Local Area Networks (LANs), each supporting the IEEE 802 MAC	IMT-2020

Table 7-4 – IEEE deliverables

Name	Responsible group	Status	Subject	Topics
			service using a different or identical media access control method, to provide Bridged Local Area Networks	
IEEE 802.1Qch-2017	IEEE 802.1	Published	IEEE Standard for Local and metropolitan area networks–Bridges and Bridged Networks–Amendment 29: Cyclic Queuing and Forwarding	IMT-2020
IEEE 802.1Qci Per-	IEEE 802.1	Published	IEEE Standard for Local and metropolitan area networks–Bridges and Bridged Networks–Amendment 28: Per-Stream Filtering and Policing	IMT-2020
IEEE 802.21-2017	IEEE	Published	802.21-2017 – IEEE Standard for Local and metropolitan area networks–Part 21: Media Independent Services Framework	Multimedia; Network security; IMT-2020
IEEE 802.21.1-2017	IEEE 802	Published	IEEE Standard for Local and metropolitan area networks – Part 21.1: Media Independent Services	IMT-2020
IEEE 802.22-2011	IEEE	Published	(adopted as ISO/IEC/IEEE 8802-22:2015)	IoT; IMT-2020; IoT & Smart Sustainable Cities Standards
IEEE 802.22.1-2010	IEEE	Published	IEEE Standard for Information Technology–Telecommunications and information exchange between systems–Local and metropolitan area networks–Specific requirements Part 22.1: Standard to Enhance Harmful Interference Protection for Low-Power Licensed Devices Operating in TV Broadcast Bands	IoT; IMT-2020; IoT & Smart Sustainable Cities Standards

Table 7-4 – IEEE deliverables

Name	Responsible group	Status	Subject	Topics
IEEE 802.22.2-2012	IEEE	Published	IEEE Standard for Information Technology–Telecommunications and information exchange between systems–Local and metropolitan area networks–Specific requirements Part 22.2: Installation and Deployment of IEEE 802.22 Systems	IoT; IMT-2020; IoT & Smart Sustainable Cities Standards
IEEE 802.22a-2014	IEEE 802	Published	IEEE Standard for Information Technology–Telecommunications and information exchange between systems Wireless Regional Area Networks (WRAN) – Specific Requirements – Part 22: Cognitive Wireless RAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications: Policies and Procedures for Operation in the TV Bands Amendment 1:	IMT-2020
IEEE 802.22b-2015	IEEE	Published	IEEE Standard for Information Technology–Telecommunications and information exchange between systems – Wireless Regional Area Networks (WRAN) – Specific requirements – Part 22: Cognitive Wireless RAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications:Policies and Procedures for Operation in the TV Bands – Amendment 2:	Security mechanisms; Network Management; Security protocol standards; Wireless; IMT-2020; IoT & Smart Sustainable Cities Standards
IEEE 802.3 – 2018 – 1000BASE-LX10 and 1000BASE-BX10	IEEE 802.3	Published	IEEE Standard for Ethernet – 1000BASE-LX10 and 1000BASE-BX10: Physical Layer specification for point-to-point 1 Gb/s Ethernet links	IMT-2020

Table 7-4 – IEEE deliverables

Name	Responsible group	Status	Subject	Topics
			over single-mode optical fiber and multimode optical fiber- IEEE Std 802.3, Clause 56, Clause 59 and Clause 66	
IEEE 802.3 – 2018 – 100BASE-LX10 and 100BASE-BX10	IEEE 802.3	Published	IEEE Standard for Ethernet – 100BASE-LX10 and 100BASE-BX10: Physical Layer specification for point-to-point 100 Mb/s Ethernet links over single-mode optical fiber – IEEE Std 802.3, Clause 56, Clause 58 and Clause 66	IMT-2020
IEEE 802.3 – 2018 – 10GBASE-PR and 10/1GBASE-PRX	IEEE 802.3	Published	IEEE Standard for Ethernet – 10GBASE-PR and 10/1GBASE-PRX: Physical Layer specification for point-to-multipoint 10 Gb/s connections over Ethernet-based passive optical networks (10G-EPON) – IEEE Std 802.3, Clause 56, Clause 75, Clause 76 and Clause 77	IMT-2020
IEEE 802.3.1-2013	IEEE	Published	IEEE Standard for Management Information Base (MIB) Definitions for Ethernet	IoT; IoT & Smart Sustainable Cities Standards; IMT-2020
IEEE 802.3.2-2019 YANG Data Model	IEEE 802.3	Published	IEEE Standard for Ethernet – YANG Data Model Definitions	YANG data models; YANG models for PtP systems; YANG models for PON systems; IMT-2020
IEEE 802.3cd – 2018	IEEE 802.3 Working Group	Published	IEEE Standard for Ethernet – Amendment 3: Media Access Control Parameters for 50 Gb/s and Physical Layers and Management Parameters for 50 Gb/s, 100 Gb/s, and 200 Gb/s Operation	IMT-2020
IEEE P1451-99	IEEE	Draft	Standard for Harmonization of Internet	IMT-2020

Table 7-4 – IEEE deliverables

Name	Responsible group	Status	Subject	Topics
			of Things (IoT) Devices and Systems	
IEEE P1451.4a	IEEE	Draft	IEEE Draft Standard for A Smart Transducer Interface for Sensors and Actuators--Mixed-Mode Communication Protocols and Transducer Electronic Data Sheet (TEDS) Formats – Amendment	IoT; IMT-2020; IoT & Smart Sustainable Cities Standards
IEEE P1451.8	IEEE	Draft	Standard for Wind Turbine Health Monitoring System Wireless Communication Protocols and Transducer Electronic Data Sheet (TEDS) Format	IMT-2020
IEEE P149	IEEE	Draft	IEEE Draft Recommended Practice for Antenna Measurements	IMT-2020
IEEE P1609.2.1	IEEE	Draft	Wireless Access in Vehicular Environments (WAVE) --Certificate Management Interfaces for End-Entities	IMT-2020
IEEE P1609.2b	IEEE	Draft	IEEE Standard for Wireless Access in Vehicular Environments – Security Services for Applications and Management Messages – Amendment 2 PDU Functional Types and Encryption Key Management	IMT-2020
IEEE P1765	IEEE	Draft	Trial-Use Recommended Practice for Estimating the Uncertainty in Error Vector Magnitude of Measured Digitally Modulated Signals for Wireless Communications	IMT-2020

Table 7-4 – IEEE deliverables

Name	Responsible group	Status	Subject	Topics
IEEE P1770	IEEE	Draft	Recommended Practice for The Usage of Terms Commonly Employed In the Field of Large-Signal Vector Network Analysis	IMT-2020
IEEE P1857.6	IEEE	Published	IEEE Standard for Digital Media Content Description	IMT-2020
IEEE P1857.9	IEEE	Draft	IEEE Draft Standard for Immersive Visual Content Coding	IMT-2020
IEEE P1903.1-2017	IEEE	Published	IEEE Standard for Content Delivery Protocols of Next Generation Service Overlay Network	IMT-2020
IEEE P1903.2-2017	IEEE	Published	IEEE Standard for Service Composition Protocols of Next Generation Service Overlay Network	IMT-2020
IEEE P1903.3-2017	IEEE	Published	IEEE Standard for Self-Organizing Management Protocols of Next Generation Service Overlay Network	IMT-2020
IEEE P1912	IEEE	Draft	Standard for Privacy and Security Architecture for Consumer Wireless Devices	IMT-2020
IEEE P1913	IEEE	Draft	Draft Standard for Software-Defined Quantum Communication	IMT-2020
IEEE P1914.1	IEEE	Draft	IEE Approved Draft Standard for Packet-based Fronthaul Transport Networks	IMT-2020
IEEE P1914.3	IEEE 1914	Draft	IEEE Draft Standard for Radio Over Ethernet Encapsulations and Mappings	IMT-2020
IEEE P1915.1	IEEE	Draft	IEEE Draft Standard for Software Defined Networking and Network Function Virtualization Security	IMT-2020

Table 7-4 – IEEE deliverables

Name	Responsible group	Status	Subject	Topics
IEEE P1916.1	IEEE	Draft	IEEE Draft Standard for Software Defined Networking and Network Function Virtualization Performance	IMT-2020
IEEE P1917.1	IEEE	Draft	IEEE Draft Standard for Software Defined Networking and Network Function Virtualization Reliability	IMT-2020
IEEE P1918.1	IEEE	Draft	IEEE Draft Standard for Tactile Internet: Application Scenarios, Definitions and Terminology, Architecture, Functions, and Technical Assumptions	IMT-2020
IEEE P1918.1.1	IEEE	Draft	IEEE Draft Standard for Haptic Codecs for the Tactile Internet	IMT-2020
IEEE P1920.1	IEEE	Draft	IEEE Draft Standard for Aerial Communications and Networking Standards	IMT-2020
IEEE P1921.1	IEEE	Draft	IEEE Draft Standard for Software-Defined Networking (SDN) Bootstrapping Procedures	IMT-2020
IEEE P1930.1	IEEE	Draft	IEEE Draft Recommended Practice for Software Defined Networking (SDN) based Middleware for Control and Management of Wireless Networks	IMT-2020
IEEE P1931.1	IEEE	Draft	IEEE Draft Standard for an Architectural Framework for Real-time Onsite Operations Facilitation (ROOF) for the Internet of Things	IMT-2020
IEEE P211	IEEE	Draft	Standard Definitions of Terms for Radio Wave Propagation	IMT-2020

Table 7-4 – IEEE deliverables

Name	Responsible group	Status	Subject	Topics
IEEE P2413	IEEE	Draft	IEEE Draft Standard for an Architectural Framework for the Internet of Things (IoT)	IoT; IMT-2020; IoT & Smart Sustainable Cities Standards
IEEE P287.1	IEEE	Draft	Standard for Precision Coaxial Connectors at RF, Microwave and Millimeter-wave Frequencies. Part 1 General requirements, definitions, and detailed Specifications	IMT-2020
IEEE P3333.2.4	IEEE	Draft	IEEE Draft Standard for Three-Dimensional (3D) Medical Simulation	IMT-2020
IEEE P802.11ax	IEEE 802	Draft	IEEE Draft Standard for Information Technology–Telecommunications and Information Exchange Between Systems Local and Metropolitan Area Networks–Specific Requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications Amendment Enhancements for High Efficiency WLAN	IMT-2020
IEEE P802.11ay	IEEE 802	Draft	IEEE Draft Standard for Information Technology–Telecommunications and Information Exchange Between Systems Local and Metropolitan Area Networks–Specific Requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications – Amendment: Enhanced Throughput for Operation in License-Exempt Bands above 45 GHz	IMT-2020
IEEE P802.15.12	IEEE 802.15	Draft	IEEE Draft Standard for Upper Layer Interface	IMT-2020

Table 7-4 – IEEE deliverables

Name	Responsible group	Status	Subject	Topics
			(ULI) for IEEE 802.15.4 Low-Rate Wireless Networks	
IEEE P802.15.3d	IEEE 802.15	Draft	IEEE Draft Standard for Information technology-- Local and metropolitan area networks-- Specific requirements-- Part 15.3: Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for High Rate Wireless Personal Area Networks (WPAN) – Amendment for a 100 Gb/s wireless switched point-to-point physical layer	IMT-2020
IEEE P802.15.8	IEEE	Draft	IEEE Draft Standard for Wireless Medium Access Control (MAC) and Physical Layer (PHY) Specifications for Peer Aware Communications (PAC)	IoT; IMT-2020; IoT & Smart Sustainable Cities Standards
IEEE P802.16s	IEEE 802.16	Published	IEEE Draft Standard for Air Interface for Broadband Wireless Access Systems – Amendment 4: Fixed and Mobile Wireless Access in Channel Bandwidth up to 1.25 MHz	IMT-2020
IEEE P802.19.1a-2017	IEEE 802	Published	IEEE Draft Standard for Information Technology – Telecommunications and Information Exchange Between Systems – Local and Metropolitan Area Networks – Specific Requirements – Part 19: TV White Space Coexistence Methods – Amendment: Coexistence Methods for Geo-location Capable Devices Operating under General Authorization	IMT-2020

Table 7-4 – IEEE deliverables

Name	Responsible group	Status	Subject	Topics
IEEE P802.19.1b	IEEE 802	Draft	New activity to develop a recommended practice with the purpose of identifying performance enhancement settings that provide improvements for IEEE 802 wireless devices in automotive environments.	IMT-2020
IEEE P802.1CF	IEEE 802.1	Draft	IEEE Draft Recommended Practice for Network Reference Model and Functional Description of IEEE 802(R) Access Network	IMT-2020
IEEE P802.1CM	IEEE 802.1	Draft	IEEE Draft Standard for Local and Metropolitan Area Networks – Time-Sensitive Networking for Fronthaul	IMT-2020
IEEE P802.21-2017/Cor 1	IEEE 802	Draft	IEEE Standard for Local and Metropolitan Area Networks – Part 21: Media Independent Services Framework – Corrigendum 1: Clarification of Parameter Definition in Group Session Key Derivation	IMT-2020
IEEE P802.22.3	IEEE 802	Draft	IEEE Draft Standard for Spectrum Characterization and Occupancy Sensing	IMT-2020
IEEE P802.3bs	IEEE 802.1	Published	IEEE Draft Standard for Ethernet – Amendment 10: Media Access Control Parameters, Physical Layers and Management Parameters for 200 Gb/s and 400 Gb/s Operation	IMT-2020
IEEE P802.3ca	IEEE 802.3 Working Group	Draft	IEEE Draft Standard for Ethernet – Amendment: Physical Layer Specifications and Management Parameters for 25 Gb/s and 50 Gb/s, Passive Optical Networks	IMT-2020

Table 7-4 – IEEE deliverables

Name	Responsible group	Status	Subject	Topics
IEEE P802.3cc	IEEE 802.3 Working Group	Draft	IEEE Draft Standard for Ethernet – Amendment 11: Physical Layer and Management Parameters for Serial 25 Gb/s Ethernet Operation Over Single-Mode Fiber	IMT-2020
IEEE P802.3cd	IEEE 802.3 Working Group	Draft	IEEE Draft Standard for Ethernet – Amendment 3: Media Access Control Parameters for 50 Gb/s and Physical Layers and Management Parameters for 50 Gb/s, 100 Gb/s, and 200 Gb/s Operation	IMT-2020
ISO/IEC/IEEE 21450:2010 (adoption of IEEE 1451.0-2007)	IEEE	Published	Information technology – Smart Transducer Interface for Sensors and Actuators – Common Functions	Sensor and Actuator; IMT-2020; IoT & Smart Sustainable Cities Standards
ISO/IEC/IEEE 21451-2:2010 (adoption of IEEE 1451.2-1997)	IEEE	Published	Information technology – Smart Transducer Interface for Sensors and Actuators – Transducer to Microprocessor Communication Protocols and Transducer Electronic Data Sheet (TEDS) Formats	Sensor and Actuator; IMT-2020; IoT & Smart Sustainable Cities Standards
ISO/IEC/IEEE 21451-4:2010 (adoption of IEEE 1451.4-2004)	IEEE	Published	Information technology – Smart Transducer Interface for Sensors and Actuators – Mixed-Mode Communication Protocols and Transducer Electronic Data Sheet (TEDS) Formats	Sensor and Actuator; IMT-2020; IoT & Smart Sustainable Cities Standards
ISO/IEC/IEEE 21451-7:2011	IEEE	Published	Information technology – Smart transducer interface for sensors and actuators – Part 7: Transducers to radio frequency identification (RFID) systems communication protocols and Transducer Electronic Data Sheet (TED) formats	Sensor and Actuator; IMT-2020; IoT & Smart Sustainable Cities Standards

Table 7-4 – IEEE deliverables

Name	Responsible group	Status	Subject	Topics
ISO/IEC/IEEE P21451-1-4	IEEE	Draft	Information technology – Smart transducer interface for sensors and actuators – Part 4: Mixed-mode communication protocols and Transducer Electronic Data Sheet (TEDS) formats	IoT; IMT-2020; IoT & Smart Sustainable Cities Standards
P802.1CF	IEEE 802.1	Draft	IEEE Recommended Practice for Network Reference Model and Functional Description of IEEE 802(R)Access Network This Recommended Practice specifies an access network, which connects terminals to their access routers, utilizing technologies based on the family of IEEE 802 Standards by providing an access network reference model, including entities and reference	IMT-2020
P802.1CM	IEEE 802.1	Draft	Time-Sensitive Networking for Fronthaul The purpose of this standard is to enable the transport of time sensitive fronthaul streams in Ethernet bridged networks.	IMT-2020
IEEE 1914.1	IEEE 1914	Draft	Standard for Packet-based Fronthaul Transport Networks	IMT-2020
IEEE P1914.3-2018	IEEE 1914	Draft	Standard for Radio Over Ethernet Encapsulations and Mappings	IMT-2020

7.5 ISO/IEC

The International Organization for Standardization (ISO) is an international standard-setting body composed of representatives from various national standards organizations. The organization promotes worldwide proprietary, industrial, and commercial standards. The International Electrotechnical Commission (IEC) is the world's leading organization that prepares and publishes International Standards for all electrical, electronic and related technologies. When appropriate, IEC cooperates with ISO or ITU to ensure that International Standards fit together seamlessly and

complement each other. Joint committees ensure that International Standards combine all relevant knowledge of experts working in related areas.

Table 7-5 provides a list of ISO/IEC deliverables associated with IMT-2020 networks.

Table 7-5 – ISO/IEC deliverables

Name	Responsible group	Status	Subject	Topics
ISO/IEC/IEEE 21450:2010 (adoption of IEEE 1451.0-2007)	IEEE	Published	Information technology – Smart Transducer Interface for Sensors and Actuators – Common Functions	Sensor and Actuator; IMT-2020; IoT & Smart Sustainable Cities Standards
ISO/IEC/IEEE 21451-2:2010 (adoption of IEEE 1451.2-1997)	IEEE	Published	Information technology – Smart Transducer Interface for Sensors and Actuators – Transducer to Microprocessor Communication Protocols and Transducer Electronic Data Sheet (TEDS) Formats	Sensor and Actuator; IMT-2020; IoT & Smart Sustainable Cities Standards
ISO/IEC/IEEE 21451-4:2010 (adoption of IEEE 1451.4-2004)	IEEE	Published	Information technology – Smart Transducer Interface for Sensors and Actuators – Mixed-Mode Communication Protocols and Transducer Electronic Data Sheet (TEDS) Formats	Sensor and Actuator; IMT-2020; IoT & Smart Sustainable Cities Standards
ISO/IEC/IEEE 21451-7:2011	IEEE	Published	Information technology –Smart transducer interface for sensors and actuators – Part 7: Transducers to radio frequency identification (RFID) systems communication protocols and Transducer Electronic Data Sheet (TEDS) formats	Sensor and Actuator; IMT-2020; IoT & Smart Sustainable Cities Standards

7.6 ITU-R

The ITU Radiocommunication Sector (ITU-R) is one of the three sectors of the International Telecommunication Union (ITU) and is responsible for radio communication. Its role is to manage the international radio-frequency spectrum and satellite orbit resources and to develop standards for radiocommunication systems with the objective of ensuring the effective use of the spectrum.

Table 7-6 provides a list of ITU-R deliverables associated with IMT-2020 networks.

Table 7-6 – ITU-R deliverables

Name	Responsible group	Status	Subject	Topics
ITU-R M.2440-0	ITU-R WP 5D	Published	The use of the terrestrial component of International Mobile Telecommunications for narrowband and broadband machine-type communications	IMT-2020
ITU-R M.2012-3	ITU-R WP 5D	Published	Detailed specifications of the terrestrial radio interfaces of International Mobile Telecommunications-Advanced (IMT-Advanced)	IMT-2020
ITU-R M.2070-1	ITU-R WP 5D	Published	Generic unwanted emission characteristics of base stations using the terrestrial radio interfaces of IMT-Advanced	IMT-2020
ITU-R M.2071-1	ITU-R WP 5D	Published	Generic unwanted emission characteristics of mobile stations using the terrestrial radio interfaces of IMT-Advanced	IMT-2020
ITU-R M.2083-0	ITU-R WP 5D	Published	IMT Vision – Framework and overall objectives of the future development of IMT for 2020 and beyond	IMT-2020
ITU-R M.2090-0	ITU-R WP 5D	Published	Specific unwanted emission limit of IMT mobile stations operating in the frequency band 694-790 MHz to facilitate protection of existing services in Region 1 in the frequency band below 470-694 M	IMT-2020
ITU-R M.2101-0	ITU-R WP 5D	Published	Modelling and simulation of IMT networks and systems for use in sharing and compatibility studies	IMT-2020
ITU-R M.2410-0	ITU-R WP 5D	Published	Minimum requirements related to technical performance for IMT-2020 radio interface(s)	IMT-2020
ITU-R M.2411-0	ITU-R WP 5D	Published	Requirements, evaluation criteria and submission templates for the development of IMT-2020	IMT-2020
ITU-R M.2412-0	ITU-R WP 5D	Published	Guidelines for evaluation of radio interface technologies for IMT-2020	IMT-2020

Table 7-6 – ITU-R deliverables

Name	Responsible group	Status	Subject	Topics
ITU-R M.2441-0	ITU-R WP 5D	Published	Emerging usage of the terrestrial component of International Mobile Telecommunication (IMT)	IMT-2020

7.7 ITU-T SG2

ITU-T Study Group 2 (SG2) is responsible for studies relating to the operational aspects of service provision and telecommunications management. SG2 is also responsible for standards on the management of telecom services, networks and equipment. Telecom management systems are a crucial part of the business processes at the heart of service providers' operations. Standards focus on fault, configuration, accounting, performance and security management (FCAPS) interfaces. FCAPS interfaces sit between network elements and management systems and also between two management systems.

Table 7-7 provides a list of ITU-T SG2 deliverables associated with IMT-2020 networks.

Table 7-7 – ITU-T SG2 deliverables

Name	Responsible group	Status	Subject	Topics
ITU-T M.3041	ITU-T SG2	Published	Framework of smart operation, management and maintenance	IMT-2020
ITU-T M.AI-TOM	ITU-T SG2	Draft	Framework of AI enhanced Telecom Operation and Management (AITOM)	IMT-2020
ITU-T M.3041	ITU-T SG2	Published	Framework of smart operation, management and maintenance	IMT-2020
ITU-T M.resm-AI	ITU-T SG2	Draft (under study)	Requirements for energy saving management of 5G RAN system with AI	IMT-2020

7.8 ITU-T SG5

ITU-T Study Group 5 (SG5) is responsible for studies on methodologies for evaluating ICT effects on climate change and publishing guidelines for using ICTs in an eco-friendly way. Under its environmental mandate, SG5 is also responsible for studying design methodologies to reduce ICTs and the adverse environmental effects e-waste, for example, through the recycling of ICT facilities and equipment.

Table 7-8 provides a list of ITU-T SG5 deliverables associated with IMT-2020 networks.

Table 7-8 – ITU-T SG5 deliverables

Name	Responsible group	Status	Subject	Topics
ITU-T K Suppl. 10	ITU-T SG5	Published	Analysis of electromagnetic compatibility aspects and definition of requirements for 5G mobile systems	IMT-2020
ITU-T K Suppl. 14	ITU-T SG5	Published	The impact of RF-EMF exposure limits stricter than the ICNIRP or IEEE guidelines on 4G and 5G mobile network deployment	IMT-2020
ITU-T K Suppl. 16	ITU-T SG5	Published	Electromagnetic field compliance assessments for 5G wireless networks	IMT-2020
ITU-T K Suppl. 8	ITU-T SG5	Published	Resistibility analysis of 5G systems	IMT-2020
ITU-T K Suppl. 9	ITU-T SG5	Published	5G technology and human exposure to radiofrequency electromagnetic fields	IMT-2020
ITU-T K Suppl. 9 (11/2017)	ITU-T SG5	Published	5G technology and human exposure to RF EMF	IMT-2020
ITU-T K.116	ITU-T SG5	Published	Electromagnetic compatibility requirements and test methods for radio telecommunication terminal equipment	IMT-2020
ITU-T K.136	ITU-T SG5	Published	Electromagnetic compatibility requirements for radio telecommunication equipment	IMT-2020
ITU-T K.5G-Lightning	ITU-T SG5	Draft (under study)	Practical guide for lightning protection, earthing and bonding, and safety consideration of 5G radio base station	IMT-2020
ITU-T K.Sup.5G.EMC	ITU-T SG5	Draft (under study)	Impacts of Electromagnetic compatibility test methods for 5G AAS	IMT-2020

Table 7-8 – ITU-T SG5 deliverables

Name	Responsible group	Status	Subject	Topics
ITU-T K.Supp.16 to ITU-T K.series	ITU-T SG5	Published	Electromagnetic field compliance assessments for 5G wireless networks	IMT-2020
ITU-T L Suppl. 36	ITU-T SG5	Published	Study on methods and metrics to evaluate energy efficiency for future 5G systems	IMT-2020
ITU-T L.1022	ITU-T SG5	Published	Circular Economy: Definitions and concepts for material efficiency for Information and Communication Technology	IMT-2020
ITU-T L.1210	ITU-T SG5	Published	Sustainable power-feeding solutions for 5G networks	IMT-2020
ITU-T L.1220	ITU-T SG5	Published	Innovative energy storage technology for stationary use – Part 1: Overview of energy storage	Cloud Computing; IMT-2020; Energy management and power supply
ITU-T L.1221	ITU-T SG5	Published	Innovative energy storage technology for stationary use – Part 2: Battery	IMT-2020; Energy management and power supply; IoT & Smart Sustainable Cities Standards
ITU-T L.1222	ITU-T SG5	Published	Innovative energy storage technology for stationary use – Part 3: Supercapacitor technology	IMT-2020; Energy management and power supply; IoT & Smart Sustainable Cities Standards
ITU-T L.1310	ITU-T SG5	Published	Energy efficiency metrics and measurement methods for telecommunication equipment	IMT-2020; Energy management and power supply

Table 7-8 – ITU-T SG5 deliverables

Name	Responsible group	Status	Subject	Topics
ITU-T L.1316	ITU-T SG5	Published	Energy efficiency framework	IMT-2020
ITU-T L.1320	ITU-T SG5	Published	Energy efficiency metrics and measurement for power and cooling equipment for telecommunications and data centres	Cloud Computing; IMT-2020
ITU-T L.1325	ITU-T SG5	Published	Green ICT solutions for telecom network facilities	IMT-2020; Energy management and power supply
ITU-T L.1331	ITU-T SG5	Published	Assessment of mobile network energy efficiency	IMT-2020
ITU-T L.1350	ITU-T SG5	Published	Energy efficiency metrics of a base station site	IMT-2020
ITU-T L.1351	ITU-T SG5	Published	Energy efficiency measurement methodology for base station sites	Security assessment and evaluation criteria; Security policy and policy mechanisms; IMT-2020
ITU-T L.1380	ITU-T SG5	Published	Smart energy solution for telecom sites	IMT-2020
ITU-T L.1410	ITU-T SG5	Published	Methodology for environmental life cycle assessments of information and communication technology goods, networks and services	Cloud Computing; IMT-2020
ITU-T L.1470	ITU-T SG5	Published	GHG emissions trajectories for the ICT sector compatible with the UNFCCC Paris Agreement	IMT-2020
ITU-T L.5G_sav	ITU-T SG5	Draft (under study)	Energy saving technologies and best practices for 5G RAN equipment	IMT-2020

Table 7-8 – ITU-T SG5 deliverables

Name	Responsible group	Status	Subject	Topics
ITU-T L.EE_5G	ITU-T SG5	Draft (under study)	Energy efficiency Metrics and measurement methodology for 5G base station	IMT-2020
ITU-T L.EE_slicing	ITU-T SG5	Draft (under study)	Energy efficiency and Slicing of IMT2020/5G	IMT-2020
ITU-T L.ENV-KPI-5G-ARCH	ITU-T SG5	Draft (under study)	Environmental KPIs/metrics for 5G architectures	IMT-2020
ITU-T L.ewaste-base_station	ITU-T SG5	Draft (under study)	Scheduled waste management for base station (inclusive of e-waste)	IMT-2020
ITU-T L.ICT_CE	ITU-T SG5	Draft (under study)	ICT response to circular economy	IMT-2020; IoT & Smart Sustainable Cities Standards
ITU-T L.methodology_arch	ITU-T SG5	Draft (under study)	Methodology to assess the environmental impact of the different proposed architectures	IMT-2020; IoT & Smart Sustainable Cities Standards

7.9 ITU-T SG9

ITU-T Study Group 9 is responsible for studies relating to television and sound transmission and integrated broadband cable networks.

Table 7-9 provides a list of ITU-T SG9 deliverables associated with IMT-2020 networks.

Table 7-9 – ITU-T SG9 deliverables

Name	Responsible group	Status	Subject	Topics
ITU-T Q.5021	ITU-T SG9	Published	Protocol for managing capability exposure APIs in IMT-2020 network	IMT-2020

7.10 ITU-T SG11

ITU-T Study Group 11 (SG11) is responsible for developing test specifications for testing conformance and interoperability (C&I) for all types of networks, technologies and services, a testing methodology and test suites for standardized network parameters in relation to the framework for Internet-related performance measurement, as well as for existing technologies (e.g., NGN) and emerging technologies (e.g., FN, cloud, SDN, NFV, IoT, VoLTE/ViLTE, IMT-2020 technologies, flying ad hoc networks, tactile Internet, augmented reality, etc.).

Table 7-10 provides a list of ITU-T SG11 deliverables associated with IMT-2020 networks.

Table 7-10 – ITU-T SG11 deliverables

Name	Responsible group	Status	Subject	Topics
ITU-T Q.3054	ITU-T SG11	Published	Signalling architecture for virtualization of control network entities	Security Architectures, Models and Frameworks; Security protocol standards; IMT-2020
ITU-T Q.3714	ITU-T SG11	Published	Signalling requirements of SDN-based access networks with media-independent management capabilities	IMT-2020
ITU-T Q.3715	ITU-T SG11	Published	Signalling requirements for dynamic bandwidth adjustment on demand on broadband network gateway implemented by software-defined networking technologies	IMT-2020
ITU-T Q.3716	ITU-T SG11	Published	Signalling requirements for mapping between physical and virtual networks	IMT-2020
ITU-T Q.3740	ITU-T SG11	Published	Signalling requirements for software-defined networking and network function virtualization- based central office services	IMT-2020
ITU-T Q.3741	ITU-T SG11	Published	Signalling requirements for SD-WAN service	IMT-2020
ITU-T Q.4061	ITU-T SG11	Published	Framework of software-defined network controller testing	IMT-2020
ITU-T Q.5001	ITU-T SG11	Published	Signalling requirements and architecture of intelligent edge computing	IMT-2020
ITU-T Q.5020	ITU-T SG11	Published	Protocol requirements and procedures for network slice lifecycle management	IMT-2020

Table 7-10 – ITU-T SG11 deliverables

Name	Responsible group	Status	Subject	Topics
ITU-T Q.5021	ITU-T SG11	Draft	Protocol for managing capability exposure APIs in IMT-2020 network	IMT-2020
ITU-T Q. 5022	ITU-T SG11	Draft (under study)	Signalling procedure of energy efficient device-to-device communication for IMT-2020 network	IMT-2020
ITU-T Q.IEC-PRO	ITU-T SG11	Draft (under study)	Protocols for microservices based intelligent edge computing	IMT-2020
ITU-T Q.IMT2020-PFW	ITU-T SG11	Draft (under study)	Protocol Framework for IMT-2020	IMT-2020
ITU-T Q.IMT2020-PIAS	ITU-T SG11	Draft (under study)	Protocol for providing intelligent analysis services in IMT-2020 network	IMT-2020
ITU-T Q.INS-PM	ITU-T SG11	Draft (under study)	Protocol for managing Intelligent Network Slicing with AI-assisted analysis in IMT-2020 network	IMT-2020
ITU-T Q.LiteIMS-SA	ITU-T SG11	Draft (under study)	Signalling architecture of Lite IMS for IMT-2020 advanced network	IMT-2020
ITU-T Q.QMP-TCA	ITU-T SG11	Draft (under study)	QoS management protocol for time constraint applications over SDN	IMT-2020
ITU-T Q. 3963	ITU-T SG11	Draft	The compatibility testing of SDN-based equipment using OpenFlow protocol	IMT-2020
ITU-T Q.telemetry-VBNS	ITU-T SG11	Draft (under study)	Signalling requirements for telemetry of virtual broadband network services	IMT-2020
ITU-T Q.TP_AR	ITU-T SG11	Draft (under study)	Testing procedures of Augmented Reality applications	IMT-2020

Table 7-10 – ITU-T SG11 deliverables

Name	Responsible group	Status	Subject	Topics
ITU-T Q.VNFT-req	ITU-T SG11	Draft (under study)	Signalling requirements for VNF lifecycle management under testing environment	IMT-2020
ITU-T Q.WLAN5G-REQ	ITU-T SG11	Draft	Signalling requirements of WLAN access network for interworking with 5G network	IMT-2020

7.11 ITU-T SG12

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

Table 7-11 provides a list of ITU-T SG12 deliverables associated with IMT-2020 networks.

Table 7-11 – ITU-T SG12 deliverables

Name	Responsible group	Status	Subject	Topics
ITU-T Y.1550	ITU-T SG12	Published	Considerations for realizing virtual measurement systems	IMT-2020

7.12 ITU-T SG13

ITU-T Study Group 13 is responsible for studies relating to the requirements, architectures, capabilities, and APIs as well as softwarization and orchestration aspects of converged future networks (FN), specifically focusing on IMT-2020 non-radio related parts. This also includes IMT-2020 project management coordination across all ITU-T study groups and release planning and implementation scenarios. It is responsible for studies relating to cloud-computing technologies, big data, virtualization, resource management, reliability and security aspects of the considered network architectures. It is responsible for studies relating to fixed mobile convergence (FMC), mobility management, and enhancements to existing ITU-T Recommendations on mobile communications, including the energy-saving aspects. Furthermore, the responsibility of Study Group 13 includes studies on emerging network technologies for IMT-2020 networks and future networks, such as information centric networking (ICN)/content centric networking (CCN). Study Group 13 is also responsible for studies relating to standardization of concepts and mechanisms to enable trusted ICT, including framework, requirements, capabilities, architectures and implementation scenarios of trusted network infrastructures and trusted cloud solutions in coordination with all study groups concerned.

Table 7-12 provides a list of ITU-T SG13 deliverables associated with IMT-2020 networks.

Table 7-12 – ITU-T SG13 deliverables

Name	Responsible group	Status	Subject	Topics
ITU-T Y.3071	ITU-T SG13	Published	Data aware networking (information centric networking) – Requirements and capabilities	IMT-2020; Cloud Computing
ITU-T Y.3100	ITU-T SG13	Published	Terms and definitions for IMT-2020 network	IMT-2020
ITU-T Y.3110	ITU-T SG13	Published	IMT-2020 network management and orchestration requirements	IMT-2020
ITU-T Y.3111	ITU-T SG13	Published	IMT-2020 Network Management and Orchestration Framework	IMT-2020
ITU-T Y.3131	ITU-T SG13	Published	Functional architecture for supporting fixed mobile convergence in IMT-2020 networks	IMT-2020
ITU-T Y.3132	ITU-T SG13	Published	Mobility management for fixed mobile convergence in IMT-2020 networks	IMT-2020
ITU-T Y.3130	ITU-T SG13	Published	Requirements of IMT-2020 fixed mobile convergence	IMT-2020
ITU-T Y.FMC-ReqMO	ITU-T SG13	Draft (under study)	IMT-2020 FMC functional requirements for management and orchestration	IMT-2020
ITU-T Y.IMT-2020.qos-mon	ITU-T SG13	Draft (under study)	IMT-2020 network monitoring functional architectural for QoS assurance	IMT-2020
ITU-T Y.3104	ITU-T SG13	Published	Architecture of the IMT-2020 network	IMT-2020
ITU-T Y.3105	ITU-T SG13	Published	Requirements of capability exposure in the IMT-2020 networks	IMT-2020
ITU-T Y.3108	ITU-T SG13	Published	Capability exposure function in the IMT-2020 networks	IMT-2020
ITU-T Y.3102	ITU-T SG13	Published	Framework of the IMT-2020 network	IMT-2020

Table 7-12 – ITU-T SG13 deliverables

Name	Responsible group	Status	Subject	Topics
ITU-T Y.3112	ITU-T SG13	Published	Framework for the support of Multiple Network Slicing	IMT-2020
ITU-T Y.3150	ITU-T SG13	Published	High-level technical characteristic of network softwarization for IMT-2020	IMT-2020
ITU-T Y.3101	ITU-T SG13	Published	Requirements of the IMT-2020 network	IMT-2020
ITU-T Y.3170	ITU-T SG13	Published	Requirements for machine learning-based quality of service assurance for the IMT-2020 network	IMT-2020

7.13 ITU-T SG15

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

Table 7-13 provides a list of ITU-T SG15 deliverables associated with IMT-2020 networks.

Table 7-13 – ITU-T SG15 deliverables

Name	Responsible group	Status	Subject	Topics
ITU-T G Suppl. 66	ITU-T SG15	Published	5G wireless fronthaul requirements in a passive optical network context	IMT-2020; Wireless – Fibre Access Networks
ITU-T G Suppl. 67	ITU-T SG15	Published	Application of optical transport network Recommendations to 5G transport	IMT-2020
ITU-T G.709.4	ITU-T SG15	Draft	OTU 25 and OTU 50G short reach interfaces	IMT-2020
ITU-T G.8261/Y.1361	ITU-T SG15	Published	Timing and synchronization aspects in packet networks	IMT-2020
ITU-T G.8262.1	ITU-T SG15	Published	Timing characteristics of synchronous equipment slave clock – Amendment 1	IMT-2020

Table 7-13 – ITU-T SG15 deliverables

Name	Responsible group	Status	Subject	Topics
ITU-T G.8262.1/Y.1362.1	ITU-T SG15	Published	Timing characteristics of an enhanced synchronous equipment slave clock	IMT-2020
ITU-T G.8271.1/Y.1366.1	ITU-T SG15	Published	Network limits for time synchronization in Packet networks – Amendment 1	IMT-2020
ITU-T G.8272.1/Y.1367.1	ITU-T SG15	Published	Timing characteristics of enhanced primary reference time clocks - Amendment 2	IMT-2020
ITU-T G.8273.2/Y.1368.2	ITU-T SG15	Published	Timing characteristics of telecom boundary clocks and telecom time slave clocks	IMT-2020
ITU-T G.8273.2/Y.1368.2	ITU-T SG15	Published	Timing characteristics of telecom boundary clocks and telecom time slave clocks – Amendment 2	IMT-2020
ITU-T G.8275/Y.1369	ITU-T SG15	Published	Architecture and requirements for packet-based time and phase distribution – Amendment 2	IMT-2020
ITU-T G.8300 (ex. G.ctn5g)	ITU-T SG15	Draft	Characteristics of transport networks to support IMT-2020/5G	IMT-2020
ITU-T G.mtn	ITU-T SG15	Draft (under study)	Interfaces for a metro transport network	IMT-2020
ITU-T G.mtn-arch	ITU-T SG15	Draft (under study)	Functional architecture for metro transport network	IMT-2020
ITU-T G.mtn-eqpt	ITU-T SG15	Draft (under study)	Characteristics of MTN equipment functional blocks	IMT-2020
ITU-T G.mtn-mgmt	ITU-T SG15	Draft (under study)	Management and Control for metro transport network	IMT-2020
ITU-T G.mtn-prot	ITU-T SG15	Draft (under study)	MTN linear protection	IMT-2020
ITU-T G.Sup.67	ITU-T SG15	Published	Application of OTN to 5G Transport	IMT-2020

Table 7-13 – ITU-T SG15 deliverables

Name	Responsible group	Status	Subject	Topics
ITU-T G.Suppl.66	ITU-T SG15	Published	5G Wireless Fronthaul Requirements in a PON Context	IMT-2020
ITU-T GSTR-TN5G	ITU-T SG15	Published	Transport network support of IMT-2020/5G	IMT-2020

7.14 ITU-T SG17

ITU-T Study Group 17 (SG17) coordinates security-related work across all ITU-T Study Groups. Often working in cooperation with other standards development organizations (SDOs) and various ICT industry consortia, SG17 deals with a broad range of standardization issues. SG17 is currently working on cybersecurity; security management; security architectures and frameworks; countering spam; identity management; the protection of personally identifiable information; and the security of applications and services for the Internet of things (IoT), smart grids, smartphones, software-defined networking (SDN), web services, big data analytics, social networks, cloud computing, mobile financial systems, IPTV and telebiometrics.

Table 7-14 provides a list of ITU-T SG17 deliverables associated with IMT-2020 networks.

Table 7-14 – ITU-T SG17 deliverables

Name	Responsible group	Status	Subject	Topics
ITU-T X.1038	ITU-T SG17	Published	Security requirements and reference architecture for software-defined networking	Threats and threat assessment; Security management standards and guidance documents; IMT-2020
ITU-T X.1042	ITU-T SG17	Published	Security services using software-defined networking	Network security; Security services; IMT-2020
ITU-T X.1043	ITU-T SG17	Published	Security framework and requirements for service function chaining based on software-defined networking	Threats and threat assessment; Network security; Security Architectures, Models and Frameworks; IMT-2020
ITU-T X.5Gsec-ecs	ITU-T SG17	Draft (under study)	Security framework for 5G edge computing services	IMT-2020
ITU-T X.5Gsec-guide	ITU-T SG17	Draft (under study)	Security guideline for 5G communication system based on ITU-T X.805	IMT-2020

Table 7-14 – ITU-T SG17 deliverables

Name	Responsible group	Status	Subject	Topics
ITU-T X.5Gsec-netec	ITU-T SG17	Draft (under study)	Security capabilities of network layer for 5G edge computing	IMT-2020
ITU-T X.5Gsec-q	ITU-T SG17	Draft (under study)	Security guidelines for applying quantum-safe algorithms in 5G systems	IMT-2020
ITU-T X.5Gsec-t	ITU-T SG17	Draft (under study)	Security framework based on trust relationship in 5G ecosystem	IMT-2020
ITU-T X.1042	ITU-T SG17	Published	Security services using software-defined networking	IMT-2020
ITU-T X.1043	ITU-T SG17	Published	Security framework and requirements for service function chaining based on software-defined networking	IMT-2020
ITU-T X.SDSec	ITU-T SG17	Draft (under study)	Framework of software-defined security in SDN/NFV network	IMT-2020
ITU-T X.1044	ITU-T SG17	Published	Security requirements of network virtualization	IMT-2020
ITU-T X.1045	ITU-T SG17	Published	Security service chain architecture for networks and applications	IMT-2020

7.15 ITU-T SG20

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

Table 7-15 provides a list of ITU-T SG20 deliverables associated with IMT-2020 networks.

Table 7-15 – ITU-T SG20 deliverables

Name	Responsible group	Status	Subject	Topics
ITU-T Y Suppl. 45	ITU-T SG20	Published	ITU-T Y.4000-series – An overview of smart cities and communities and the role of information and communication technologies	IMT-2020; IoT & Smart Sustainable Cities Standards
ITU-T Y.4100/Y.2066	ITU-T SG13	Published	Common requirements of the Internet of things	IMT-2020; IoT & Smart Sustainable Cities Standards
ITU-T Y.4113	ITU-T SG20	Published	Requirements of the network for the Internet of things	IMT-2020; IoT & Smart Sustainable Cities Standards
ITU-T Y.4114	ITU-T SG20	Published	Specific requirements and capabilities of the Internet of things for big data	IMT-2020; IoT & Smart Sustainable Cities Standards
ITU-T Y.4208	ITU-T SG20	Published	IoT requirements for support of edge computing	IMT-2020
ITU-T Y.IoT-EC-GW	ITU-T SG20	Draft (under study)	Capabilities and framework of edge computing-enabled gateway in the IoT	IMT-2020
ITU-T Y.UAV.arch	ITU-T SG20	Draft (under study)	Functional architecture for unmanned aerial vehicles and unmanned aerial vehicle controllers using IMT-2020 networks	IMT-2020

7.16 MEF

The Metro Ethernet Forum (MEF), founded in 2001 as the MEF is a non-profit international industry consortium, dedicated to the adoption of assured services orchestrated across a global ecosystem of automated networks. The work of MEF includes optical, carrier Ethernet, IP, SD-WAN services and cloud services, as well as the orchestration of the service lifecycle.

Table 7-16 provides a list of MEF deliverables associated with IMT-2020 networks.

Table 7-16 – MEF deliverables

Name	Responsible group	Status	Subject	Topics
MEF 10.4	MEF	Published	Subscriber Ethernet Services Attributes	IMT-2020
MEF 22.3	MEF	Published	Implementation Agreement – Transport Services for Mobile Networks	IMT-2020
MEF 23.2	MEF	Published	Carrier Ethernet Class of Service – Phase 3 Implementation Agreement	IMT-2020
MEF 23.2.1	MEF	Published	Models for Bandwidth Profiles with Token Sharing Amendment to MEF 23.2	IMT-2020
MEF 26.2	MEF	Published	External Network Network Interface (ENNI) and Operator Service Attributes	IMT-2020
MEF 30.1	MEF	Published	Service OAM Fault Management Implementation Agreement: Phase 2	IMT-2020
MEF 30.1.1	MEF	Published	Amendment to MEF 30.1– Correction to Requirement	IMT-2020
MEF 35.1	MEF	Published	Service OAM Performance Monitoring Implementation Agreement	IMT-2020
MEF 43	MEF	Published	Virtual NID (vNID) Functionality for E-Access Services	IMT-2020
MEF 51.1	MEF	Published	Operator Ethernet Service Definitions	IMT-2020
MEF 6.2	MEF	Published	EVC Ethernet Services Definitions Phase 3	IMT-2020
MEF 61	MEF	Published	IP Service Attributes for Subscriber IP Services	IMT-2020
MEF 62	MEF	Published	Managed Access E-Line Service Implementation Agreement	IMT-2020
MEF 63	MEF	Published	Subscriber Layer 1 Service Attributes	IMT-2020

7.17 NGMN

The Next Generation Mobile Networks (NGMN) Alliance is a mobile telecommunications association of mobile operators, vendors, manufacturers and research institutes. It was founded by major mobile operators in 2006 as an open forum to evaluate candidate technologies to develop a common view of solutions for the next evolution of wireless networks. Its objective is to ensure the successful commercial launch of future mobile broadband networks through a roadmap for technology and friendly user trials. The NGMN Alliance complements and supports standards organizations by providing a coherent view of what mobile operators require.

Table 7-17 provides a list of NGMN deliverables associated with IMT-2020 networks.

Table 7-17 – NGMN deliverables

Name	Responsible group	Status	Subject	Topics
Architectural Proposal for the Handling of Network Operations Data with Specific Focus on Virtualized Networks	NGMN	Draft	Network Management & Orchestration	IMT-2020
Final Report on 5G NSA & SA IoT	NGMN	Draft	Trial & Testing	IMT-2020
Final report on 5G pre-commercial trials	NGMN	Draft	Trial & Testing	IMT-2020
First Version of Framework document to 3GPP and others	NGMN	Draft	E2E Architecture Framework	IMT-2020
First version of pre-commercial trials framework document	NGMN	Draft	Trial & Testing	IMT-2020
Initial report on 5G pre-commercial trials	NGMN	Draft	Trial & Testing	IMT-2020
Intermediate Report on 5G NSA IoT	NGMN	Draft	Trial & Testing	IMT-2020
Position Paper on "Additional spectrum bands for 5G and the WRC-19"	NGMN	Draft	Spectrum	IMT-2020
Spectrum White Paper on "Spectrum licensing and other regulatory issues for 5G"	NGMN	Draft	Spectrum	IMT-2020
Technology Building Blocks	NGMN	Draft	Trial & Testing	IMT-2020
V2X White Paper	NGMN	Draft	V2X	IMT-2020
White Paper on 5G and IPR Related Questions	NGMN	Draft	IPR	IMT-2020
White Paper on 5G RAN CU-DU network architecture, dimensioning and performance requirements	NGMN	Draft	RAN functional split & X-haul	IMT-2020

Table 7-17 – NGMN deliverables

Name	Responsible group	Status	Subject	Topics
White Paper on Active Antenna Requirements	NGMN	Draft	Base Station Antenna Requirements	IMT-2020
White Paper on Extreme 5G Requirements	NGMN	Draft	Extreme 5G Requirements	IMT-2020
White Paper on Passive Antenna Requirements	NGMN	Draft	Base Station Antenna Requirements	IMT-2020
White Paper on recommendations for RAN functional decomposition	NGMN	Draft	RAN functional split & X-haul	IMT-2020
White Paper on Service-Based Architecture in 5G	NGMN	Draft	Service-Based Architecture in 5G	IMT-2020

7.18 TM Forum

TM Forum is the global member association for digital business. It provides a platform for hundreds of global members across a wide range of industries: communications, technology, cities and municipal government, finance, healthcare and so on, to collaborate and partner to co-create, prototype, deliver, and monetize innovative digital services for their billions of customers.

Table 7-18 provides a list of TM Forum deliverables associated with IMT-2020 networks.

Table 7-18 – TM Forum deliverables

Name	Responsible group	Status	Subject	Topics
GB922 Logical and Compound Resource R19.0.1	TM Forum	Published	Network function virtualization | NaaS	IMT-2020
TM Forum GB922 Information Framework (SID) R17.0.1	TM Forum	Published	Network function virtualization | NaaS	IMT-2020
TM Forum GB922 Standards Addenda for Information Framework R17.0.1	TM Forum	Draft	Network function virtualization | NaaS	IMT-2020
TM Forum IG1139 Business Rationale and Technical Overview for Orchestration and Autonomic Control Loops R16.0.1	TM Forum	Published	Network function virtualization | NaaS	IMT-2020
TM Forum TMF070 Hybrid Environment Implementation Blueprints Suite R17.0.1	TM Forum	Draft	Network function virtualization | NaaS	IMT-2020

Table 7-18 – TM Forum deliverables

Name	Responsible group	Status	Subject	Topics
TM Forum TMF070B Advanced Platform Deployment Blueprints R17.5.1	TM Forum	Published	Network function virtualization | NaaS	IMT-2020
TM Forum TMF628 Performance Management API REST Specification R14.5.1	TM Forum	Published	NaaS, OpenAPIs	IMT-2020
TM Forum TMF664 Resource Function Activation and Configuration API REST Specification R17.5.1	TM Forum	Published	NaaS, OpenAPIs	IMT-2020
TM Forum TR255 Resource Function Activation and Configuration Suite R17.0.1	TM Forum	Draft	Network function virtualization | NaaS	IMT-2020
TM Forum TR262 Hybrid Infrastructure Platform Blueprint R17.0.1	TM Forum	Published	NaaS	IMT-2020

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[b-ITU-T Y.3321] Recommendation ITU-T Y.3321 (2015), *Requirements and capability framework for NICE implementation making use of software-defined networking technologies*.

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