



# Advancing Standards

## Forward thinking

At ETSI we're continually exploring new tools, processes and working methods that can enhance the quality, speed and efficiency of standards production to benefit the widest audience.

This agile approach is exemplified by last year's establishment (2023) of our first Software Development Groups. Building on the success of earlier ETSI-hosted open source initiatives – and operating alongside our existing Technical Committees – these SDGs reflect the progressive evolution from hardware- to software-based communication systems, and the accompanying need for collaboratively developed code to accompany traditional standards. In 2024 we'll see the first outputs of our OpenSlice and OpenCAPIF groups. These will play a pivotal role in the realization of tomorrow's ecosystem of increasingly intelligent and autonomous software-oriented networks and applications.

Recognizing the fundamental role of grass-roots technological research in the development and eventual implementation of standards, we continue to deepen links with R&D and academic communities internationally. In particular, our flourishing Industry Specification Groups provide an efficient conduit for organizations and individuals who may not be ETSI members to channel cutting-edge innovation through our own pre-standardization activities and onward into tomorrow's standards, both in ETSI and 3GPP.

The success of the 10th ETSI/IQC Quantum-Safe Cryptography Conference – held in Singapore in May 2024 – has highlighted the importance of standards in a post-quantum world. With today's cybersecurity infrastructures facing new threats, standardization provides an opportunity to consolidate fragmented global research efforts in the development of quantum-safe algorithms and business practices that will protect the Internet and everyone who relies on it.

This Work Programme highlights just some of the current activities of our TCs, ISGs and SDGs, driven both by European standardization mandates and the business goals of our 900+ membership. It also gives a taste of ETSI's participation in other partnerships and open source projects that are creating standards and related deliverables to satisfy the needs of a vast range of industries and end users, both in Europe and further afield.

Find out more about our innovative approach to creating standards for a fast-evolving digital world – and the role your own organization could play in shaping our future – at [etsi.org](https://www.etsi.org).



**Luis Jorge Romero**  
ETSI Director-General

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When I'm asked 'what does ETSI do?' my immediate answer is twofold. Firstly, we exist to support the European Commission in the implementation of its public policy strategy. This is realized through our development of high quality standards and other deliverables – more than 56 000 of them since our inception in 1988 – that are relevant to a wide range of information and communication technologies sold on the European market. Equally, the globally relevant standards and specifications we produce lay the foundations for interoperable, reliable and competitively priced ICT equipment and services that address a vast spectrum of industries and market needs.

In order to meet European policymaking objectives, we are always looking for new opportunities to extend the scope of our activities and to improve the efficiency of our working methods. One example of this is the recent transformation of our Industry Specification Group on Securing Artificial Intelligence (ISG SAI) into a Technical Committee (TC SAI). It's much more than a cosmetic change, allowing us to produce deliverables in response to European standardization mandates, specifically aligned with EU policy needs in the fields of AI and Machine Learning.

This complementarity powerfully demonstrates ETSI's strength in supporting the needs of its membership and the wider market. While our Technical Committees are an effective foil to support European policymaking needs, our Industry Specification Groups provide a uniquely agile platform for ETSI members and non-members alike to collaborate on pre-standardization activities.

ETSI is anything but a private members' club. As a European Standards Organization (ESO), we are one of the most inclusive Standards Development Organizations (SDOs) in the world. Our membership brings together global companies, SMEs, academia, administrations and societal stakeholders who can all contribute directly to – and benefit from – the work of our Technical Committees and Industry Specification Group. Getting involved in technical standardization has never been easier, or more rewarding, for organizations of all kinds and sizes!

This Work Programme can only offer the briefest of insights into the broad spectrum of ETSI's standardization activities. On our website you'll find out more about the ongoing work of our technical bodies, alongside news of upcoming conferences, seminars and interoperability events that bring the breadth of our activities to a wide audience.



**Markus Mueck**  
Chair of the ETSI Board





# Early 6G vision crystallizes



**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). The standardization activities of 3GPP 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. 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. At the start of 2024, of the 817 member organizations of 3GPP, 460 (56%) were via their membership of ETSI.**

Delivering a new mobile generation is a multi-year process. As discussions about future 6G become increasingly commonplace, the latest mid-generational specifications for 5G are part of the conversation that will surely lay early foundations for future work on 6G technologies.

3GPP Release 18 represents the first set of specifications characterized by the '5G-Advanced' marker. A functional freeze for Release 18 Stage-3 in March 2024 has anticipated protocol stability by June 2024, signifying the availability of commercially implementable Release 18 specifications.

Technical work on 3GPP Release 19 meanwhile intensifies throughout 2024. This second 5G-Advanced iteration signals the direction of travel for future standardization work on 6G technologies.

Requirements studies and Technology studies for 6G in 3GPP are expected to start from Release 20, with IMT-2030 submission and normative work for 6G in 3GPP anticipated to start from Release 21.

## 3GPP Release 19 topics

Intensive technical discussions during 2024 in 3GPP's RAN (Radio Access Networks), CT (Core Network & Terminals) and SA (Service & System Aspects) Working Groups accordingly focus on bringing the real-world benefits of wireless machine-to-machine communications to an even broader range of vertical industries in Release 19 (5G Advanced). Here are the major topics prioritized for the release, in TSG SA and TSG RAN in December 2023:

### Prioritized TSG RAN topics for Rel-19

- AI/ML Air Interface
- MIMO Evolution
- Duplex Evolution
- Ambient IoT
- Network Energy Saving Enhancement
- Mobility Enhancement
- NTN Evolution
- XR Evolution
- AI/ML for NG-RAN
- SON / MDT
- Channel modelling for further RAN Evolution
- + Several WG led/prioritized items

### Prioritized TSG SA Core & Miscellaneous topics for Rel-19

- Satellite Architecture Enhancement
- XRM Enhancement and Metaverse
- Energy Efficiency / Energy Saving as a Service
- IMS and NG\_RTC Enhancement
- AI / ML Enhancement
- Multi-access (Dual 3GPP + ATSSS Enhancement)
- Integrated Sensing and Communication
- Ambient IoT
- Edge Computing Enhancement
- Proximity Services Enhancement
- TSC/URLLC/TRS Enhancement
- Network Sharing
- Network Slicing
- User Identities + Id of device behind RG/AP
- 5G Femto
- UAS Enhancement
- VMR Enhancement
- UPEAS Enhancement
- Traffic Management (Monitoring + + QUIC)
- RVAS (Roaming Value-Added Services)



A GLOBAL INITIATIVE

While full-scale commercial 6G deployments aren't anticipated until around 2030, 3GPP and its Organizational Partners are already busy mapping the shape of tomorrow's mobile communications ecosystem, building on a quarter of a century's work to create specifications for 3G, 4G and 5G.

The announcement in April 2024 of a new logo signifying future 6G specifications is a symbolic step in preparation for the next generation of mobile systems. This new brand mark makes an early public appearance at the 3GPP Stage-1 Workshop on IMT 2030 Use Cases organized by Working Group SA, held face-to-face in Rotterdam and online in May 2024.

View the complete 3GPP work plan at [www.3gpp.org/specifications/work-plan](http://www.3gpp.org/specifications/work-plan)





# World without wires

**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

ETSI ESI is responsible for a wide range of radio product and electromagnetic compatibility (EMC) standards and the overall co-ordination of radio spectrum matters. Much of this work is conducted in our committee for Electromagnetic compatibility and Radio spectrum Matters (TC ERM) that develops Harmonised Standards and other deliverables in response to Standardization Requests received from EC/EFTA, as well as other technical deliverables.

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. In addition, we directly liaise with CEPT Working Groups by officially appointed ETSI Liaison Officers.

Through TC ERM, ETSI liaises with several EC groups in which it is an observer, notably the Expert Group of Radio Equipment (EG-RE), the Telecommunication Conformity Assessment and Market Surveillance Committee (TCAM), 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).

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. Hence much of the work of TC ERM Working Groups and Task Groups is in response to the RED, underscored by a strong cooperation between ERM and its groups with CEPT/ECC groups. TC ERM is currently maintaining over 300 Harmonised Standards related to the RED and EMCD.

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

- C-ITS communications
- EMC
- Ground Based Synthetic Aperture Radar (GBSAR)
- Inductive glueing systems
- Inductive loop systems for robotic mowers
- Level Probing & Tank Level Probing Radars
- Low Frequency Building determination
- Maritime radar, navigation and communications
- Measurement and testing
- Networked Short Range Devices (SRD)
- Non-SOLAS radars
- Nuclear Magnetic Resonance (NMR) technology
- Primary & Secondary Surveillance Radar
- Radiodetermination
- RFID equipment
- Satellite Personal Locator Beacons (PLBs)
- Security scanners
- Transport and Traffic Telematics (TTT) radar equipment
- Ultra Low Power Active Medical Implants (ULP-AMI)
- Ultra Short Range Communication Device
- Ultra Wide Band systems
- Vehicular radar and surveillance radar
- VHF air-ground Digital Link (VDL) Mode 2
- Wideband data transmission devices
- Wireless microphones & Audio PMSE

## Millimetre Wave Transmission

Widescale deployment of 4G/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 from 4G to 5G, 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 stakeholders in the microwave and millimetre-wave value chain to exchange technical information and increase operators' confidence in the use of microwave and millimetre-waves. The group's work aims to remove bottlenecks in releasing new spectrum, and to change spectrum licensing rules to make microwave and millimetre-wave wireless backhaul practical in the medium/long term for 5G operators.

In 2024 we are developing a report on the use of innovative antenna systems (integral and separated TX/RX antennas) in millimetre wave transmission, and its impact on standards and regulations. Two further reports in development respectively address: propagation measurements and modelling for PP radio links in the E, W and D bands; and the development of a practical methodology utilizing the new BTA (Backhaul Traffic Availability) KPI metric for planning microwave and millimetre-wave backhaul networks. Work also progresses on a multi-part Conformance Test Specification for Wireless Transport Profile for Standard SDN Northbound Interfaces, scheduled to be published as a Group Specification.







## 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. Scope of the committee's work encompasses Software Defined Radio (SDR) and Cognitive Radio (CR). TC RRS continuously 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 2024 work progresses on specifications for a spectrum sharing framework to meet the needs of local private networks for dynamic and temporary use cases. This is derived from existing sharing frameworks such as eLSA, AFC and CBRS. International cooperation with the WInnForum also continues, with the long-term goal of a global framework concept with relevant specifications.

Pending a EC decision on a possible future delegated act(s) on Article 3(3)(i) and 4 of the RED, TC RRS will meanwhile continue to support process/discussions in EG RED and the EC with provision of technical background and relevant specifications.

## Reconfigurable Intelligent Surfaces

RIS (Reconfigurable Intelligent Surface) describes a new type of network node that leverages smart radio surfaces – with thousands of small antennas or metamaterial elements – to dynamically shape and control radio signals in the electromagnetic domain.

RIS corresponds to a planar surface composed of unit-cells, whose properties can be controlled dynamically to 'tune' the incident wireless signals through reflection, refraction, focusing, collimation, modulation, absorption, or any combination of these. RIS deployments can be indoors and outdoors, including offices, airports, shopping centres, lamp posts and advertising billboards, and may take any shape or be integrated onto objects. Its characteristics may also result in low energy consumption, making RIS a sustainable technology solution. RIS can be configured to operate at any part of the radio spectrum, including frequencies from below 6 GHz to sub-THz, and may harness tools from Artificial Intelligence (AI) and Machine Learning (ML) to enable systems operation and optimization.

RIS technology effectively turns the wireless propagation environment into a programmable entity, inspiring a host of new use cases, including enhancements targeted around capacity, coverage, positioning, security, and sustainability. RIS hence has the potential to serve as a new low-cost energy-efficient deployment solution for enhancing coverage and capacity performance in future 6G networks, by reflecting signals to and from end users. It may also be used to enable new types of wireless applications such as Integrated Sensing and Communications (ISAC).

ETSI's Industry Specification Group on Reconfigurable Intelligent Surfaces (ISG RIS) gives ETSI members the opportunity to coordinate their pre-standardization research efforts on RIS technology across various EU/UK collaborative projects, together with global initiatives, paving the way for future standardization of the technology.

In 2024 we anticipate publishing three new ETSI Group Reports (GR). The first investigates practical considerations for implementation RIS in a wide range of frequency bands and deployment scenarios. The second considers use cases and deployment considerations for RIS-based diversity and multiplexing schemes. The third studies channel modelling, optimization and operational aspects of Multi-functional Reconfigurable Intelligent Surfaces (MF-RIS), evaluated based on real-world deployment scenarios.

## NEW Integrated Sensing and Communications

The use of radio signals to detect and estimate characteristics of target objects in the environment can be integrated into the communications network. In this context the network can use its own radio signals to sense and comprehend the physical world it operates in, collecting data on the range, velocity, position, orientation, size, shape, image, materials of objects and devices. Integrated sensing thus enables innovative use cases in transport, urban environments, homes, factories and more. These range from object and intruder detection in secure areas around critical infrastructures to fall detection and rain/pollution monitoring.

The launch of ETSI's Industry Specification Group for Integrated Sensing and Communications (ISG ISAC) was announced in November 2023. Establishing the foundations for ISAC technology development and standardization in 6G, the group will coordinate ETSI members' 6G pre-standardization research efforts on ISAC, particularly across various funded projects.

Currently in development, ISG ISAC's initial suite of deliverables includes four Group Reports. The first presents 6G use cases for integrated sensing and communications, with a discussion of deployment scenarios and suitable frequency bands. The second explores channel models, together with an evaluation methodology framework and feasibility analysis of link budgets using the proposed models. The third presents a system and RAN architectures for ISAC, focusing on identified sensing types, integration levels and deployments towards 6G. The fourth discusses security, privacy, trustworthiness and sustainability aspects for the identified 6G ISAC use cases.





## Broadband Radio Access Networks

ETSI's 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 license-exempt bands. The committee's primary responsibility covers all aspects of standardization for broadband radio access networks.

In 2024 we anticipate publication of a revised version of our Harmonised Standard for access to radio spectrum of RLAN systems in the 5 GHz band. Meanwhile we have embarked on revising our Harmonised Standard for access to radio spectrum of 6 GHz RLANS. We also expect to complete a new Harmonised Standard for access to radio spectrum covering Wideband Data Transmission Systems (WDTS) for fixed and mobile network radio equipment in the 57 GHz to 71 GHz band.



## Satellite Systems

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

The work of our Satellite Earth Stations and Systems technical committee (TC SES) 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 mounted on a vehicle.

We continue to ensure compliance of our Harmonised Standards with the Radio Equipment Directive as part of the ongoing consultation process with the EC. This involves regular interaction with the HAS consultant of the European Commission on several ENs to confirm compliance with requirements of the RED, addressing any comments received to ensure our Harmonised Standards meet these requirements. Once this is completed the EN is passed on to the ENAP procedure, with the goal of achieving listing in the Official Journal of the EU.

The committee's ongoing activities accordingly include development and revision of standards and specifications covering: Global Navigation Satellite System (GNSS) based location systems; integration of NTN (Non Terrestrial Network) 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.

In 2024 work progresses on revising the Harmonised Standard for Earth Stations on Mobile Platforms (ESOMP) transmitting towards satellites in non-geostationary orbit operating in the 27,5- 29,1 GHz and 29,5- 30,0 GHz bands. Similar work is underway on further updates of the Harmonised Standard for Fixed earth stations communicating with non-geostationary satellite systems in the 20 GHz and 30 GHz FSS bands.

We are developing a new Technical Specification on Satellite-Quantum Key Distribution (S-QKD) Satellite Systems & Associated Optical Earth Stations (OES).

We are meanwhile developing a technical comparison of DVB-S2x/RCS2 and 3GPP NR (New Radio) NTN (Non terrestrial networks) based systems for broadband satellite communication systems operating above 10 GHz via geostationary satellites.

Two further Technical Reports are in development: one regarding small transmit-only IoT satellite terminals operating in the C-band and Ku-band; and the other providing an independent evaluation of IMT-2020 Satellite Radio Interface proposals submitted to ITU-R for satellite IMT-2020.



## Mobile Standards

The primary responsibility of ETSI's Mobile Standards Technical Committee (TC MSG) is to perform work as requested by mandates from the European Commission and 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.

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 or 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 – to align with 3GPP Release 15 and now Release 17.

The committee maintains close liaison with 3GPP, ITU, CEPT, ECC and IEEE, as well as other ETSI bodies that might be affected by deliverables produced by MSG and TFES.

A continuing focus in 2024 are specifications submitted by the O-RAN Alliance within the scope of the PAS (Publicly Available Specification) process. A number of PAS Work Items are currently in development, anticipating publication as ETSI Technical Specifications and Technical Reports.



## Terahertz Communications

A huge amount of bandwidth is available in THz bands (identified by ITU as 137 GHz of spectrum between 275 and 450 GHz). At such frequencies it is possible to achieve extremely high data rates, as well as easing spectrum scarcity problems. The small wavelength of THz signals enables the realization of compact and miniaturized devices and antennas. It is possible to integrate multiple antenna elements within a limited form factor and realize pencil-sized beams. The specific propagation properties of THz signals enable accurate sensing and imaging capabilities, and may be exploited for integrated sensing and communication functionalities.

ETSI's Industry Specification Group (ISG) THz provides the opportunity for ETSI members to share their pre-standardization efforts on THz technology resulting from various collaborative research projects and global initiatives, paving the way towards future standardization. Complementing the work of various ETSI Technical Bodies and other organizations – including 3GPP, IEEE 802, ITU-R, NGMN, one6G and O-RAN Alliance – the group concentrates on establishing the technical foundation for the development and standardization of THz communications.

Three Group Reports published in 2024 variously address: 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 NR

ETSI's Digital Enhanced Cordless Telecommunications (DECT) specification is the leading standard for digital cordless telecommunications. Originally developed in the early 1990s, it is implemented in more than a billion short-range communication devices around the world. The capabilities of DECT have progressively evolved 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 with the DECT Forum and ITU-R (WP5D), our DECT Technical Committee's activities in recent years have been primarily focused on development of the DECT-2020 NR ('New Radio') system. Now officially recognized as an IMT-2020 technology, ITU-R confirms that DECT-2020 NR fulfils Ultra-Reliable Low Latency Communications (URLLC) and massive Machine Type Communications (mMTC) requirements.

In 2024 the committee expects to publish 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 NR as well as 'traditional' DECT and its evolutions.

Development progresses on an Application Specific Profile for DECT-2020 NR, comprising an overview plus a profile for Smart Metering and other machine type communications. We are also studying frequency bands and associated technical requirements – including media access methods – for DECT-2020 NR.

In the domain of machine-to-machine communications, we anticipate publishing a revision of the second part of our Technical Specification on Ultra Low Energy (ULE) devices, addressing home automation networks.

As part of the ongoing DECT Evolution programme we are studying the design of a codec to support low data rate audio connections. Meanwhile a revision of the committee's existing DECT Technology Roadmap is in progress, reflecting ongoing developments in DECT-2020 NR.





## Trusted partners

***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. Cybersecurity is essential to supporting the progressive development of networked systems such as the Internet of Things (IoT) and Industry 4.0, where technologies such as virtualization and cloud computing bring with them specific threats. Balancing the twin demands of privacy and protection, effective security solutions also rely on the trust of individuals and businesses so that their needs and concerns are properly addressed.***

### Cybersecurity

The needs for security and privacy are inescapable aspects of our digital existence. An evolving threat landscape and rapid growth in the complexity of new systems and networks present challenges to maintaining the security of Information and Communications Technologies (ICT). Security is particularly important to developments in networked systems such as the Internet of Things (IoT) as well as in consumers' daily lives. In addition, technologies such as virtualization, cloud computing and the wide adoption of generative AI bring with them specific security challenges.

Sensitivity towards the privacy of individuals/organizations and their data intensifies with media exposure of insecure products and services. To encourage industry to address these challenges, the EU and other national regulators are placing demanding requirements on manufacturers and operators of ICT products and services. While many of these initial regulations are effectively optional, second generation regulations such as the EU Cyber Resilience Act (CRA) will place mandatory requirements on manufacturers and service providers. A trusted centre of expertise, ETSI's Cybersecurity Technical Committee (TC CYBER) develops market-driven standardization solutions to meet strategic high-level needs, as well as offering guidance to regulators, users, manufacturers and network operators. ETSI and TC CYBER co-operate with international, regional and national bodies

involved in cyber security, including the European Cybersecurity Agency (ENISA), CEN, CENELEC, the International Telecommunication Union (ITU) and the International Organization for Standardization (ISO).

Anticipating the European Cyber Resilience Act (CRA), TC CYBER – in collaboration with other ETSI groups – has analyzed the proposed legislation, provided comments to the European Commission on the draft Standardisation Request, and developed a mapping to assess existing standards and identify further work required in support of the Act. This activity is due to be finalized in early 2024, following the availability of the final draft of the CRA.

The security of consumer IoT devices and systems has been a focus of TC CYBER for many years. Publication of the updated standard 'Cyber Security for Consumer Internet of Things: Baseline Requirements' is expected during 2024, building on feedback from industry and test labs who have been using the initial version.

Expanding and updating guidance to organizations on Critical Security Controls for Effective Cyber Defence, a report on the implementation of the revised Network and Information Security (NIS2) Directive will be published as a revised Technical Specification.

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 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.

Several QSC deliverables are scheduled for completion in 2024. These include new Technical Reports addressing: the combination of classical and post-quantum algorithms to construct 'hybrid' cryptographic schemes; the impact of quantum computing on symmetric cryptography; a repeatable framework for quantum-safe migrations; and a QSC protocol inventory. We are preparing a new Technical Specification on efficient quantum-safe hybrid key exchanges with hidden access policies, while updating our existing specification on quantum-safe hybrid key exchanges.

### Quantum Key Distribution

There is a concern that today's network communications that are encrypted using conventional public key cryptography may be decrypted in the future, when more powerful processors or new methods of cryptanalysis are available. Unlike conventional methods, quantum cryptographic protocols should be resilient to all advances in computing and mathematics. First applications are likely to be those requiring long term secrecy, such as encryption of sensitive government or corporate data or the health records of individuals. Examples include secure communication of human genome sequences and inter-site data replication in the financial sector.

ETSI's Industry Specification Group (ISG) on QKD is developing common interfaces and specifications for the quantum communications industry. Fundamental to enabling future interoperability of QKD networks, its work will ensure that quantum cryptography is implemented in a secure manner that mitigates the risk of side channels and active attacks.

Group Specifications being developed or revised in 2024 include: QKD security proofs, design and operation of QKD systems intended to protect against Trojan horse attacks; procedures for characterizing properties of complete QKD transmitter modules; a QKD application interface; an update of the REST-based key delivery API; control interface of Software Defined Networks for interoperable key management systems; a REST-based interoperable key management system API; an orchestration interface for interoperable key management systems; a QKD network architecture; and a QKD monitoring interface and data model.

Meanwhile we anticipate completion of two Group Reports: one reviewing the variety of architectures that have been proposed for QKD networking; and the other exploring the design of classical interfaces for QKD systems that include appropriate authentication measures. 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 technologies specified by the Third Generation Partnership Project (3GPP™). Indeed, all the standardized 3GPP-specific security algorithms in 3G, 4G and 5G mobile telecommunications have been specified by SAGE.

The group's recent activity has focused on a request by 3GPP SA3 to develop 256-bit algorithms for 5G. This spans 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. Specifically, the requirement has been to accommodate a 256-bit secret master key and to produce 256-bit session keys.

This work has culminated in the completion of a new Authentication and Key Agreement (AKA) algorithm for 3GPP. Completed during summer 2023, the new algorithm has now been submitted to ETSI Office for further distribution to the 3GPP SA3 group.

In 2024, SAGE will look at changing the integrity algorithms for the previously proposed 256-ZUC algorithm. This is a request from SA3 in order to increase the speed of 256-ZUC integrity calculations. The previous design was chosen since SAGE received clear indications that the designers of 256-ZUC wanted to keep full backwards compatibility with the 128-bit ZUC previously deployed. This seems to have changed now, and SA3 is asking for a unification of the integrity algorithms across the algorithms.

Additionally, SAGE will continue to support SA3 in the transition to 256-bit algorithms in the 3GPP system.





## 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. Any network management oversight that’s 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) is developing insights on the evolutionary path of this paradigm, as well as its impact on network resilience and security, where attackers may take advantage of encryption to spread malicious code or exfiltrate sensitive data through networks. A primary goal of the group is to describe the issues and to establish essential requirements to allow for retention of network controls and protection, thus giving guarantees of security and resilience. As a pre-standardization activity, the work of ISG ETI is intended to frame concerns arising from widespread adoption of encryption by default, and to build the foundation of a longer-term response to threats to networks and users.

In 2024 work progresses on a new Group Specification on integration strategies and techniques. These allow a network manager (as an authorized user) to access encrypted traffic for management or other lawful purposes. We are also developing a new Guide to the pre- and post- conditions of moving towards Zero Trust as a model in support of ETI. Intended to give a balanced and impartial summary of the pros and cons of Zero Trust, it considers legacy equipment and service integration as well as the ideal ‘clean-slate’ approach.

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 growth and 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 law enforcement agencies as well as mobile network operators and equipment vendors, ETSI’s committee on Lawful Interception (TC LI) develops standards supporting common international requirements for LEAs, including the interception of content and disclosure of electronic communications related data with supporting standards for warrantry and internal interfaces. The committee acts in partnership with bodies inside and outside ETSI to capture the requirements of LEA users, and translate these into requirements that are applied to technical specifications.

Work continues in 2024 on development or revision of various Technical Specifications (TSs). These include the revision of the seven-multipart on Handover Interface and Service-Specific Details (SSD) for IP delivery; Internal Network Interfaces X1 and X2/3; handover interface for retained data; handover interface for warrant information; dictionary for common parameters; handover interface for HTTP delivery; and Interface for Lawful Disclosure of vehicle-related data. In addition, TC LI is working on the following new specifications: definition of Internal Network Interface X0; LI architecture and Data Structures for Lawful Disclosure.

## Securing Artificial Intelligence

AI is becoming increasingly endemic, with many software applications eventually likely to include AI elements. There is a concern that autonomous mechanical and computing entities may make decisions that act against the relying parties, either by design or as a result of malicious intent. The conventional cycle of risk analysis and countermeasure deployment therefore needs to be re-assessed when an autonomous machine is involved.

The primary responsibility of ETSI’s Technical Committee on Securing Artificial Intelligence (TC SAI) is to develop reports and specifications that mitigate against threats arising from the deployment of AI – and threats to AI systems – from both other AIs and from conventional sources. As the only ETSI technical body focused on securing AI, TC SAI is working to rationalize the role of AI within the threat landscape, and to identify measures that will lead to its safe and secure deployment. The group also works closely with TC CYBER and OCG AI to consider how ETSI’s activities can contribute to the development of future EU Harmonised Standards under the EU AI Act. To this end TC SAI is currently analyzing the standardisation requirements of the AI Act, mapping this against the workplan of all ETSI technical bodies.

Work continues in 2024 on an extensive suite of deliverables. Various reports and specifications address: automated manipulation of multimedia identity representations; security aspects of using AI/ML techniques in the telecom sector; baseline cybersecurity requirements for AI models and systems; privacy aspects of AI/ML systems; security testing of AI-based components; explicability and transparency of AI processing; a Proofs of Concepts (PoC) framework; an AI computing platform security framework; AI critical security controls; and data supply chain security.

As well as developing an ontology and definitions of AI threats, we are researching a structured description of organizations and activities globally relevant to AI security. We are also updating the previously published ISG SAI ‘problem statement’: this explores the challenges of securing AI systems to address the ever-changing AI landscape and the evolving problems it presents.

## The Secure Element

ETSI’s Technical Committee on Secure Element Technologies (TC SET) is responsible for developing and maintaining specifications for the Secure Element (SE) used in communication 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 cards with contactless interfaces used in financial services. It is of particular importance for the user that for each topic addressed, the committee’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 – and also the Smart Secure Platform (SSP). Designed to cover needs from diverse industries (e.g. automotive, banking, telecom, IoT). SSP offers a flexible platform that can be adapted to multiple different products, while maintaining a common set of features and some 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 flexible file system, and built-in capabilities to support multiple authentication methods (such as biometrics).

In 2024 work progresses on a new Technical Report that analyzes the impact of post-quantum cryptography on TC SET specifications.

Meanwhile our Working Groups are revising existing specifications that detail a non-removable UICC with a new smaller form factor. Our TEC Working Group is updating its existing specifications related to the I3C interface for non-removable UICCs. This new interface will significantly increase the performances of the UICC, and will simplify integration in mobile devices. Our TEST Working Group is revising various test specifications, covering the Logical Secure element Interface (LSI) and the Single Wire Protocol (SWP) interface.



## Electronic Signatures and Trust Infrastructures

ETSI's committee on Electronic Signatures and Trust Infrastructures (TC ESI) addresses the requirements of digital signatures, including formats and procedures and policies for creation and validation, as well as trust service supporting the authenticity of transactions. The committee's scope embraces 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.

TC ESI's work notably supports the eIDAS (electronic IDentification, Authentication and Signatures) regulation, as well as general requirements of the international community to provide confidence in electronic transactions, where ETSI coordinates its eIDAS-related activities with CEN/CENELEC.

In addition to ongoing maintenance of existing standards for digital signatures and trust services

supporting regulation EU 910/2014, ETSI TC ESI is embarking a major programme on trust services in support of the recently introduced regulation (EU) 2024/1183 amending regulation (EU) 2014/910 (eIDAS 2) to support a new EU digital Identity Framework). This includes:

- Requirements for trust services in support of EU Digital Identity Wallets
- Support for signing through an EU Digital Identity Wallet
- Updated requirements for Identity Proofing to support the higher level of identity assurance required under eIDAS 2
- Profiles and audit requirements for Electronic Attestation of Attributes which provide additional credentials associated with a natural or legal person such as identified through the EU Digital Identity Wallet
- Qualified Certificate for Website Authentication as required under eIDAS 2 to be recognised by web browsers.

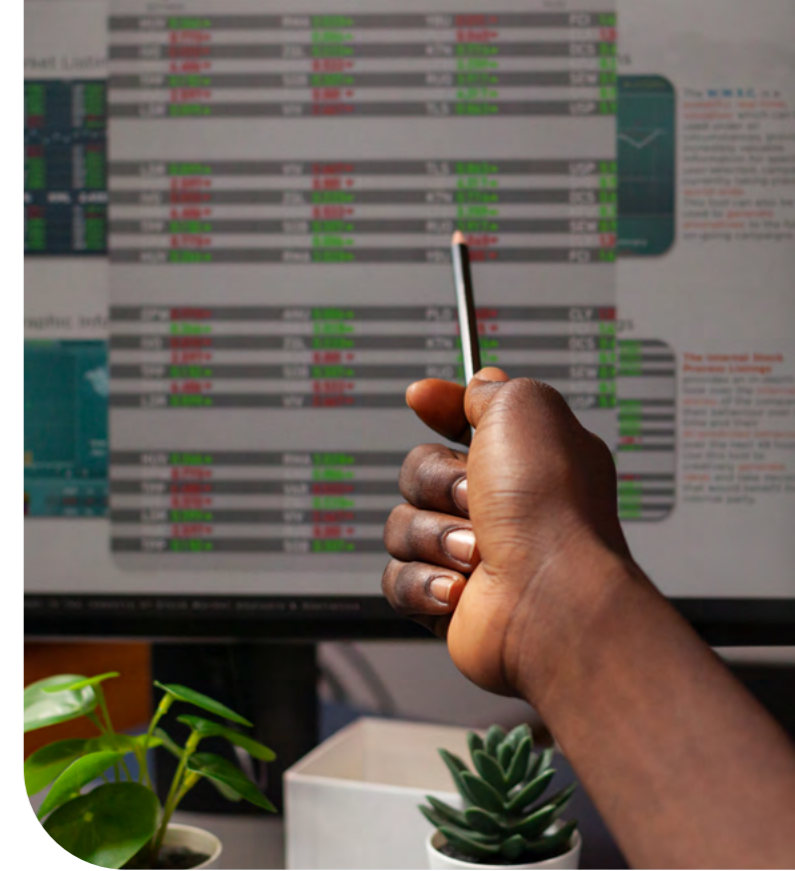
## Distributed Ledgers

Distributed ledger technologies record transactions and their details in multiple places at the same time, in a manner that eliminates the need for a centralized data store or administration functionality as with traditional databases. Their ability to store any kind of data as a consensus of replicated, shared, and synchronized digital records distributed across multiple sites – without depending on any central administrator, together with their properties regarding immutability (and therefore non-repudiation) and multi-party verifiability – opens a wide range of applications, and new interaction models among those entities willing to record the transactions associated to those interactions through these ledgers. While distributed ledgers are mostly known from their use to facilitate cryptocurrencies, numerous other examples of their application include smart contracts, support to digital identity attributes, object tracking, or verification of adherence to service level agreements.

While most ledgers in ICT are already centralized, recent approaches based on distributed ledgers can provide higher openness, reduced dependency on third parties and better resiliency. Permissioned (managed) distributed ledgers (PDL) in particular are suited to business-oriented use cases of industry and governmental institutions. From a technical perspective, PDL reduces the cost and delays of recording a transaction as access to such ledger is only permitted to trusted participants; other benefits include lower costs associated with implementing a consensus algorithm, offline operation and the fairness properties among participants. In parallel, the legal benefits of PDL include the support from external legal agreements or the regulatory enforcement in critical sectors.

ETSI's 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.

Work Items being developed in 2024 reflect ETSI's commitment to support industry's and government institutions' rapidly expanding need for PDL solutions.



We anticipate publication of two Group Reports. One describes the features of a PDL to be applicable as a qualified electronic ledger in eIDAS; and the other explores how PDL can be employed in standardized oneM2M IoT service layer platforms through various use cases.

Several Group Specifications are meanwhile in development. These variously address: the use of PDL in a multi-domain/multi-entity (provider/issuer) wholesale supply chain; PDL service enablers for Decentralized Identification and Trust Management; architecture enhancements for PDL service provisioning in telecom networks; services to enable wireless distributed consensus for reliable industrial connected autonomous systems; use of PDL in commercial settlement of usage-based services; and requirements and solutions to build a native self-sovereign identity (SSI) system under the constraints of telecom networks.

A further new study is also underway on minimum requirements for operating a Distributed Autonomous Organization (DAO) in a hybrid environment with multiple chain types and code bases.

ISG PDL meanwhile continues to develop a number of Proofs-of-Concept (PoCs) in order to facilitate collaboration with research projects developing or incorporating distributed ledger technologies.



## Joined-up thinking

**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 community that creates open, accessible and internationally recognized IoT standards to enable interoperable, secure and simple-to-deploy services for the IoT ecosystem.

Launched in 2012, oneM2M is a partnership initiative between eight of the world's preeminent standards development organizations that brings

together more than 200 players including industry fora, consortia and diverse business domains. Its primary goal is the development of technical specifications for a common M2M service layer that can be readily embedded within various hardware and software systems, facilitating the connection of field-based devices with M2M application servers. A critical objective of oneM2M is to actively involve organizations from M2M-related domains such as telematics and intelligent transportation, healthcare, utilities, industrial automation, smart homes, smart cities, public safety, retail and agriculture.

Finalization of oneM2M Release 5 is tentatively scheduled in early 2025. This latest iteration includes a number of work items that leverage latest technological evolutions to bring significant new capabilities. These notably include: enhanced support for AI; enablement of IoT in the metaverse; digital twins enablement; and enhanced support for data protection regulations.

Find out more at [onem2m.org](https://onem2m.org)



## 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](https://onem2m.org)). Supporting European policy and regulatory requirements including mandates 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.

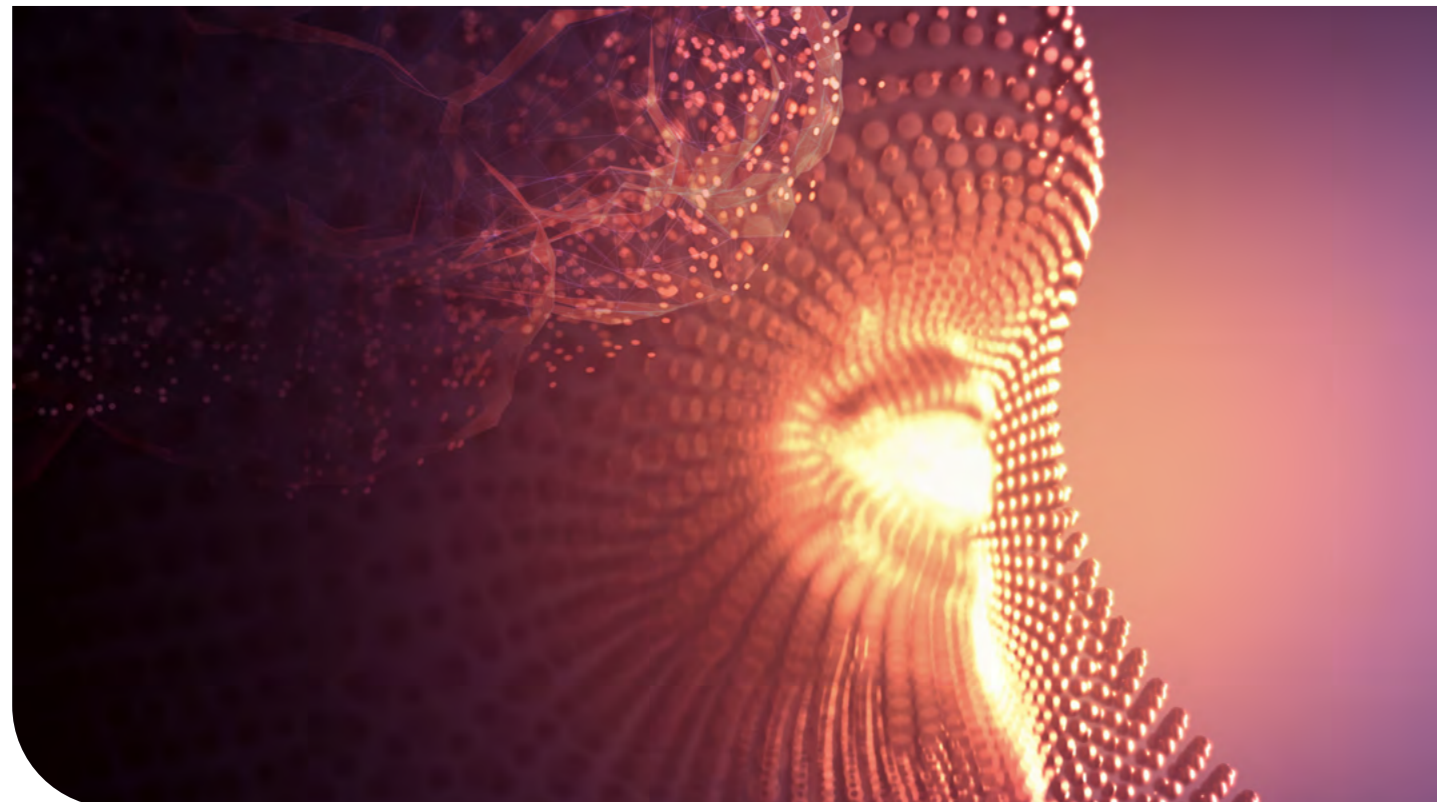
TC SmartM2M continues to serve as a 'bridge' between European requirements in IoT, and support for European industry/institutions in identifying and adopting IoT standards regarding the oneM2M

framework. The committee's work embraces evolution of IoT Semantic Interoperability, IoT Semantic Discovery and Query and the global oneM2M base ontology. This sees an ongoing expansion of SAREF mappings domains that include Energy, Environment, Buildings, Smart Cities, Industrial and Manufacturing, Smart Agriculture and Agrifood, Automotive, eHealth and Ageing well, Wearables, Water, Lifts (Elevators), Escalators, Smart Energy Grids and Maritime.

In 2024 the committee targets completion of its SAREF Guidelines for IoT Semantic Interoperability. Considering the application, extension and evolution of Smart Applications ontologies, these guideline provide a clear and actionable process for the adoption and usage of SAREF.

Other deliverables in progress – intended for publication as various Technical Specifications and Technical Reports – consider topics including 'digital twins' and performance evaluation of oneM2M-based IoT platforms.

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. We continue to develop and maintain our catalogue of SAREF extensions, specifications and documentation. Visit [saref.etsi.org](https://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 (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 simplify the exchange of information between end-users, information systems, data spaces, IoT platforms and 3rd-party applications – with proper formal definitions, between vertical applications – so that these applications get the original meaning. The group develops and maintains specifications that enable the development of interoperable software implementations, using the NGSI-LD API. This enables near real-time update/access to information from many different sources such as IoT, documents, multimedia, open-data and geographical information systems. This ongoing activity is reflected in regular incremental API releases, drawing on feedback from

developers, end users and stakeholders. ISG CIM's work accordingly sees the group co-operating closely with other organizations, funded projects and open source communities.

In 2024 the group continues to enhance the NGSI-LD API and its supporting set of specifications and reports to embrace wider applications, including service execution for digital twins, buildings information management and data spaces. Topics under study include: a revision of our Group Specification defining an NGSI-LD cross-domain information model; an updated assessment of handling of geo-information; revision of our NGSI-LD primer; maintenance and evolution of test suite and interoperability test descriptions, including implementation conformance statement and test purposes descriptions; example case studies of real-world NGSI-LD adoptions; a study of NGSI-LD architecture deployment scenarios; and CIM provenance to enhance AI data quality.

The first NGSI-LSP API Plugtests event is scheduled to take place in the first half of 2025, where developers of NGSI-LD brokers and applications will be invited to evaluate interoperability of their implementations.



## eHealth

eHealth represents the application of ICT (information and communications technologies) across a wide range of functions that affect the health sector. Use cases 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 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.

We are updating our Technical Report that identifies and analyzes use cases in the eHealth domain to drive future standardization efforts. Its scope includes examples from EU Research projects, and from current eHealth and Health industry practices. This revised version includes description of a presence preserving proximity function trigger. Its goal is the design of a multi-input function triggering framework for use on smartphones and other IoT devices to allow widespread deployment for a variety of eHealth uses. Potential applications include logistics control, venue navigation, diary management, and aid visitors when using a health facility.

A new ETSI Guide is also in progress. This discusses the role of Artificial Intelligence (AI) as an accelerator for eHealth processing, with specific consideration of ethical, security and privacy issues surround the use of AI in an eHealth context.

The committee is meanwhile developing a specification on data recording requirements for eHealth in order to identify and specify requirements for recording eHealth events, namely those from ICT based eHealth devices and from health practitioners. Its purpose is to specify a 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.

## Body Area Networks

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

In domains such as digital healthcare/wellness and medical monitoring, personal safety, sports and leisure, wireless connectivity between the data collection or control centre and sensing nodes requires a standardized communications interface. Key challenges in these use cases include interoperability over heterogeneous networks, ultra-low power consumption, latency, security, reliable operation in harsh environments (such as implant communications) and robust operation in the presence of radiofrequency interference.

In response to these requirements, ETSI's Smart BAN Technical Committee (TC SmartBAN) is addressing the need for global standards to support the market success of BAN technology. Scope of the committee's interests includes communications media, physical and network layers, security, QoS and lawful intercept. This work also extends to the provision of generic applications and services for standardization in the domain of BAN technologies.

A number of Technical Specifications are currently in development. These variously address; design and implementation of the Data Scanner Agent for SmartBAN low power devices; an in-body UWB communications specification applicable to a swallowable, pill-camera wireless device; a description of SmartBAN coordinator requirements; and revision of an existing specification on associate service model/ontology/enablers extensions. A new Technical Report is also in progress, offering a description of the Brain Computer Interface (BCI) architecture.





# Open access

**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 5G and beyond – and 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, ETSI’s Industry Specification Group (ISG) on NFV creates specifications that can accommodate today’s and tomorrow’s network requirements. The primary purpose of the group is to facilitate

development of an open, interoperable ecosystem, enabling lifecycle management of virtualised network functions hosted on independently deployed and operated NFV infrastructure platforms. These can be distributed across various locations such as centralized data centres, edge clouds and end-user premises.

The group’s work addresses new requirements brought by advances in cloud-native technology, network resources management and orchestration, network connectivity technologies, hardware and other infrastructure resources management, virtualization and cloud technologies, as well as new use cases for industry verticals and operational models.

ISG NFV uses a system of incremental Releases to structure its work programme. After concluding development of Release 4 specifications during 2023, Release 5 activities in 2024 focus primarily on NFV ecosystem and consolidation aspects, with the extension of current features and addition of new features. Topics addressed in various studies include VNF configuration, NFV for vRAN, flexible VNF deployments, service-based architecture concepts, cloud-native VNF reliability and ‘green’ NFV.

Work also accelerates on Release 6 that focuses on NFV architecture evolution/simplification and infrastructure aspects. Extension of current topics includes new virtualization forms and latency aspects.



## 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.

ETSI OSG (Open Source Group) OSM (Open Source MANO) has primary responsibility to develop an open source implementation of ETSI NFV MANO. As a community-led project, the output of OSM is a production-quality MANO stack aligned with ETSI NFV Information Models that meets operators’ requirements for commercial NFV deployments.

The group’s work complements that of ISG NFV and vice versa. In particular, OSG OSM provides an opportunity to capitalise on the synergy between standardization and open source approaches by accessing a greater

and more diverse set of contributors and developers than would normally be possible. This approach maximizes innovation, efficiency and time to market, and ensures a continuous feedback loop into NFV standardization with a continuing series of conformant reference implementations.

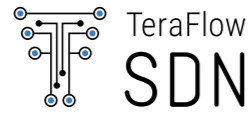
The OSM community delivers one Long Term Support (LTS) and one regular release every year, providing the OSM user base with continuous innovations and production-ready stability.

The launch of Release SIXTEEN is anticipated in Summer 2024. It will represent the first Release delivered under an extended scope that provides cloud-native infrastructure management and support of GitOps methodologies. This new working process facilitates more efficient and convenient management of cloud resources and workloads.

See OSM Hackfest presentations, demonstrations and talks on the dedicated [Open Source MANO YouTube channel](#). Learn more about OSM activities at [osm.etsi.org](https://osm.etsi.org).



## TeraFlow SDN



Software Development Group TeraFlowSDN (SDG TFS) is an ETSI-hosted initiative based on the TeraFlow research project funded by the European Commission under the Horizon 2020 Programme. It defines a framework for the development of a cloud-native SDN controller for high-capacity multi-technology and multi-layer networks, aimed at supporting future networks beyond 5G.

Built on a cloud-native micro-services architecture, TeraFlowSDN 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. Software developed by SDG TFS will also provide a valuable tool for other ETSI groups working on network transformation, enabling the alignment of goals and helping to accelerate standardization cycles.

The third release of TeraFlowSDN represents a robust SDN orchestrator and controller, delivering a fully featured Network Automation Platform. This iteration enhances the capabilities of TeraFlowSDN with the integration of an Optical SDN controller, expanding device support to include gNMI and OpenConfig protocols. It also features enriched network integrations for end-to-end orchestration like IP over DWDM, L3VPN, MEC, and network topology exposure. The management of network topologies is improved with the addition of a new BGP-LS speaker able to discover the topologies, and a new Forecaster component is introduced, providing predictive insights for network management. These additions substantially augment the versatility and management capabilities of the TeraFlowSDN platform.

Under development in collaboration with ETSI ISG MEC, a PoC (Proof of Concept) investigates how MEC Bandwidth Management allows applications to allocate specific amounts of bandwidth to gaming applications, while TeraFlowSDN allows management



and control of traffic flows to improve the gaming experience for users. Publication of a PoC report is anticipated by the end of 2024.

TFS is also developing with ETSI ISG ZSM a PoC on ‘Building Cloud AR/VR Service on CAMARA by Using ZSM Framework’. This demonstrates the possibility of building a cloud-based AR/VR service on CAMARA platform using the ZSM framework.

The group is meanwhile contributing to work by ETSI ISG F5G on a PoC ‘End-to-end Management and Control for Building Cloud AR/VR Service’. This demonstrates the feasibility of deploying an end-to-end management and control system for a F5G network architecture, composed of an optical access network segment and an optical transport network segment to deploy a Cloud AR/VR gaming use-case.

Organized by ETSI and the TeraFlowSDN Community, the 4th TFS Hackfest took place in Athens in May 2024.

Originally created as a pilot Open Source Group (OSG), TeraFlowSDN is renewed as an ETSI Software Development Group (SDG) in June 2024 to facilitate collaboration with other SDGs and standardization groups. Find out more at <https://tfs.etsi.org>.

## NEW OpenSlice



ETSI has positioned itself as a focal point for development and experimentation in network as a service technologies with the launch in 2023 of OpenSlice, its first Software Development Group (SDG).

SDG OpenSlice offers an open-source, service-based Operations Support System (OSS) to deliver Network as a Service (NaaS) in alignment with specifications from leading Standards Development Organizations. As part of ETSI’s broader efforts in Future Networks, OpenSlice aligns with Open Source MANO and TeraFlowSDN initiatives to enrich the suite of ETSI open source components. Designed to facilitate experimentation, proofs-of-concept, integration, and testing, this comprehensive framework provides early and regular feedback to the standardization process.

Building on code seeds developed by European Research, OpenSlice is developed using ETSI Zero touch Service and Network Management (ZSM) principles, implementing the ETSI NFV data model and APIs. The group’s inception marks a significant milestone for the wider telecommunications industry, where collaboration among software development and standardization groups will foster validation of new technologies and accelerate time for market of next-generation networks.

The ETSI OSL community offered an online demonstration of OpenSlice Release 0 at its TECH Day in February 2024, explaining to participants how to install the latest OSL release and deploy two use cases.



## NEW OpenCAPIF



The use of Application Programming Interfaces (APIs) to enable programming and service provisioning is growing exponentially in converged telecom and IT networks. This trend has accentuated the need for a standardized framework that supports interoperability, security, and discoverability of APIs and services.

Originally specified in 3GPP Release 15, the Common API Framework (CAPIF) has evolved to support a wide range of use cases, with the main goal of providing a unified northbound API management framework across different 3GPP functions. CAPIF is thus considered a cornerstone in the realization of multi-vendor 5G, 6G and future networks. Allowing the secure exposure of core network APIs to third party domains, it enables third parties to define and expose their own APIs in a unified way.

Announced in November 2023, ETSI’s Software Development Group OpenCAPIF has been established with the goal of developing an open-source Common API Framework as defined by 3GPP, to allow for secure and consistent exposure and use of APIs.

The group will collaborate with other ETSI software and open-source projects – such as Open Source MANO, TeraFlowSDN and OpenSlice – to share best practices and foster opportunities for component reuse. OpenCAPIF will allow developers working on Network Exposing Functions (NEF) or Network Applications to test their CAPIF-based solutions, accelerating time-to-market for deployment of applications in 5G networks. SDG OpenCAPIF is also collaborating and providing feedback to 3GPP SA6 and ETSI ISG MEC.

Several SNS projects based on OpenCAPIF are already underway, using fully functional Version 0 seed code. SDG OpenCAPIF will announce Release 1 in June 2024, which will be showcased at the EuCNC (European Conference on Networks and Communications) & 6G Summit in Antwerp, Belgium. A second Release and a first Hackfest are scheduled in Q4 2024.



## 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.

MEC fosters the rapid deployment of innovative applications and services for mobile subscribers, enterprises and vertical segments. As a key supporting technology for many 5G use cases MEC can be also deployed in Wi-Fi and fixed networks, and is a key enabler for interworking with cloud providers, edge data centres and neutral hosts.

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](https://forge.etsi.org)) which now exploits an automated generation process directly from MEC group specifications.

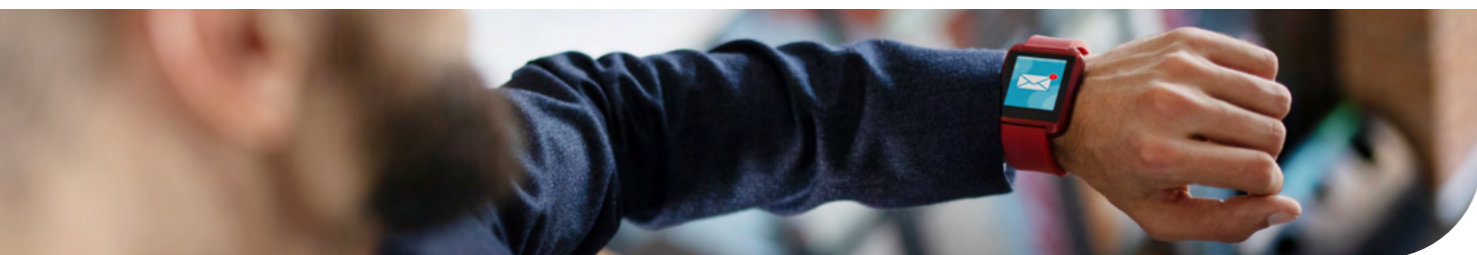
Following delivery of the final set of Phase 3 specifications in the first quarter of 2024, work accelerates during the year on MEC Phase 4 activities. Work Items currently in development notably include studies on constrained devices, abstracted network

information exposure for vertical industries, and distributed edge networks. This is accompanied by the addition of new features and enhancements to previously published MEC specifications.

The group meanwhile continues to enhance its MEC Open Area, a publicly accessible folder containing stable drafts for all MEC specifications as well as selected early drafts. This provides visibility for all stakeholders about ongoing ISG MEC progress, as reflected in ongoing collaboration with other bodies including GSMA and 3GPP.

Motivated by 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. With MEC Phase 4 underway, DECODE's activities in 2024 include further enhancement of the MEC Sandbox (see [try-mec.etsi.org](https://try-mec.etsi.org)), an interactive environment where developers can test their own applications based on ETSI MEC service APIs from anywhere in the world. With an emulated edge network set in Monaco, the sandbox implements key MEC services and capabilities, including support for MEC platforms that are geographically distributed within the MEC Sandbox's edge network. A key focus for the ongoing sandbox enhancements is access without requiring the GUI and widening of its scope and applicability by considering relevant work with groups both within ETSI (such as the SDG OpenCAPIF) and outside (such as 3GPP and their work on the EDGEAPP architecture).

Latest additions by the group to its growing set of tutorials can be viewed on the 'MEC Tech Series' YouTube channel.



## Experiential Networked Intelligence

Technologies such as Software Defined Networking (SDN), Network Functions Virtualization (NFV) and network slicing are making networks more flexible and powerful. However, these same innovations are also making networks 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 network deployment and operation. ETSI's Industry Specification Group on Experiential Networked Intelligence (ISG ENI) develops standards that use AI mechanisms to assist in the management and orchestration of the network. The group's work focuses on improving QoE (Quality of Experience) and service value for end users, while driving business efficiencies and improved service delivery for network operators. This is achieved through the use of self-calling data sets using AI with context-aware, metadata-driven policies, enabling the ENI system to recognize and incorporate new and changed knowledge, and hence make actionable decisions.

In 2024 the continuing focus of the group's technical work is on ENI Release 4, as well as updates to existing Release 3 deliverables. Topics addressed in various specifications and reports include: evaluation of categories for AI application to networks; overview of prominent control loop architectures; transformer architecture for policy translation (e.g. Chat GPT); construction and application of fault maintenance network knowledge graphs; processing and management of intent policy; and In-situ Flow Information Telemetry (IFIT) deployment scenarios.

Further work items also in development consider: intent policy multi-stage translating; network policy conflict detection; space/ground cooperative network slicing; multi-element coordination orchestration; centralized management and sharing of AI models; large language model application; management and orchestration functions for network OAM large models; network knowledge management capabilities; collaborative blockchain-based multi-operator service sharing; intelligent customer services based on LLM; interaction between network LLM and add-on components; and application scenarios of network OAM large models.

Currently in development, a new ENI White Paper complements three other papers previously published by the group. "Experiential Networked Intelligence for AI technologies to increase Autonomicity" describes the AN-level categorization with examples in specific

domains. It outlines the use of technologies such as deep learning, policy management and cognitive management to achieve increasing autonomicity, combined with network architecture evolution in multiple domains.

Developed according to our Proof of Concept Framework, ENI Proofs of Concept (PoC) are intended to demonstrate ENI as a viable technology, with results being fed back to the relevant Industry Specification Group for each PoC. Descriptions of all ENI PoC – currently 22 – are available on the public ETSI ENI wiki pages.

## 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. In particular, the automation of network and service management has become an urgent necessity to deliver 5G services with speed and agility while ensuring their economic sustainability.

Our Industry Specification Group on Zero touch network and Service Management (ISG ZSM) is examining requirements, defining specifications and demonstrating technologies for tomorrow's zero-touch networks. The group's ultimate target is to enable network autonomous operation steered by high-level policies. These autonomous networks will be able to self-manage and self-organize (configuration, healing, assurance, optimization, etc) without human intervention beyond the initial transmission of intents.

Progress continues on a number of Work Items, anticipating publication during 2024. We are developing two new Group Specifications: the first details capabilities to support the combination of closed-loop automation with intents originating from ZSM consumers; the second specifies extensions and new capabilities to integrate Network Digital Twin technologies with the ZSM reference architecture, in order to enhance end-to-end ZSM and automation.

Two Group Reports are also in preparation. The first analyses security risks related to closed-loop automation based on ETSI standards, proposing new security capabilities for the ZSM framework architecture. The second examines the automation of CI/CD (continuous integration/continuous development) for ZSM services and managed services. Meanwhile we are revising our Group Report that presents a study of intent-driven autonomous networks.



## Non-IP Networking

As long ago as 2015, mobile operators identified problems with the TCP/IP-based technology used in 4G. These included the inefficient use of spectrum resulting from adding mobility, multihoming, security, quality-of-service, and other features 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. ETSI's Industry Specification Group on Non-IP Networking (ISG NIN) is standardizing protocols that provide better support for demanding 21st century use cases than the ageing TCP/IP stack, with improved energy efficiency and simpler management. The outputs of ISG NIN are initially applicable to private networks for applications such as factory automation, and to local area networks supporting time-sensitive applications such as sound reinforcement.

In 2024 work continues on a new Group Report that offers guidance on implementing non-IP networking over satellite access. It outlines options for replacing IP in the satellite access network stack with non-IP networking, using Flexilink as an example. The report also compares KPIs against TCP/IP satellite networking and details test methods, including suggestions for client/server/baseband/hardware modules.

We are meanwhile developing a Group Specification (GS) that specifies procedures and packet formats for the carriage of Flexilink flows over the DECT 2020 New Radio interface. Our definition of use cases is being updated to identify issues that may give rise to a need for improvements leading to next generation network protocols.

There is increasing industry interest in the use of Ultra Wideband (UWB) technology for audio applications. ISG NIN is currently liaising with the Audio Engineering Society's recently-formed task group on the potential extension of ETSI's GS on Flexilink over DECT-2020 NR to cover UWB.

## Fifth Generation Fixed Network

The evolution of fixed networks will be vital and complementary to the success of 5G and future mobile systems. Building on previous technology iterations, the 'fifth generation' targets the goals of delivering full-fibre connection, enhanced fixed broadband and a reliable experience in both industrial and consumer applications by secure, low-latency connections. F5G-Advanced generation further extends this with technologies for reducing energy and carbon emissions, improved low latency and reliability for industrial applications, and the addition of optical network sensing. For home scenarios, emerging services such as Cloud VR (virtual reality) and AR (augmented reality) video streaming or gaming introduce the necessity for ultra-broadband and extreme low latency. Business scenarios such as the cloudification of enterprise networks or POL (Passive Optical LAN) require high reliability and high security. Industrial applications have their own specific requirements, including tolerance for extreme environmental conditions.

ETSI's Industry Specification Group F5G is dedicated to defining the fifth generation of Fixed Network and beyond. By applying fibre technology to various scenarios, the group's work aims to transform the 'Fibre to the Home' paradigm into 'Fibre to Everything Everywhere' including Fibre to the Room (FTTR), Fibre to the Office (FTTO), Fibre to the Machine (FTTM), and Fibre to the Thing.

Following the completion of Release 2, ISG F5G activities in 2024 focus on developing the F5G Advanced technologies for Release 3 and starting Release 4. Areas under study include: F5G Advanced use cases, gaps analyses, requirements, architecture, features, end-to-end management, quality and autonomous network classification; optical cloud networks; collaboration of compute and optical networks; PON based industrial networks; quality monitoring and evaluation of residential and SME services; and test specifications for residential FTTR functionality and performance.



## Cable

ETSI's Integrated Broadband Cable Telecommunication Networks committee (TC CABLE) addresses the evolution of the capabilities of broadband cable networks. At the same time, it serves as the point of contact within ETSI for expertise in hybrid-fibre coax (HFC) network technology and systems. By maintaining a close collaboration with other ETSI Technical Committees, TC CABLE contributes its expertise on horizontal topics led by those committees also assessing potential impact on integrated broadband cable telecommunication networks and services. The committee's work leverages relationships with the Society of Cable Telecommunications Engineers (SCTE), CENELEC (especially TC209) and ITU-T (especially SG9).

Driven by contributions from the cable operator community and vendor partners, 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. TC CABLE is addressing the technology transition that its members and contributors are currently undergoing by increasing its focus on distributed architectures and fibre optical networks. Its work also considers service, security, energy efficiency and sustainability aspects of integrated broadband cable telecommunication networks.

The committee is developing a new ETSI Standard on standalone routers that enables multiple subscribers to access high-speed data services independently of the underlying access network. This core set of features allows for both IPv4- and IPv6-enabled devices to gain connectivity to the Internet.

Reflecting a current industry priority, work on energy efficiency focuses on the revision of global KPIs for energy management in operational infrastructures, with specific requirements for HFC access networks.

The development of a Technical Specification on network performance measurement methods for broadband data services continues, with an approach aligned across access networks and thus addressing requirements of service providers.

Also in development is a Technical Report that considers mapping cable equipment and standards to support assessment of conformity with the European Commission's Radio Equipment Directive (RED), the Electromagnetic Compatibility (EMC) Directive, and the Low Voltage Directive (LVD) covering safe operation of electrical equipment for consumer and professional use. The report continues to evolve, taking into account latest developments in technical standards and regulation.

TC CABLE is also producing a Technical Specification on performance characteristics of coaxial cables used for RF signal transmission in hybrid fibre-coax (HFC) telecommunication networks.

These deliverables will establish important tools for operators and manufacturers of cable technology.



# Travel transformed

**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 and more efficient use of transport networks. They offer the potential to increase safety for travellers and the public, minimize environmental impact and improve traffic management.

ETSI's ITS Technical Committee (TC ITS) has primary responsibility to produce and maintain standards, specifications and other deliverables to support the development and implementation of ITS service provision across the network, for transport networks, vehicles and transport users. This work embraces interface aspects and multiple modes of transport and interoperability between systems, but not including ITS application standards, radio matters, and EMC. Scope of the committee's deliverables includes communication media, and associated physical layer, transport layer, network layer, security, lawful intercept, and the provision of generic web services. In addition, TC ITS develops conformance test specifications which are crucial for the commercial deployment of the technology and are closely involved in radio spectrum requirements for ITS.

The committee and its working groups continue to enhance existing Technical Specifications for ITS, 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.

In 2024 the continuing focus of the committee's work is the ITS Release 2 framework. This specifies the structure of the Release 2 package and principles for referencing between the ITS standards, as well as common aspects such as context and ecosystem.

## 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

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), successor to the GSM-R (GSM™ for railways) standard.

Working with the rail industry in Europe and worldwide, ETSI's Rail Telecommunications Technical Committee (TC RT) liaises closely with the International Union of Railways (UIC) to assess user requirements, and with 3GPP to standardize FRMCS. The committee plays a major role in organizing the transition towards the corresponding 3GPP study and the evolution of current specifications to consider rail users' needs. Among other aspects, this work considers train speeds up to 500 km/h, evolution of the 3GPP Mission Critical Framework (MCX) for railway needs, and the integration of 3GPP radio technologies with a primary focus on 5G NR (in particular railway harmonized bands n100 and n101).

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. 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 ETSI specifications supporting the FRMCS industrial plan. Further, a Technical Report on radio performance, is expected to be published in Summer 2024.

The work on Technical Specifications for FRMCS is partially supported by an ETSI-funded STF (interworking) and an EC-funded STF (architecture,

transport and service strata, trackside functions and interfaces, radio characteristics).

Recent additions to the work programme include a new study on functionality, protocols, QoS and other aspects of the Onboard Radio Interface (OBrad) for FRMCS. Also, a series of ETSI Testing Task Force have been initiated to contribute conformance tests on FRMCS usage of MCX have been initiated.

While TCRT continues its work on FRMCS specifications, a new FRMCS standardization request (replacing the former M/570) has been accepted by ETSI and will be executed by the committee. The first phase of the FRMCS standardization request foresees the completion of 8 Technical Specifications early 2025.

In parallel with this FRMCS-focused activity the committee continues to maintain the GSM-R standard, a new work item is foreseen to enable interworking with FRMCS for SMS.

In the domain of spectrum sharing for Urban Rail ITS and Road ITS applications, JTFIR continues to make progress on a Technical Specification on shared use of spectrum in the 5 855 – 5 925 MHz band. Revisions to the corresponding Technical Report are also underway. Conducted under the scope of an EC-funded STF, this activity is linked to the Commission Implementing Decision (EU) 2020/1426 on the harmonized use of radio spectrum in the 5 875- 5 935 MHz frequency band. Publication of the report is expected in Summer 2024, the work on the Technical Specification is targeted for the end of 2024.

In cooperation with ETSI TC ERM TG37, the committee is also developing a new Harmonised Standard for access to radio spectrum in relation to radio equipment for applications such as Communications-Based Train Control (CBTC) operating in the 5 875 MHz- 5 935 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 2024 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 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 set of technical specifications that allow data exchange among different legacy systems within the CISE framework. The group's work facilitates information exchange between user communities, member states, public authorities or EU agencies. It also supports the EU's maritime security strategy (EUMSS).

In 2024 ETSI continues to revise and extend its suite of specifications, going beyond the maritime domain. In this regard ISG CDM has already been working on the extension of the use cases and related requirements to the land surveillance domain, taking into account results from EU projects. The ETSI Testing Platform can be reused for the validation of future extensions linked to the capabilities of CISE. Several follow-up activities have already started, including:

- Standardization activity with TCSmartM2M focused on the development of a SAREF extension covering the maritime domain (namely SAREF4MARI). A joint work item with TC SmartM2M specifies an extension to SAREF to include the semantic model for the Maritime domain, including the CISE Data Model as well as other Maritime sector relevant semantic models;
- Extension of the CISE Data Model to include the Generic Under Water Application Language (GUWAL) used in the underwater communications domain;
- A joint work item with TC CYBER to perform a risk analysis of the CISE Architecture and define a proper set of security requirements.

CISE is also considered as part of the policies and standardization activities specified in the Rolling Plan for ICT Standardization 2024 under the Sustainable Growth pillar.

Meanwhile the Marine group in our Technical Committee on EMC and Radio Spectrum Matters 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.



## For all audiences

***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 2024 we continue to produce and maintain standards and specifications for a wide range of broadcast platforms and systems.

We are developing three new Technical Specifications. The first addresses service discovery and delivery protocols for a DVB Home Broadcast system. The second considers Coded Multisource Media Format (CMMF), allowing the distribution of content (including real-time media) with support for delivery from multiple sources to a single receiver. The third describes a native IP end-to-end broadcast system based on existing DVB standards.

Meanwhile we are revising various specifications, including operator applications for Hybrid Broadcast Broadband Television (HbbTV); service discovery and programme metadata for DVB-I; and metadata schemas for TV-Anytime. We are also continuing to update both parts of a 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.

ETSI's 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 – thus enabling players in the ecosystem to offer parts of an overall AR solution.

A Specialist Task Force established in summer 2023 aims to develop API specifications and a validation application based on existing implementations focussing on reference points (AR8 & AR11) between the World Storage, World Analysis, and Scene Management function. We anticipate completion of this activity in 2024 with the publication of an Open API specification on ETSI Forge.

We are developing the sixth part of a multi-part specification on interoperability requirements for AR components, systems and services, relating to

the high level reference points AR15 and AR19 of our AR reference architecture. Also in development, a new Group Specification introduces an interface specification for the reference point AR 8 (pose) of the AR framework architecture. We are also extending our specification that describes open APIs for the creation, management and querying of the world representation, adding an API for the reference point AR 11 (relocalization information).

During the year we aim to publish a new Standards Landscape based on ISG ARF's functional reference model. Meanwhile we continue to develop our multi-part Group Specification in interoperability requirements for AR components, systems and services. This is complemented by updates to our existing AR framework architecture to address industrial applications and services.

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. It also maintains active liaison with other ETSI groups (e.g. ISG CIM, ISG MEC) and with 3GPP SA WG4 group.





# Optimizing efficiency

***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, mechanical and other environmental conditions (e.g. rain, corrosion); physical requirements of equipment racks and cabinets; power supplies and grounding; Circular Economy (including lifecycle analysis) and energy performance measurement and assessment methods for different parts of radio access networks and fixed 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 this work supports European Commission policies, regulation and legislation on eco-design aspects, where we liaise with CENELEC and CEN to develop relevant standards. The committee also interacts with ITU-T SG5 on the production of technically aligned deliverables. A joint workshop on sustainability is being organized in collaboration with SG5, scheduled to take place in Geneva in December 2024.

In 2024 our activities continue to address four key areas: revision of environmental classes to consider climate change adaptation aspects; measurement methods for the energy efficiency of ICT equipment; standardization on eco-design aspects of servers and storage products as well as mobile devices; and requirements for power supply interfaces of ICT equipment.

Our Working Group EE 01 (environmental conditions) continues its revision of the environmental classes in line with latest IEC classification, taking into account

climate change aspects. Furthermore, the revision of environmental test standards has progressed to clarify expected performance criteria and the application of the tests, and to align with the new environmental classes. The group is also developing a 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 the 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. Other topics under study include interworking between Direct Current/Isolated (DC/I) and Direct Current/Common (DC/C) electrical power systems.

Our EEPS Working Group creates environmental efficiency standards for radio access and fixed networks, including ICT products that are part of network infrastructure. In 2024 it aims to publish a Technical Specification on requirements for a global digital sustainable 'product passport' to support the circular economy. Facilitating the comparison of different ICT products with a focus on circularity aspects, it can also enable preparation and reuse in the second-hand market and the reverse supply chain. Other topics under study include: energy efficiency metrics for servers, data storage equipment and wireless access network equipment; an energy measurement method for 5G base stations; power management capabilities of future energy telecommunication fixed network nodes; Life Cycle Assessments (LCA) of Information and Communication Technologies (ICT) goods, networks and services; and an assessment of how the use of ICT solutions impacts on greenhouse gas emissions in other sectors.

Our EE M-ICT Working Group (environmental matters associated with mobile ICT devices) is developing a standardized method for assessing and scoring the environmental performance of smartphones.

## 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.

The committee works closely with ETSI's Industry Specification Group on Operational energy Efficiency for Users (ISG OEU), with the common objectives of improving the implementation of efficient and interoperable ICT services, increasing the sustainability and interoperability of networks and devices, and improving the efficiency of energy management and ICT waste management. TC ATTM activities align closely with ETSI's European SDO peers CEN and CENELEC in areas of shared interest, notably via active participation in the CEN-CENELEC-ETSI Coordination Group on Smart Grid (CG SG).

## 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), Smart Machine-to-Machine communications (TC SmartM2M) 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 2024 work progresses on a new Group Report that explores best practices in eco-responsible ICT solutions for efficient smart buildings and campuses.





## Human Factors and Accessibility

Human Factors is the scientific application of knowledge about human capacities and limitations to make products, systems, services, and environments efficient and easy for everyone to use. In ETSI we are helping to achieve these objectives through the work of our Technical Committee on Human Factors (TC HF). The committee produces standards and other deliverables that set the criteria necessary to embed optimum usability in the emerging digital networked economy. Its work on the development of standards for accessibility of ICT products and services is conducted to support EU regulations, and in line with international best practices. Within ETSI it has a responsibility for ‘Design for All’, addressing all users including children, seniors and people with special accessibility needs.

TC HF coordinates relevant standardization activity under the responsibility of the CEN/CENELEC/ETSI Joint Technical Body on eAccessibility. 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 accessibility requirements for products and services in support of the European Accessibility Act.

TC HF is currently revising the harmonized ETSI standard on accessibility requirements for ICT products and services, to align the document with new requirements introduced by the European Accessibility Act and the latest WCAG 2.2 of W3C.

In addition, the committee is developing a new ETSI Standard on requirements for (Interoperable) Total Conversation Services, and has adopted a new work item to produce a Technical Report on applying EN 301 549 accessibility requirements to digital television receivers, which can serve as guidelines for the industry in this field.

In 2024 TC HF will publish an updated version of its ETSI Guide on User-centred terminology for existing

and upcoming ICT devices, services and applications, extending it to all 27 official EU and EFTA languages.

Finally, TC HF plays a significant role in making ETSI’s own standardization processes more accessible and inclusive. In 2024 work continues on implementing ETSI’s Accessibility Policy that formally came into force in 2023.

## User Needs

Our 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. It also liaises with external organizations such as the International Telecommunications Users Group (INTUG) or national such as AFUTT (Association Française des Utilisateurs de Télécommunications).

The Covid-19 pandemic highlighted 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. A new Technical Report in development presents results of surveys and studies 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 needs for standardization, regulation and innovation to respond to user needs.

Also in development, a further Technical Report presents the User Information System (UIS) concept, enabled by new data-driven technologies such as AI and deep learning. As a final result, the project will define, develop and demonstrate the concept of ‘Smart Customized Services’, based on the smart identity and the UIS.

## 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 its 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 2024 we continue to develop or revise a number of Technical Specifications that variously address: transmission requirements for wearable wireless wideband terminals; speech quality performance measurement of wideband terminals in the presence of background noise; qualification of the ETSI LC3plus speech codec developed in cooperation by TC STQ and TC DECT; test methods for active noise cancellation headsets and earphones; a sound field reproduction method for terminal testing, including a background noise database; a nonlinearity measure for distortion analysis of speech communication terminals; reference benchmarking, background traffic profiles and KPIs and exchange performance requirements for UMTS, IMS/PES/VoLTE, currently being extended to VoNR.

Revisions also continue on a series of ETSI Standards relating to speech transmission performance requirements for narrow- and wideband VoIP terminals from a QoS perspective of the user, including handset, hands-free and headset devices.

We recently completed a technical report on gender-related aspects of listening quality and effort in speech communications systems. Meanwhile we progress development of a Technical Report that explores impact of different languages on listening effort, and relationships between listening quality and listening effort. A further Technical Report is in development on test methods for insert-type headsets which use human structure-borne voice as an additional input signal to the airborne transmitted voice of the near end talker.

In parallel to revision of existing deliverables, our STQ Mobile group is developing a new Technical Report that describes development of a generic web page for repeatable and comparable performance testing of web content delivery via HTTP2/3.

After the successful TC STQ Workshop held in Bratislava in November 2022, we are planning a further workshop with the provisional title

“Communications for all - Supporting diversity and accessibility in speech and audio transmissions and human-machine communication.” This is currently anticipated to be held during 2025.

## Safety

Working actively with appropriate ITU -CENELEC -EC -CEPT-IEC 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 on any work 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 2024 is in relation to implementation of changes in documents and regulation worldwide. TC SAFETY works with CENELEC TC106X – 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 EC requirements and ICNRP that will impact many ETSI groups.

We participate 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 when appropriate.





# Situational awareness

**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.

The TETRA system is designed to address a specific set of communication requirements. These include secure, highly reliable 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 response to feedback from 3GPP, the committee's work is close to completion on 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 later 5G) will be enhanced by interfaces and applications that make them suitable for Mission-Critical applications.

In 2024 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. With the goal of ensuring the security of TETRA systems for years to come, this work has included the incorporation of a new set of air interface security algorithms, appropriate for a lifetime beyond 2040.

In 2023 TCCE decided by consensus to release the TETRA security algorithms into the public domain. This has generated various new Work Items that are ongoing, relating to Technical Specifications which will define the algorithms in detail.



## 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/organisations; 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.

In 2024 we anticipate publishing a new Technical Specification on interoperability testing of core elements for network independent access to emergency services.

We are making further progress on a Technical Specification on ESInet (Emergency Services IP

network) peering requirements. This summarizes requirements for interconnecting mobile operators (IMS) or VoIP service providers with an ESInet.

We are progressing a new Technical Specification on 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. This serves as the basis for developing the corresponding Harmonised Standard in response to the EC Standardisation Request on Accessibility/M587.

We are also revising our existing Technical Specification on Total Conversation Access to Emergency Services.

Meanwhile we are updating our report on Terms and Definitions for Emergency Communications Terminology. This reflects recent legislative changes (e.g. Directive (EU) 2018/1972 and Commission Delegated Regulation (EU) 2023/444), causing a need to align definitions in ETSI deliverables.

A new Work Item in the area of PEMEA (Pan-European Mobile Emergency Application) covers specification of a File Exchange Extension. This allows applications and PSAPs to share files – such as photos or videos from the scene – when requested by the PSAP.





# Designed with confidence

**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

Rapid advances in areas such as ICT, industrial automation, transportation, healthcare and biotechnology are placing ever increasing demands on testing methodologies and techniques. ETSI's Methods for Testing and Specification committee (TC MTS) identifies and defines advanced specification and testing methods to improve the efficiency of both standard descriptions as well as associated conformance and interoperability testing processes. TC MTS is the steering committee for the definition of the methodologies for ETSI's Centre for Testing and Interoperability (CTI). It also conducts field trials and pilot applications of new test methods to ensure they're ready for use at ETSI.

In 2024 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.

Reflecting the growing importance of Artificial Intelligence in the AI-related work items, work progresses on a new Technical Specification covering the Continuous Auditing Based Conformity Assessment (CABCA) process for AI-enabled systems. This includes its definition, principles, tasks and benefits compared to traditional 'point-in-time' certifications. We are also developing a Technical Report on test methodology and test specification for AI-enabled systems.

The committee also continues its participation in the OCG AI group. Work has been initiated on a harmonized documentation scheme for trustworthy AI systems.

## Core Network and Interoperability Testing

Interoperability is crucial to ensuring Quality of Service and Quality of Experience in complex end-to-end systems. ETSI's Technical Committee on Core Network and Interoperability Testing (TC INT) develops core network test specifications for interoperability, conformance, performance and security. These are based on – but not limited to – 3GPP specifications including virtual, layered and autonomic networks. The committee produces test purposes, test descriptions and TTCN-3 test cases to enable interoperability testing of the core network elements and covering the single-network, interconnect and roaming scenarios. Use cases and requirements are regularly tested via 'industry standards-anchored' Proof of Concept (PoC) events.

In 2024 we continue to develop our suite of test specification. Topics addressed variously cover: emergency calling 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; test requirements for E2E federated testbeds; and validation of nApp based services over 5G networks.

Meanwhile our Working Group on AFI (Autonomic Management and Control Intelligence for Self-Managed Fixed and Mobile Integrated Networks) is developing various reports on topics including: business drivers for autonomic networking; building confidence in autonomic functions; and GANA impacts and guidelines for GANA instantiation, confidence and implementation. A further new Work Item on energy saving use cases has been proposed: this explores the data-sharing ecosystem including stakeholders, data transactions, dynamics and requirements on PoCs to be built around the telco data space.

## 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 2024 we 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.

CTI oversees 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](https://forge.etsi.org).

## 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. These may be remote, distributed or single-site events, or a combination.

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](https://www.etsi.org/events/plugtests) for detailed information on upcoming interoperability events in 2024.





# Sharing the word

## Events

We organize a busy programme of face-to-face and hybrid events that offer broad opportunities for both physical and virtual participation. Check [etsi.org/events](https://etsi.org/events) for latest information on our regularly-updated programme of conferences, seminars and other events.

## Webinars

Attracting over 18,000 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 offers a comprehensive suite of high-quality educational materials on ICT standardization. Drafted by academic experts in Europe and the Secretariat, our successful textbook on 'Understanding ICT Standardization' is available for use by universities, NSOs and member organizations for training purposes. Reflecting 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](https://etsi.org/media-library/education).

*Master Tech Standardization*  
with ETSI

## 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, Software

Development 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



**oneM2M**  
One Machine-to-Machine Partnership Project

## Committees, Projects & Other Groups

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

## Industry Specification Groups

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

## Software Development Groups

<b>OCF</b> OpenCAPIF	<b>OSL</b> OpenSlice	<b>OSM</b> OpenSource MANO	<b>TFS</b> TeraFlowSDN
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# Design Tomorrow's World with the Standards People

## ETSI Vision

“To design tomorrow's world; be at the forefront of new Information and Communication Technology; and to lead the development of standards that enable a sustainable and securely connected society.”

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 (SMEs), micro-enterprises and innovative start-ups, alongside universities, R&D organizations and societal interest groups.

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](https://etsi.org/membership).





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