ALL FOR
STANDARDS

WORK
PROGRAMME | 2023
2024

ETSI
The Standards People

INTRODUCTION FROM THE DIRECTOR-GENERAL

ALWAYS LOOKING AHEAD

This Work Programme highlights some of the current activities of our 100+ technical bodies that create standards, specifications and other deliverables that are applicable across an expansive panorama of technologies, market sectors, territories and user needs.

In ETSI we are proud to describe ourselves as 'The Standards People', a reflection of the very human nature of our work. Behind every standard – whether it's applicable to emergency communications, driverless cars, smart buildings or the cybersecurity of connected devices – lies the collective wisdom, curiosity and commitment of hundreds of experts in their respective fields.

The formal process of drafting, refining, testing, approving and publishing that standard is curated by ETSI members and our own technical experts. However this is just the 'last mile' of a complex journey, sometimes lasting several years, that may have begun in the labs of a university, a commercial company or under the auspices of a funded international research project.

ETSI's ongoing initiatives to strengthen engagement with R&D and academic communities enhance our ability to create world-class ICT standards that serve the interests of members and end-users alike. Pivotal to the strength of this vibrant ecosystem

are ETSI's Industry Specification Groups – seventeen of them currently – that provide a fertile environment for pre-standardization work to flourish. Our ISGs provide a trusted and flexible platform to channel future technologies into standardization activities. Furthermore, their uniquely agile structure and working methods offer an environment where organizations and individuals who are not ETSI members can play a key role in shaping tomorrow's world.

ETSI's work as a Standards Development Organization is by definition focused on the future. It is thus no surprise that our own working methods are constantly evolving to embrace new industry trends and opportunities. In this respect, enabling groups in ETSI to develop software in support of standardization – including open source software development – is a big step forward to enhance the quality and timeliness of our deliverables.

Visit us at **www.etsi.org** to learn more about the innovative ways we're supporting the standardization needs of our members and the wider market as we embrace the opportunities and challenges of a fast-evolving digital ecosystem.

Luis Jorge Romero,
ETSI Director-General

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FROM THE CHAIR OF THE ETSI BOARD

In ETSI we produce robust, high quality technical standards and other deliverables – over 3 300 of them in 2022 – that are instrumental in supporting European regulatory and policy needs. Driven directly by the needs of the industries we serve, ETSI's work also embraces the production of globally applicable standards that are crucial to the market success of thousands of technologies, products and services.

Technical standardization is an intrinsically collaborative process, dependent on consensus and openness. Our programme of work – deciding what to standardize, as well as the timing and resourcing dedicated to the task – is decided entirely by our members, based on proven rules and procedures that are widely regarded as an industry 'gold standard'.

Reaching back to the late 1980s, ETSI's roots in telecommunications standardization are strongly reflected in our current activities. This heritage can be seen in our role as a founding partner in 3GPP, and also our work in radio spectrum matters where we cooperate closely with the European Commission.

Digital communications pervade almost all aspects of our daily lives. The interests of ETSI members have accordingly expanded over the last three decades to embrace a complex and rapidly evolving ecosystem of ICT networks, devices and services. The opportunities – and challenges – of this hyperconnected world are reflected through our standardization activities in areas such as cybersecurity, Artificial Intelligence and Machine Learning.

While our efforts are driven directly by the needs of our members, they also acknowledge the paramount importance of the end user. Through the work of our Technical Committee on Human Factors, we are actively addressing accessibility requirements for ICT products, services and applications to ensure that the technologies we are standardizing can benefit the greatest number of people.

This Work Programme offers a brief glimpse of the scale and scope of ETSI's standardization activities. Visit us online to discover more about our planned outputs over the year ahead, including our busy programme of interoperability events, webinars and educational resources.

Dirk Weiler,
Chair of the ETSI Board

3GPP AND 5G

Always advancing

As one of the founding partners of The Third Generation Partnership Project (3gpp.org), ETSI plays a pivotal role in the evolution of mobile communications. Initially conceived to develop technical specifications for the third generation of mobile cellular network (UMTS), the standardization activities of 3GPP today span radio access, core network and service capabilities that together offer a complete system description for operators, vendors and service providers. Its specifications also provide hooks for non-radio access to the core network, and for interworking with non-3GPP networks. At the start of 2023, of the 817 member organizations of 3GPP, 460 (56%) were via their membership of ETSI.

Established in 1998, 3GPP™ brings together Standards Development Organizations (SDOs) from around the world to create technical specifications for a full range of advanced cellular communication technologies. 3GPP now encompasses seven SDOs: ARIB and TTC (Japan), ATIS (USA), CCSA (China), ETSI (Europe), TSDSI (India) and TTA (South Korea). 3GPP is a leading participant in developing the radio interface specifications for IMT-2020 - the latest member of the family of radio interface standards for mobile systems as recognized by the International Telecommunication Union. A central focus of the partnership's work is connecting the Internet of Things – with usage scenarios extending from ultra-reliable low latency communications to energy efficient low-cost, low-power sensors and devices.

The 5G and LTE-Advanced ecosystem allows for global network evolution at the appropriate pace for the market need and the local state of readiness. Leveraging maximum compatibility with legacy 3GPP infrastructure and equipment, this model enables the realization of a ubiquitous end-to-end ecosystem that can support a growing number of use cases.

Following the formal completion of 3GPP Release 17 in mid-2022, work on Release 18 continues at pace, in anticipation of a functional freeze by the end of 2023 with further maintenance scheduled to continue into the early months of 2024. Release 18 plays a significant role in helping lay the early foundations for future work on 6G technologies. Areas addressed include tactile and multi-modality communication services, access to localized services, enhanced access to and support of network slicing, timing resiliency system, smart energy and infrastructure, ranging-based services, residential 5G, personal IoT networks, performance requirements for AI/ML model transfer and guidelines for extra-territorial 5G systems.

Meanwhile RAN (Radio Access Network) and SA (Service & System Aspects) workshops being held during 2023 will explore the capabilities of Release 19, focusing on key aspects including mobility, coverage, power consumption and the increased integration of intelligence into the system. It is expected that this activity will yield a clear picture of Release 19 specifications by the end of 2023. Like its predecessor, Release 19 will be characterized by the mid-generational marker '5G Advanced', clearly distinguishing its capabilities from future 6G systems.

View the complete 3GPP work plan at www.3gpp.org/specifications/work-plan.

Source: 3GPP SP-230382
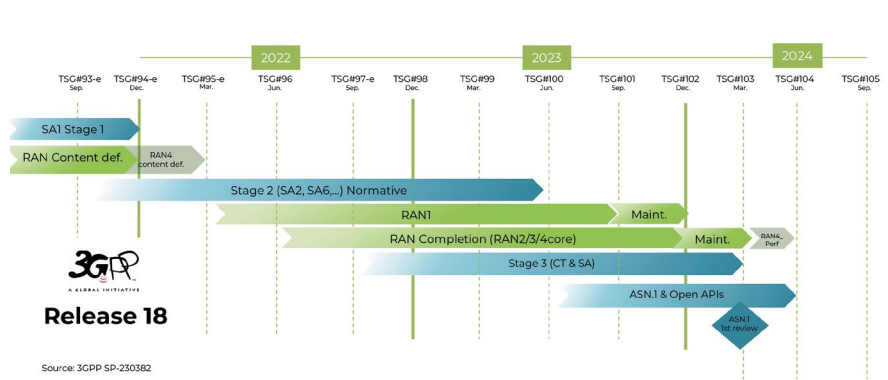
WIRELESS SYSTEMS

Radio activity
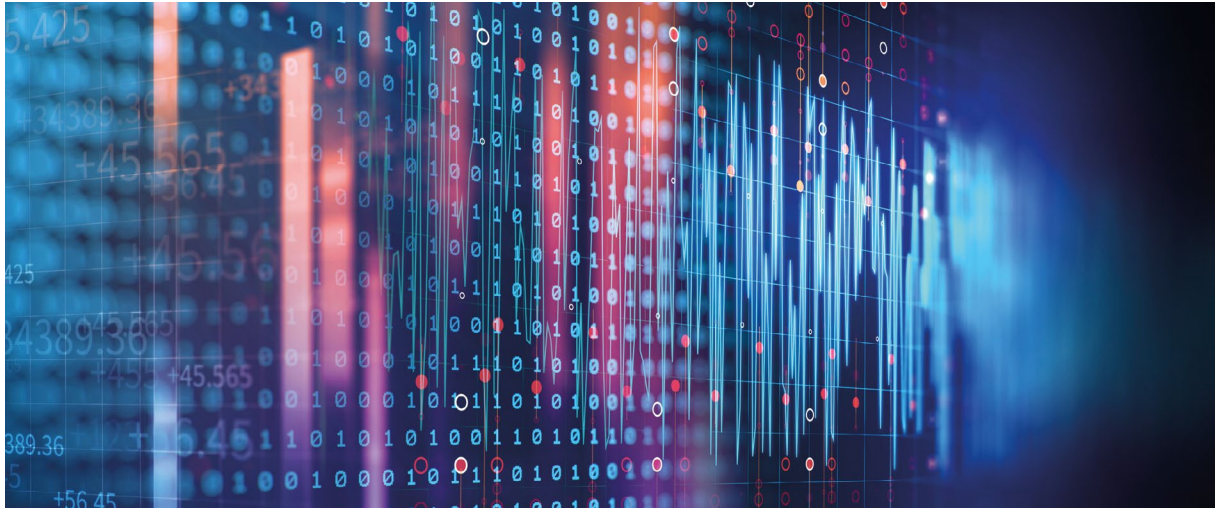
Our reliance on radio technology has never been greater, with wireless systems being intrinsic to a vast array of industries as well as our personal lives. ETSI creates standards that define many radio technologies and systems, including those used for mobile phones, broadcast radio and television, broadband networks, satellite communications, smart grids, short-range devices and cordless technology. We also create standards used by regulatory authorities in Europe and elsewhere to manage the use of radio spectrum, and to ensure safe co-existence of systems competing for use of limited spectrum resources.

Spectrum, Harmonised Standards and the Radio Equipment Directive

In ETSI we are responsible for a wide range of radio product and electromagnetic compatibility (EMC) standards and the overall co-ordination of radio spectrum matters, with much of this work being conducted in our committee for Electromagnetic compatibility and Radio spectrum Matters (TC ERM).

We assist the European Conference of Postal and Telecommunications Administrations (CEPT) in harmonizing the use of spectrum, usually by providing a technical basis in System Reference documents (SRdocs) and via our members' direct participation in CEPT Project Teams.

Through TC ERM we liaise with several EC groups in which ETSI is an observer, notably the Expert Group of Radio Equipment (EG-RE), the Radio Spectrum Policy Group (RSPG) and the Radio Spectrum Committee (RSC). We also work closely with the CEPT Electronic Communications Committee (CEPT/ECC), the Radio Equipment Compliance Association (REDCA) and the market surveillance and conformity assessment authorities through ADCO RED (Group of Administrative Co-operation under the Radio Equipment Directive).

Ensuring that users can benefit from spectrum as efficiently as possible, the scope of work across our fourteen Working and Task Groups within TC ERM embraces a broad range of industries, systems and applications. These include horizontal groups on radio and EMC matters, as well as vertical groups covering various types of Short Range Devices (SRDs), ultra wide band and wide band data systems, wireless medical devices, RFID devices, intelligent transport systems, digital mobile radio, aeronautics, maritime, radio amateur, cordless audio, PSME and TV/radio broadcast systems.

In force across Europe, the Radio Equipment Directive 2014/53/EU (RED) has required the revision or replacement of all ETSI's existing related Harmonised Standards and the development of new ones. The EC's creation of a revised approval procedure for our Harmonised Standards has thus necessitated a change in ETSI's working methods to ensure compliance with legislative requirements. In

2023 TC ERM continues to co-operate closely with the EC to optimize the efficiency of this process, as exemplified by participation in several bi-lateral events.

ETSI's co-operates with CENELEC, notably in the area of smart/connected devices where electromagnetic compatibility (EMC) requirements for the base machine need to be reconciled with requirements for radio elements providing the connectivity. This affects, for example, smart domestic appliances and some industrial machinery. We also work actively with CENELEC to align processes and support a homogeneous single market in support of competition and innovation.

An area of continuing focus in 2023 is in the area of Cybersecurity regulation, where the Delegated Act and Standardisation Request for Article 3.3 d/e/f of the RED requires the development of new Harmonised Standards. Although ETSI is not addressed directly in the Standardisation Request M/585, ETSI TC CYBER experts (together with TC ERM and TC RRS) are still supporting the activities ongoing within CEN/CENELEC.

TC ERM meanwhile continues to develop and revise various Harmonised Standards, European Standards, Technical Specifications, Technical Reports and System Reference Documents, including those relating to:

- Antennas for broadcast reception
- Aeronautical systems
- AM/FM broadcast sound
- Avalanche beacons
- C-ITS communications
- DAB and DRM transmitters
- Data Link Services (DLS)
- Digital Mobile Radio (DMR)
- Digital Terrestrial TV
- EMC
- Ground Based Synthetic Aperture Radar (GBSAR)
- Inductive loop systems for the hearing impaired
- Land Mobile Service for public protection and disaster relief
- Marine radar, navigation and communications
- Measurement and testing
- Meteorological radar
- Multiple Gigabit Wireless Systems (MGWS)
- Networked Short Range Devices (SRD)
- Primary Surveillance Radar
- Radio equipment operating below 9 kHz
- Radiodetermination
- Security scanners
- Ultra Low Power devices
- Ultra Wide Band systems
- Vehicular radar and surveillance radar
- Wideband transmission systems
- Wireless audio
- Wireless power transmission

Millimetre Wave Transmission

Widescale deployment of 5G – and the number of connections required for massive machine-type communications in the Internet of Things – are making unprecedented demands on radio access networks and backhauling.

Spectrum in the traditional microwave (6-42 GHz) and millimetre-wave (50-300 GHz and above) ranges offers enormous amounts of under-utilized bandwidth, providing more spectrum for radio transmission than lower bands with a wider channel bandwidth and fibre-like capacity. These frequencies are a major enabler for the evolution of mobile communications, including 5G and machine-type communications on a massive scale in the IoT that will make unprecedented demands on radio access networks and backhauling.

The increase in capacity needed for 5G backhaul, and the importance of microwave/millimetre wave as a backhaul medium, demand innovative ways to harness the use of spectrum for fixed services. As mobile networks evolve a key challenge is providing increased capacity, with a consequent need for more spectrum and its more efficient use.

Our Industry Specification Group on millimetre Wave Transmission (ISG mWT) provides a platform for all stakeholders in the microwave and millimetre-wave value chain to exchange technical information and increase the confidence of operators worldwide in the use of microwave and millimetre-waves. The group's work aims to remove bottlenecks in releasing new spectrum to

make microwave and millimetre-wave wireless backhaul practical for 5G operators and beyond.

Activity in 2023 includes development of two new Group Reports. These address: the use of innovative antenna systems (integral and separated TX/RX antennas) within millimetre wave transmission and consequent impact on standards and regulations; and the definition of KPIs for planning microwave and millimetre-wave backhaul networks.

Work has also been launched on a two-part conformance test specification for Wireless Transport Profile for standard SDN Northbound interfaces.

In parallel, the group continues to explore how current mWT technology and its evolution can satisfy future applications such as 5G and Fixed Wireless Access services in the timeframe beyond 2020. This considers new mobile and fixed access requirements in terms of topologies, data rates, latency and range. This is reflected in a new ETSI White Paper titled 'Worldwide analysis and proposals to promote and facilitate the wireless transport network as the key enabler for fast 5G deployment', with publication scheduled in the first half of 2023.

Reconfigurable Radio Systems

The telecommunications industry faces a major challenge – a lack of spectrum to meet growing demand, particularly for Internet and mobile communications. However, a significant amount of spectrum is allocated exclusively to organizations that do not take full advantage of it. For example, much is used only across certain areas or at specific times.

Reconfigurable Radio Systems (RRS) are smart radio entities or functions that can react to their environment and/or have their radio parameters updated via software. This offers an opportunity to support the needs of our connected world – including the Internet of Things (IoT) – by sharing spectrum among multiple services and radio networks. Spectrum sharing will also play a key role in the further development of 5G, and subsequently 6G.

ETSI's Technical Committee on RRS is responsible for the standardization of these systems, including reconfigurable equipment architecture and cognitive radio. Supporting implementation of the Radio Equipment Directive, the Cyber Resilience Act and other regulations under preparation, the committee's work encompasses Software Defined Radio (SDR) and Cognitive Radio (CR). TC RRS thus develops technical standards to meet stakeholders' needs, such as evolved Licenced Shared Access (eLSA), to enable technical interoperability as well as regulatory compliance in this scope.

In 2023 we intend to publish two Technical Reports developed by RRS Working Group 1. The first is a feasibility study that explores existing spectrum sharing frameworks for temporary and flexible spectrum access. This is accompanied by a new Technical Specification on spectrum sharing framework enhancements suited to the needs of local private networks, covering dynamic and temporary use cases. The second is a feasibility study on the use of software reconfiguration solutions in support of European regulations.

Reconfigurable Intelligent Surfaces

Reconfigurable Intelligent Surfaces (RIS) describe a new type of system node that leverages smart radio surfaces – with thousands of small antennas or metamaterial elements – to dynamically shape and control radio signals in a goal-oriented manner.

RIS technology will effectively turn the wireless environment into a service, inspiring a host of new use cases. These include enhancing systems Key Performance Indicators such as coverage and capacity, as well as enabling new wireless applications such as localization and sensing. RIS is expected to serve as a key technology in future wireless systems including 5G-Advanced and 6G.

RIS can be deployed for both indoor and outdoor usage, including offices, airports, shopping centres, lamp posts and advertising billboards, and may take any shape or be integrated onto objects. The characteristics of RIS may also result in low energy consumption, making it a sustainable, environmentally friendly technology solution.

RIS can be configured to operate at any part of the radio spectrum, including frequencies from below 6 GHz to THz, and may harness tools from Artificial Intelligence (AI) and Machine Learning (ML) to enable systems operation and optimization.

Our Industry Specification Group on Reconfigurable Intelligent Surfaces (ISG RIS) gives ETSI members the opportunity to streamline and coordinate their research efforts into RIS technology, paving the way towards future standardization in 3GPP.

Publication of three new Group Reports is expected in 2023. The first identifies and defines relevant RIS use cases, with corresponding general Key Performance Indicators (KPIs) and deployment scenarios where RIS technology will be applicable. It describes potential requirements for each identified use case, with the aim of promoting interoperability with existing and upcoming wireless technologies and networks. The second describes the technological challenges in deploying RIS as a new network node. Exploring potential impacts to network architecture, protocol architecture and a RIS control framework, it offers recommendations for requirements and potential impact to specifications supporting RIS as a new feature. The third report explores communication models, channel models, channel estimation and methodologies for evaluating the performance of RIS-integrated systems.

Broadband Radio Access Networks

Our Broadband Radio Access Networks committee (TC BRAN) produces and maintains standards and specifications for current and future Wireless Access System (WAS) and Radio Local Area Network (RLAN) technologies in different frequency ranges. The committee has primary responsibility for all aspects of standardization for broadband radio access networks, including systems as defined in ITU-R Recommendation F.1399-1.

In 2023 we expect to conclude the development and/or revision of Harmonised Standards for access to radio spectrum, addressing: WAS/RLANs operating in the license-exempt 6 GHz band; RLANs in the 5 GHz band; and Wideband Data Transmission Systems (WDTS) for fixed network radio equipment in the 57 - 71 GHz band.

We also plan to publish a Technical Report on applying new and existing mitigation techniques to systems including radio local area networks (WAS/RLAN), radar and RTTT/smart tachographs to enable coexistence in the 5 725 - 5 850 MHz band.

Satellite Systems

The applications of satellite communications technology range from direct-to-home TV and mobile links to location services and high-speed Internet access, especially for rural and outlying regions or onboard aircraft and ships.

Our Satellite Earth Stations and Systems technical committee (TC SES) is the technical body within ETSI that is responsible for creating standards for satellite terminals (earth stations) and systems. This work notably includes the development and revision of Harmonised Standards covering all aspects of satellite earth station fixed terminals or terminals on the move, whether in an aircraft, on board a ship or in a vehicle. We also continue to ensure compliance of our Harmonised Standards with the Radio Equipment Directive as part of the ongoing consultation process with the EC. This work involves regular interaction with the HAS consultant on several ENs to receive comments on compliance with RED requirements, and addressing them to ensure our Harmonised Standards are better positioned to pass the ENAP procedure and achieve listing in the Official Journal of the EU.

Ongoing activities include development and revision of standards and specifications covering: Global Navigation Satellite System (GNSS) based location systems; integration of NTN (Non-Terrestrial Network) systems into 5G; satellite broadcast reception equipment; Mobile Earth Stations (MES); Receive-Only Mobile Earth Stations (ROMES); Fixed and in-motion Wide Band Earth Stations communicating with non-geostationary satellite systems (WBES); Aircraft Earth Stations (AESs); fixed and in-motion Earth Stations communicating with non-geostationary satellite systems (NEST); Land Mobile satellite Earth

Stations (LMES); Maritime Mobile satellite Earth Stations (MMES); Earth Stations on Mobile Platforms (ESOMP) communicating with geostationary satellites; Satellite Earth Stations on board Vessels (ESVs); Vehicle-Mounted Earth Stations (VMES); Tracking Earth Stations on Trains (ESTs); and Very Small Aperture Terminal (VSAT) satellite earth stations.

Other publications anticipated in 2023 include a new Technical Report comparing DVB-S2x/RCS2 and 3GPP NR and NTN based systems for broadband satellite systems; and the revision of our Technical Specification on the Return Link Encapsulation (RLE) protocol.

Mobile Standards

The primary responsibility of our Mobile Standards Technical Committee (TC MSG) is to perform work regarding areas of activity as requested by mandates from the European Commission and all other tasks attributed to ETSI in support of European regulation of related systems.

As well as identifying European regulatory requirements on cellular systems to be developed by 3GPP, TC MSG develops Harmonised Standards covering essential requirements under article 3.2 of the Radio Equipment Directive 2014/53/EU and related ETSI deliverables for GSM as well as the IMT family of technologies and their evolution. The committee maintains close liaison with 3GPP, IEEE and the WiMAX Forum as well as other ETSI bodies which might be affected by deliverables produced by MSG.

TC MSG works alongside ETSI's Electromagnetic Compatibility and Radio Spectrum Matters Committee (TC ERM) in the joint Task Force for European Standards for IMT-2000 and IMT-2020 (TFES). TFES has primary responsibility to develop European Norms (ENs) intended to become Harmonised Standards under the Radio Equipment Directive (RED) for members of the IMT family of radio interfaces (GSM, UMTS, LTE, NB-IoT and 5G NR), as defined in ITU-R Recommendation M.1457. In specific relation to the RED – and to align with different 3GPP releases including support for 5G – this work includes ongoing development revision of our

multi-part Harmonised European Standard on access to radio spectrum for IMT cellular networks, variously addressing base stations, repeaters, user equipment and conformance testing.

In 2023 we anticipate publication of an update to our existing Harmonised Standard on Mobile Communication On Board Aircraft (MCOBA) systems, reflecting changes in regulation and the inclusion of 5G-NR non-AAS in the 1 800 MHz band.

Other expected deliverables in 2023-24 include the publication of our Base Stations and Mobile Harmonized Standards supporting 5G, as well as the issue of further specifications submitted by the O-RAN Alliance as ETSI publications within the scope of the PAS process.

A further focus of the committee's work is in support of the European Commission's next generation eCall initiative, where we interact with CEPT/ECC and CEN/TC 278 groups with a focus on testing. In 2023 we accordingly expect to publish a revision of our Technical Specification on eCall HLAP (High Level Application Protocol) interoperability testing, covering updated and new test descriptions produced from latest ETSI/3GPP base specifications.

Terahertz Communications

A huge amount of bandwidth is available in THz spectrum bands as identified by ITU between 275 and 450 GHz. At such frequencies it is possible to achieve extremely high data rates and ease spectrum scarcity problems. The very small wavelength of THz signals enables the realization of miniaturized devices and antennas. The propagation properties of THz signals may also be exploited in advanced integrated sensing and communication (ISAC) systems.

Several European and international initiatives promoting 6G research and development activities anticipate that terahertz communications will play an important role in the next generation of cellular networks. ETSI's Industry Specification Group (ISG) on THz thus provides the opportunity for members to share their pre-standardization efforts on THz technology from various collaborative research projects and other global initiatives, paving the way towards future standardization.

In 2023 we anticipate publication of the group's first deliverables as Group Reports. The group's initial Work Items variously address: use cases for THz communication systems; identification of frequency bands of interest for THz communications systems; channel measurements, radio propagation aspects and modelling; and RF hardware modelling.

DECT and DECT-2020

Originally developed by ETSI as a European standard in the early 1990s, DECT™ (Digital Enhanced Cordless Telecommunications) is implemented in more than a billion short-range communication devices around the world. The capabilities of DECT have evolved over the last three decades, with improvements to security and voice quality plus the addition of video telephony and broadband data streaming. In 2011 ETSI's specification of DECT ULE (Ultra Low Energy) broadened the technology's appeal to M2M markets such as smart metering and home automation. In parallel with these initiatives, DECT Evolution is an ongoing programme that includes new audio codecs and coding enhancements.

Interacting closely with the DECT Forum and ITU-R (WP5D), our DECT Technical Committee's activities in recent years have been focused on development of the DECT-2020 NR ('New Radio') system. With approval by ITU-R in 2022 and publication of a first revision of the IMT-2020 Recommendation ITU-R M.2150 – including 'DECT 5G - SRIT' technology – DECT-2020 NR is now officially recognized as an IMT-2020 technology. Furthermore ITU-R has confirmed that DECT-2020 fulfils 'Ultra-Reliable Low Latency Communications' (URLLC) and 'massive Machine Type Communications' (mMTC) requirements.

In 2023 the committee is developing DECT-2020 NR 'Release 2' specifications that will be used for the next revision of IMT-2020 Recommendation ITU-R M.2150. Scope of this work includes radio reception and transmission as well as Physical, MAC, DLC and Convergence Layers.

In parallel the committee continues to develop and revise numerous standards, specifications and reports supporting DECT-2020 as well as 'traditional' DECT and its evolutions. In 2023 we anticipate publication of the second part of our Harmonised Standard for access to radio spectrum that considers DECT-2020 NR operating in the 1 880 MHz - 1 900 MHz band. Other ongoing work addresses: interworking with 3GPP networks (published Q1 2023); radio test specifications; support for low data rate audio; Ultra Low Energy (ULE) machine-to-machine communications for home automation; an Application Profile for smart metering; and additional functionality to support new applications in future releases. An update of the committee's DECT Technology Roadmap is also in preparation, reflecting ongoing developments in DECT-2020 technology.

SECURITY

Enabling trust

Our need for security is heightened by the scale and complexity of today's systems and networks, where increasingly sophisticated threat vectors present an ever-evolving challenge to the integrity of ICT infrastructures. As well as satisfying users' requirements for privacy and protection, the effectiveness of all security solutions is also reliant on the trust of individuals and businesses that employ them.

Cybersecurity

The needs for security and privacy are inescapable aspects of our digital lives. Rapid growth in the complexity of new systems and networks, plus the sophistication of changing threats, present demanding challenges to maintain the security of Information and Communications Technologies (ICT) infrastructures. Security is particularly important to developments in networked systems such as the Internet of Things (IoT) and Industry 4.0. In addition, technologies such as virtualization, AI and cloud computing bring with them specific security threats.

Balancing the twin demands of privacy and protection is a major challenge. Solutions must include a reliable and secure network infrastructure, but they also depend on trust on the part of users – both individuals and businesses – that privacy, confidentiality, secure identification, privacy-friendly security, the visibility of security and other concerns are properly addressed.

A trusted centre of expertise, our Cybersecurity Technical Committee (TC CYBER) develops market-driven standardization solutions to meet strategic high-level needs, as well as offering guidance and support to regulators, users, manufacturers and network operators. TC CYBER works in close co-operation with numerous international, regional and national organizations and governments involved in cyber security, including the European Cybersecurity Agency (ENISA), CEN, CENELEC, the International Telecommunication Union (ITU) and the International Organization for Standardization (ISO). The committee also develops standards for requirements that are not catered for elsewhere in ETSI.

In anticipation of the proposed European Cyber Resilience Act (CRA), TC CYBER – in collaboration with other ETSI groups – will in 2023 analyze the proposed legislation to assess relevant existing standards and identify required work in ETSI in support of the Act.

In the area of consumer devices and privacy the committee's continuing work embraces: the devel-

opment of standards for specific consumer IoT verticals (such as residential smart door locking devices and smart voice-controlled devices); enhancements of our Consumer Mobile Device Protection Profile; and an update of our existing standard EN 303 645 'Cyber Security for Consumer Internet of Things: Baseline Requirements' – first as a Technical Specification – to improve applicability and testability as a baseline security and data protection standard. We are also developing design practices to protect consumers against technology-enabled coercive control.

Quantum computers pose a major challenge to conventional cryptographic techniques, where information such as bank account details become subject to potential discovery and misuse. The focus of our CYBER Quantum Safe Cryptography (QSC) Working Group is on the practical implementation of quantum-safe primitives, including performance considerations, implementation capabilities, protocols, benchmarking and practical architectural considerations for specific applications. QSC deliverables scheduled for completion in 2023 include new Technical Reports addressing: migration strategy for ITS and C-ITS use cases; the impact of quantum computing on cryptographic security proofs; and the combination of classical and post-quantum algorithms to construct 'hybrid' cryptographic schemes. We are also revising our Technical Specification on quantum-safe hybrid key exchange methods. In parallel we plan publication of a QSC extended roadmap that's intended to augment future work.

Quantum Key Distribution

There has been remarkable progress in the deployment of quantum technologies in communication infrastructures, with several quantum key distribution (QKD) networks currently under construction. First applications for these highly secure cryptographic methods are likely to be those requiring long term secrecy, such as encryption of sensitive government, corporate data or the health records of individuals.

In response to the pressing need to develop industrial standards for the technology, ETSI's Industry Specification Group (ISG) on QKD is leading activities to develop common interfaces and specifications that will stimulate markets for components, systems and applications.

In 2023 we aim to publish various new Group Specifications that consider: design and operation of QKD systems intended to protect against Trojan horse attacks; procedures for characterizing properties of complete QKD transmitter modules; a Protection Profile for QKD systems; and a REST-based interoperable key management system API.

Meanwhile we anticipate completion of two new Group Reports: one reviewing the variety of architectures that have been proposed for QKD networking; and another exploring the design of classical interfaces for QKD systems that include appropriate authentication measures.

We expect to publish a revision to our Group Specification on security proofs, focusing on security definition, device models, implementation security and relevant quantum key distribution protocols. We are also revising our existing Group Report on QKD vocabulary and definitions.

Security Algorithms

Our Security Algorithms Group of Experts (SAGE) Special Committee responds to the needs of other ETSI committees for cryptographic algorithms as well as organizations with whom ETSI has a formal relationship, including other European standards bodies. In particular it specifies authentication, encryption and key agreement mechanisms for a range of different standardized technologies.

In recent years most of the group's work has been for mobile telephone standards – the Global System for Mobile Communication (GSM™), the General Packet Radio Service (GPRS), the Universal Mobile Telecommunications System (UMTS™), Long Term Evolution (LTE™), and most recently 5G – all radio technologies specified by the Third Generation Partnership Project (3GPP™). Indeed, all the standardized 3GPP-specific security algorithms in 3G, 4G and 5G mobile telecommunications, as well as more recent 2G algorithms, have been specified by SAGE.

Work commissioned by 3GPP SA3 on 256-bit algorithms for 5G represents the main focus of current SAGE activities. This includes new radio interface encryption and integrity algorithms for use in both user plane traffic (data) and control plane traffic. Providing long-term resistance to possible future quantum computing attacks in 5G systems, these same 256-bit algorithms could also be potentially retrofitted to previous-generation mobile systems if required. These finalized specifications have subsequently been handed over to 3GPP SA3.

Work progresses in parallel on development of new authentication and key agreement (AKA) algorithms which will operate on 256-bit primary secrets (the keys shared by the UICC and Home Operator). SAGE was asked to build a 256-bit variant using standard AES as building block. AES has 128-bit wide input/output, and the task of building a

provable secure Pseudo Random Permutation (PRP) with 256-bit wide input/output from it, while adhering to the performance requirements, has turned out to be more difficult than anticipated. This work is ongoing.

SC SAGE continues to liaise with other ETSI Technical Committees including TC DECT (Digital Enhanced Cordless Telecommunications) regarding their own requirements for new algorithms as part of a future-proof overall security architecture.

Encrypted Traffic Integration

A paradigm of 'encrypted by default' has been adopted by many network and service providers, without taking due account of threats to network resilience and security. The network management oversight that is accepted for non-encrypted traffic – together with the ability to secure and protect enterprise networks and data centres – may be lost when an all-encrypted paradigm is adopted.

ETSI's Industry Specification Group on Encrypted Traffic Integration (ISG ETI) aims to develop insights on this evolutionary path, as well as its impact on network resilience and on security where attackers may take advantage of encryption to spread malicious code or exfiltrate protected customer or sensitive data through networks. A goal of the group is to better describe the issues and to establish essential requirements to allow for retention of network controls and protection, thus giving guarantees of security and resilience despite the growth of such a paradigm.

In 2023 we are developing a new Group Specification on integration strategies and techniques, allowing a network manager as an authorized user to access encrypted traffic for management or other lawful purposes.

A survey of the ETI ecosystem – including bodies and activities for Encrypted Traffic concepts, techniques and capabilities – is maintained in a regularly updated Wiki (https://etiwiki.etsi.org).

Lawful Interception

Lawful Interception (LI) and Lawful Disclosure (LD) play a crucial role in the development of the Information Society, by helping law enforcement agencies (LEAs) to investigate terrorism and serious criminal activity. Bringing together the interests of governments and LEAs as well as mobile network operators and equipment vendors, ETSI's committee on Lawful Interception (TC LI) develops standards supporting common international requirements, including the interception of content and disclosure of electronic communications related data with supporting standards for warranty and internal interfaces.

In 2023 we anticipate completion of a new Technical Specification that specifies flexible and extensible data structures for Lawful Disclosure, intended for use in combination with existing ETSI handover interface standards. We also expect to publish revisions to our multi-part Technical Specification on Handover Interface and Service-Specific Details (SSD) for IP delivery of services.

Securing Artificial Intelligence

Autonomous mechanical and computing entities may make decisions that act against the relying parties, either by design or as the result of malicious intent. The primary responsibility of our Industry Specification Group on Securing Artificial Intelligence (ISG SAI) is to develop technical specifications that mitigate against threats arising from the deployment of AI – and threats to AI systems – from both other AIs and from conventional sources. The group's work is intended to frame the security concerns arising from AI. It will also build the foundations of a longer-term response to the threats to AI in sponsoring the future development of normative technical specifications.

Group Reports in development in 2023 variously address: the traceability of AI models; security testing of AI; security aspects of pervasive and collaborative AI; automated manipulation of multimedia identity representations; explicability and transparency of AI processing; security aspects of pervasive and collaborative AI; privacy aspects of AI/ML systems; and security aspects of using AI/ML techniques in the telecom sector. Work has also been launched on a Group Specification that details an AI computing platform security framework.

The group continues to work closely with TC CYBER and OCG AI to consider how its own activities can contribute to the development of future EU Harmonised Standards under the EU AI Act.

The Secure Element

Formerly known as TC SCP (Smart Card Platform), ETSI's Technical Committee on Secure Element Technologies (TC SET) is responsible for developing and maintaining specifications for the Secure Element (SE) used in telecommunication systems including the Internet of Things (IoT) and Machine-to-Machine (M2M) applications.

TC SET develops 'agnostic' specifications that can find their way into other applications such as ID management, ticketing and contactless cards used in financial services. TC SET's specifications encompass not only requirements and the technical solution but also conformance testing for both the SE and the terminal. The remote management of SEs and the interfaces required for the interaction of servers involved in this management are also addressed in the committee's work.

TC SET is the home of the UICC – the most widely deployed Secure Element with more than five billion pieces entering the market every year just as SIM cards, a share of well over 50% of the Secure Elements market (source: EUROSMART). The committee is also home of the new Smart Secure Platform (SSP). Designed as a flexible platform to cover needs from diverse industries (e.g. automotive, banking, telecom, IoT) SSP offers a more flexible platform than the UICC. It can be adapted to multiple different products and markets, while maintaining a common set of features and some of the characteristics of the UICC platform. SSP offers an open platform for multiple applications, a choice of physical interfaces and form factors to adapt to market needs, a new modern and flexible file system, built-in capabilities to support multiple authentication methods (such as biometric). It is designed to further the design of scalable secure solutions that can be optimized to fit different markets and products.

In 2023 TC SET and its Working Groups continue to provide enhancements and improvements to the committee's extensive suite of specifications, reports and test documents. TC SET WG TEC is working on technical realization of requirements for the CAT-Runtime environment for the support of logical Terminal-UICC interfaces and logical SEs. TC SET WG REQ will progress further work on collecting and defining requirements for the non-removable UICC to support the I3C® interface. TC SET WG TEST is addressing test specifications for the Logical Secure element Interface (LSI). Meanwhile TC SET is progressing work on Toolkit Test Events API support for device testing.

Electronic Signatures and Infrastructures

ETSI's committee on Electronic Signatures and Infrastructures (TC ESI) addresses the requirements of digital signatures and trust services supporting authenticity and accountability of electronic transactions. These include formats, procedures and policies for creation and validation of provision signatures, as well as trust service supporting the accountability and authenticity of transactions.

The committee's scope covers policy, security, and technical requirements for trust service providers (TSPs) such as certification authorities, time-stamping authorities, TSPs providing remote signature creation or validation functions, registered e-delivery providers, and long-term data preservation providers and provision attributes associated with electronic identities. The work of TC ESI accordingly supports eIDAS (electronic identification and trust services) regulations, as well as general requirements of the international community to provide confidence in electronic transactions.

Reflected in the committee's development and ongoing maintenance of existing standards and technical specifications, key focus areas in 2023 include: standards in support of revised eIDAS regulation and the use of new technologies such as zero knowledge proofs, distributed ledgers and digital identity wallets. This includes profiles and policies for electronic attestations; revised general requirements for trust services to support

the newly-enforced NIS2 Directive (EU-wide legislation on cybersecurity); standards for policy and security requirements of ledgers for smart contracts; standards for electronic identities and electronic signatures for smart contracts; and next-generation registered electronic delivery and electronic mail.

Distributed Ledgers

Distributed ledger technologies record transactions and their details on multiple, distributed, nodes, disintermediating a centralized data store or administration functionality as with traditional databases. While distributed ledgers are mostly known through their application to blockchain and cryptocurrencies, other use cases include support of digital identity attributes, object tracking, or the verification of service level agreements.

While most ledgers in ICT are centralized, recent approaches based on distributed ledgers can provide disintermediation, openness and better resiliency. Permissioned (managed) distributed ledgers (PDL) in particular are suited to business-oriented use cases of industry and governmental institutions in environments where a certain level of trust may exist. From a technical perspective, PDL reduces the overheads associated with recording a transaction through use of suited consensus algorithms, advanced governance methods and standardized processes among participants.

Our Industry Specification Group on Permissioned Distributed Ledgers (ISG PDL) is exploring the challenges presented by the operation of permissioned distributed ledgers. The group also addresses application scenarios, functional architecture and solutions for the operation of permissioned distributed ledgers, including interfaces/APIs/protocols and information/data models.

In 2023 we are revising our PDL reference architecture framework to align with the GSMA. In parallel several Group Reports are in development. These variously address: interaction between Smart Contracts and 'oracles' in alignment with the European legislative proposal for the Data Act; PDL applicability as a qualified electronic ledger for eIDAS for authentication and identification; redactability of distributed ledgers, investigating potential use cases and assessing existing solutions with a discussion of potential standardization areas; analysis of PDL services for decentralized identity and trust management; applicability of operator networks for PDL services; wireless consensus network architecture; and an overview of PDL use cases specific to 3GPP networks.

We are also developing a Group Specification that discusses the use of PDL in wholesale supply chain management, with an emphasis on the ICT services sector. Meanwhile ISG PDL continues to develop Proofs-of-Concept (PoCs) in order to facilitate collaboration with research projects developing or incorporating distributed ledger technologies.

CONNECTING THINGS

Better together

Billions of connected devices are the drivers for transformative user experiences, applications and sources of business value. This is the Internet of Things (IoT), drawing together technologies including Radio Frequency Identification (RFID), Machine-to-Machine (M2M) service platforms and wireless sensor networks. IoT use cases span smart cities, devices and grids, connected vehicles, eHealth, home automation and energy management, public safety, logistics, process control and more.

oneM2M

ETSI is a founding partner in oneM2M, the global initiative launched in 2012 that develops specifications to ensure the efficient deployment of Machine-to-Machine (M2M) communications systems and the Internet of Things (IoT). Covering requirements, architecture, Application Programming Interface (API) specifications, security solutions and interoperability for M2M and IoT technologies, oneM2M's architecture and standards are applicable in many different industries.

Across the world, IoT devices, gateways and platforms are being built based on the oneM2M standard. Other organizations are deploying IoT solutions and data-exchange systems using such components within oneM2M's horizontal architecture framework.

Aiming to ensure the global functionality of M2M and prevent duplication of standardization effort, oneM2M draws together players from business domains including industrial automation, smart grid, telematics, utilities, intelligent transportation, public safety and health.

A primary goal is development of specifications for a common M2M and IoT service layer that can be embedded within hardware and software to connect a wide range of devices worldwide with M2M application servers. This will enable users to build platforms that allow devices and services to be connected – regardless of the underlying technology used – thus enabling interoperability across IoT applications. In this way, oneM2M specifications can reduce complexity for application developers while reducing costs for service providers. Specification development is complemented by a certification programme and regular interoperability test events.

Following ratification of oneM2M Release 4 in December 2022, the milestone plan for Release 5 suggests tentative ratification and publication in Q4 2024. This latest iteration considers functionalities including advanced semantic discovery, system enhancements to support data protection regulations, interworking with SensorThings API, AI enablement to oneM2M, and effective IoT communication for protecting 3GPP networks as well as smart city and other use cases. Furthermore, work continues to enhance and improve the oneM2M standard with sustainability-oriented features, drawing on results from case studies in real-world IoT deployments.

Machine-to-Machine Communications

M2M (Machine-to-Machine) communications are the foundations for a fast-evolving world of smart devices, appliances, homes, cities and communities. TC SmartM2M (Smart M2M Communications Technical Committee) is the main Technical Body in ETSI that reflects our role in oneM2M (onem2m.org). Supporting European policy and regulatory requirements including standardization requests in the areas of M2M and IoT, SmartM2M creates reports and specifications that enable users to build platforms that allow devices and services to be connected, regardless of the underlying technology used.

The committee's work enables devices to exchange information through SAREF, ETSI's Smart Applications REFerence ontology that runs with oneM2M-compliant communication platforms. Providing building blocks that allow separation and recombination of different parts of the ontology depending on specific needs, SAREF specifies core concepts in the smart applications domain and the relationships between them.

In 2023 much of the committee's work is focused on comprehensive revision of the suite of SAREF extensions, using updated reference ontology patterns. These extensions cover the domains of Water, Lifts, Energy, Environment, Building, Smart Cities, Industry & Manufacturing, Smart Agriculture and Food Chain, Automotive, eHealth/Ageing well, and Wearables. A new extension for the Smart Grid domain is also in development. This work is accompanied by revision of the SAREF core and SAREF development framework and workflow. Other deliverables in progress – intended

for publication as various Technical Specifications and Technical Reports – address 'digital twins' and evaluating the performance of oneM2M-based IoT platforms.

Part of ETSI's New Working Methods initiative, the official ETSI portal for SAREF gives user communities direct links to SAREF ontologies and SAREF-related work items, allowing stakeholders to share their specific requirements and give direct feedback on their use of ontologies. In 2023 we will continue to develop and maintain our catalogue of SAREF extensions, specifications and documentation. Visit saref.etsi.org for latest updates.

Context Information Management

From the digitizing of industrial processes to creating smart services for citizens, it is essential to accurately record data together with its context information (such as space, time, relations) and to transfer these without misinterpretation to other systems.

The mission of ETSI's Industry Specification Group on cross-cutting Context Information Management (ISG CIM) is to make it easier for end-users, information systems, data spaces, IoT platforms and 3rd-party applications to exchange information – with proper formal definitions, between vertical applications – so that these applications get the original meaning.

The group develops and maintains technical specifications and reports that enable development of interoperable software implementations of a cross-cutting Context Information Management (CIM) Layer, using a RESTful interface called the NGSI-LD Application Programming Interface (API) that enables close to real-time update/access to information from many different sources (not limited to IoT). In 2023 we will continue to release incremental API updates, drawing on feedback from developers, end users and stakeholders.

Other Work Items in development notably include: a revision of our Group Specification defining an NGSI-LD cross-domain information model; an updated assessment of security and privacy issues, in particular related to the NGSI-LD API; revision of our NGSI-LD primer; a new Group Report on recommendations for NGSI-LD interworking; an NGSI-LD testing framework, interoperability test descriptions and implementation conformance statement, plus revisions to our NGSI-LD test suite and test purposes descriptions; extension of our survey of CIM use cases to cover further areas such as smart food, smart agriculture, smart industry and multi-modal transport; example case studies of real-world NGSI-LD adoptions; and a study of NGSI-LD architecture deployment scenarios.

eHealth

eHealth represents the application of ICT (information and communications technologies) across a wide range of functions that affect the health sector. Examples of eHealth systems and applications include health information networks, electronic health records, telemedicine services, personal wearable and portable communicable systems including those for medical implants, health portals, and many other ICT-based tools assisting disease prevention, diagnosis, treatment, health monitoring and lifestyle management.

eHealth promises to improve the quality of healthcare, reduce costs and help to foster independent living. However its successful implementation relies on the widespread digitization of all sectors of society. Our Technical Committee on eHEALTH is responsible for coordinating ETSI's activities in the eHealth domain, and for identifying gaps where further standardization activities may be required.

In 2023 the committee is progressing a new ETSI Specification on data recording requirements for eHealth. Its scope is to identify and specify requirements for recording eHealth events, namely those from ICT based eHealth devices and from health practitioners. The intended output is a normative framework for ensuring events/transactions related to a patient are recorded accurately by identifiable entities (devices or health professionals), and made available with minimum delay to other health professionals.

A further critical role for eHealth is emerging with the introduction of Artificial Intelligence (AI) into many areas where eHealth presents important use cases. In particular the Covid-19 pandemic has highlighted the potential of AI/eHealth in areas including: the design and testing of new vaccines; tracking and tracing the spread of disease; rapid decision making for treatments as new cases appear; monitoring the success of isolation and lock down policies, and an assessment of economic and societal costs; and supporting the work of public health authorities and governments to make effective policy decisions. Currently in development, a new ETSI Guide explores the role of AI as an accelerator for eHealth processing, with specific consideration of ethical, security and privacy issues surrounding the use of AI in an eHealth context.

Work also continues on a Technical Report describing a presence preserving proximity function trigger (3PFT) that can be employed for a variety of eHealth uses whilst a visitor is present at a public venue. Its goal is the design of a multi-input privacy protected presence-aware function triggering framework for use on smartphones and other IoT-devices.

Body Area Networks

As the use of wearables and connected in- and on-body sensor devices grows rapidly in the Internet of Things (IoT), Wireless Body Area Networks (BAN) facilitate the sharing of data in environments such as smart homes, living environments, automotive and aerospace.

In areas such as digital healthcare/wellness and medical monitoring, personal safety, sports and leisure, wireless connectivity between the data collection or control centre and devices or sensing nodes requires a standardized communications interface and protocols. Key challenges in these use cases include interoperability over heterogeneous networks in the future IoT, ultra-low power consumption for greater autonomy, latency, security, communications in harsh environments (such as implant communications), robust operation in the presence of RF interference and the ability to interact with embedded intelligence in smart environments.

ETSI's Smart BAN committee (TC SmartBAN) addresses the need for global standards to support the successful market roll-out of BAN technology. Various Technical Specifications in development in 2023 address: extensions of the SmartBAN MAC to enable hub-to-hub communications between neighbouring SmartBANs; specification of the Data Scanner Agent for SmartBAN low power and low energy devices; ultra-low power, ultra-wide band (UWB) physical layer (PHY) specifications for swallowable pill-camera wireless devices; and specifications for a SmartBAN coordinator acting as a 'bridge' between the SmartBAN and its surrounding infrastructure. Meanwhile we are updating an existing specification on associate service model/ontology/enablers extensions with the addition of unified service/application level representation formats, a semantic open data model and corresponding ontology. We are also developing a new Technical Report describing the Brain Computer Interface (BCI) architecture.

NETWORKS

Net gains

Networks are rapidly becoming smarter, more complex and harder for human operators to manage efficiently. Organizations and individuals are dependent on reliable, feature-rich communications services that can be accessed anytime, anywhere and on any device – putting pressure on operators to make their networks more agile, resilient and sustainable through technologies including virtualization, automation and AI. At ETSI we provide a comprehensive set of standards to increase the utility and efficiency of today's access networks – and tomorrow's.

Network Functions Virtualization

A key enabler for the success of 5G and beyond – and also relevant to other telecoms network architectures – Network Functions Virtualisation (NFV) consolidates heterogeneous network equipment types onto standard IT servers, switches and storage. NFV is an essential aspect of modern network design, simplifying roll-out of new services while reducing deployment and operational costs.

With the support of dozens of organizations worldwide, the goal of ETSI's Industry Specification Group (ISG) on NFV is to create specifications that can accommodate today's and tomorrow's network requirements. The group's primary responsibility is to consolidate technical specifications towards the definition of a consistent operational integration with current and future network services. It is also addressing additional requirements for NFV technologies brought by the evolution of telecommunications networks, notably in relation to 5G and subsequent generations.

ISG NFV uses a system of incremental Releases to structure its work programme. With the acceleration of NFV-based deployments triggered by the introduction of 5G systems – especially core network – areas addressed in Release 4 include: evolution of NFV framework to support new cloudification and virtualization technologies; increased support for automation; and novel management architectural styles and operationalization aspects, leveraging virtualization characteristics to simplify deployments.

The development of normative specifications based on these requirements is a key area the group's 2023 work programme.

In parallel, work in 2023 on Release 5 focuses on two main directions: namely consolidation of the NFV framework, while expanding its applicability and functionality. Continuing to embrace wide industry needs, this includes studies on enhanced container networking, network connectivity integration and operationalization, multi-tenancy enhancement for NFV-MANO, service based architecture for NFV-MANO and VNF generic management functions that have been ongoing since 2022 in anticipation of normative work. During early 2023 we accordingly anticipate completion of studies addressing areas such as multi-tenancy, NFV for vRAN, GreenNFV, Flexible VNF deployment and reliability for cloud native VNF.

ISG NFV has also commenced work to identify the need for Release 6. The group is currently reviewing proposals from its members and participant companies on key features. Release 6 activities are accordingly expected to accelerate during 2023.

Open Source MANO

ETSI is actively exploring synergies between the worlds of open source and standardization in its work on NFV. Two key components of the ETSI NFV architectural framework are the NFV

Orchestrator and the Virtualized Network Function (VNF) manager, referred to collectively as NFV Management and Orchestration, or MANO.

Open Source MANO (OSM) is an ETSI-hosted initiative to deliver a regularly updated implementation of the MANO stack, aligned with ETSI NFV Information Models and meeting the requirements of production NFV networks. Development is based on accepted open source working procedures, using a software development platform managed by ETSI.

Complementing the work of ETSI ISG NFV, OSM aims to support the growth of a thriving NFV vendor ecosystem capable of delivering solutions rapidly and cost effectively. Accessing a diverse set of contributors and developers, it harnesses synergies between standardization and open source approaches – maximizing innovation, efficiency and time to market by ensuring a continuing series of reference implementations.

Announced in December 2022, OSM Release THIRTEEN introduces a new scalable architecture for service assurance and closed-loop operations leveraging on cloud-native versions of Apache Airflow and Prometheus. This architecture is prepared to cover the most demanding service assurance scenarios such as auto-healing and auto-scaling in large clouds and multiple edge sites. In addition, Release THIRTEEN includes significant improvements in other key areas: these include new capabilities for Network Service deployment, improved

execution environments, architectural evolution of the LCM module, OSM air-gapped installation and enhancements in the OSM client.

Release FOURTEEN is anticipated by the middle of 2023, with Release FIFTEEN due towards the end of the year.

By the end of 2022 code for OSM Releases ONE to TWELVE had been downloaded over 55,000 times from more than 85 countries.

Our OSM Release THIRTEEN webinar demonstrates new capabilities and use cases that the OSM community has been working on during the latest development cycle.

See OSM Hackfest presentations, demonstrations and talks on the dedicated Open Source MANO YouTube channel. Learn more about OSM activities at osm.etsi.org

TeraFlowSDN

Launched in May 2022, Open Source Group TeraFlowSDN (OSG TFS) is modelled on the success of ETSI's OSM (Open Source MANO) initiative which has already been adopted by over 30 EU-funded research projects.

Hosted by ETSI and based on results of the European Union-funded TeraFlow 5G PPP research project, OSG TFS defines a framework for the development of a cloud-native SDN controller for high-capacity IP and optical networks, aimed at supporting future networks beyond 5G.

Based on a cloud-native, micro-services architecture, it provides a 'toolbox' for research projects and ETSI groups working on network transformation to experiment with new features for flow aggregation, management, network equipment integration, AI/ML based security, and forensic evidence for multi-tenancy.

Supporting use cases such as autonomous networks and cybersecurity, it will help service providers and telecommunication operators to meet the challenges of future networks. Software developed by OSG TFS will also be a valuable tool for other ETSI groups working on network transformation, enabling the alignment of goals and helping to accelerate standardization cycles.

Announced in February 2023, TeraFlowSDN Release 2 provides extended and validated support for end-to-end transport network slicing over multiple network domains. Other highlights include improved scalability and resilience of the SDN controller; re-engineered Service Level Agreement (SLA) validation; updates to cybersecurity mechanisms; and the extension of Distributed Ledger Technology (DLT).

The source code of TeraFlowSDN is publicly available under the Apache Software Licence 2.0 for download and installation at https://labs.etsi.org/rep/tfs/controller. TeraFlowSDN Release 2.1 is planned for June 2023 and will include more integrated contributions, bug fixes and security patches.

Multi-Access Edge Computing

Multi-access Edge Computing (MEC) offers application developers and content providers cloud computing capabilities at the edge of the network, in an environment characterized by ultra-low latency and high bandwidth together with real-time access to radio network information that can be leveraged by applications.

Allowing operators to open their Radio Access Network (RAN) to authorized third parties, MEC enables the rapid deployment of innovative applications and services for mobile subscribers, enterprises and vertical segments. If on one hand it is a key supporting technology for many 5G use cases, MEC (given its access-agnostic nature) can be deployed also in Wi-Fi and fixed networks. Moreover, MEC is not only addressing the needs of mobile operators, but it is a key enabler for interworking also with cloud providers, edge data centres and neutral hosts. MEC enables a wide range of IoT and mission-critical vertical solutions, from gaming and Virtual Reality to Intelligent Transportation Systems and the industrial Internet. Supporting increasing QoS requirements for these applications and use cases, it also offers improved privacy and security.

ETSI's ISG (Industry Specification Group) MEC is standardizing an open environment to enable the integration of applications from infrastructure and edge service providers across MEC platforms and

systems. This work focuses on the development of a standardized solution that enables seamless integration of applications from vendors, service providers and third parties across multi-vendor MEC platforms in a distributed cloud environment. Crucial to this is the creation of a consistent set of Application Programming Interfaces (APIs) for edge developers to build services and applications. All MEC APIs are freely available from the ETSI Forge (forge.etsi.org).

While 2023 will be focused on the consolidation of the normative work of Phase 3, the group is already planning the transition toward Phase 4, that will start in 2024.

In Phase 3 the ISG has released a new version of the MEC framework and reference architecture, and it is revising/updating terminology, use cases and normative technical requirements, together with a new version of the specification on general principles, patterns and common aspects of MEC Service APIs. Other existing publications being revised include the specification on edge platform application enablement; enhancements to the application mobility service API in order to support inter-MEC system communication; and updates to MEC federation enablement APIs. The group is also developing new QoS Measurement APIs and a set of sensor-sharing APIs. Meanwhile new Group Reports under development study many topics, including MEC security, abstracted APIs for Industries and MEC application slices.

Focused on accelerating growth of the MEC ecosystem, ISG MEC Working Group DECODE (Deployment and ECOsystem Development) continues to manage all MEC STFs, Proofs of Concept (PoCs), Deployment Trials (MDTs), MEC APIs, testing/compliance and Hackathons as well as the MEC ecosystem wiki. DECODE deliverables in progress in 2023 include revisions to its multi-party MEC API Conformance Test Specification.

DECODE also curates the MEC Sandbox, an environment that allows developers to experience and interact with an implementation of ETSI MEC APIs while testing their own applications. See try-mec.etsi.org. STF644 has just successfully concluded, introducing a host of new Sandbox capabilities. There is now support for the Bandwidth Management API (MEC 015), the Device Application Interface (Mx2) API (MEC 016) and enhanced support for the V2X Information Service API (MEC 030), including V2X related information exchange via message broker. During 2023 DECODE will continue to explore further Sandbox development opportunities.

During the year, the group also plans to make regular additions to the growing set of tutorials that can be viewed on our 'MEC Tech Series' YouTube channel.

Experiential Networked Intelligence

Software Defined Networking (SDN), Network Functions Virtualization (NFV) and network slicing are making networks more flexible and powerful, at the expense of making them harder to manage efficiently. The use of Artificial Intelligence (AI) techniques in the network supervisory and management system can help address some of the challenges of future deployment and operation. Our Industry Specification Group on Experiential Networked Intelligence (ISG ENI) develops standards that use AI mechanisms based on context-aware, metadata-driven policies. By recognizing new or changed knowledge – and thus make actionable decisions for operators – this enables an efficient intelligence-based assistance to SDN and NFV deployments which will in turn manage and orchestrate the network. The group accordingly considers a range of ENI related issues including architecture, AI, security and Proof of Concept (PoC) frameworks.

Activity in 2023 addresses ENI Release 4 as well as publication of updates to existing Release 3 deliverables. Alongside approval to our ENI use cases, requirements, terminology and system architecture, a report on evaluation of categories for AI application to networks is expected to be approved later toward the end of 2023. Several specifications and reports are in approval relating to: prominent control loop architectures and data processing requirements mechanisms; ENI information model definition; construction and application of fault maintenance network knowledge graphs. A further report is published on Intent policy modelling.

Several new specifications and reports are in development, relating to: processing and management of intent policy (expected to be completed later in 2023); transformer

architecture for ENI policy translation moved to Release 4; in-situ flow information telemetry (IFIT) deployment scenarios; intent policy multi-stage translating; network policy conflict detection; and definition of network autonomicity features and levels for IP networks.

Developed according to our Proof of Concept Framework, ENI Proofs of Concept (PoC) are intended to demonstrate ENI as a viable technology. Results are fed back to the relevant Industry Specification Group for each PoC. A list and descriptions of all current ENI PoC are available on the public ETSI ISG ENI Wiki.

Zero Touch Network and Service Management

Maximizing the efficiency of end-to-end network operations requires increased automation of functions that are currently administered with direct human intervention, such as configuration and capacity management. Today, the automation of network and service management has become an urgent necessity to deliver services with speed and agility while ensuring their economic sustainability. The goal of our Industry Specification Group on Zero Touch Network and Service Management (ISG ZSM) is to provide an end-to-end solution steered by high-level policies, where all operational processes and tasks – including delivery, deployment, configuration, assurance, and optimization – are executed automatically, without manual supervision beyond the initial transmission of intents.

Progress continues on several Work Items, anticipating publication during 2023. We are developing two Group Specifications: the first addresses security aspects for ZSM, and the second details capabilities to support the combination of closed-loop automation with intents originating from ZSM consumers.

Three new Group Reports are also in preparation. The first augments our multi-part study on closed-loop automation, investigating advanced topics such as learning and cognitive capabilities. The second examines the automation of CI/CD (continuous integration / continuous development) for ZSM services and managed services. The third describes the Network Digital Twin concept, investigating its applicability for automation of zero-touch network and service management with an examination of scenarios that can benefit from it. Meanwhile we are revising our Group Report that presents a study of intent-driven autonomous networks. We are also updating our glossary of ZSM-related terms and concepts.

Non-IP Networking

Limitations of the ageing TCP/IP-based technology used in today's networks result in the inefficient use of network resources and capacity. This is because mobility, multihoming, security, quality-of-service, and other features are being added to a protocol that was never designed to support them. In today's 5G, fibre-optic and satellite networks and beyond, network owners and service providers are therefore exploring new technologies that can serve their needs for advanced services better than the ageing TCP/IP stack.

ETSI's Industry Specification Group on Non-IP Networking (ISG NIN) is standardizing protocols that will provide better support for 21st century use cases than the one provided by the TCP/IP-based networking used in current systems. The group is dedicated to the specification of alternative networking protocols to support today's demanding applications, as well as being more energy-efficient and easier to manage and hence drive lower network operation costs. The group thus intends to develop standards which define technologies that make more efficient use of capacity, are secure by design, and easily provide lower latency for live media. The outputs of ISG NIN are initially applicable to private networks for applications such as factory automation, and to local area networks (wired and wireless) supporting time-sensitive applications such as sound reinforcement. It is anticipated this will expand to embrace public systems, both in access networks and, eventually, in radio elements.

In 2023 we anticipate publication of a Group Specification that describes procedures and packet formats for the carriage of Flexilink flows (both basic service and guaranteed service) over the DECT 2020 New Radio interface. Work has also been launched on a Group Report that offers guidance for implementing non-IP networking in the satellite access network stack.

Fifth Generation Fixed Network

The evolution of fixed networks will also play a vital role in the success of 5G and future mobile systems. Building on previous technology iterations, this 'fifth generation' of fixed networks targets the goals of delivering full-fibre connections, enhanced fixed broadband and a guaranteed user experience in both industrial and consumer applications.

For home scenarios, emerging services such as Cloud VR (virtual reality) and AR (augmented reality) video streaming or online gaming introduce the necessity for ultra-broadband, extremely low latency and zero packet

loss. Business scenarios such as the cloudification of enterprise networks, leased lines, or POL (Passive Optical LAN) require high reliability and high security. Industrial applications have specific requirements on the deployment of fibre infrastructures, including tolerance for extreme environmental conditions such as humidity, temperature or electromagnetic interference.

ETSI's Industry Specification Group dedicated to defining the fifth generation of Fixed Network (ISG F5G) is studying the evolution in fixed networks to match and enhance the benefits that 5G already has brought to mobile communications.

In 2023 we aim to complete a set of essential documents – including landscape, technology gaps and architecture – for the second release of F5G specifications, while also developing detailed specifications for the measurement of the Quality of Experience in residential services, and specifications for data models related to access network telemetry applications.

We are also developing specifications for PON based industrial networks. This work is complemented by a study on the application of optical networks to support and enhance users' access to cloud services. Meanwhile the group is already addressing the evolution to F5G-Advanced networks, collecting specific use cases and developing a description of the new generation of fixed network it represents.

Cable

Our Integrated Broadband Cable Telecommunication Networks committee (TC CABLE) develops standards and specifications addressing the evolution of the capabilities of broadband cable networks. With its focus on the cable platform, TC CABLE works in close cooperation with several other ETSI technical bodies such as TC RRS, TC CYBER and TC ERM to address general developments in the telecommunications space.

The committee's work leverages close relationships with the Society of Cable Telecommunications Engineers (SCTE), CENELEC and ITU-T. TC CABLE takes input from the wider global cable community to foster innovation and competitiveness, making technology available industry-wide based on voluntary standards.

TC CABLE deliverables primarily relate to network terminals (including cable CPE devices and network terminating devices) and their interfaces, as well as to network infrastructure including network topologies, HFC (hybrid fibre-coax) network distribution and frequency management. Its work also considers service, security, energy efficiency and sustainability aspects of integrated broadband cable telecommunication networks.

Following publication in 2022 of a multi-part standard – based on DOCSIS® 4.0 specifications – that enables multi-Gbps symmetrical services in the cable access network, further work on the evolution of the broadband cable communication platform continues in 2023. We are also launching work on a new standalone router standard. This will define a core set of features that enable multiple subscriber devices to gain access to operator provided high-speed data service independently of the underlying access network.

Enabling further contributions to industry efforts to use energy and other resources efficiently, we are developing sub-parts of our European Standard on design and operational KPIs for energy management in operational infrastructures considering cable access networks.

Meanwhile we expect to make further progress on a Technical Specification on network performance measurement methods for broadband data services as well as on signal transmission characteristics of coaxial cables in HFC networks.
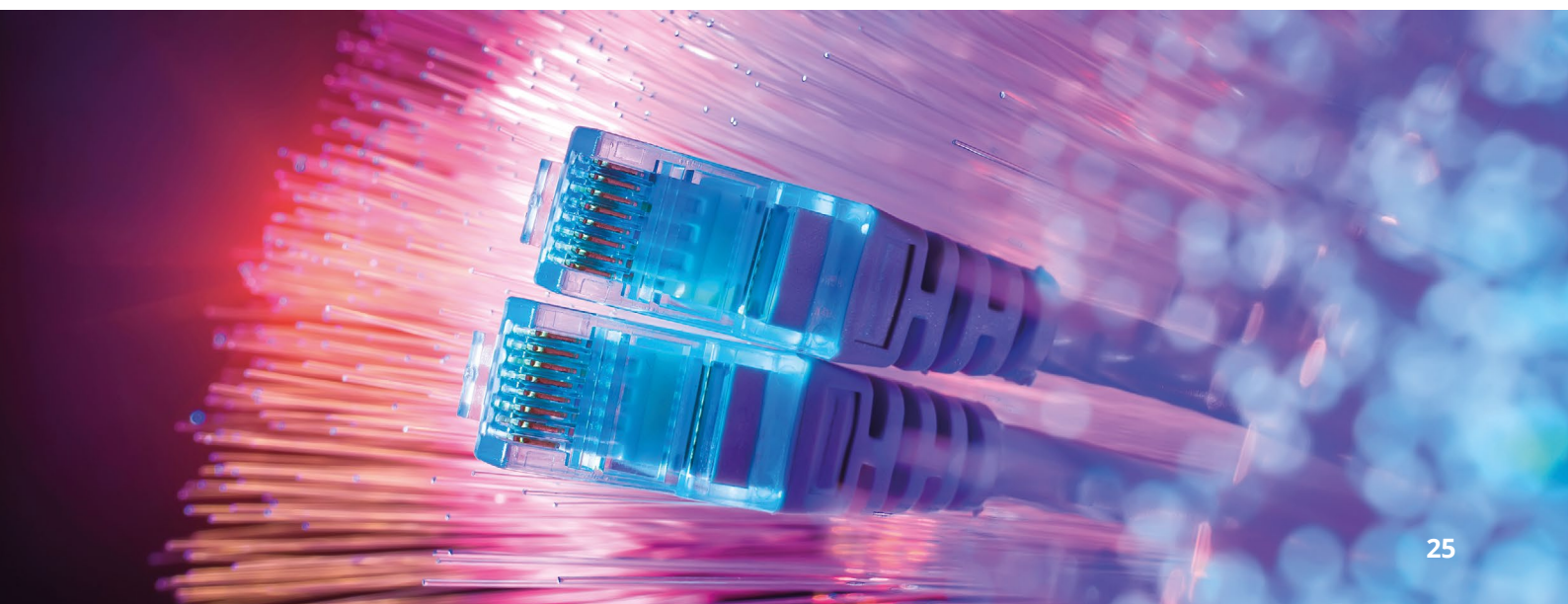
TRANSPORTATION

Direction of travel

Information and Communication Technologies are revolutionizing the transport sector, increasing reliability and safety while providing opportunities for reducing energy consumption and improving sustainability. We develop standards to accelerate the introduction of Intelligent Transport Systems (ITS) services and applications, based on experience gained from early market deployments. Our work also addresses rail, aeronautical and maritime transportation, and the use of satellite communications standards for high-speed Internet access on board aircraft, ships or in vehicles..

Intelligent Transport Systems

Intelligent Transportation Systems (ITS) enable smarter, more coordinated and efficient use of transport networks. In ETSI we are helping to accelerate the introduction of ITS services and applications, and to maximize their benefits by developing common European standards and technical specifications to enable interoperability. With the progressive deployment of ITS services in many world regions, our work is playing a significant role in making roads safer and more efficient.

Our ITS Technical Committee (TC ITS) has primary responsibility for the development and maintenance of standards, specifications and other deliverables to support ITS service provision for transport networks, vehicles and transport users. This work covers interface aspects and multiple modes of transport and interoperability between systems, while ITS-related EMC and radio spectrum matters are dealt with in TC ERM TG37.

In 2023 the committee and its five working groups continue to enhance existing Technical Specifications, with the addition of further features enabling greater protection of vulnerable road users, as well as functionalities to support the longer-term goal of fully automated driving. To reflect latest technology advances, TC ITS is also updating its wide range of ITS-related Technical Specifications and test specifications. These variously address application requirements and services, architecture and cross layers, transport and network, privacy, security and media/medium-related aspects.

Radio Spectrum for Road Transport Services

TC ITS cooperates with ETSI's Rail Telecommunications technical committee (TC RT) on Urban Rail and Road ITS applications in the 5,9 GHz frequency band. The purpose of this work is to specify a spectrum sharing solution to be applied in the ITS band (5 875-5 925 MHz) to meet Urban Rail ITS and road ITS applications requirements. This work is being supported through progress on a measurement campaign to validate interference simulation results and confirm simulation parameters which would be used to define the proper mitigation area to protect Urban Rail communications in the 5,9 GHz band. The outcome of this work serves as the baseline for a new Technical Specification detailing requirements for the use of shared spectrum for safety related applications.

Railways

The international railway community is actively addressing harmonized telecommunication requirements for tomorrow's rail systems that take into account users' needs. In 2020 ETSI was requested by the European Commission to draft new European Standardization deliverables – and revise existing standards – for the Future Railway Mobile Communication System (FRMCS), the successor to the GSM-R (GSM™ for railways) standard. This has driven an intensive ongoing Work Programme that sees our Rail Telecommunications technical committee (TC RT) liaising with 3GPP and the International Union of Railways (UIC) to develop an extensive suite of specifications for FRMCS.

Numerous standards, specifications and reports currently in development address areas including system architecture, transport and service strata, on-board and trackside functions and interfaces, radio characteristics, user equipment capabilities as well as interworking. Among other aspects, this work considers train speeds up to 500 km/h and the integration of 3GPP radio technologies with a primary focus on 5G NR. The committee's analysis

of potential interworking scenarios between FRMCS and legacy GSM-R systems is also guiding the development of a corresponding specification on FRMCS/GSM-R interworking, an important constituent of the set of ETSI specifications supporting the FRMCS industrial plan.

In parallel the committee continues to maintain the GSM-R standard, enhancing it with new features specific to the railway environment, including data and voice communications at very high speeds.

In liaison with ETSI TC ERM TG 37, the committee is developing a new Harmonised Standard for access to radio spectrum in relation to technical characteristics and methods of measurements for radio equipment in urban rail applications such as Communications-Based Train Control (CBTC) operating in the 5 875 - 5 935 MHz band.

In the domain of spectrum sharing for Urban Rail ITS and Road ITS applications, the committee's JTFIR (ITS/RT Joint Task Force) Working Group continues its development of a Technical Specification detailing shared use of spectrum in the 5 855 – 5 925 MHz band.

JTFIR meanwhile continues to work in cooperation with ERM TG 37 to define a solution considering the Road ITS standards/TR/TS and on the principle of technology neutrality: this original schedule has been extended, now targeting completion of work by Summer 2024.

JTFIR is also revising its existing Technical Report that investigates solutions to protect Urban Rail ITS communications in the 5 915 – 5 925 MHz band.

Aviation

The activities of our Aeronautics group (ERM TG AERO) are focused on three principal areas: the development and revision of Harmonised Standards under the Radio Equipment Directive – notably relating to communications, navigation and surveillance equipment; the development of European Standards in support of Regulation (EU) 2018/1139 (the EASA Regulation); and the evolution of DataLink – a key pillar in the SESAR (Single European Sky ATM Research) project and a crucial aspect of the Single European Sky.

In 2023 we are developing or updating various standards relating to use of radio spectrum for aeronautical applications. These address: Advanced Surface Movement Guidance and Control System (A-SMGCS); Primary and Secondary Surveillance Radar for Air Traffic Control; Wide-area Multilateration Systems; Advanced Surface Movement Guidance and Control System (A-SMGCS); Data Link Services (DLS); Airport Surface Data Link (AeroMACS); and VHF air-ground Digital Link (VDL).

Maritime

The Common Information Sharing Environment for the maritime domain (CISE) is an EU initiative towards an Integrated Maritime Surveillance, aiming to make European and EU/EEA Member States surveillance systems interoperable and to give all concerned authorities from different sectors access to information they need to conduct missions at sea. Its primary objective is to generate a situational awareness of activities at sea, impacting on the seven maritime sectors – Maritime Safety & Security, Border Control, Maritime Pollution & Marine Environment Protection, Fisheries Control, Customs, General Law Enforcement and Defence – as well as the economic interests of the EU.

ETSI's Industry Specification Group on European Common Information Sharing Environment Service and Data Model (ISG CDM) is developing a consistent set of technical specifications that allow data exchange among different legacy systems within the CISE framework.

Through standardization of the CISE data model – and in particular through Common Interface and Core Infrastructure Services – the work of ISG CDM facilitates information exchange between user communities, member states, public authorities or EU agencies. It also supports the EU's maritime security strategy (EUMSS).

In 2023-24 we continue to revise and extend the group's specifications that embrace system requirements, architecture, data model and protocols. We are also developing a complementary testing platform and suite of test specifications.

Meanwhile our Marine group continues to develop standards for all aspects of communications and radiolocation equipment and systems for maritime and inland waterways. These variously address communications systems including Digital Selective Calling (DSC) and broadband communication radio links for ships and offshore installations; navigation and radiolocation/positioning systems; coastal surveillance, vessel traffic and harbour radar systems; navigation radar for inland waterways; and emergency and distress services including VHF personal locator beacons, safety of life at sea (SOLAS) and non-SOLAS radio systems.

CONTENT DELIVERY

Media matters

Our broadcasting standards are among the most widely accessed downloads from the ETSI website. Playing a leading role in the development of specifications for radio, television and data broadcasting, our work covers services delivered via cable, satellite and terrestrial transmitters, as well as by the Internet and mobile communication systems. For many of these technologies ETSI addresses system and equipment specifications, as well as Harmonised Standards for equipment to be placed on the market in compliance with European legislation.

Broadcasting

ETSI plays a leading role in the development of specifications for technologies that are used globally for radio, television, and data broadcasting. The specifications cover services delivered via cable, satellite, and terrestrial transmitters, as well as by the Internet and mobile communication systems. Related topics such as Ultra High Definition (UHD) TV and interactive television are also included.

For many of these technologies, ETSI addresses two aspects: system and equipment specifications; and Harmonised Standards for equipment to be placed on the market in line with European legislation. In addition, for systems that use the radio frequency spectrum, ETSI works with relevant organizations to secure appropriate frequency allocations. Within ETSI our standardization of broadcast systems, programme transmission and reception equipment is managed by JTC Broadcast – the Joint Technical Committee that brings us together with the European Broadcasting Union (EBU) and the European Committee for Electrotechnical Standardization (CENELEC).

This work also sees ETSI collaborating with other organizations in the broadcast domain, including DVB Project, WorldDAB (Digital Audio Broadcasting), DRM (Digital Radio Mondiale), RadioDNS Hybrid Radio, HbbTV (Hybrid broadcast broadband TV) and the 5G-MAG. In addition to its 'traditional' scope of interests (including e.g. DVB, DAB, DRM, AC3/AC4, DTS, TV Anytime), JTC Broadcast develops related standards and technical specifications including High Dynamic Range (HDR), Next Generation Audio and hybrid radio.

In 2023 we continue to produce and maintain standards and specifications for a wide range of broadcast platforms and systems. We anticipate publication of three new Work Items. The first is a DVB-related specification on the use of Video and Audio Coding (AVC) in Broadcasting and Broadband Applications; the second describes the MPEG-DASH Profile for Transport of ISO BMFF Based DVB Services over IP Based Networks; and

the third is on Coded Multisource Media Format (CMMF) for content distribution and delivery.

Work also progresses on a new Technical Specification that describes a native IP end-to-end broadcast system based on existing DVB standards. We are also developing a new Technical Report offering guidelines for the delivery of DVB-I services over 5G networks. Meanwhile we are revising our previously-published Technical Specification on LTE-based 5G Broadcast System for linear TV and radio services, in reference to 3GPP Release-17 specifications. We are also revising both parts of a Technical Specification describing the AC-4 digital audio compression standard.

Spectrum for Broadcast and Content Creation

Harmonised Standards on access to spectrum for a wide range of broadcast and content creation related technologies and applications are created and maintained by the TG17 group within our committee for Electromagnetic compatibility and Radio spectrum Matters (TC ERM) that works in close cooperation with relevant groups within ITU-R. The scope of our ongoing activities includes wireless microphone systems, digital terrestrial TV transmitters and broadcast receivers; wireless digital video links; assisted listening devices; amplifiers and active antennas for broadcast reception in domestic premises; DAB (Digital Audio Broadcasting) and DRM (Digital Radio Mondiale) transmitters; and broadcast sound receivers for DAB, DRM and AM/FM radio reception.

Augmented Reality

Augmented Reality (AR) blends real-time spatially registered digital content with our experience of the real world. Transparent and reliable interworking between different AR components is key to the successful roll-out and wide adoption of AR technologies and services.

Our Industry Specification Group on Augmented Reality Framework (ISG ARF) is defining a framework for the interoperability of Augmented Reality components, systems and services. Allowing components from different providers to interoperate through defined interfaces, this framework avoids vertical silos and reduce market fragmentation – and thus enables players in the ecosystem to offer parts of an overall AR solution.

In 2023 we anticipate completion of a new standards landscape report, based on the group's existing ARF functional reference model. It is envisaged that SDOs and other stakeholders in the AR industry will be able to use this standards landscape for prioritizing new work, or for continuing their own standards development activities.

Meanwhile the group continues its close collaboration with external bodies including The AREA, Khronos Group and the Open AR Cloud Association (OARC). These liaisons allow the exchange of views and expertise, enable coordination of work activities, foster collaboration on the interoperability of AR components, systems and services, and contribute to the development of a thriving eco-system with a diverse range of technology and solution providers.

BETTER LIVING WITH ICT

Optimized impact

The transformative benefits that Information and Communications Technologies (ICT) bring must be carefully balanced with their potentially negative impact on individuals, society and the healthy long-term future of our planet. At ETSI we're making products and services safer, simpler to use and more efficient. We are also committed to identifying energy efficiency solutions that mitigate the impact on climate change of the growing use of ICT.

Enabling ICT Product and Network Sustainability

Our Environmental Engineering Committee (TC EE) manages various engineering aspects of telecommunication equipment in different types of installation. These include climatic, thermal and other environmental conditions; physical requirements of equipment racks and cabinets; power supplies and grounding; Circular Economy (including lifecycle analysis and Digital Product Passport) and energy performance measurement and assessment methods for different parts of radio access networks including data centres. The committee's work also embraces innovative energy storage technologies for ICT equipment – for example to provide resilience in sustainable smart cities.

Much of our work supports European Commission (EC) policies, regulation and legislation on eco-design aspects, where we liaise with the European Committee for Electrotechnical Standardization (CENELEC) and CEN to develop relevant standards. The committee is also in continuous interaction with ITU-T SG5 for the production of technically aligned deliverables.

In 2023 our activities continue to address these key areas: measurement methods for the energy efficiency of ICT equipment with a focus on 5G; standardization on eco-design aspects of servers and storage products; improvement of Life Cycle Assessment methodology, Digital Product Passport and requirements for power supply interfaces of ICT equipment.

Our Working Group EE 01 (environmental conditions) continues to update the multi-part European Standard on environmental conditions and environmental tests for telecommunications equipment. This includes revision of the environmental classes to take into account changes in climate conditions. The group is also developing a new ETSI Standard on requirements for liquid cooling and high energy efficiency solutions for 5G Baseband Units in C-RAN mode.

Our Working Group EE 02 (power supply, bonding and related topics) is revising our multi-part standard that describes a monitoring and control interface for infrastructure equipment (power, cooling, building environment systems etc) used in telecommunication networks. It is also revising our Technical Specification describing the impact on ICT equipment architecture of multiple AC, -48 VDC or up to 400 VDC power inputs.

Our EEPS Working Group creates environmental efficiency standards for radio access networks, including ICT products that are part of network infrastructure. Various deliverables in progress address: energy efficiency measurement methodology and metrics for various server architectures; eco-design specifications for servers and storage products; energy efficiency metrics for data storage equipment; assessment of the material efficiency of ICT network infrastructure goods in the circular economy; requirements for a global digital sustainable 'product passport'; improvement of methodology for environmental Life Cycle Assessment of ICT goods, networks and services; network energy efficiency metrics; energy measurement method for 5G base stations; and power management of servers.

Sustainable Networks

Our Access, Terminals, Transmission and Multiplexing committee (TC ATTM) continues to produce standards and specifications relating to the operational and physical parts of Information and Communications Technologies, including broadband transmission networks, equipment and sites. ATTM Working Group AT2 considers physical networks and communication systems; Working Group TM4 addresses fixed radio systems; Working Group TM6 focuses on wireline access network systems; and our Working Group on SDMC (Sustainable Digital Multiservice Communities) addresses the deployment of ICT systems and services in cities and communities.

Towards Efficient ICT

Our Industry Specification Group on Operational energy Efficiency for Users (ISG OEU) is addressing operational eco-efficient Information and Communications technologies (ICT), including the power consumption and greenhouse gas emissions related to infrastructure, equipment and software within ICT sites (e.g. data centres, central offices) and networks.

The group brings together ICT professionals from a broad cross-section of European industries including the aeronautical and automotive sectors, banking, insurance and smart cities. ISG OEU works closely with ETSI's Access, Terminals, Transmission and Multiplexing (TC ATTM) and Environmental Engineering (TC EE) committees, and benefits from involvement in its work of the European Commission (EC), specifically DG Growth and DG Communications Networks, Content and Technology (CNECT).

In 2023 ISG OEU received a users' request to start work on a position paper on critical raw materials, and anticipates the adoption of two new Work Items as requested by TC ATTM SDMC. The first of two proposed Group Reports addresses network interoperability in building and campus environments. The second is a further Group Report in the context of smart territories: this describes the framing of training and labelling of community prescribers and managers for community work related to data management, using ETSI engineering standards.

With regard to in-building networks, ISG OEU is launching collaboration with SmartM2M on a new Work Item on sensor management.

Human Factors and Accessibility

Human Factors is the scientific application of knowledge about human capacities and limitations to make products, systems, services and environments effective, efficient and easy for everyone to use. It is a key factor for the commercial success of any ICT product or service in the digital networked economy. In ETSI we are helping to achieve these objectives through the work of our Technical Committee on Human Factors (TC HF). The committee has primary responsibility to produce standards, guidelines and reports that set the criteria necessary to embed optimum usability in the emerging digital networked economy. TC HF co-operates with other groups within ETSI and outside to assist in the production of standards and other deliverables in accordance with good Human Factors practice. Within ETSI it has a special responsibility for 'Design for All', addressing all users including young children, seniors and people with accessibility needs.

TC HF coordinates the most relevant standardization activity under the responsibility of the CEN/CENELEC/ETSI Joint Working Group on eAccessibility, the revision of EN 301 549. The committee has a central coordination role in ETSI and with CEN and CENELEC on activities relating to the standardization request from the EC to the ESOs (Mandate M/587), regarding the accessibility requirements of products and services in support of European Accessibility Act.

In 2023 we anticipate publication of a new Technical Report that investigates design practices and accessibility requirements for video games, with particular attention to users with hearing, vision, touch, cognitive and motor control disabilities. Work continues in parallel on a further Technical Report describing the functional needs of individuals with cognitive disabilities when using ICT products and services, including those based on emerging technologies such as IoT, Artificial Intelligence, Virtual and Augmented Reality.

Meanwhile we are updating our European Norm on accessibility requirements for ICT products, services and applications, together with our accompanying guide to user-centred terminology.

User Needs

The User Group Special Committee (SC USER) works with other ETSI committees to ensure that our standardization work reflects the needs of all users of ICT products and services, including consumers and businesses, network operators, service providers and individuals with special needs.

The Covid-19 pandemic demonstrated society's reliance on digital platforms and services to support universal requirements for teleworking, online shopping, sharing

vital information and simply keeping in touch. It also accentuated how users have become increasingly aware of the importance of quality of service (QoS) and the many factors contributing to it. In 2023 we are developing a Technical Report that presents results of a survey conducted in different European countries, with an analysis based on different products, services and use cases that span e-learning, e-working, entertainment and communications. The report also identifies requirements for standardization, regulation and innovation to answer user needs.

Media Quality

Our Speech and Multimedia Transmission Quality committee creates and maintains standards relating to speech and end-to-end media quality performance for terminals and networks. With our Working Group STQ Mobile the committee liaises with 3GPP, ITU-T and other organizations to support development of specifications for test methods, equipment and performance requirements for use in existing and future network telecommunications services, both fixed and mobile.

In 2023 we continue to develop or revise a number of Technical Specifications that variously address: prediction of perception of impairments caused by echo control systems; assessing speech quality of terminals in wideband mode in the presence of background noise; qualification of the ETSI LC3plus speech codec developed in cooperation by TC STQ and TC DECT; and background noise simulation for measurement of speech quality performance.

Meanwhile we are developing a Technical Report exploring the impact of different languages on listening effort, and relationships between listening quality and listening effort. We are also revising our Technical Report on test methods for headsets which use human structure-borne voice as an additional input signal to the airborne transmitted voice of the near end talker.

Revisions continue on a series of ETSI Standards relating to speech transmission performance requirements for wide- and narrow-band VoIP terminals from a QoS perspective of the user, including handset, hands-free and headset devices. We are also revising the Technical Specification on methods for evaluating performance of voice-controlled devices.

In parallel to revision of existing deliverables, in 2023 our STQ Mobile group is progressing a suite of new Technical Reports addressing: measurement campaign planning in mobile networks, considering factors such as geographical resolution, population, day/time, influence of heterogenous network setups, RAN sharing, national

roaming and other network sharing scenarios; encrypted mobile OTT voice/video and video streaming applications testing, with a framework for validation in real live applications; parametric non-intrusive QoS evaluation of cloud gaming services over RTP/UDP streaming; and evaluation of transport data capacity achievable by devices in mobile networks.

Safety

Working actively with appropriate ITU groups, ETSI's Safety committee (TC SAFETY) monitors developments in electromagnetic fields (EMF), electrical safety and safety in cable television systems, as these impact the interests of ETSI members.

The role of SAFETY is quite distinct from other ETSI Technical Committees. While it does not normally write standards, the primary role of the committee is as an information exchange, collecting information from other bodies including CENELEC, IEC, ITU and WHO, as well as the EC for any work on Directives related to Safety in order to provide information for ETSI members. Accordingly the committee has primary responsibility for ETSI deliverables dealing with electronic communications equipment safety as well as electronic communications installations safety. It also co-ordinates ETSI positions on electronic communications and systems safety requirements, while ensuring that work within TC SAFETY is co-ordinated with other European and International Standards organizations.

The committee's continuing focus in 2023 is in relation to implementation of changes in ITU documents and the Radio Equipment Directive (RED). Here TC SAFETY works with CENELEC – the body responsible for the development of Harmonised Standards for EMF in Europe – to revise current EMF standards in the light of changes brought about by the RED that will impact many ETSI groups.

The committee also continues to monitor work in CLC/TC106X, the group within CENELEC addressing various aspects of human exposure to electromagnetic fields at frequencies up to 300 GHz. It also maintains participation in the EC Low Voltage Directive (2014/35/EC) Working Party to distribute relevant EC notifications; and also in ITU-WHO groups dealing with Safety, distributing information as appropriate.

PUBLIC SAFETY

Always alert

Public safety organizations and frontline responders depend on the availability of real-time multimedia communications to manage a wide range of situations, from the routine to the exceptional. At ETSI our standardization work supports the secure, resilient operation of mission-critical public networks and platforms. Our activities also embrace standards for maritime safety equipment, Personal Locator Beacons (PLBs) to alert emergency rescue services and mechanisms for road safety through the use of Intelligent Transport Systems.

TETRA and Critical Communications

Developed to meet the needs of Professional Mobile Radio (PMR) users in public safety, security, transportation, military, governmental, commercial and utilities applications, TETRA (Terrestrial Trunked Radio) is the leading technology choice for critical communications users.

With an installed base of over 5.1 million users, TETRA is designed to address a specific set of communication requirements. These include high reliability, single and group calling capabilities, PTT (Push-To-Talk), and the possibility for direct peer-to-peer communications in situations such as natural disasters and emergencies when the supporting network is unavailable. Accordingly, much of the work of our TETRA and Critical Communications Evolution committee (TC TCCE) is driven by the requirements of Public Protection and Disaster Relief and other mission-critical services.

In 2023 the committee continues to maintain and further develop TETRA with user-driven standards for authority-to-authority secure voice and data services over broadband and narrowband air interfaces.

Since around 2015 TCCE has been working with 3GPP to ensure that broadband functionality matches the requirements of critical communications

users, particularly when using commercial networks as bearers. In response to feedback from 3GPP, the committee's ongoing work includes further development of specifications covering the detailed interfaces between Mission-Critical broadband systems and TETRA, as well as the required security between the two systems. To optimize this standardization activity, existing standards for technologies such as LTE and 5G will be enhanced by interfaces and applications that make them suitable for Mission-Critical applications.

Development continues on specifications for additional encryption algorithms to complement the existing set relating to TETRA. This reflects the needs of users to keep TETRA up to date throughout the 2030s, where work on the design of new security algorithms is being performed in collaboration with experts from ETSI's SC TSA (TETRA secure algorithms) group.

Emergency Calling and Alerting

Our Emergency Communications Technical Committee (TC EMTEL) is focused on the access to emergency services through different media, data transmission to public safety answering points, networks and IoT (Internet of Things) devices in the provision of emergency situations and in the context of the European Public Warning System. The scope of its work includes emergency communications between individuals and authorities/organizations; between authorities/organizations; and between individuals.

Much of the committee's activity is centred on IP-based emergency communications services, involving communications between IoT devices in emergency situations. This work includes the architecture (known as Next Generation 112 by the community), core elements and technical interfaces for network-independent access to emergency services.

TC EMTEL has been closely involved in discussion with regards of the drafting of a standardization request to the European standardization organizations as regards the accessibility requirements of products and services in support of Directive (EU) 2019/882 of the European Parliament and of the Council. In 2023, with EC/EFTA funding, the committee will work on the creation of the Harmonised Standard for the accessibility and interoperability of emergency communications, and for the answering of emergency communications by the public safety answering point (PSAPs) (including to the single European Emergency number 112).

Complementing other work on Advanced Mobile Location (AML), we anticipate publication of a revision to our

Technical Specification on transporting handset location to PSAPs for emergency communications.

In the area of Network Resilience and Preparedness, we expect to issue a revision of our Technical Report that was originally published in 2006. This updated version reflects more recent communication network technologies used by emergency services.

In regard to Public Warning systems, we anticipate publication of an update to our Technical Specification on the European Public Warning System (EU-ALERT) using the Cell Broadcast Service, with the addition of support for Device-Based Geo-Fencing, and potentially including silent alert and the alert with the default device ringtone and vibration.

We are revising our Technical Specification on Total Conversation Access to Emergency Services, together with accompanying implementation guidelines. We also expect to publish or revise a number of other Technical Specifications. These variously consider core elements for network independent access to emergency services; a multi-party Audio/Video capability for PEMEA; and requirements for interconnecting mobile operators (IMS) or VoIP service providers with an ESInet.

TESTING AND INTEROPERABILITY

Being assured

Interoperability is driven by market demand. One of the main reasons we develop standards, it's crucial in a multi-vendor, multi-network and multiservice environment. Giving users far greater choice of products, interoperability also allows manufacturers to benefit from the economies of scale of a wider market. At ETSI our class-leading validation and testing activities complement the creation of high-quality standards, supporting industry's timely ability to deliver innovative, cost-effective products and services.

Methods for Testing and Specification

Our Methods for Testing and Specification committee (TC MTS) creates standards and guides for testing and specification languages. Providing frameworks and methodologies that enable other ETSI committees to produce documents that are easy to understand and use, our work is critical to the market success of many technologies.

TC MTS is the steering committee for the definition of the methodologies for ETSI's Centre for Testing and Interoperability, where it also assists with the development of background materials. The committee also conducts field trials and pilot applications of new test methods to ensure they are ready for daily use at ETSI.

In 2023 TC MTS continues to evolve and maintain ETSI's successful testing language, TTCN-3, along with its tool conformance test suites. This work is complemented by ongoing updates to our Test Description Language (TDL) that fills the gap between the simple expression of 'what needs to be tested' and the concrete coding of executable tests with existing test specification languages such as TTCN-3. This work has recently expanded to embrace new conformance tests, addressing Core Standard test cases, XML test cases, Object Oriented extension test cases and JSON test cases.

Within TC MTS, the MTS Testing (TST) Working Group develops studies, guidelines, test catalogues and test specifications for specific ICT technologies

that are not already covered by other ETSI groups. In 2023 we plan to publish a new Technical Specification on IoT module security testing, accompanied by a Technical Report on IoT security architecture conformity.

TC MTS anticipates joint finalization with TC INT of two Technical Reports on Artificial Intelligence (AI) in Test Systems and Testing of AI Models. The committee also continues its participation in the OCG AI group. Organized by TC MTS and the ETSI Events team, the 10th User Conference on Advanced Automated Testing (UCAAT) takes place in Romania on 14-16 November 2023.

Core Network and Interoperability Testing

ETSI's Technical Committee on Core Network and Interoperability Testing (TC INT) develops test specifications to verify interoperability, conformance, performance and security. Our end-to-end methodology includes verification of both the control and user plane: test specifications are based on – but not limited to – 3GPP specifications, allowing operators to test network services for both fixed and mobile customers.

The committee produces test purposes, test descriptions, and TTCN-3 test cases to enable interoperability testing of core network elements, covering single-network, interconnect and roaming scenarios. Use cases and requirements specified by ETSI for autonomous management and control of networks and services are tested via industry standards-anchored Proof of Concept (PoC) events.

In 2023 we continue to develop our suite of test specifications that includes: emergency call and NG eCall interoperability over 5G and VoLTE; IPv6-only service test scenarios over 5G; VoNR/ViNR and VoLTE/ViLTE interconnection testing for interworking and roaming scenarios; 5G NGAP and 5G NAS conformance testing; and test specifications for the Closed User Group (CUG) using IP multimedia core network subsystem at the AGCF connecting legacy access.

TC INT is also launching work on a PoC (Proof of Concept) series on enabling the data sharing aspect (Data Spaces) according to the new EU DATA ACT and other related directives. The PoC will focus on telco, and which data can be processed and shared on a certified cloud infrastructure.

Meanwhile our Working Group on AFI (Autonomic Management and Control Intelligence for Self-Managed Fixed and Mobile Integrated Networks) is developing various Technical Reports on topics including business drivers for autonomic networking, GANA impacts and guidelines for GANA instantiation, confidence and implementation.

Ensuring Interoperability

Integrating validation and testing activities into the standards development process can contribute significantly to the production of interoperable standards and, ultimately, to the release of interoperable products based on those standards. Mutual feedback between the standardization process and the validation and testing activities helps to maximize the quality of both the implementations and the standards. Timely validation and testing can also reduce the overall development duration of a standard, leading to shorter time to market for interoperable products.

Our Technical Committees apply best working practices to ensure that our standards are well-specified and testable, and thus provide a solid basis for the implementation of robust and interoperable products. We also apply comprehensive validation of our standards through interoperability events, and we develop conformance test specifications to accompany a significant proportion of our standards.

ETSI's Centre for Testing and Interoperability (CTI) supports our standardization groups in the use of best practices for the specification and validation of standards, the development of conformance and interoperability test specifications and the organization of developer events. Technologies that CTI currently covers include 5G mobile, safety and mission critical communications, intelligent transport, electronic signatures, network virtualization and the Internet of Things.

During 2023 we will offer ongoing support for the development of conformance test specifications for 3GPP and oneM2M. Keeping pace with 3GPP's own release schedule, this work includes test specifications for 5G user equipment including smartphones and IoT devices. Meanwhile our ongoing series of interoperability events and hackathons allows us to engage with developers who do not participate directly in our core standardization activities.

We continue to oversee ETSI's Testing Task Force process that supports enhanced planning for future test activities, developing a multi-annual roadmap of planned testing activities requiring ETSI funding. We will continue to support the use of the ETSI Forge, our repository for managing code used for developments of various APIs, standards and test specifications in ETSI committees. We also support a similar repository dedicated to use in 3GPP standardization. See forge.etsi.org

We are continuing to explore the benefits of software development linked to standards, and Open Source methodologies and frameworks in ETSI. We will support the development and operation of the first ETSI Software Development Groups (SDGs), following the recent adoption of the SDG structure by the ETSI General Assembly.

Plugtests™

Organized by our Centre for Testing and Interoperability (CTI), ETSI's popular series of Plugtests™ events offers an opportunity for companies to interconnect prototype or production implementations of standards to test for interoperability and – where necessary – conformance to requirements. As such Plugtests provide a highly cost-effective and practical means of identifying inconsistencies in either a specific implementation or the standard itself. As such they provide essential feedback to our technical committees, helping us improve our standards and accelerating the standards-making process.

Some events may have conformance testing facilities available, and others may be formatted as hackathons or hackfests. They may be remote, distributed or single-site events, or a combination. At least eight events are currently planned for 2023.

Plugtests events are enabled by ETSI's Hub for Validation and Interoperability (HIVE), our shared online lab environment that now features the HIVE Test Automation Platform (TAP).

Please visit www.etsi.org/events/plugtests for detailed information on upcoming interoperability events.

EVENTS AND EDUCATION

Uniting people, ideas and inspiration

Events

Since the global pandemic we are progressively re-introducing a number of face-to-face events, blended with 'hybrid' events that offer the widest opportunities for both physical and virtual participation.

Check etsi.org/events for news on our regularly-updated programme of forthcoming conferences, seminars and other events.

Webinars

Attracting over 16 000 subscribers, the ETSI BrightTalk channel hosts regular webinars that provide in-depth coverage of our standardization activities in telecommunications, radiocommunications and ICT. These online sessions feature expert contributions from our membership, as well as Chairs, Vice Chairs and officials involved in our 100+ technical bodies. Webinars are free to access and include Q&A sessions. All live sessions are recorded, giving the opportunity to listen again.

Education about Standardization

While standardization serves as a critical enabler for technological innovation and interoperability, its practical details have not always been readily accessible to a wider audience. To help prepare the next generation of standards professionals, ETSI produces a comprehensive suite of high-quality educational materials on ICT standardization.

Drafted by academic experts in Europe and the Secretariat, the second edition of our successful textbook on 'Understanding ICT Standardization' reflects latest accessibility requirements. It is accompanied by a modular slide set that allows components to be used in a range of engineering, business and law courses. The textbook and slides are available for download free of charge from the ETSI website at etsi.org/media-library/education.

OUR TECHNICAL BODIES

The participation in some of our technical groups (Technical Committee, ETSI Project) is reserved to our members whereas the participation to other technical groups (ETSI Partnership Project, Industry Specification Group, Open Source Group) is possible for both members and non-members. If you want to get involved, please check the information for the group of your interest in the chart here below.

ETSI Partnership Projects

3GPP - Third Generation Partnership Project

one2M

Committees, Projects & Other Groups

ATTM Access, Terminals, Transmission and Multiplexing	**BRAN** Broadband Radio Access Networks	**BROADCAST** EBU/CENELEC/ETSI on Broadcasting	**CABLE** Integrated broadband cable telecommunication networks	**CYBER** Cyber Security	**DECT** Digital Enhanced Cordless Telecommunications (DECT)	**EE** Environmental Engineering	**eHEALTH** eHEALTH
EMTEL Emergency Communications	**ERM** EMC and Radio Spectrum Matters	**ESI** Electronic Signatures and Infrastructures	**HF** Human Factors	**INT** Core Network and Interoperability Testing	**ITS** Intelligent Transport Systems	**LI** Lawful Interception	**MSG** Mobile Standards Group
MTS Methods for Testing & Specification	**OSM** OpenSource MANO	**RRS** Reconfigurable Radio Systems	**RT** Railway telecommunications	**SAFETY** Safety	**SES** Satellite Earth Stations & Systems	**SET** Secure Element Technologies	**SmartBAN** Smart Body Area Network
SmartM2M Smart M2M	**STQ** Speech and multimedia Transmission Quality	**TCCE** TETRA and Critical Communications Evolution	**TFS** TeraFlowSDN	**USER** User Group			

Industry Specification Groups

ARF Augmented Reality Framework	**CDM** european Common information sharing environment service and Data Model	**CIM** cross-cutting Context Information Management	**ENI** Experiential Networked Intelligence	**ETI** Encrypted Traffic Integration	**F5G** 5th Generation Fixed Network	**MEC** Multi-access Edge Computing
mWT millimetre Wave Transmission	**NFV** Network Functions Virtualisation	**NIN** Non-IP Networking	**OEU** Operational energy Efficiency for Users	**PDL** Permissioned Distributed Ledger	**QKD** Quantum Key Distribution	**RIS** Reconfigurable Intelligent Surfaces	**SAI** Securing Artificial Intelligence
THz TeraHertz technology	**ZSM** Zero-touch network and Service Management					

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Design Tomorrow's World with the Standards People

Recognized by the European Union as a European Standards Organization, ETSI produces globally applicable standards and specifications for Information and Communications Technologies (ICT) systems and applications, including fixed, mobile, radio, aeronautical, broadcast and Internet technologies.

ETSI standards facilitate interoperability, security, and competitive advantage across all sectors of industry and society. Widely deployed across all sectors of industry and society, our standards help ensure the free movement of goods within the single European market, allowing enterprises in the European Union to be more competitive.

ETSI's diverse membership includes companies from the manufacturing and service sectors, regulatory authorities and government ministries, as well as small and medium-sized enterprises and innovative start-ups, alongside universities, R&D organizations and societal interest groups. Of almost 940 ETSI members (as of January 2023), nearly a quarter are small or medium-sized enterprises (SMEs).

We provide the opportunities, resources and platforms for organizations to understand, shape, drive and collaborate on globally applicable standards in an open and inclusive environment. By joining ETSI, you can become part of one of the leading communities for the development of world-class ICT standards – and have your say in shaping the future of our industry.

Find out more about the benefits of ETSI membership at etsi.org/membership.

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