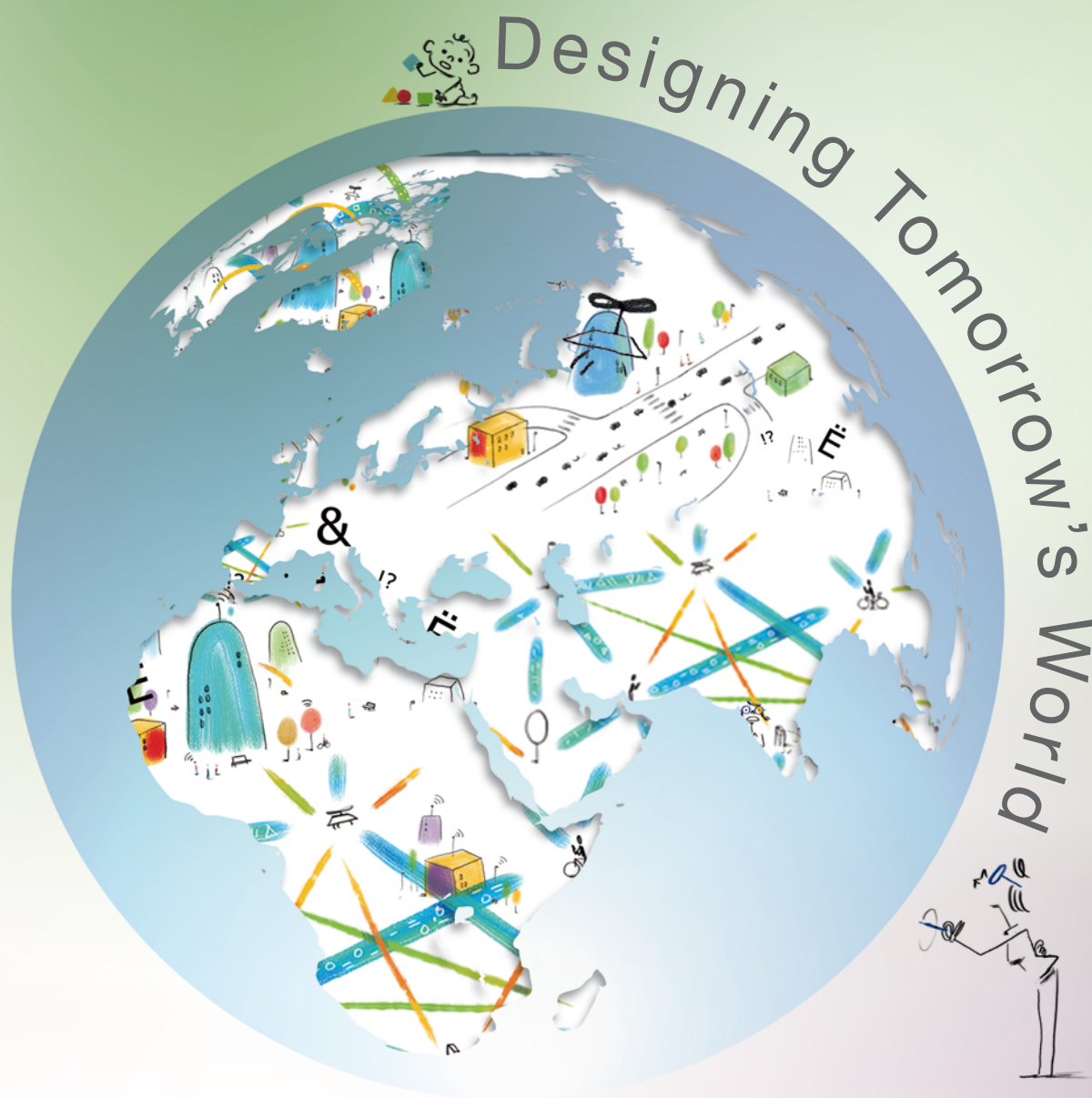


WORK
PROGRAMME

2019/20





A warm welcome to our Work Programme for 2019-2020



At ETSI, it's exclusively our members who define and drive our standardization activities. This survey of current and planned activities demonstrates the areas where our energies are focused over the year ahead, underpinned by ETSI's Long Term Strategy. It also gives a taste of our methodology that fosters a uniquely fertile environment for innovation to flourish. As such, this Work Programme offers a clear illustration of the stakeholder agenda that matters right now to our expanding worldwide membership.

I invite you to visit us online at etsi.org, where you'll find out more about the latest outputs of all our Technical Committees and Industry Specification Groups

Luis Jorge Romero, ETSI Director-General

Meet the Standards People

ETSI produces globally applicable technical standards for ICT-enabled systems, applications and services that are widely deployed across all sectors of industry and society.

Recognized by the European Union as a European Standards Organization, our outputs provide globally applicable standards for Information and Communications Technologies (ICT), including fixed, mobile, radio, aeronautical, broadcast and Internet technologies. Our standards help ensure the free movement of goods within the single European

market, allowing enterprises in the European Union to be more competitive. Building on this heritage, the consistent excellence of our work and our open approach sees ETSI's influence extend beyond our European roots to the entire world.

Our diverse membership includes some of the world's leading companies from the manufacturing and service sectors, regulatory authorities and government ministries, as well as small and medium-sized enterprises and innovative start-ups, alongside universities, R&D organizations and societal interest groups.



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From the Chairman of the ETSI Board



We are already seeing the first fruits of ETSI's current Long Term Strategy (LTS), including the preparation of a bold new technology roadmap that's directing our activities through 2019 and beyond.

Last year saw the introduction of an amended process with the European Commission for production and approval of our Harmonised Standards. In 2019 there is an expected increase in the number of ETSI Harmonised Standards: we are continuing our positive dialogue with the EC to ensure the ongoing efficiency of this process.

In a world that's getting more deeply connected, ETSI is engaging with a wider range of vertical market players. Welcoming these new members enriches the quality and value of our work. It also highlights the contrast between

the standards-based worlds of telecoms/ICT and other industries built on proprietary technologies.

While the interests of our members continue to expand, at ETSI our core values remain constant. Our standardization activities are underpinned equally by strong relationships with the European Commission and a wide range of societal stakeholders, as well as the global reach of our standards and our worldwide partnerships.

I'm often asked how we are different from other standardization organizations. My answer is that ETSI's activities are 100% driven by our members, who bring new topics to the table with high relevance for industry. And you can see that single-minded commitment demonstrated in this year's Work Programme, where we respond to our members' requests to create solid standards in emergent areas such as blockchain, Artificial Intelligence (AI), Augmented Reality (AR) and Autonomous Networks.

Dirk Weiler
Chairman of the ETSI Board

20% membership growth in the past 10 years

More than 45 000 published standards, now more than 2 500 annually



More than 850 ETSI members from 65 countries

25% of members are SMEs and micro-enterprises

Over 90 technical groups are active



3GPP and 5G Making the Next Mobile Generation

We are a founding partner of the Third Generation Partnership Project (3GPP™), where ETSI is united with six other standardization organizations around the world to develop specifications for advanced mobile communications technologies. 3GPP activities consider radio access, core transport network and service capabilities - including work on codecs, security, quality of service and more. At mid-2019, of more than 660 member organizations of 3GPP over 450 were via their membership of ETSI.

2019 sees the commercial introduction of the world's first fifth generation networks. Accordingly, much of ETSI's activity as a 3GPP partner is focused on supporting the timely technical and market success of 5G.

Many of our areas of interest in 3GPP – such as Network Functions Virtualization (NFV), Multi-Access Edge Computing (MEC) and Experiential Networked Intelligence (ENI) – represent crucial building blocks for the realization and long-term commercial success of 5G. These are considered key components of the next generation of ICT platforms. As a further example, we are investigating the use of spectrum resources in the millimetre range to help meet future demand for 5G services. We are also developing standards for monitoring and controlling power consumption in 5G networks. These will all be significant factors in the commercial and environmental viability of 5G.

In 2018, much of our effort was focused on completion of 3GPP Release 15 – the first full set of 5G standards. The scope of Release 15 covers 'standalone' 5G, with a new radio system (NR) complemented by a next-generation core network. It also embraces enhancements to LTE and, implicitly, the Evolved Packet Core (EPC). This crucial milestone has enabled vendors to progress rapidly with chip design in anticipation of initial network implementations this year.

With much Release 15 work completed by the end of the previous year, the group's interest in 2019 now focuses on Release 16 – often referred to informally as '5G Phase 2' - with delivery expected by mid-2020. Following on from the first set of Release 15 NR specifications that make up 3GPP's early submission for the ITU's IMT-2020 mobile

system, Release 16 will be the 'final submission' for their 5G International Mobile Telecommunication system.

During 2019 work on Release 16 accelerates, with over 70 studies underway. Topics include Multimedia Priority Service, Vehicle-to-everything (V2X) application layer services, 5G satellite access, Local Area Network support in 5G, wireless and wireline convergence for 5G, terminal positioning and location, communications in vertical domains and network automation and novel radio techniques. Further items being studied include security, codecs and streaming services, Local Area Network interworking, network slicing and the IoT.

As part of Release 16, Mission Critical (MC) services are extended to address a wider business sector than the initial rather narrow public security and civil defence services for which they had originally been developed. If the same or similar standards can be used for commercial applications (from taxi dispatching to railway traffic management, and other vertical sector scenarios currently being investigated), this can bring enhanced reliability to those MC services through wider deployment, and reduced deployment costs due to economies of scale – to the benefit of all users.

Technical Reports are also being developed on broadening the applicability of 3GPP technology to non-terrestrial radio access – initially satellites, but airborne base stations are also to be considered – and to maritime aspects (intra-ship, ship-to-shore and ship-to-ship). Work meanwhile progresses on new PMR (Professional Mobile Radio) functionality for LTE, enhancing the railway-oriented services originally developed using GSM radio technology that is now nearing end of life.

More 5G system enhancements are set to follow in Release 17, scheduled for delivery around mid-2021. Release 17 studies consider 5G LAN; high precision positioning; 5G



A GLOBAL INITIATIVE



IoT; evolved ultra reliable and low latency communications; network controlled interactive services; communication services for critical medical applications; asset tracking; relays for energy efficiency and extensive coverage; application layer support for 5G factories; enhancements for cyber-physical control applications in vertical domains; support for multi-USIM devices; unmanned aerial systems connectivity-identification-tracking; minimization of service interruption; audio/visual service production; multimedia priority service phase 2; architectural enhancements for 5G multicast-broadcast services; service-based support for SMS in 5G Core; edge computing/applications in 5G Core; application architecture for enabling edge applications; and user plane function enhancements for the service-based architecture.

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





A Spectrum of Possibilities

Communication. Transport. Entertainment. Health – and much more. At work, at home and on the move, there are few aspects of our daily lives that radio technology does not touch on. We depend on it for mobile phones, broadcast radio and television, WLAN and cordless technology, satellite, navigation, radar, Short Range Devices and countless other applications. ETSI creates the standards that define many of these radio technologies and systems. We also provide standards used by regulatory authorities in Europe and elsewhere to manage the radio spectrum environment and ensure safe co-existence of systems competing for the use of finite spectrum resources.



Harmonised Standards and the Radio Equipment Directive

Equipment complying with the Harmonised Standards for a European Directive is presumed to comply with the requirements of that Directive and can therefore be placed on the market throughout the European Union (EU). By creating the relevant Harmonised Standards, ETSI plays an important role in enabling a large-scale unified European market.

ETSI's Harmonised European Standards are developed by our members in our technical committees, with much of the work being conducted in our committee for Electromagnetic compatibility and Radio spectrum Matters (TC ERM). In force since 2014 and implemented throughout the EU from June 2016, the Radio Equipment Directive 2014/53/EU (RED) has necessitated the revision or replacement of all ETSI's existing related Harmonised Standards and the development of new ones. An enhanced approval process for our Harmonised Standards has necessitated a change in ETSI's working methods to ensure compliance with legislative requirements. TC ERM accordingly co-operates closely with the EC to optimize the efficiency of this process.

We continue to create new Harmonised Standards or make updates to existing publications. At the start of 2019, ETSI had published more than 200 Harmonised Standards in support of the RED, of which more than 150 are cited in the Official Journal of the European Union (OJEU).

Our ongoing work in 2019 is applicable to a wide range of industries and use cases. These include: metal/object detection sensors; security scanners; robotic mowers; wideband transmission systems; Short Range Devices (SRD) and Ultra Low Power devices for medical and other applications; satellite systems; Ultra Wide Band (UWB) systems including ground/wall-probing radio determination and level probing radar; wireless industrial applications; tracking; keyless entry systems; generic UWB communications; wireless power transmission systems; Radio Frequency Identification Equipment (RFID); and radio equipment operating at frequencies below 9 kHz.

We also complement the work of other ETSI committees and working groups developing and updating Harmonised Standards in areas such as broadcasting and professional audio, Intelligent Transport Systems, rail transport, aviation, marine, satellite services, emergency services, public protection and disaster relief.

We continue our co-operation with the European Committee for Electrotechnical Standardization (CENELEC), in particular in the area of smart/connected devices where the electromagnetic compatibility (EMC) requirements for the base machine need to be reconciled with EMC requirements for the radio elements providing the connectivity. This affects, for example, smart domestic appliances and some industrial machinery. We continue to work actively with CENELEC to align processes in order to support and homogeneous single market, in support of competition and innovation.

Efficient Use of Radio Spectrum

At ETSI we are responsible for a range of issues relating to radio spectrum usage. Our standards enable administrations to ensure that users can benefit from spectrum as widely as possible. We help the European Conference of Postal and Telecommunications Administrations (CEPT) to harmonize the use of spectrum throughout the 48 countries of Europe

and beyond, usually by producing System Reference documents (SRdocs). We participate in the Radio Spectrum Committee to assist them in achieving legal certainty on the use of spectrum by equipment built to ETSI Harmonised Standards. We also participate in the Radio Spectrum Policy Group (RSPG) to ensure full coherence between radio standardization and the developing policy framework.

Reconfigurable Radio Systems

The telecommunications industry faces a major challenge: a lack of spectrum to meet growing demand, particularly from the 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. If this under-used spectrum could be shared, it could free up spectrum resources to support the needs of our connected world, including the Internet of Things (IoT). Sharing will also play a key role in the development of 5G.

Reconfigurable Radio Systems – intelligent radio devices that can characterize and act upon their environment – offer an opportunity to share unused spectrum among multiple services and radio networks. In ETSI our Technical Committee on RRS (TC RRS) is responsible for the standardization of these systems, including reconfigurable equipment architecture and Cognitive Radio. The committee provides regular input to the European Commission Expert Group on Reconfigurable Radio Systems.

Our studies on Licensed Shared Access (LSA) – the technology which allows for the co-existence of the original incumbent with a new cellular operator in the same frequency band – have led to the development of a specification covering RRS system requirements for spectrum access for local high-quality wireless networks. This is intended as a first step towards the definition of an evolved LSA (eLSA) system architecture specification to provide spectrum access for local high-quality wireless networks. In 2019 we plan to issue the second part of our Technical Specification (TS) on eLSA, covering system architecture and high-level procedures.

This year we also expect to complete several Technical Specifications (a multipart deliverable) describing Radio Equipment (RE) information models and protocols for generalized software reconfiguration architecture. Other active work items include revision of our Technical Report on software-based radio equipment reconfiguration use cases, and development of a TS to define requirements for the dynamic recertification of reconfigurable radio equipment.

Broadband Radio Access Networks

Our Broadband Radio Access Networks committee (TC BRAN) produces and maintains standards and specifications for current and future Broadband Wireless Access (BWA) technologies in different frequency ranges.

In 2019 we continue to update various Harmonised Standards. These consider Radio LANs operating in the 5 GHz band; White Space Devices (WSD) operating in the 470 - 790 MHz TV broadcast band; broadband fixed wireless access (BFWA) systems in the 5,8 GHz band; and multiple-Gigabit equipment operating in the 60 GHz band.

Ultra Wide Band

Ultra Wide Band (UWB) radio technology enables a new generation of location tracking systems and sensor devices, as well as high-speed data devices for short range communication purposes. It opens new markets with a variety of innovative applications. UWB devices may form an integral part of other portable electronic equipment such as future generation cellular phones or laptops equipped with UWB enabled short range air interfaces.

ETSI continues to develop and update our Harmonised Standards for radio equipment using UWB technology. These cover a wide range of different equipment and applications including Short Range Devices (SRDs) using UWB; ground- and wall-probing radio determination (GPR/WPR) devices; sensing devices for building material analysis; generic UWB communication and detection applications; level probing radar; ground based synthetic aperture radar; location tracking applications; and keyless entry systems for road vehicles.

Short Range Devices

Short Range Devices (SRD) offer a low risk of interference with other radio services as their transmitted power, and hence their range, is low. While they often benefit from a relaxed regulatory regime, SRDs – like all radio equipment – must comply with the Radio Equipment Directive (RED) to be placed on the market within the European Community.

We continue to develop and update Harmonised Standards for SRDs used in a wide range of applications, covering technical requirements as well as parameters to ensure compliance with the RED. These include access control (such as door and gate openers); alarms and movement detectors; closed-circuit television (CCTV); cordless audio devices including wireless microphones; industrial control; Local Area Networks; medical implants and capsules; UWB sensors and radars (such as ground probing radar); radiodetermination devices; avalanche beacon equipment; devices using Nuclear Magnetic Resonance (NMR) technology; remote control; radio frequency identification (RFID); road transport telematics and telemetry.

Satellite Services

Satellite technology is an important delivery platform for diverse services such as direct-to-home TV and mobile, high-speed Internet access and location services. It is particularly useful for rural and outlying regions, where it is difficult to deploy other systems on a commercial basis, and therefore plays a key role in ensuring that all European citizens are able to access high quality information services.



In 2019 our Satellite Earth Stations and Systems committee (TC SES) maintains its focus on developing and revising Harmonised Standards for satellite earth station fixed terminals or terminals on the move, whether in an aircraft, on board a ship or in a vehicle. This ongoing work includes the pursuit of compliance of our Harmonized Standards with the Radio Equipment Directive.

For example, we are addressing numerous standards covering Mobile Earth Stations (MES); Receive-Only Mobile Earth Stations (ROMES); 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); Satellite Earth Stations on board Vessels (ESVs); Vehicle-Mounted Earth Stations (VMES); Tracking Earth Stations on Trains (ESTs); and Very Small Aperture Terminal (VSAT) satellite earth stations.

Other ongoing areas of activity include Global Navigation Satellite System (GNSS) based location systems; and integration of satellite and/or HAPS (High Altitude Platform Station) systems into 5G.

Mobile Standards

Our Mobile Standards Group (TC MSG) provides the regulatory standards needed to support the deployment of GSM, UMTS, LTE, NB-IoT and NR networks in Europe.

In 2019 we continue with revisions to our Harmonised Standards that consider access to radio spectrum in IMT cellular networks to include 5G support.

We aim to complete a Technical Report (TR) exploring the possibility of sharing the band 6 425 - 7 125 MHz between incumbent services and Mobile/Fixed Communication Network (MFCN) services.

We are developing two new Technical Specifications (TS). One covers Active Antenna System (AAS) base station conformance testing, and the other addresses eCall High



Level Application Protocol (HLAP) interoperability testing. We are also revising our TS on prose specification for Pan-European eCall testing, considering updated conformance requirements for different codec and radio conditions.

Millimetre Wave Transmission

Widescale deployment of 4G, the anticipated needs of 5G and the number of connections needed for massive machine-type communications in the Internet of Things (IoT) place unprecedented demands on radio access networks and backhauling.

Millimetre wave bands (30 - 300 GHz) offer large amounts of under-utilized bandwidth, as well as more spectrum for radio transmission than lower bands and wider channel bandwidth. As a source of largely untapped spectrum resource, millimetre wave technologies are thus expected to be a major enabler for future mobile communications.

Our Industry Specification Group on millimetre Wave Transmission (ISG mWT) is helping facilitate the use of these bands for large volume backhaul and fronthaul applications to support mobile network implementation, wireless local loop and other services.

Following on from previous Group Reports, a new study discusses potential usage of the W-Band (92 – 114,5 GHz) and D-Band (130 – 174.8 GHz) for future high capacity backhaul systems. Other GRs in preparation investigate frequencies above 174,8 GHz. We are also surveying deployment status and international regulation in the E-Band (71 - 76 and 81 - 86 GHz).

The increase in capacity needed for 5G backhaul, and the importance of microwave/millimetre wave as a backhaul medium, lead us to seek innovative way to use Fixed Service spectrum. 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 work in ISG mWT therefore aims to remove bottlenecks in releasing new spectrum, and to change spectrum licensing rules to make wireless backhaul practical in the medium/long term for mobile operators.

After our successful SDN Plugtests™ event, a new Work Item has been launched to define the profile for the NorthBound Interface and to enrich use cases for a second event. A mmW/microwave profile for SDN standard models (as, for example, ITU-T8275.1 is for IEEE1588-2008) is useful to facilitate interoperability and technical requirement specification. It is also an essential tool for practical implementation of SDN, since mmW and microwave usually require a small subset

of some large, general-purpose models, and have specific attributes that may lead to multiple interpretations.

We are also exploring how current mWT technology and its evolution can satisfy future applications – such as 5G and Fixed Wireless Access – in the timeframe beyond 2020. This considers new mobile and fixed access requirements in terms including topologies, data rates, latency and range.

Multi-Access Edge Computing

A key 5G enabler, Multi-Access Edge Computing (MEC) offers application developers and content providers cloud computing capabilities and an IT service environment at the edge of the network. This environment is characterized by ultra-low latency and high bandwidth as well as real-time access to radio network information that can be leveraged by applications.

MEC provides operators capabilities to expose their network edge to authorized third parties, allowing rapid deployment of innovative services for mobile subscribers and enterprises. Allowing software applications to tap into local content and real-time information about local network conditions, MEC enables new business segments and services ranging from IoT, augmented reality and location services to video analytics and optimized local content distribution.

Our Multi-access Edge Computing Industry Specification Group (ISG MEC) creates a standardized environment allowing seamless integration of applications from vendors, service providers and third parties across multi-vendor MEC platforms. Created at the end of 2018, our new working group DECODE is focused exclusively on issues related to MEC ecosystem development and deployment.

We are currently working on Phase 2 of our specifications. A major focus of this work phase, conducted under the DECODE umbrella, is on operational and implementation issues. This year we expect to complete our Group Report (GR) on a testing framework for MEC, which defines a methodology for development of interoperability and conformance test strategies, systems and specifications for MEC standards Work items for normative follow-up work have already been approved and the work is starting. Of course, we are continuing to support and expand API availability through ETSI forge and seeing an increased use of the site by developers.

Within the main ISG, we are continuing to work on providing a complete set of APIs to the MEC market. Two further GRs are in progress, considering MEC support for containers / alternative virtualization technologies and support for network slicing. Other work includes new publications on MEC 5G integration; a Vehicular-to-Everything (V2X) API; and Fixed Access Information API for cable, xDSL and Point-to-Point fibre Ethernet access to MEC. We are also creating or revising several other specifications. These cover an API for end-to-end ME application mobility support in a multi-access edge system; MEC location API; WLAN Information API.

Our increasingly popular Hackathons provide a platform for the IT development community to validate ETSI specifications through a series of live demonstrations and practical challenges. Endorsed by ETSI, the 2019 MEC Hackathon in September invites teams to test their skills as Multi-Access Edge Application developers – demonstrating MEC as an enabler for different use cases and business objectives, and driving development of a diverse, open ecosystem.



Standards to Make Everyone's Digital World Safer

The world has never been more connected. The Internet is critical to our everyday lives, and so too is its security. With our growing dependence on networked digital systems comes an inevitable increase in the variety, scale and sophistication of threats and cyber-attacks targeting businesses, organisations and individuals. Standards have a key role to play in strengthening our cyber security, protecting the Internet and everyone who relies on it.

Cyber Security

Our Cyber Security committee (TC CYBER) is recognized as a trusted centre of expertise offering market-driven cyber security standardization solutions, advice and guidance to users, manufacturers, network, infrastructure and service operators and regulators. We work closely with stakeholders to develop standards that increase privacy and security for organizations and citizens across Europe and worldwide. Our standards are applicable across different domains for the security of infrastructures, devices, services, protocols, and to create security tools and techniques.

This year we continue to explore a wide range of security-related matters. These include Consumer IoT security; enterprise network security; metrics for identification and categorization of critical ICT infrastructures; privacy assurance and verification; identity management and naming schema protection mechanisms; assuring digital materials; use of Identity Based Encryption (IBE); and the specification of external encodings for the Advanced Encryption Standard (AES).

Current highlights include the Consumer IoT Security specification which aims to raise the cyber security bar for all consumer IoT products and has been well received by consumer groups and industry alike. We will be taking this further during 2019, developing test specifications. In addition, TC CYBER has a continuing focus on so-called 'middleboxes' implemented in the boundaries between networks to enable secure communication between endpoints. Our Middlebox Security Protocol (MSP) specifications are key to supporting data centre operations including compliance and detection of external attacks on encrypted networks.

Smart Cards and the Secure Element

Our Smart Card Platform committee (TC SCP) develops and maintains specifications for the Secure Element (SE) for its use in telecommunication systems including the Internet of Things (IoT). Our committee develops 'agnostic' specifications that can find their way into other applications

such as ID management, ticketing and cards used in financial services. In all these areas, our specifications encompass not only the requirements and technical solutions but also conformance testing for both the SE and the terminal.

The work of TC SCP is based on inputs from both inside and outside ETSI. Our committee liaises with external contributors such as GlobalPlatform, GSM Association, 3GPP, 3GPP2, oneM2M, SIMalliance, NFC Forum, OMA and the Global Certification Forum (GCF). We also provide and maintain the application identity register for smart card applications on behalf of a number of organizations.

TC SCP is also the home of the UICC – the most widely deployed Secure Element, with more than five billion pieces entering the market every year just as SIM cards. Accordingly, we continue to maintain and advance UICC specifications, covering evolving market needs.

This year we keep our focus on the Smart Secure Platform (SSP), the next generation SE that aims to offer a flexible platform that can be adapted to multiple different products and markets, while maintaining a common set of features and some of the characteristics of UICC.

SSP will offer an open platform for multiple applications, a choice of physical interfaces and form factors to adapt to market needs, a flexible new file system and built-in capabilities to support multiple authentication methods such as biometrics. In high-end deployments, the SSP will offer greater speed, security and flexibility than the UICC, while supporting existing features such as Toolkit and the contactless interface.

Having published the SSP requirement specification in early 2019, the technical realization of these requirements is now a major topic in TC SCP. The initial phase of this work will result in two specifications: one describing general SSP characteristics, and one describing the specific case of the SSP integrated into a SoC (System on Chip) solution. This is of particular interest for IoT applications as it reduces the complexity and cost of SE deployment. Work on the second case, the embedded SSP, has started and will be followed by studies on the removable SSP.

Electronic Signatures

Our Electronic Signatures and Infrastructures committee (TC ESI) is responsible for standards on digital signatures and trust services within ETSI. ESI deliverables aim at supporting Regulation (EU) No 910/2014 as well as supporting the general requirements of the international community to provide trust and confidence in electronic transactions.

In 2019 we are progressing several new standardization related activities, including revisions to a number of European Standards (EN). These span procedures for the creation and validation of AdES digital signatures; a brand new signature format JAdES; a schema for machine-readable cryptographic algorithm catalogues; and requirements for conformity assessment bodies assessing Trust Service Providers.



We aim to complete a TS on signature policies, considering formats and a signature validation policy for European qualified electronic signatures/seals using trusted lists along with guidance on the use of trusted lists. Completion is also expected of two TS on policy and security requirements on one hand and on a protocol on the other side for trust service providers, providing long-term preservation of digital signatures or unsigned data using signature techniques.

Other work includes revision of our framework for standardization of digital signatures and related trust services.

This year we expect to complete a Technical Report (TR) addressing global acceptance of EU Trust Services, and to organize four workshops in Middle East, Asia, Central America and North America on this topic.

Lawful Interception and Data Retention

Lawful Interception (LI) and Retained Data (RD) plays a crucial role in the growth and development of the Information Society, helping law enforcement agencies (LEAs) to investigate terrorism and serious criminal activity.

Bringing together the interests of governments and law enforcement agencies (LEAs) as well as mobile network operators and equipment vendors, our Technical Committee on Lawful Interception (TC LI) develops standards supporting common international requirements for LEAs, including the interception of content and retention/disclosure of electronic communications related data with supporting standards for warrantry and internal interfaces.

Work continues in 2019 on a Technical Report (TR) to assess and characterize problems associated with interception and secure onward delivery of high-bandwidth user traffic using TCP or TLS as currently defined in ETSI TC LI specifications.

We are progressing our definition of an electronic interface for the exchange of information between systems relating to the establishment and management of LI, including revisions to our specification for an internal network interface X1 for LI-related messages over Handover Interface 1 (HI1) and a specification for both interfaces X2 and X3

for LI-related messages over Handover Interfaces 2 and 3 (HI2 and HI3) respectively. We aim to complete a Technical Specification (TS) on dynamic triggering of interception / CTF standardization, as well as to regularly work on revisions to the 7-multipart TS on service-specific details (SSD) for IP delivery, with special importance to the TS part 2 on messaging services.

ETSI is hosting the first Inter Law Enforcement Monitoring Facility (LEMF) Handover Interface (ILHI) interoperability Plugtests™ event, taking place at our Sophia Antipolis headquarters in July 2019. The event focuses on the cross-border data exchange for electronic evidence, based on the specification developed by TC LI. This standard supports European Investigation Orders related to Lawful Interception and Retained Data.

Security Algorithms

Our Security Algorithms Group of Experts (SAGE) responds to the needs of other ETSI committees for cryptographic algorithms. In particular it specifies authentication, encryption and key agreement mechanisms for a range of different standardized technologies.



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

Additional work is undertaken for Terrestrial Trunked Radio (TETRA) and Digital Enhanced Cordless Telecommunications (DECT™), and from time to time the group advises other ETSI committees and external groups.

In response to a liaison statement from 3GPP SA3, work progresses in 2019 on the development of new 256-bit algorithms that will offer greater resistance to possible future Quantum Computing attacks in 5G systems. These same algorithms could also be potentially retrofitted to previous-generation mobile systems if required.

Blockchain

An intrinsic feature of today's secure decentralized cryptocurrencies, a blockchain uses cryptographic techniques to link a growing list of 'blocks' or records in an open distributed ledger that's immune to modification. Aside from their financial application, these ledgers can also be used for digital identity attributes, object tracking or verification of service level agreements.

Formally starting work in January 2019, our ISG on Permission Distributed Ledger (PDL) is exploring the challenges presented by the operation of permissioned (managed) distributed ledgers, business use cases, functional architecture and solutions for the operation of permissioned distributed ledgers, including interfaces/APIs/ protocols and information/ data models.

In its first full year of activity, the group is developing a landscape document to identify current activities in standardization and research which are particularly relevant to PDL.

Work has been launched on a Group Report (GR) describing permissioned distributed ledger Application Scenarios. Its aim is to describe potential application scenarios for the operation of PDLs, including provision models with special emphasis on 'as-a-service' paradigms, and PDL infrastructure governance aspects. The report will define terms to be used in our future standardization work.

A further GR examines essential data processing requirements in terms of trust, security and effective

conformity assessment, making recommendations on how PDL can be used by organizations, operations, deployment, hardware, and software to be trusted.

Quantum-Safe Cryptography

Quantum computers already pose a major challenge to conventional cryptographic techniques. Previously secure encrypted information – such as bank account details, identity information and military security – will become potentially subject to discovery and misuse. Thus new 'quantum safe' cryptographic techniques have emerged in recent years to provide protection against these threats.

Our Working Group on Quantum Safe Cryptography (QSC) maintains its interest in practical implementation of cryptographic techniques that are immune to quantum computers. Our activities address performance considerations, protocols, benchmarking and architectural considerations for specific applications. The group's work also feeds into other organizations such as the International Telecommunications Union (ITU) and Internet Engineering Task Force (IETF).

In 2019 we aim to complete our set of recommendations and user guidelines for migration strategies to a quantum safe operating model from an existing non-QSC environment. Also ongoing is our comparison of proposals in the academic literature for quantum-safe signature schemes.

Completion is expected of our TR presenting a quantum-safe hierarchical identity-based encryption scheme, together with illustrative use cases. Work on a Technical Specification (TS) for hybrid key exchange subsystem is ongoing. Meanwhile we continue to develop our QSC extended roadmap that will feed into the group's future work.

Quantum Key Distribution

Quantum Key Distribution (QKD) enables digital keys to be shared privately without relying on computational complexity. The security offered by QKD will not be vulnerable to future advances in algorithms, computational power or the emergence of quantum computers.

With QKD, security keys are shared over optical fibre or free space links encoded on single photons or weak pulses of light. Demonstrator networks are now being constructed in several locations around the world and standards are needed urgently to enable adoption of these new security technologies.

ETSI's Industry Specification Group (ISG) on QKD is leading activities to help fulfil this need, by developing standards for the quantum communications industry that will promote and shape the market.

We are developing a Protection Profile for QKD under the Common Criteria framework for use in the certification of QKD systems. The work will be performed in conjunction with an evaluation lab and will guide our future work on implementation security. We are also updating our Group Specification (GS) on Security Proofs that gives a framework



for security statements of QKD implementations and how these relate to a security proof of the underlying QKD protocol.

We are finalising a GS for a QKD Control Interface for Software Defined Networks (SDN) and preparing a Group Report (GR) on QKD Network Architectures as well as updating our GS for a QKD Application Interface to include additional parameters to adapt to new network architectures.

Work progresses this year on a GS defining procedures for characterizing the optical output of QKD transmitter modules under operational conditions and on a GS exploring security aspects of the design, construction, characterization and operation of QKD systems to safeguard against Trojan horse attacks.

ETSI Security Week

Taking place in June at our Sophia Antipolis headquarters, the ETSI Security Week explores the cybersecurity challenges underpinning our digital world. This annual event provides a unique opportunity for the security community to network, share and learn. Topics explored in 2019 have included the cyber security landscape, policy actions, Artificial Intelligence (AI) and an exploration how security can keep pace with the rapid change of technology, networks and society, together with a Hackathon event on new Middlebox Security Protocol standards.



Connecting Things



Linking Objects to Create New Experiences

It's estimated that the number of connected devices in the Internet of Things (IoT) already exceeds the world's population. And with this figure anticipated to outstrip 20 billion by 2020, the IoT is having a transformative influence on the way we live and work in domains including smart cities, connected vehicles, eHealth, home automation and energy management, public safety and industrial process control. Standardization is key to achieving universally accepted specifications and protocols for true interoperability between devices and applications.



IoT and M2M (Machine-to-Machine) communications are the foundation layer for tomorrow's world of smart devices, appliances, homes and cities. oneM2M draws together the many diverse IoT-related business domains including industrial automation, smart grid, telematics, utilities, intelligent transportation, public safety and health. This cross-industry initiative is developing specifications that will enable users to build platforms that allow devices and services to be connected – regardless of the underlying technology used – thus enabling interoperability across IoT applications. In this way, oneM2M's specifications can reduce complexity for application developers and reduce costs for service providers.

Acknowledging its efforts to accelerate mass adoption of the IoT through standardization, in April 2019 oneM2M has been named as 'Top IoT Standards Body of the Year' at the Annual Compass Intelligence Awards.

ETSI and oneM2M

ETSI is one of the founding partners in oneM2M, the global standards initiative that covers requirements, architecture, Application Programming Interface (API) specifications, security solutions and interoperability for M2M and IoT technologies. oneM2M's architecture and standards for M2M communications are designed to be applied in many different industries and take account of input and requirements from any sector. oneM2M brings together eight of the world's preeminent ICT standards development organizations (SDOs), together with other industry fora or consortia and almost 200 member organizations.

Learn more at onem2m.org



During 2019, work accelerates on development of the initiative's fourth release of specifications. Release 4 adds new capabilities to the oneM2M service layer, enabling its deployment across a wider range of use cases. Further enhancements in Release 4 focus on topics such as enhanced semantic support, vehicular domain services and 3GPP/V2X interworking; railway domain devices and services; edge and fog computing; industrial domain information model mapping and semantics support; services and platforms discovery; attribute based access control policy; modbus interworking; public warning services and subscribers/user services as well as ontologies for Smart City services.

In ETSI we also support oneM2M via interoperability events and hackathons that invite developers to demonstrate working oneM2M solutions.

Supporting Development of the IoT

The work of oneM2M builds on the activities of our own technical committees, including TC SmartM2M which has developed and now maintains specifications for a standardized platform.

Developing standards to enable M2M services and applications and certain aspects of the IoT, TC SmartM2M addresses the need for connected appliances to be able to communicate among themselves and with the service platforms, allowing interoperability of applications and 'plug and play' connectivity. Interoperability is a key factor in creating an IoT ecosystem, and the availability of a standardized solution with open interfaces, along with related test suites, will be an essential enabler of the IoT.

This year we are continuing to extend the applicability of SAREF, our Smart Applications REference ontology that runs on oneM2M compliant communication platforms. Domains currently under consideration include automotive, water, wearables and eHealth/ageing well.

We are considering the application of Artificial Intelligence (AI) within the scope of IoT (AI4IoT) as a detailed Proof of Concept that considers specific use cases.

Other work in progress includes a smart applications communications framework that aligns SAREF with latest oneM2M developments; the development of a SAREF portal facilitating the inclusion and self-contribution of the actors from different vertical business sectors; and the release of SAREF V3.

In 2019 we are developing guidelines on the use of IoT semantic interoperability in the industry, as well as issues relating to security and privacy. We are also developing a suite of SmartM2M IoT Security and Privacy teaching materials.

ETSI IoT Week

Taking place in October, ETSI IoT Week is a focal point for all stakeholders with an interest in standards-enabled technologies for IoT service deployments. This popular annual event presents an overview of the major IoT standardization activities in our own SmartM2M and SmartBAN committees, oneM2M and 3GPP. Highlights in 2019 include a Developer's Tutorial on oneM2M open source solutions with practical hands-on development activities. The ETSI IoT workshop focuses on service layer interoperability, security/privacy and standard based communication technologies such as those developed by the 3GPP NB-IoT, LTE-M, 5G. IoT Standard Showcases enable attendees to interact with real implementations of standards-based technologies for oneM2M standard and SAREF, and communication networks (e.g. 3GPP cellular 5G) applied to IoT services.



Working alongside ETSI's Centre for Testing and Interoperability (CTI), we are planning a Plugtests™ event – potentially taking place in 2020 – on IoT Semantic Interoperability based on AIOTI High Level Architecture, oneM2M base ontology and oneM2M service layer information sharing.





Building Smart Cities

Tomorrow's smart cities and communities will be characterized by standardized services that enhance the appeal of these connected urban environments to residents, businesses, investors and tourists. Totally new and evolved applications will embrace health and social care, building management and connected homes, energy efficiency, waste management, transportation, mobility and environmental issues.

Our City Digital Profile Industry Specification Group (ISG CDP) is supporting the deployment and roll-out of smart city infrastructures by providing coordinated overviews of existing standards and specifications, including relevant work from many groups including TC ATTM, ISG CIM, TC CYBER, ISG MEC, TC SmartM2M, and oneM2M. ETSI presented a comprehensive overview at the 22nd Global Standards Collaboration meeting of all global SDOs in March 2019.

The Group is focused on identification of standards-based frameworks and corresponding technology roadmaps. This will enable city administrators to deliver advanced services to their citizens, whilst avoiding lock-in to proprietary systems, ensuring interoperability for upgrades, respecting essential environmental factors, sustainability objectives and reducing overall complexity and therefore also reducing costs.

To enable this, ISG CDP provides a focal point within a recognized standards body where other actors may share, collect and develop their various technology requirements based on common use cases, with a focus on those that have cross domain aspects. We are also collecting initial feedback on the results from early trials and pilot projects: accordingly, the group seeks to identify best practice recommendations for city service deployments to be made available to the ISG community and beyond.

In 2019 a Group Report will examine the value of standards for smart cities – considering issues such as cost savings, risk management, legal compliance, avoidance of vendor lock-in and replicability across multiple city departments and cities.

Meanwhile our Human Factors committee (TC HF) continues to assess the needs of consumers and citizens that must be addressed by smart city standardization, including accessibility, usability, personalization, interoperability and personal data protection. In 2019 the committee aims to complete its Technical Report (TR) on smart cities and communities standardization for citizens & consumers.

Our Access, Terminals, Transmission and Multiplexing committee (TC ATTM) is developing standards to support the deployment and roll-out of sustainable multi-service smart city infrastructures. This year we are progressing specifications in areas such as broadband deployment and energy management, the use of lamp-posts for hosting sensing devices and 5G networking, and KPIs (Key Performance Indicators).

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, the so-called metadata, and to transfer these without misinterpretation to other systems. Single-purpose solutions – such as measuring traffic flow along a highway – work well within a known/preset context; however transfer of the data to another system (for example personal travel planner) or from country to country requires pre-agreed standards. A century of international collaborations has achieved thousands of such agreements, but technologies such as Big Data, semantic web, Linked Data, autonomous decision making and eGovernment are enormously forcing the pace.

ETSI's Industry Specification Group on cross-cutting Context Information Management (ISG CIM) is developing Group Specifications (GSs) for applications – including legacy data from municipal departments – to publish, discover, update and access context information, initially for a broad range of smart city applications and later for other areas such as Smart Agriculture and Smart Manufacturing.

In 2019 we expect to complete a number of specifications and related studies. Following delivery of CIM's NGS-LD Application Programming Interface (API) as a Group Specification, publication is scheduled of a Group Report

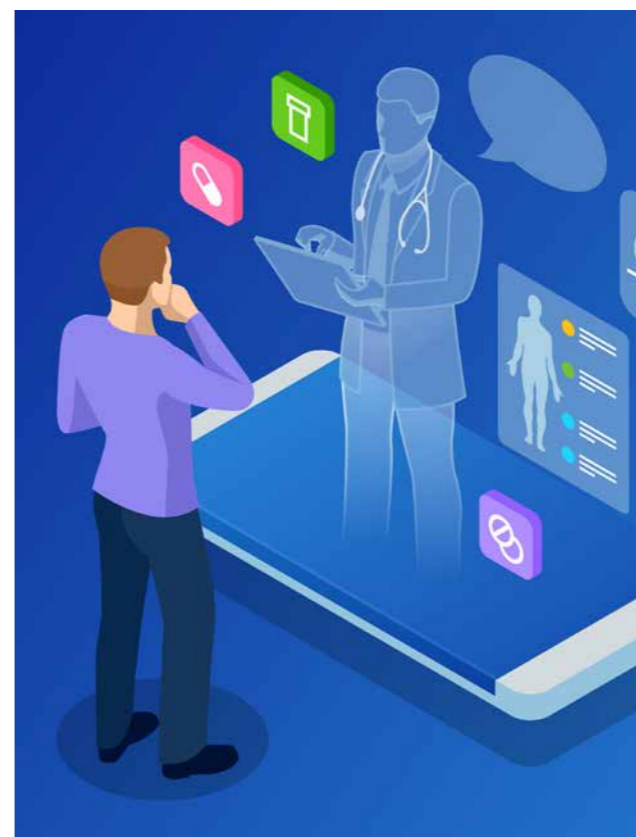
(GR) on recommendations for NGS-LD interworking with (e.g.) oneM2M. Progress continues on further deliverables covering security/privacy, a cross-domain information model, and a 'primer' for developers describing how to use NGS-LD.

The group maintains its co-operation with other ETSI committees and other industry entities, including H2020 IoT/Smart Cities Projects, ETSI SmartM2M, oneM2M, GSMA, OGC, W3C and TM Forum.

eHealth

eHealth offers numerous potential benefits, such as improving the quality of healthcare and helping to foster independent living. But the success of its implementation relies on the widespread digitization of all sectors of society and, although an increasing number of patients enjoy access services such as telecare and telemonitoring, the use of Telemedicine is still very limited. One of the problems currently hindering the development of the 'virtual' clinic is a lack of interoperability. Standards therefore have a key role to play in assisting the development of new eHealth products and the growth of Telemedicine.

The work of our eHealth Project (EP eHEALTH) focuses on eHealth in the new environment created by the IoT. An industry 'hot topic' attracting the attention of new stakeholders is the Electronic Health Records (EHR) needs/standards requirements as described in the ICT Standardisation Action Rolling Plan. This has led to the creation of a new work item on data recording requirements for eHealth. Based on EHR requirements, work is also ongoing on a Technical Report on eHealth standardization use cases for eHealth. Both work items involve active discussion between eHEALTH and other groups within ETSI.



Body Area Networks

The use of wearables and body sensor devices is growing rapidly in the Internet of Things (IoT). At the same time, the emerging field of digital health represents a convergence of digital technologies and health.

Wireless Body Area Networks (BAN) facilitate the sharing of data, interaction and interoperability in environments such as smart homes, living environments, automotive and aerospace. In the specific areas of medical and health monitoring, equipment and systems are moving towards the trend of wireless connectivity between the data collection or control centre and the medical devices or sensing nodes. Therefore, the need for a standardized communication interface and protocols between actors is required. Smart Body Area Network (SmartBAN) technology uses a set of low-power embedded devices – mainly sensors, wearables or actuators – to collect and monitor vital data of a human being and their environment. Working in close co-operation with TC SmartM2M, our Smart BAN committee (TC SmartBAN) addresses the pressing need for global standards to support the successful market roll-out of technology.

Publication in May 2019 of our SmartBAN specification establishes standardized service and application interfaces and facilitators, APIs (Application Programming Interfaces) and infrastructure for interoperability management; it also offers secure interaction and access to any SmartBAN data or entities. The resulting reference architecture is a global and integrated IoT reference architecture, oneM2M and Multi-Agent-based. It features cross-functional components, allowing non-SmartBAN enabled environments to interoperate with SmartBAN and addresses network, syntactic, informational and semantic interoperability.

In 2019 we continue to make progress on development of our SmartBAN system level description. A number of Technical Reports (TR) are also underway. These include a comparative analysis between SmartBAN and other short-range standards and an investigation into use cases and requirements for SmartBAN security, privacy and trust. We are updating our report Low Complexity Medium Access Control (MAC) and routing for SmartBANs. Meanwhile we are progressing updates to our TS covering a unified data representation formats, a semantic open data model and a corresponding ontology by adding extensions for semantic interoperability.

Also in the area of smart wearable devices, we are discussing requirements in the Radio Equipment Directive (RED) to protect the privacy and security of users of smart watches and other Internet-connected wearable radio equipment.

Connected medical devices

In the emerging area of medical implant communications we are evaluating the use of Ultra Wide Band (UWB) for a swallowable, pill-type wireless medical camera device and revising our standards specifying technical characteristics and methods of measurements for Ultra Low Power (ULP) wireless medical capsule devices for endoscopy applications operating in the 430 - 440 MHz frequency band.

We are revising ENs on Short Range Devices (SRD) used for Ultra Low Power Active Medical Implants (ULP-AMI) and Ultra Low Power Animal Implantable Devices (ULP-AID).



Unlimited Access, Today and Tomorrow

Any device, any place, any time: businesses and consumers expect seamless round-the-clock access to communications services, wherever they are and whatever they're doing. We provide a comprehensive set of standards for network technologies.

Network Functions Virtualization

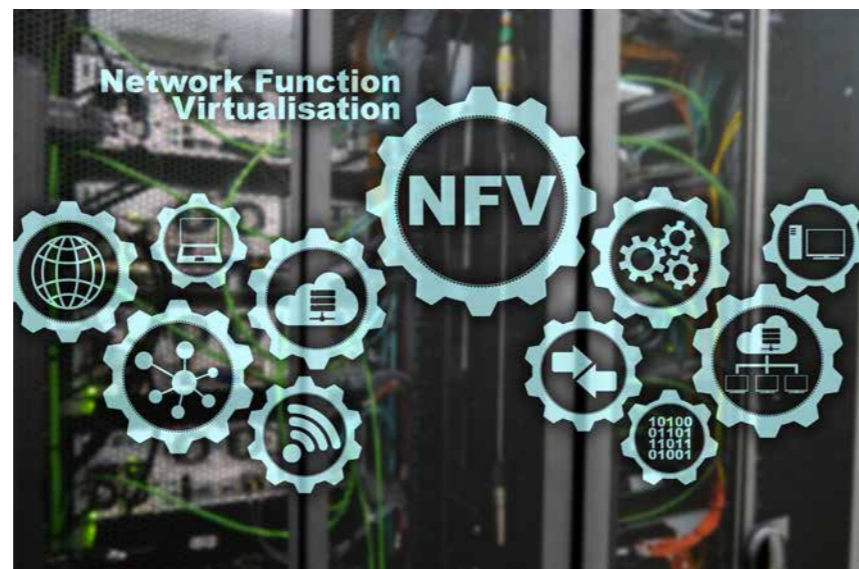
Network Functions Virtualization (NFV) adapts standard IT virtualization technologies, consolidating heterogeneous network infrastructures based on disparate, ad hoc equipment types onto industry standard servers, switches and storage. This sees network functions running as software on a homogeneous 'off the shelf' infrastructure that can be introduced to various network locations as needed.

NFV simplifies roll-out of network services, reduces deployment costs and operational expenditure, facilitates network management automation and encourages innovation. It is being increasingly adopted for network planning, deployment and evolution, and has become an essential element of modern network design. NFV also delivers significant benefits to service users and providers, especially in the area of emerging 5G networks.

The goal of our Industry Specification Group on Network Functions Virtualization (ISG NFV) is to create strong specifications that are flexible enough to accommodate current

demands and emerging requirements. These specifications will enable network functions to be deployed dynamically and on-demand. In turn, they will allow organizations to be more agile in addressing customer needs and the new challenges facing network technologies.

In 2019 we are continuing to maintain existing specifications, drawing on experiences gained from actual deployments. We are consolidating our 'stage 3' work, covering all the data models and protocols/APIs required to build and run an NFV-



based network. We are developing testing methodologies and procedures, focused on interoperability verification and validation of, and on the creation of more agile methods for function and service validation. In addition, the group has started to discuss features that will be addressed in Release 4 – this will define the focus of our activities in 2020.

Work also proceeds on our industry roadmap, as well as revisions to our glossary of terms and definitions that aims to establish a common language across all our own NFV working groups and also for wider industry discussion.

Effective interoperability is the ultimate goal of any standardization activity. Collaborating with our Centre for Testing and Interoperability (CTI), ISG NFV builds on the success of our popular Plugtests™ events. Hosted in June 2019 at ETSI's headquarters in Sophia Antipolis, the 4th NFV Plugtests™ event has given NFV and MEC solution providers and open source projects an opportunity to meet and assess the level of interoperability of their NFV and Edge solutions. Test sessions include NFV interoperability, NFV API conformance and MEC-in-NFV interoperability.

Effective collaboration with other standardization bodies and Open Source projects remains a priority for the group. ISG NFV maintains its close collaboration our Multi-Access Edge Computing (MEC) and Zero Touch Network and Service Management (ZSM) ISGs as well as other bodies dealing with 5G technologies. We also collaborate closely with the Open Source NFV Management and Orchestration (OSM) and Open Platform for NFV (OPNFV) Open Source projects. Other important Open Source projects with which we collaborate include OpenStack, the reference open source implementation for cloud management, and the Open Networking Automation Platform (ONAP).

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 ETSI's NFV architectural framework are the NFV orchestrator and the virtualized network function manager – known collectively as the NFV Management and Orchestration, or MANO.

To enable accelerated standardization with a fast feedback loop to ISG NFV, our Open Source MANO group (ETSI OSM) is developing a software reference implementation example for the ETSI NFV MANO along with Slice Manager functionality, according to accepted Open Source working procedures and using a software development platform which we host and manage.

ETSI OSM is a community driven effort that aims to offer a production-quality Open Source MANO stack that meets the requirements of commercial NFV networks.

In 2019 work progresses on the upcoming OSM Release SIX and Release SEVEN, planned for delivery before the end of

the year. New capabilities and features include: end-to-end orchestration across heterogeneous networks and cloud technologies; easier management of complex services, with extended capabilities for Network Service primitives and extension of Service Assurance (SA) framework; a wider range of underlying technologies supported by OSM (new connectors and improvements from previous releases); a more flexible operator experience, with improved control over orchestration roles and real-time feedback; and streamlined VNF onboarding and testing phases.

Open Source collaboration is a hallmark of our popular Hackathons and Hackfest events that provide a platform for the IT development community to validate ETSI specifications through live demonstrations and practical challenges. ETSI's Centre for Testing and Interoperability



(CTI) and the OSM community are joint organizers of the 6th OSM Hackfest, held in May 2019 in Santa Clara, California. Further OSM Hackfests are scheduled in September (Patras, Greece) and November (Luca, Italy).

Cable

Our Integrated Broadband Cable Telecommunication Networks committee (TC CABLE) continues its work on standards addressing the evolution of broadband cable network capabilities.

We work with the global cable community to foster innovation and competitiveness, making technology available industry-wide based on voluntary standards.

We continue to update and extend Data Over Cable Service Interface Specification (DOCSIS) 3.1 – one of the core technologies for cable access networks – into ETSI Standards (ESs). This spans the DOCSIS 3.1 physical layer; MAC and upper layer protocols; cable modem operations support system interface; converged cable access platform operations support system interface; and security aspects.



In 2019 we expect to publish two new Technical Specifications (TS). The first relates to the performance characteristics of coaxial cables used for RF signal transmission in hybrid fibre-coax (HFC) telecommunication networks. The second discusses network performance measurement methods for broadband data services.

Meanwhile drafting continues on a Technical Report (TR) that considers mapping of cable equipment and standards to support the assessment of conformity with the European Commission's Radio Equipment Directive (RED), the Electromagnetic Compatibility Directive (EMCD) and the Low Voltage Directive (LVD) that covers the safe operation of electrical equipment for consumer and professional use.

In many of our activities we leverage our close relationships with the Society of Cable Telecommunications Engineers (SCTE), CENELEC and ITU-T.

The Transition to IPv6

Upgrading the Internet with the provision of additional public IP addresses is essential to maintain growth and allow new entrants to join. Developed by the Internet Engineering Task Force (IETF) to solve the problem of IPv4 address exhaustion, IPv6 provides enhanced features and enables new Internet services in need of end-to-end connectivity and security. It is also the key technology to enable the deployment of billions of new devices that form the Internet of Things (IoT). As mobile data traffic continues to increase significantly, major Internet Service Providers (ISPs) have started prioritising IPv6 traffic.

ETSI's Industry Specification Group on IPv6 Integration (ISG IP6) is addressing the transition from IPv4 to IPv6. The

group brings together stakeholders worldwide to work on pre-standardization in a neutral environment, defining requirements and use cases, outlining best practices, gathering support and creating awareness of the impact of IPv6.

ISG IP6 continues to liaise with the IETF, the 5G Focus Group of the Telecommunications Standardization sector of the International Telecommunication Union (ITU-T), the Next Generation Mobile Networks (NGMN) Alliance, the Third Generation Partnership Project (3GPP™), the Institute of Electrical and Electronics Engineers (IEEE) and the IPv6 Forum. Within ETSI, the group co-operates with our ISG NFV and the Network Technologies (TC NTECH) and Integrated Broadband Cable Telecommunication Networks (TC CABLE) committees.

In 2019 we have delivered a new Group Report (GR) on 6TiSCH interoperability testing. 6TiSCH enables IPv6 over the TSCH mode (Time Slotted Channel Hopping) of the IEEE802.15.4 standard. 6TiSCH (IETF work) defines a standard for Low Power and Lossy Networks (LLN) to be deployed in environments requiring determinism in the radio communications.

We have also launched work on a GR examining the integration of IPv6 in Vehicular Networking (V2X) applications.

Next Generation Protocols

The Transmission Control Protocol/Internet Protocol (TCP/IP) suite has enabled the evolution of connected computing and many other developments since its invention in the 1970s. However it can no longer provide the scale, security,

mobility, performance, and ease of deployment required for the connected society of the 21st century. The industry has reached a point where developments in the technology of local access networks (such as LTE™-Advanced, G.Fast, DOCSIS 3.1 and 5G) will not deliver their full potential unless corresponding communications and networking protocols evolve in parallel.

ETSI's Next Generation Protocols Industry Specification Group (ISG NGP) explores the future landscape of networking technology, identifying and documenting requirements and triggering co-ordinated follow-up activities. Its driving vision is a more efficient network that is responsive to the user – whether 'the user' is an individual person or millions of devices in the Internet of Things (IoT). The prize is to allow next generation networks to interwork in a way that accelerates a post-2020 connected world, unencumbered by past developments.

ISG NGP also provides a forum for interested parties to share research and results from trials, as well as other developments, with a wider audience. In particular, the group offers an opportunity for the 5G community to discuss options and prepare the case for the Internet community's engagement in a complementary and synchronized modernization effort.

In 2019 work progresses on three Group Reports (GR). These consider preferred path routing (PPR) for Next Generation Protocols to provide optimization for existing and new data planes; large-scale deterministic networks; and network layer multipath support for 5G.

Experiential Networked Intelligence

The introduction of technologies such as Software Defined Networking (SDN), NFV and network slicing means that networks are becoming more flexible and powerful.

The use of Artificial Intelligence (AI) techniques in the network supervisory and management system can help



solve some of the problems of future network deployment and operation.

Our ISG on Experiential Networked Intelligence (ISG ENI) develops standards that use AI mechanisms to recognize new or changed knowledge, and thus make actionable decisions for operators. ENI will thus enable an efficient, intelligence-based deployment of SDN and NFV, and will in turn assist the management and orchestration of the network.

In 2019 work nears completion on a Group Report (GR) defining networked intelligence categorization, as well as a new Group Specification (GS) on ENI system architecture. In parallel we are revising our GS describing an ENI Proof of Concepts (PoC) framework; our GR on terminology for main concepts in ENI; and specifications on ENI requirements and use cases.

ISG ENI maintains its cooperation with H2020 (including 5G-PPP) projects, specifically SliceNet, 5G-MoNArch and SHIELD.

Zero Touch Network Management

Tomorrow's 5G operators will face the challenges of dealing with increasing complexity, new services and support for a far greater number of devices. Maximizing the efficiency of end-to-end network operations will require increased automation of functions from configuration and capacity management to fault management that are currently administered with direct human intervention.

Driven by documented business scenarios, our ISG on Zero Touch Network and Service Management (ISG ZSM) is examining requirements for tomorrow's autonomous networks, with the ultimate goal of achieving 100% automation of all operational processes and tasks, from delivery and deployment to configuration, assurance and optimization.

Following last year's development of a modular, service-based architectural framework that enables a zero-touch automated network and service management in a multi-vendor environment, work in 2019 continues on topics including end-to-end network slicing management and orchestration.

A new study on the means for automation describes mechanisms to achieve automation and zero-touch network management, analyzing their implications for design of the ZSM framework architecture and their use as a basis for future ZSM compliant solutions. We have developed an initial review of areas with the highest impact for automation, highlighting the vital role of several key means, such as intent-based modelling and orchestration, network governance and network coordination.

In parallel we are developing a ZSM landscape report that surveys current activities in other organizations.



Leading the Journey with Smarter ICT

At ETSI we're working to make transport networks safer and more reliable while reducing energy consumption. We develop standards to accelerate the introduction of Intelligent Transport Systems (ITS) services and applications, based on experience gained from early market deployments. We also address 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

In many respects vehicles on our roads are already connected devices. In the very near future they will also interact directly with each other and the road infrastructure through 'Co-operative Intelligent Transport Systems' (C-ITS), allowing road users and traffic managers to share and use information and to co-ordinate their actions. C-ITS are expected to significantly improve road safety, traffic efficiency and the comfort of driving, helping drivers to make better-informed decisions and adapt to the traffic situation. Communication between vehicles, infrastructure and other road users can also increase the safety of automated vehicles and their integration into the overall transport system.

It is anticipated that around 15 countries will start deployment of ITS services during 2019, using ETSI and other standards. Our ITS Technical Committee (TC ITS)

is leading the drive to global standards supporting the development and implementation of ITS service provision across the network for transport networks, vehicles and transport users, including interface aspects, multiple modes of transport and interoperability between systems. Specific application areas of our work include road safety, traffic control, fleet management and location-based services, driver assistance, hazard warnings and assistance to emergency services. As well as developing standards related to the overall communication architecture, management, security and conformance testing, ETSI is also closely involved in related spectrum requirements for ITS.

This year we are developing a two-part pre-standardization architecture study for ITS. This explores communication between ITS stations with multiple access layer technologies, and an investigation into interoperability and backward compatibility between heterogeneous ITS systems.

We are revising the Harmonised Standard covering the ITS-G5 access layer specification for ITS operating in the 5.9 GHz frequency band. We are also preparing a pre-standardization study on payment applications in ITS-G5.

In anticipation of GeoNetworking Release 2 we are producing a pre-standardization study that addresses the additional requirements of new use cases. We are also making further revisions to the current Harmonised Standard on GeoNetworking in ITS.

Reflecting latest industry activities in the area of ITS security, we are updating our Threat, Vulnerability and Risk Analysis (TVRA).

In response to mandate M/453 on C-ITS systems and mandate M/546 on Urban ITS, we are working on specifications for the cooperative ITS Vulnerable Road Users (VRU) service.

Work continues on other topics relating to ITS including collective perception services, cooperative adaptive cruise control, manoeuvre coordination, malicious/misbehaviour detection, platooning, congestion control, transport pollution management, multi-channel operations and general security improvements.

We are exploring technical concepts and applications for a diagnosis, logging and status service between ITS-Stations. One application of this work is to support the communication of measurement data for maintenance and information purposes.

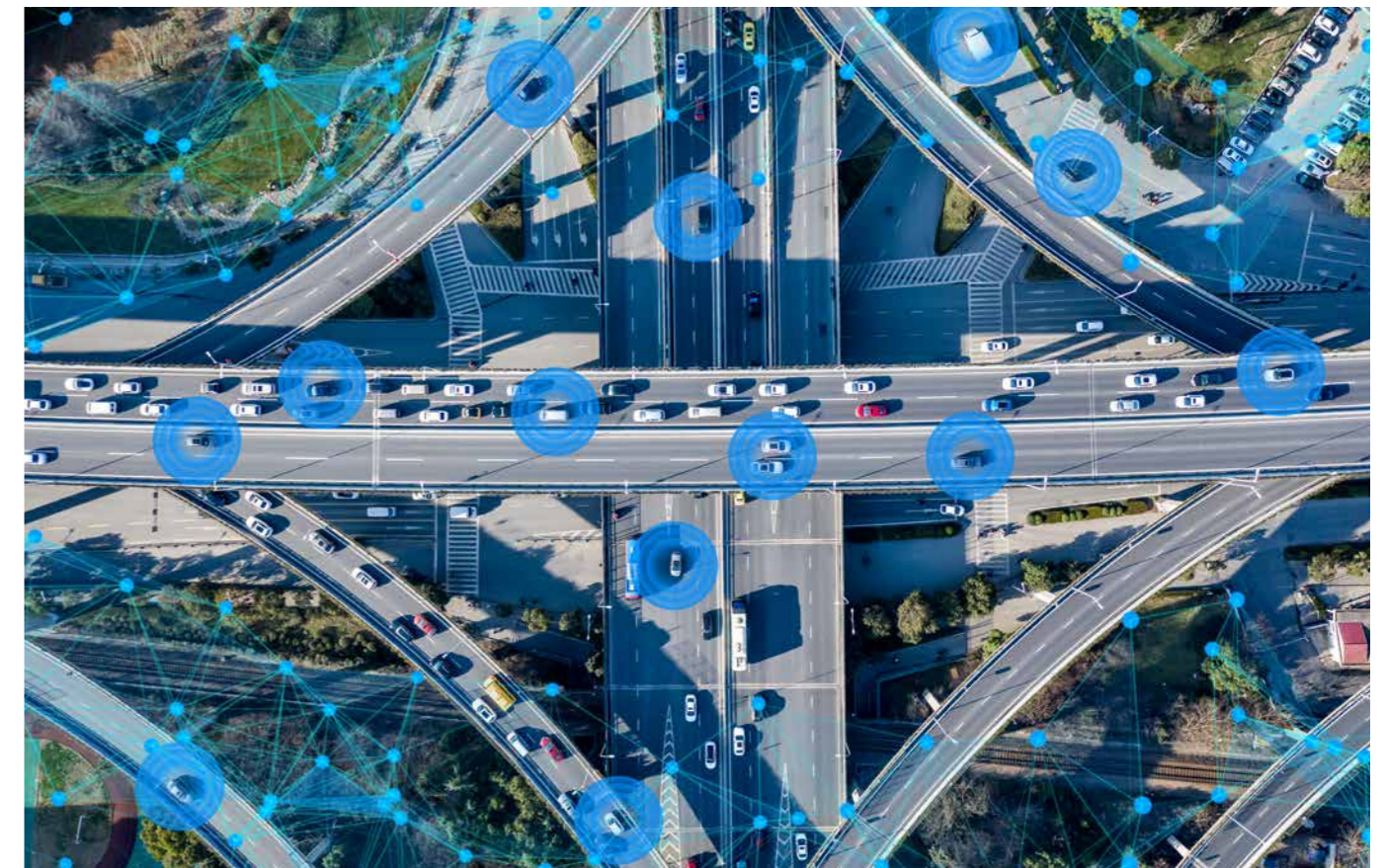
Meanwhile we continue to progress testing aspects of ITS, including updates to existing conformance test specifications.



Cellular V2X

We are reviewing our C-ITS standards to reflect the introduction of Cellular Vehicle to Everything (C-V2X) communication that uses mobile radio technology to deliver services. This work considers the architectural changes needed to support devices with multiple access technologies. We are also investigating how to ensure interoperability and backwards compatibility between existing and future ITS architectures.

This year we are revising the Harmonised Standard on specification of the LTE-V2X access layer for ITS operating in the 5,9 GHz band. We continue development of the Multimedia Content Dissemination (MCD) service specification to enable the V2X exchange of multimedia information including video, audio, images and data. Meanwhile we are preparing a Technical Report (TR) that explores the development and revisions of our standards to consider C-V2X in different working groups.



Radio spectrum for road transport services

In parallel with the work of TC ITS, our ERM committee (TC ERM) develops and updates standards for both Automatic Cruise Control (ACC) radar and anti-collision radar. In 2019 we continue to review receiver technical requirements, parameters and measurement procedures for automotive and surveillance radar equipment including anti-collision radar systems.

Aviation

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

In 2019 we are drafting or updating standards relating to DataLink; Advanced Surface Movement Guidance and Control System (A-SMGCS) including Multilateration

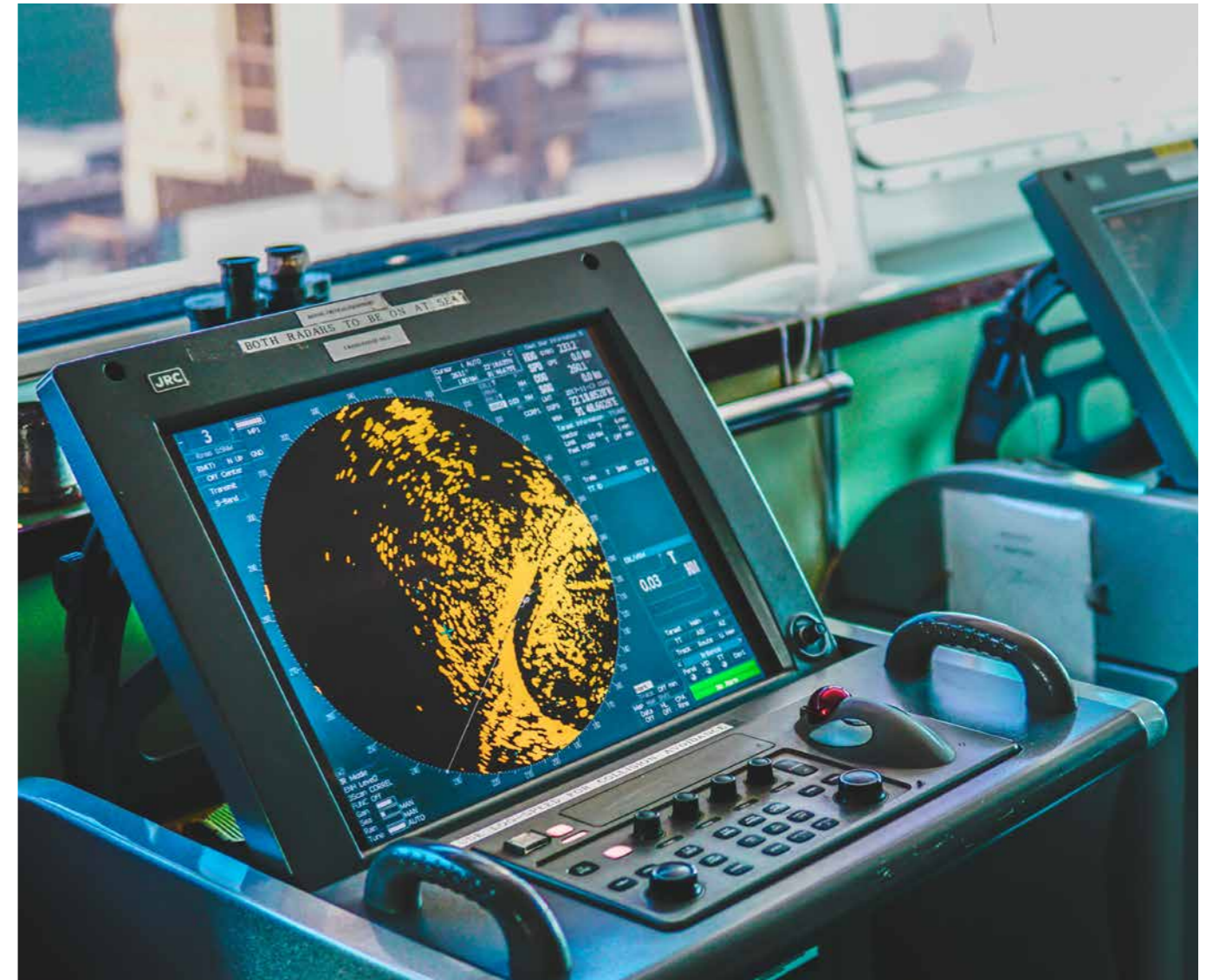
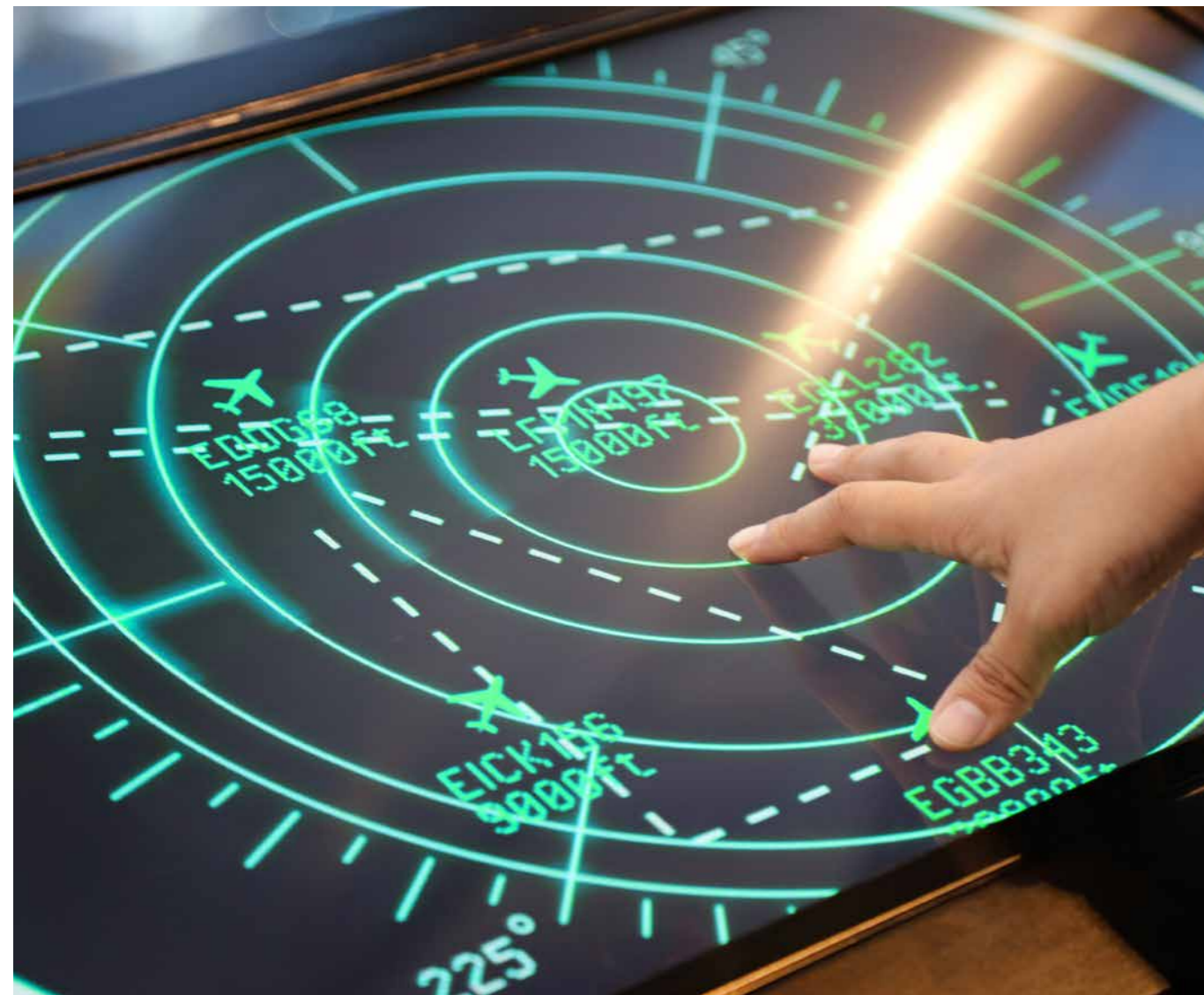
equipment; Multi-Static Primary Surveillance Radar (MSPSR); ground-based Primary Surveillance Radar (PSR) and Secondary Surveillance Radar (SSR) for air traffic control systems; and meteorological radar systems operating in C, S and X bands.

Railways

The international railway community has long used enhanced GSM™ technology. Now there is a need to address the harmonized telecommunication requirements for tomorrow's railway systems.

Our Rail Telecommunications committee (TC RT) continues to maintain the GSM-R (GSM™ for railways) standard, enhancing it with new features specific to the railway environment, including data and voice communications at very high speeds. For example, we are currently revising specifications for the use of Session Initiation Protocol (SIP) for GSM-R voice recording. We are also developing a new Technical Specification (TS) on IP interconnection of GSM-R networks.

Collaborating closely with the rail industry in Europe and throughout the world, we liaise with 3GPP on defining requirements and system architecture for the Future Railway Mobile Communication System (FRMCS).



In 2019 we are developing a two-part Technical Report (TR) on the Next Generation Communication System. This considers both Long Term Evolution (LTE) and New Radio (NR) radio performance simulation and evaluation in a rail environment.

In regard to spectrum-related matters for railway systems, we are updating Harmonised Standards (EN) on radio equipment for Euroloop railway systems.

TC RT also continues to work in cooperation with TC ITS on topics such as urban rail systems.

Maritime

Our Maritime group (ERM TG MARINE) continues to develop and update Harmonised Standards relating to wireless systems using radio spectrum for communication, navigation, surveillance, vessel traffic, harbour, emergency and distress services.

In 2019 our work embraces navigation radar for use on vessels not covered by the International Convention for the Safety of Life at Sea (SOLAS); maritime Digital Selective Calling (DSC) radios; marine VHF radiotelephone transmitters and receivers; radio link equipment for maritime location/positioning systems operating in the 9 200 – 9 300 MHz

band; Maritime Broadband Radiolink (MBR) for ships and off-shore installations operating in the 5 852 – 5 872 MHz and 5 880 – 5 900 MHz bands; Coastal Surveillance, Vessel Traffic Services and Harbour Radars (CS/VTS/HR); Personal Locator Beacons (PLBs) to alert search and rescue services; and New Technology (NT) navigation radar equipment for inland waterways.

Launched in May 2019, ETSI's new Industry Specification Group on a European Common Information Sharing Environment Service and Data Model (ISG CDM) is developing technical standards to allow data exchange between maritime legacy systems in a cooperative network. This supports one of the key strategic objectives of the European Union under the Integrated Maritime Policy with increased coordination between different policy areas. The objective of the maritime Common Information Sharing environment (CISE) is to improve maritime situational awareness by enhancing public authorities' abilities to monitor detect and track occurrences at sea. To promote a common understanding of information relevant to maritime surveillance, CISE must foster the use of common standards to process exchanged information by performing aggregation, correlation and data fusion. Thus ISG CDM will provide a universal data and service model that may serve as reference for all cross-sectoral and cross-border information exchange between European public authorities.



High Quality Pictures and Sound on Every Platform

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

Broadcasting

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). As well as assessing work performed within other organizations, the JTC is responsible for coordinating the drafting of standards for broadcast systems (emission-reception combination) for television, radio, data and other services via satellite, cable and terrestrial transmitters. This includes interactive TV, terrestrial TV, radio (including hybrid radio), satellite TV, fixed line TV, mobile TV and audio technologies.

This year in the area of Digital Video Broadcasting (DVB) we are revising specifications for the Second Generation DVB Interactive Satellite System (DVB-RCS2). We are also revising the Harmonised Standard specifying Service Information (SI) in DVB systems among other key DVB specifications.

We are revising specifications for the single layer High Dynamic Range (HDR) system for use in consumer electronics devices.

In the area of Hybrid Digital Radio (DAB, DRM, RadioDNS), we are making revisions to mainly the DAB guide, DAB audio coding, DAB SI behaviour and DAB Registered Tables. A new specification for DAB will define the Carison application, allowing service providers to deliver information to groups of receivers with configurable filters, such as text language, model number or date of registration.

We are making further revisions to TV-Anytime (TVA) metadata schemas specifications that enable the search, selection, acquisition and rightful use of content on local and/or remote personal storage systems from broadcast and online services.

In the area of audio we are revising the specifications for the DTS Coherent Acoustics coding system to include fixes and define a DTS-HD.

Spectrum for Broadcast and Content Creation

Our committee for Broadcast, as well as Programme-Making and Special Events, PMSE equipment/services (ERM TG17) continues its work on developing and maintaining Harmonised Standards for a wide range of broadcast and



content creation related technologies and applications. In 2019 the scope of our activities variously covers: digital terrestrial TV transmitters and broadcast receivers; 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.

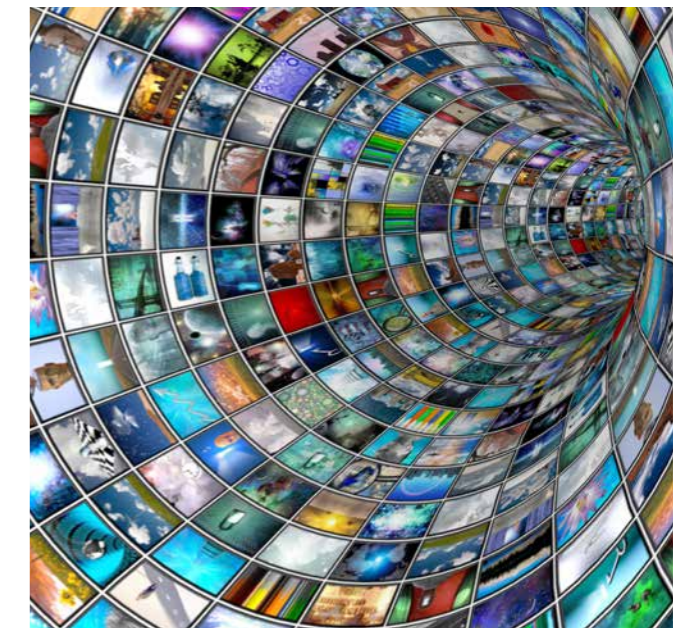
In the area of professional and semi-professional content creation we are examining the use of higher frequency bands for wireless video links used in programme production, as well as alternative spectrum arrangements for wireless microphone systems.



Augmented Reality

Augmented Reality (AR) mixes real-time spatially registered digital content with the real world to enable context-rich user experiences. ETSI's Industry Specification Group on Augmented Reality Framework (ISG ARF) is defining a framework for the interoperability of Augmented Reality (AR) components, systems and services. This framework will define an overall functional architecture, identify key components and interfaces. Its development will allow components from different providers to interoperate through the defined interfaces. This will in turn avoid the creation of vertical silos and market fragmentation and enable players in the ecosystem to offer parts of an overall AR solution.

Published in spring 2019, our analysis of the standards landscape identifies the role of existing standards relevant to AR from various standards setting organizations and industry fora.



We are also seeking a deeper understanding of typical AR use cases with an initial focus on industry 4.0. An online survey to collect insights into the planned uses for and challenges faced by this emerging technology will form the basis of a report due to be published in this year.

Work on a modular reference architecture is well advanced and should be published in the first half of 2020. This will form the basis of the AR interoperability framework. A further work item considers the development of a set of interoperability requirements to identify which of the many interfaces identified in the reference architecture are essential to achieve interoperability between solutions from different providers. This will be used to prioritise future work on interfaces.

ISG ARF liaises with other technical and industry bodies to focus on complementary interests and promote the development of interoperable AR components and services. Ongoing partnerships include the AREA, ISO/IEC MPEG, 3GPP and GSMA as well as ETSI's ISG MEC which have ongoing work relevant to the group's activities.



Making Products and Services Simpler, Safer and More Efficient

While technology has transformed the way we keep in touch, we need to minimize its negative impacts on individuals, society and our planet. At ETSI we focus on 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 Information and Communications Technologies (ICT). The ultimate goal is to ensure that ICT improve the quality of life for all.

Enabling Energy Efficiency

Our Environmental Engineering Committee (TC EE) manages various engineering aspects of telecommunication equipment in different types of installation. These include climatic, thermal and other environmental conditions; physical requirements of equipment racks and cabinets; power supplies and grounding.

The committee considers eco-environmental matters relating to energy efficiency (including the Circular Economy), environmental impact analysis and alternative energy sources. Here, much of our work on energy efficiency supports European Commission (EC) policies, regulation or

legislation: we liaise closely with the European Committee for Electrotechnical Standardization (CENELEC) in the development of relevant standards.

Currently our activities are centred on three key areas: metrics and measurement methods for the energy efficiency of ICT equipment; standardization terms and trends in energy efficiency; and energy-aware networking measurement methods.

Working with ETSI's Access, Terminals, Transmission and Multiplexing (TC ATTM) and Cable (TC CABLE) committees, we develop standards in support of EC Mandate M/462 on enabling efficient energy use in fixed and mobile information and communication networks.

We are revising our ETSI Standard (ES) on the energy efficiency of wireless access network equipment to add the 5G networks. This work has started with the revision of the ES for the static load, and later will be started the revision of the Technical Specification for the dynamic traffic loads.

Working with our NFV Industry Specification Group (ISG NFV), we are preparing an ETSI Standard to define appropriate methods for NFV energy efficiency, and on extending the ES on the 'Green Abstraction Layer' to NFV applications.

Our Working Group on environmental matters associated with mobile ICT devices (EE M-ICT) plans to publish a Technical Report (TR) analyzing possible methods for assessing the environmental impact of smartphones.

Our Working Group on Environmental Conditions (WG EE1) is revising Harmonised Standards for environmental classification and tests for telecommunication equipment. Publication of the EN for equipment installed in weather-protected locations is expected this year, as work concludes on two ENs for underground locations and portable use: revisions clarify the applicability of tests and the performance criteria, taking into account the climate change parameters. We are also revising specifications on the reliability of liquid cooling solutions for ICT infrastructure equipment.

Our Working Group on Power Supply, Bonding and related topics (WG EE2) continues its work on the series of standards addressing the requirements of the ICT equipment connected to 400 V DC or AC power sources. This year we are working with ITU-T SG5 to deliver an ETSI Standard (ES) on the management of the progressive migration of existing ICT site installations from existing -48 V DC power distribution to the new 400 V DC sources and distribution.

Meanwhile we are revising our existing standard on powering of equipment in access network to introduce reverse powering handshake and 400 V DC remote powering on power cable and power back-up.

Together with ITU-T SG5, we are progressing three Technical Specifications (TS) that examine the evolution of battery technology for use with stationary ICT and telecommunication equipment. This work has implications for smart cities and other applications that rely on batteries used in conjunction with alternative power sources.

Work also continues on an ES standard to define sustainable power feeding solutions for 5G equipment and networks, and their environmental impact.

Sustainable Networks

Our Industry Specification Group on Operational energy Efficiency for Users (ISG OEU) is working to minimize the power consumption and greenhouse gas emissions of infrastructure, utilities, equipment and software within ICT networks and sites such as data centres and central offices. This includes the measurement of energy consumption by IT servers, storage units, broadband fixed access and mobile access, with a view to developing global Key Performance Indicators (KPIs). Our work also embraces the management of the end of life of ICT equipment, including waste management and equipment maintenance.

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

This year ISG OEU has launched work on a life cycle analysis to compare internally-hosted and cloud-hosted ICT solutions, considering factors such as energy consumption, greenhouse gas emissions and waste management. In parallel TC ATTM is progressing a Technical report on lifecycle analysis comparison between internally and cloud-hosted solutions. We also aim to complete a Group Specification (GS) that defines CO2 equivalent emission levels for ICT sites.



In the area of video surveillance networks, we are comparing the relative costs and environmental benefits of power-over-coaxial and Ethernet cabling in specific use cases such as subways. We are also detailing tests plan, metrics and methodologies for our upcoming IP and power-over-coax Plugtests™ event, currently scheduled to take place in December 2019. This complements a new TS prepared by TC ATTM, describing the transmission of both Ethernet data and power over a single coaxial cable in IP surveillance networks.

In parallel, TC ATTM focuses on the green needs of operational networks, sites and broadband transmission, including overall energy efficiency and the management of ICT waste. These activities include the development of global KPIs to help ICT users monitor their eco-efficiency and energy management. In support of the European Commission's Ecodesign of Energy Related Products Directive, we offer standards for improving the efficiency of transmission equipment. Working together with CENELEC, the committee is also focused on broadband implementation in Europe, where energy consumption is a major consideration in widespread deployment.

In 2019 the committee is augmenting its previously published Technical Specification (TS) on broadband deployment and energy management in sustainable digital multiservice cities. New work considers the use of lamp posts for hosting sensing devices and 5G networking.

We are revising specifications on energy-efficient broadband deployment in customer network infrastructures, considering both multi-tenant and single-tenant premises.

We have launched new work to define KPIs for sustainable digital multiservice areas, considering both urban and rural environments.

We are continuing to develop practical recommendations to improve the end-of-life collection and treatment of waste electrical and electronic equipment (WEEE).

Usable ICT for All

The study of Human Factors applies scientific knowledge about the capacities and limitations of users to make products and services safe, efficient and easy to use. In ETSI we are helping to achieve this objective through the work of our Technical Committee on Human Factors (TC HF).

Increasing the uptake and use of new technologies can benefit both individual members of society and industry. Accordingly, a goal of current human factors research and



development is to explore innovative approaches that extend digital inclusion to the widest possible range of users, irrespective of their abilities or impairments.

In 2019, we are revising our Harmonised Standard (EN) on accessibility requirements for ICT products and services. A new Technical Report (TR) explores requirements for ICT standardization to address the needs of citizens and users in smart cities – including accessibility, usability, personalization, interoperability and personal data protection. We will also publish updates to an ETSI Guide on user-centred terminology for existing and upcoming ICT devices, services and applications, extending the terminology and addressing languages other than English.

Media Quality

Our Speech and Multimedia Transmission Quality committee (TC STQ) is responsible for standardization relating to terminals and networks for speech and media quality, end-to-end media transmission performance, Quality of Service (QoS) parameters for networks and services and Quality of Experience (QoE) descriptors and methods. With our Working Group STQ Mobile, the committee works closely with 3GPP and collaborates with other standards organizations.

This year we are revising speech transmission performance requirements for wideband/narrowband VoIP loudspeaking & handsfree / handset & headset terminals, such as softphones and group audio terminals. We are also exploring requirements to evaluate the speech communication performance of wideband-capable wearable devices and developing a methodology for evaluating the performance of voice assistant devices.

We are revising our standard on transmission requirements for IP-based narrowband and wideband home and network media gateways.

We are developing subjective test methodologies for the evaluation of echo control systems in speech communication devices. We are also developing a test method for the prediction of perception of impairments caused by echo control systems and specifying test methods for assessing the performance of active noise cancellation headsets. In addition we are revising our specifications on methods for simulating reverberation conditions for communication device measurements.

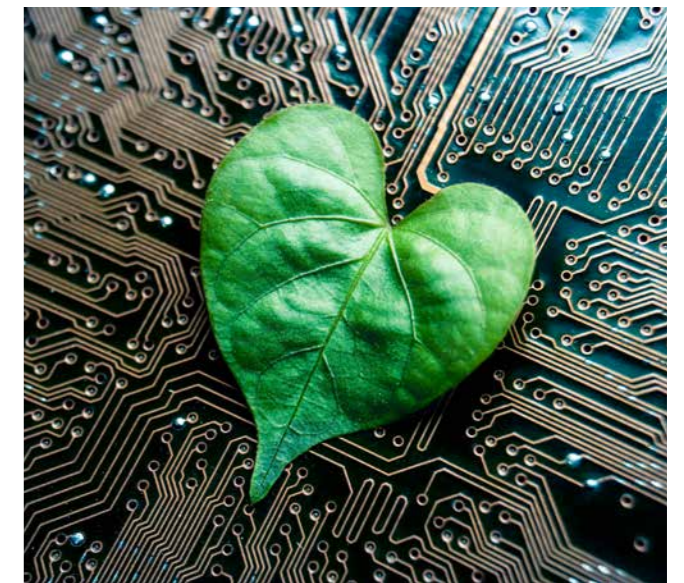
We are developing a new framework on time-slicing KPIs for speech transmission over IP networks using RTP (Real-time Transport Protocol).

In the domain of mobile systems, we are defining Quality of Service (QoS) parameters for mission-critical applications. Working with TC DECT we are developing qualification requirements for a new ETSI speech codec.

This year we are also starting new work on a specification on Methods for Objective assessment of Listening Effort (MOLE) based on subjective test data bases. In response to EC standardization plans in the context of accessibility of ICT products and services, this focuses specifically on the intelligibility of telecommunication as perceived by people with disabilities.

Safety

ETSI's Safety committee (TC SAFETY) monitors developments in electromagnetic fields (EMF), electrical safety and safety in cable television systems, where these impact the interests of ETSI members.



The role of SAFETY is quite distinct from other ETSI Technical Committees. While it does not normally write standards, the primary role of the committee is as an information exchange, collecting information from other bodies including CENELEC, IEC and the EU for distribution to ETSI members.

TC SAFETY also works closely with other European and international standards organizations in order to establish, wherever possible, globally applicable standards for telecommunications equipment safety and to avoid the duplication of effort.

The committee's continuing focus is in relation to implementation of the Radio Equipment Directive (RED). Here TC SAFETY works with CENELEC – which is responsible for the development of Harmonised Standards for EMF in Europe – to review current standards in the light of changes brought about by the RED.





Developing the Future of Digital Cordless Communications

ETSI's Digital Enhanced Cordless Telecommunications (DECT™) specification is the leading standard around the world for short-range digital cordless telecommunications. Over 1 billion devices have been installed worldwide: the system has been adopted in over 110 countries and more than 100 million new devices are sold every year. DECT can be adapted for many applications and can be used over unlicensed frequency allocations worldwide.

Enhancing DECT

Suited to voice (including PSTN and VoIP telephony), data and networking applications with a range up to 500 metres, DECT dominates the cordless residential market and the enterprise PABX (Private Automatic Branch eXchange) market.

DECT is now being enhanced to include Ultra Low Energy (ULE) – the new networking technology for residential and building applications driven primarily by low power requirements for battery-operated devices. With around 80% of data traffic generated by indoor systems, low-latency

DECT ULE systems have the potential to be key contributors to the success of 5G and the Internet of Things – both in smart homes and in a range of vertical markets. DECT ULE enjoys all the advantages of the DECT spectrum and technology as well as adhering to the technical parameters for the Internet of Things. As well as low power consumption, it offers good Quality of Service (a unique feature compared with other low power wireless standards) and wider coverage than competing technologies. Although specifically designed for optimal coverage of homes and industrial premises, it can also be used in Personal Area Networks due to its low power consumption.



DECT ULE is not a minor adaptation of DECT but has been developed specifically for Machine-to-Machine communications. DECT ULE reuses the physical layer and channel structure of DECT, but there are significant differences in the MAC layer, security algorithms and channel selection. DECT ULE operates over license-exempt 'high-quality' spectrum in the 1 880 - 1 900 MHz range which offers greater reliability than the industrial, scientific, and

medical (ISM) radio band. Target applications of DECT ULE in the first phase of its development include smart home and smart living applications such as home automation and energy control, remote switches, control of smart appliances, smart metering and temperature controls, security, alarms and eHealth applications.

In 2019 our DECT Technical Committee (TC DECT) maintains its focus on two main work areas, DECT evolution and DECT-2020, which will both support home automation, industrial automation, the creative and culture industries (e.g. audio production), eHealth and conferencing. DECT evolution is the shorter-term activity. It aims to provide a lower end-to-end latency, higher data rates and higher reliability based on the current DECT physical layer. The longer-term activity, DECT-2020, is a new radio interface supporting Ultra Reliable Low Latency Communications (URLLC) and Machine Type Communications (MTC) as specified for International Mobile Telecommunications-2020 (IMT-2020) usage scenarios. This new DECT-2020 air interface will co-exist with the existing DECT system.

A new Technical Report (TR) in development on the DECT-2020 New Radio (NR) interface serves as a study of self-evaluation towards IMT-2020 submission. In parallel, we are progressing specifications for the PHY, MAC and DLC layers for DECT-2020, and a report describing a security architecture for the DECT-2020 radio interface. This year we also aim to publish a TR that describes an interworking framework for DECT and 3GPP networks.





Mission Critical Communications to Rely on

Effective real-time communication is a critical factor in responding to and managing emergency situations, from minor road traffic accidents to large-scale public incidents, terrorism and natural disasters such as an earthquake or tsunami. At ETSI our standardization work supports public safety via secure, resilient public networks or platforms such as Professional Mobile Radio. The ubiquitous smartphone plays its own important role in public safety, allowing an emergency number such as 112 or 911 to be dialled directly, even when the keypad is locked or no SIM card is present. 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

TETRA (TErrestrial TRunked RADio) is the leading technology choice for critical communications users. With a projected 5 million terminals in use by 2020, the use of TETRA in security as well as other business-critical markets such as the transport, military, commercial and utilities sectors is forecast to grow by 15% annually up to 2023.

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

Designed as a narrowband system, TETRA today cannot support all the growing demands of emergency services for additional mission critical capabilities such as streaming high-quality video from the scene of an accident. Reflecting these evolving needs – and an opportunity to benefit from the economies of scale of the mobile broadband ecosystem – the community of TETRA users has asked the Third Generation Partnership Project (3GPP™) to determine how this functionality can be realized using LTE™ or 5G systems running over public network operators' licensed spectrum.

This year we continue to explore 'hybrid' methods to integrate TETRA into current broadband solutions. To optimize the standardization process, 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 response to feedback from 3GPP, as a top priority we are continuing to develop specifications covering the detailed interfaces between mission critical broadband systems and TETRA, as well as the required security between the two systems.

A further important work item is the development of new encryption algorithms to complement the existing set relating to TETRA. This reflects user needs to be able to keep TETRA up to date through to the 2030s.

Enabling Next Generation Mission-Critical Services

Providing a platform for Mission Critical (MC) services has been a key priority for 3GPP™ in recent years, with the specification of voice, video and data services in Releases 13, 14 and their subsequent refinement in Release 15. Within the scope of Release 16 we are currently completing work on the interconnection between 3GPP-defined MC systems and interworking between 3GPP-defined and legacy systems such as TETRA.

Studies are now ongoing to ensure support for Mission-Critical services over both Standalone and Non-Standalone 5G access methods, as new critical communications users – such as rail and maritime transport, satellite communications and broadcast – move to make use of 3GPP MC features for their own systems.

Professional Mobile Radio

Professional Mobile Radio (PMR) allows business users – such as taxi services – to keep in contact over relatively short distances with a central base station. It is also widely used by emergency services and other closed user groups. Our Professional Mobile Committee (ERM TGDMM) is updating our Harmonised Standard for access and sharing of channels for PMR service equipment, as well as ENs for Citizen's Band (CB) and a variety of land mobile radio equipment. We are updating our Harmonised Standard (EN) for access and sharing of channels for PMR service equipment, as well as ENs for Citizens' Band (CB) and a variety of land mobile radio equipment. We are also developing a Harmonised Standard covering broadband radio equipment for Public Protection and Disaster Relief, operating below 1 GHz.

Emergency Calling and Alerting

Our Emergency Telecommunications Special Committee (SC EMTel) focuses on emergency applications for smartphones, networks for emergency services, IoT devices in the provision of emergency situations and the European Public Warning System (EU-ALERT).

Following our successful Next Generation 112 (NG112) Emergency Communications Plugtests™ event in early 2019, work continues on a Technical Specification (TS) that describes core elements and corresponding technical interfaces for network independent access to emergency services (currently known as NG112 architecture). This is complemented by a Technical Report (TR) that considers interoperability testing of core elements for independent access networks. Scenarios explored include location-based and policy-based emergency call routing, network- or handset-derived caller location – such as AML (Advanced Mobile Location) – as well as legacy, IP, enterprise/campus, and IMS-based access networks. With AML likely to be implemented in most European countries, this year we aim to complete a dedicated specification based on our previously published Technical Report.

We are currently in discussions with the European Commission regarding caller location services for smartphones, in the case of emergency calls using primarily the Galileo global navigation satellite system (GNSS). It is expected this technical work will be conducted in our EMTel and SES committees.

As the IoT permeates a wide range of applications and domains, requirements for communications involving people and IoT devices in emergency situations have not yet been specified. Drawing on work in other bodies including oneM2M and 3GPP, a Specialist Task Force (STF) set up by EMTel has prepared a report on requirements for communications to, from and between individuals and authorities/organizations involving IoT devices in various emergency scenarios.

Taking into account the recently introduced European Electronic Communications Code (EECC), we are exploring new ways to contact the emergency services via – for example – social media, texting or sending video clips.

Testing and Interoperability



Supporting success in a multi-vendor, multi-network market

Interoperability is crucial in a multi-vendor, multi-network and multiservice environment, giving users far greater choice of products while allowing manufacturers to benefit from the economies of scale of a wider market. Interoperability is therefore a crucial factor in the success of modern technologies – especially in the introduction of new technologies. Products and standards evolve in parallel, requiring feedback in both directions. At ETSI our pre-standardization, validation and testing activities are a first-rate means for generating this feedback. They complement the creation of high-quality standards, enabling industry to deliver innovative, interoperable and cost-effective products and services.

Methods for Testing and Specification

Working closely with the Centre for Testing and Interoperability (CTI), our Methods for Testing and Specification committee (TC MTS) creates standards for testing and specification languages. The frameworks and methodologies we produce enable other ETSI committees to produce documents that are easy to understand and use, supporting the market success of numerous technologies.

In 2019 we continue to evolve and maintain our enormously successful testing language, TTCN-3, along with its tool conformance test suites.

Our Test Description Language (TDL) 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. TDL continues to attract growing interest, with the TDL Open Source Project (TOP) providing a toolset for the TDL user community.

The seventh annual ETSI User Conference on Advanced Automated Testing (UCAAT) takes place in Bordeaux in October 2019. Focusing on practical challenges, this event is dedicated to all aspects of automated testing including AI techniques, cloud testing, mobile testing, test methodologies, test management and standardized test specifications.

An Innovative Approach

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.

This year we maintain our focus on development of LTE/5G test specifications, keeping pace with 3GPP’s own release schedule. Further highlights included our ongoing series of interoperability events and hackathons that allow us to engage with developers who do not participate directly in our core standardization activities.



We also oversee early standardization Proofs of Concept (PoC) and coordinate open software development related to the standards. This ongoing work includes the development of test specifications for open APIs developed by our MEC and NVF Industry Specification Groups that are maintained at ETSI’s FORGE open source repository.

Collaboration with Open Source communities and foundations can help to accelerate the development of innovative new digital technologies by working across traditional borders. In 2019 we continue to explore the benefits of Open Source methodologies and frameworks in ETSI. As one notable example, our Centre for Testing and Interoperability is expanding its use of Open Source-like software development approaches in the production of test specifications and platforms. We are also developing the Test Description Language (TDL) Open Source Project (TOP) to provide our committees, our Secretariat and external parties with an integrated Open Source toolset for TDL.





Plugtests™

Our Plugtests™ events offer an opportunity for companies to interconnect prototype or production implementations of standards to test for interoperability and, where necessary, conformance to requirements. These events provide a highly cost-effective and practical way of identifying inconsistencies in either an implementation or the standard itself. We are running 17 Plugtests events in 2019, of varying formats to meet the specific needs of our members and the industries we serve. Our events cover topics as varied as Network Functions Virtualization, Open Source MANO, oneM2M, Digital Signature, Lawful Interception, Next Generation 112, Intelligent Transport Systems and Mission Critical communications. Some events may have conformance testing facilities available, and others may be formatted as hackathons or hackfests. They may be remote, distributed events, single-site events, or combinations of both.

The following events take place in the second half of 2019:

OSM Hackfest #7, 09 to 13 September, Patras, Greece
 4th MCX Plugtests, 23 to 27 September, Kuopio, Finland
 e-Signature Validation Plugtests, all November, remote
 ITS CMS Plugtests #7, 4-8 November, ETSI
 OSM Hackfest #8, 18-22 November, Lucca, Italy
 NGN eCall Testfest #7, 18-22 November
 ATTM IP & Power over Coax, 9-13 December, ETSI

We are developing events in 2020 on the following topics: 5G, Cellular V2X, IoT semantic interoperability, millimetre Wave Transmission, Mission Critical communications, Network Functions Virtualization, Open Source MANO, oneM2M, and Reconfigurable Radio Systems, among others.

Test Specifications and Frameworks

Our Core Network and Interoperability Testing committee (TC INT) produces specifications to test interoperability, conformance, performance and security. Using an end-to-end (e2e) methodology that includes verification of both the control and user plane, our work enables network operators to test their network for services for both fixed and mobile customers.

We produce test purposes, test descriptions, and Testing and Test Control Notation version 3 (TTCN-3) test cases to enable interoperability testing of core network elements, covering single-network, interconnect and roaming scenarios. Use Cases and requirements specified by ETSI for Automated and Autonomic Management and Control (self-management) of networks and services are tested via 'industry standards-anchored' Proof of Concepts (PoC) events.

The work of TC INT directly connects our methodology and specifications to the world of 5G. Our activities see us liaising closely with other bodies and work groups, including ETSI's Centre for Testing and Interoperability and STQ Technical Committee, 3GPP™, the GSM™ Association and ITU-T Study group 11.

Following 3GPP deliverables, we continue to develop and revise conformance test specifications that can be used in third party certification schemes. In 2019 we expect to complete our specifications for Diameter Conformance testing for Sh/Dh interfaces, relating to 3GPP Release 13. Validation against LTE components is scheduled during the year.

TC INT liaises with the GSM™ Association on activities relating to VoLTE implementation and testing. Work continues accordingly on VoLTE/ViLTE interoperability test description over 4G and early 5G networks in physical/virtual environments.

We are also revising our specification for network integration testing between SIP and ISDN/PSTN network signalling protocols.

We continue to evolve TTCN-3, and are developing further conformance test suites for TTCN-3 tools and the application of TDL. For example we are introducing Object Oriented features to widen acceptance of the language and support testing in new areas.

We are studying GANA as a multi-layer Artificial Intelligence (AI) reference model for implementing autonomic management and control of networks and services. We are developing a lifecycle management framework for designing and testing individual GANA cognitive elements. We are also exploring methods for testing AI models for Autonomic (Closed-Loop) Management & Control (AMC) of networks and services, and a framework for testing GANA Decision Elements (DEs) and other functional blocks.

Our sub-group on Autonomic Management and Control Intelligence for Self-Managed Fixed & Mobile Networks (INT AFI) develops test frameworks, test specifications and use cases for autonomic network architectures. Much of the subgroup's work is focused on ETSI's GANA (Generic Autonomic Networking Architecture) framework. Current areas of interest include execution of a 5G POC programme covering network slices creation, cognitive management, end-to-end orchestration, and E2E closed-loop service and security assurance using GANA knowledge plane(s).



We are demonstrating to the Industry the value of GANA as a multi-layer Artificial Intelligence (AI) reference model for implementing autonomic management and control of networks and services. We are developing a lifecycle management framework for designing, training, testing and evaluating the quality of decision-making capability of individual GANA cognitive elements. We are also exploring methods for testing AI models for Autonomic (Closed-Loop) Management & Control (AMC) of networks and services, providing an implementation guide and a framework for testing GANA Decision Elements (DEs) and other functional blocks for automated and autonomic management and control of networks and services.





Where people and new ideas meet

Every year we organize, host and support a busy schedule of workshops, seminars, summits, conferences and fora. Held at our own headquarters in Sophia Antipolis and further afield, these events bringing communities together, provide valuable opportunities to share news of our work and its progress, and stimulate new standardization activities. They also provide a platform for researchers to share their results and to identify next steps for standardization. They thus facilitate early consensus-building and fertilize our ongoing technical work.

Check our website etsi.org for latest news on forthcoming events.
For details on our schedule of Plugtests™ events, please see page 40.

June

- **London Tech Week**, London
 - 5G World, 11-13 June
 - Telco Blockchain Forum, 11 June
 - Mission Critical Technologies, 12-13 June
 - IoT World Europe Summit, 12-13 June
 - AR/VR World Summit, 12-13 June
 - The AI Summit, 12-13 June
 - Blockchain for Business Summit, 12-13 June
- **ETSI Security Week**, 17-21 June, Sophia Antipolis

July

- **Telco AI Summit Asia**, 3-4 July, Kuala Lumpur

August

- **5th National Summit on 100 Smart Cities India 2019**, 22 August, New Delhi

September

- **Network Virtualization & SDN Americas**, 17-19 September, Dallas
- **5G Core Summit**, 24-25 September, Madrid
- **Network Virtualization & SDN Asia**, 10-12 September, Singapore
- **Network Virtualization & SDN Americas**, 17-19 September, Dallas
- **Edge Computing Congress**, 17-19 September, London

October

- **SDN NFV World Congress 2019**, 14-17 October, The Hague
- **e-SIM Connect**, 14-15 October, London
- **Broadband World Forum**, 15-17 October, Amsterdam
- **ETSI IoT Week, including IoT Standard Showcases**, 21-25 October, Sophia Antipolis
- **TU-Automotive Europe**, 29-30 October, Munich
- **Smart Cities Summit**, October 31 - November 1, Atlanta

November

- **IEEE NFV-SDN Conference**, 12-14 November, Dallas
- **ITS Cooperative Mobility Services Event 7**, 4-8 November, Sophia Antipolis
- **ETSI/IQC Quantum Safe Cryptography Workshop 2019**, 5-7 November, Seattle (hosted by Amazon)
- **FOKUS FUSECO Forum**, 7-8 November, Berlin
- **Smart City Expo World Congress**, 19-21 November, Barcelona
- **Software-driven Operations**, 5 November, London
- **Telco AI Summit Europe**, 6 November, London
- **5G Transport & Edge USA**, 10 October, New York
- **eCall 7**, 18-22 November, venue to be confirmed
- **Telco AI Summit Americas**, 3-4 December in San Francisco
- **5G Techritory**, 27-29 November, Riga

December

- **ATTM-IPCF**, 9-13 December, Sophia Antipolis

The home of ICT standards

At ETSI our standardization activities address a wide range of Information and Communications Technologies. Our work is consensus driven, with members directly contributing to meetings either face to face or remotely.

Committees, Projects & other groups

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



ETSI Partnership Projects

Third Generation Partnership Project (3GPP)

oneM2M (oneM2M)

Industry Specification Groups

Augmented Reality Framework (ARF) 	European Common information sharing environment service and Data Model (CDM) 	City Digital Profile (CDP)
cross-cutting Context Information Management (CIM) 	Experiential Networked Intelligence (ENI) 	IPv6 integration (IP6)
Multi-access Edge Computing (MEC) 	millimetre Wave Transmission (mWT) 	Network Functions Virtualisation (NFV)
Next Generation Protocols (NGP) 	Operational energy Efficiency for Users (OEU) 	Permissioned Distributed Ledger (PDL)
Quantum Key Distribution (QKD) 	Zero touch network and Service Management (ZSM) 	



ETSI Headquarters, Sophia Antipolis

Design Tomorrow's World

with The Standards People



Join our community

Design Tomorrow's World with the Standards People

ETSI offers an open and inclusive environment to support the development and testing of globally applicable standards for ICT-enabled systems, applications and services across all sectors of industry and society.

ETSI provides the opportunities, resources and platforms for organizations to understand, shape, drive and collaborate on globally applicable standards.

ETSI standards facilitate interoperability, security, and competitive advantage across all sectors of industry and society. Our international membership includes universities, research bodies, associations and public authorities, as

well as industrial companies of all sizes: a quarter of ETSI's members are small or medium-sized enterprises (SMEs). We're a world-renowned organization with a longstanding reputation for technical excellence. Our standards are produced by our members, through active participation, co-operation and consensus in an atmosphere of openness and transparency, where all contribute as equals. We work in partnership with all relevant worldwide Standards Developing Organizations, particularly the other ESOs, as well as communities, fora and consortia. This ensures that our standards are aligned with those produced elsewhere and avoids the duplication of effort.

By joining ETSI, you can become part of one of the leading communities for the development of world-class ICT standards – and have your say in shaping the future of our industry.

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



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