ANNUAL REPORT
2019

NEW STANDARDS, NEW CONNECTIONS.

ETSI
The Standards People

INTRODUCTION

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

Officially recognized by the European Union as a European Standards Organization (ESO), our outputs include globally applicable standards for Information and Communications Technologies, including fixed, mobile, radio, transportation, broadcast and Internet technologies.

Established in 1988 as a not-for-profit organization, ETSI has over 900 members drawn from 65 countries and five continents. These include 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.

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.

This Annual Report highlights just some of our achievements during 2019. Full details about the work of our Technical Committees, Industry Specification Groups and other technical bodies can be found online at etsi.org/technologies, and on the ETSI Portal at portal.etsi.org. You'll also find more information about our current and planned activities in the ETSI Work Programme 2020-2021.

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2019 AT A GLANCE

01 JANUARY

- 1st Millimetre Wave Transmission Plugtests™
- 3rd NG112 Emergency Communications Plugtests™

02 FEBRUARY

- 1st remote NFV API PlugtestsTM
- First consumer IoT cybersecurity standard released

03 MARCH

- Multi-Access Edge Computing Phase 2 specifications released
- First live synchronized music performance enabled by Open Source MANO

04 APRIL

- ETSI Artificial Intelligence Summit
- Memorandum of Understanding signed with Linux Foundation
- OneM2M wins Top IoT Standards Body of the Year
- 2019 ETSI Fellows honoured at 73rd General Assembly
- ETSI Director General elected for second term

05 MAY

- Memorandum of Understanding signed with Cellular Operators Association of India
- New ISG launched on European Common information sharing environment service and Data Model

06 JUNE

- ETSI Security Week focuses on policy actions and securing AI
- OSM Release SIX enhances edge support
- 4th NFV Plugtests™

07 JULY

- Report on IoT devices for emergency communications
- Netherlands first country to implement shared spectrum access based on ETSI specifications

09 SEPTEMBER

- 4th MCX Plugtests™ validates interoperability for Mission Critical Services
- Open Source MANO Hackfest

10 OCTOBER

- ETSI IoT Week explores semantics and real-world experiences
- Collaborative White Paper on Network Transformation published
- New ISG launched on Securing Artificial Intelligence
- 'Calling the Shots' report published, targeting European policy makers
- New ETSI web site exceeds 80,000 monthly visitors

11 NOVEMBER

- First specifications for Smart Secure Platform focus on 5G and IoT

12 DECEMBER

- 1st C-V2X Plugtests™ addresses specifications for cellular vehicle-to-everything
- OSM Release SEVEN brings cloud-native applications to NFV deployments

REVIEWING ACHIEVEMENTS

Neviana Nikoloski, Chair of the General Assembly

You'll see the global relevance of ETSI's standards reflected in our growing membership that now includes some of the world's biggest names in online search, e-commerce and social media.

You may already be harnessing the Internet of Things to transform the efficiency of your factory and supply chain operations. You could be exploring the potential of aerial drones and autonomous vehicles to deliver parcels to your customers, faster and at lower cost. Or you might be harnessing 5G and satellite communications to extend the appeal of your services to customers in far-flung places.

Whether you're a global Internet giant or rooted in more 'traditional' industries, digital transformation is driving conversations around data, connectivity and security that are common to every boardroom agenda. And it's no surprise that these topics have informed many of our standardization activities in 2019. An example of this is the work of our cybersecurity committee, where we liaise closely with European standardization partners CEN and CENELEC to create robust security standards for consumer electronics devices and the Internet of Things.

Network owners are becoming increasingly reliant on Artificial Intelligence techniques to help orchestrate their networks that are becoming more complex with millions of connected end-points to manage. And as AI agents become smarter and more autonomous, this raises pressing operational and ethical issues. In ETSI we are attempting to pre-empt these questions – and frame meaningful answers – in the shape of technical standards that will make tomorrow's networks safer, more secure and trustworthy for operators and end-users alike.

While topics like AI, 5G and the IoT grab the lion's share of news headlines, it's easy to overlook other areas where ETSI has continued to perform invaluable work. A great example of this is our development of standards that ensure greater accessibility for users of IT products and services, driven by our Human Factors group.

During my first year in the role as Chair of the General Assembly, my efforts have been focused on strengthening co-operation with the European Commission to ensure citation of ETSI standards in

the Official Journal of the European Union. Intensive dialogue with other stakeholders has included a meeting with our European standardization partners and DG GROW, the Commission's Directorate-General for Internal Market, Industry, Entrepreneurship and SMEs. We are already seeing positive steps to streamline the process, and in 2020 I look forward to seeing further acceleration in the official listing of our standards.

Dirk Weiler, Chairman of the Board

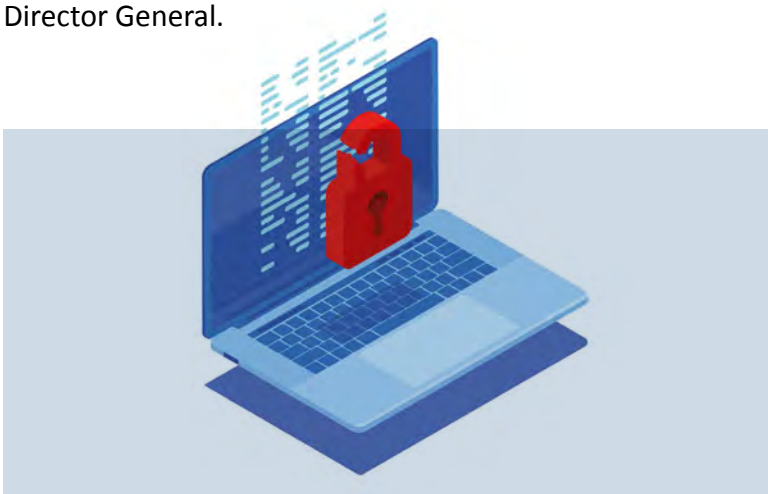
Since ETSI's foundation in 1988 it's been the commercial goals of our members – as well as the policy and regulatory goals of European governments – that have given consistent purpose to our standardization activities. And in today's hyper-connected world you'll see issues like cybersecurity, augmented reality, machine-to-machine communications and energy efficiency reflected in the interests of our diverse membership, where traditional players from the worlds of telecoms and IT rub shoulders with an unprecedented breadth of industries and market segments.

We are always thinking about the future. The rapidly evolving field of Artificial Intelligence is just one illustration of how ETSI's relevance stretches across many disciplines and commercial interests. For good reasons we have no 'AI committee' as such. But in 2019 it's been a topic that informed the work of our technical bodies and ISGs creating standards for network virtualization, automation and zero-touch network and service management, security and privacy, computing at the edge of the network and more.

A review of the year is incomplete without acknowledging the achievements of the Third Generation Partnership Project (3GPP). Successful completion in 2019 of Release 15 gave mobile network operators a solid baseline to launch the first 5G networks. Meanwhile rapid progress on Release 16 emphasizes an extraordinary coordination of effort between all our technical committees. Equally, the comprehensive specification of a new radio interface and 5G core network in just over two years will go down as one of the outstanding highlights of the project. As a founder member of this flourishing global initiative, ETSI members' direct input to 3GPP deliverables remains a cornerstone of what we do. Demonstrating this, the three 3GPP Technical Specification Groups are currently all chaired by ETSI members.

The year has not been without its challenges. In particular, we have worked hard with our partner ESOs to streamline the timely citation of our standards in the EU's Official Journal. I'm looking forward to further positive progress in 2020, with more ETSI standards listed and doing the job they were created to do. The Board's Task Force Bildt Report, set-up in December 2019, will identify actions that allow Europe to make even better use of our deliverables in support of regulation, legislation and market access.

Closing on a personal note, I am delighted to record that 2019 was marked by the re-election of our Director General.



Luis Jorge Romero, Director General

What is standardization? On one level, it's a process that can be characterized as people working together to build products and systems that always work together.

Digital transformation re-shapes our notion of 'togetherness', forging connections between devices, data and processes to create new user experiences and fresh sources of business value. Technical standards allow this transformation to happen in an orderly way. They give manufacturers a blueprint to create solutions that optimally address market needs – faster, with greater certainty and at lower cost. The output of this process could be networks, applications and consumer appliances that are secure by design against the threat of cyberattacks. It could be vehicles capable of interacting with their environment to ensure safer journeys and less congested roads. Or it might mean more effective coordination of emergency services in the event of a natural disaster.

'Togetherness' also expresses our mission and activities at ETSI. As this Annual Report demonstrates, developing standards is a truly international team effort that draws on an enormous spectrum of talents, knowledge and resources channelled through the work of our Technical Committees and Industry Specification Groups.

Standardization might appear to be a dry, abstract exercise that's closer in spirit to drafting legislation than hands-on engineering.
That view is quickly dispelled by a visit to any of our interoperability events, where researchers, developers and end-users stress-test ETSI standards in real-world conditions to prove they're fit for purpose. The growing success of this programme was underlined last year by the debut of new PlugtestsTM events covering specifications for millimetre wave transmission, cross-border exchange of electronic evidence by law enforcement authorities and cellular vehicle-to-everything (C-V2X) communication.

Any kind of connectivity brings with it the threat of data being compromised by other parties. Accordingly, security and privacy are themes that recur in the work of our own committees as well as in 3GPP and oneM2M – two global initiatives that in themselves demonstrate the power of togetherness.

2019 was marked by several initiatives in ETSI to enhance security for individuals, enterprises, public bodies, transportation systems, communities and critical infrastructures. As well as publishing standards to combat cyberattacks and Internet fraud, our activities ranged from the delivery of a Smart Secure Platform – the successor to today's ubiquitous smart card – to the development of quantum safe cryptographic techniques, new work on securing AI and specifications to protect customer data that's stored in the cloud.

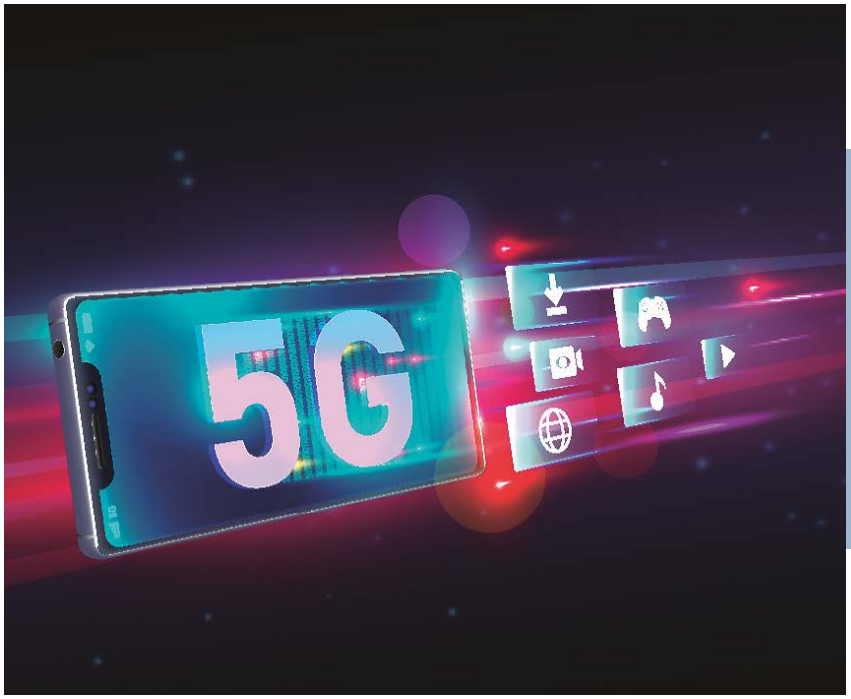
Any effort to standardize ICT systems cannot exist in isolation, as demonstrated by ETSI's thriving relationships with other standards development organizations and industry bodies. During the year we strengthened or renewed many existing partnerships, while forging wider links with research and innovation communities. Together we are stronger – for the benefit of our members, and for all citizens in the digital ecosystem.

STANDARDS FOR A NEW GENERATION

5G goes live

The first wave of fifth-generation systems is already open for business, and much of our activity in ETSI was focused on enabling the successful market rollout of 5G. As a founding partner of the Third Generation Partnership Project (3GPP™), our standardization work covers a full range of advanced mobile communication technologies, including radio access, core network and service capabilities that provide a complete system description for mobile network operators, vendors and service providers.

A process of evolution



2019 saw completion of 3GPP Release 15, which signifies the formal conclusion of 'Phase 1' 5G standardization activities. Delivered to schedule, an intense workload ensured that Release 15 supports any permutation of radio access (NR or LTE) and core network technologies (EPC or 5GS ready) to accommodate all 5G operator rollout scenarios.

Signing off Release 15 also marked a shift in the group's attention to 'Phase 2' activities. This in turn set the stage for a functional freeze in March 2020, when Release 16 specifications underpinned 3GPP's technology submission towards the ITU-R IMT-2020 process. In parallel, completion of Global Core Specifications for IMT-2020 by our RAN Technical Specification Group made 3GPP a front-runner for the allocation of spectrum bands to support greater capacity and new 5G services at the World Radiocommunications Conference (WRC-19) in November 2019.

The current work of 3GPP meshes with a wider long-term vision of autonomous machines, safer transportation, futuristic healthcare and hundreds more use cases, many of them still unimagined. Far from being the end of specification work for 3GPP, the submission to ITU-R is itself the foundation stone of 5G's further evolution. This is illustrated in the future work plan for 3GPP Release 17 that was rubber-stamped at the end of 2019. This promises many significant enhancements that will accelerate the adoption of 5G networks as a critical enabler for the Internet of Things.

2019 saw 3GPP working groups respond increasingly to the needs of new players in the mobile ecosystem. The priority for 3GPP is to remain on course as the system evolves, ensuring that the Internet of Things continues to thrive over NR and LTE-Advanced Pro networks.

Conceived around the pillars of enhanced mobile broadband, massive machine-type connectivity and ultra-reliable, low latency communications, the impact of 5G will extend far beyond conventional cellular applications. Accordingly the activities of all 3GPP working groups reflect the new demands of newcomers to the 5G ecosystem, from smart cities, public safety and e-health to broadcasting and agriculture. One sector already seeing significant progress in standardization activities is transportation, with use cases for V2X (vehicle-to-everything), future railways, maritime communications and unmanned aerial vehicles all driving our technical work.

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

"As a founding partner in 3GPP, ETSI has a major role to play in contributing and aligning specifications and requirements."

Cristina Badulescu, Vice-Chair of ISG NFV

About 3GPP

Established in 1998, The Third Generation Partnership Project (3gpp.org) brings ETSI together with six other regional standardization organizations in Asia and North America, plus market associations and several hundred individual companies. As one of the founding partners of 3GPP, ETSI plays a prominent role in the development of mobile communications. At the end of 2019, of the 758 member organizations of 3GPP, 489 (65%) were via their membership of ETSI.

MORE POWERFUL TOGETHER

Connections that create new experiences

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

Machine-to-Machine communications

The number of connected devices in the Internet of Things (IoT) already exceeds the world's population. With this number anticipated to outstrip 70 billion by 2025, the IoT will have a transformative influence on the way we live and work. As a founding partner in oneM2M, ETSI helps produce standards and specifications that simplify connection between devices and services, regardless of the underlying technology.

During 2019 work continued intensively on oneM2M Release 4. This release will feature ontologies for smart city and public warning services, railway and vehicular applications – including 3GPP V2X interworking – as well as support for industrial domains. Release 4 also addresses semantic enhancement, user security and data privacy, edge and fog computing support, system optimization and testing.

In April oneM2M was named 'Top IoT Standards Body of the Year' at the 7th Annual Compass Intelligence Awards that honours the top companies, products and technology solutions in mobile, IoT, and emerging technology industries. In September our oneM2M Industry Day in Hyderabad, India attracted around 120 participants. In December a liaison agreement was signed with the IoT Connectivity Alliance to share deliverables and engage in other joint activities; ETSI's Smart M2M Communications committee creates reports and specifications for M2M services and applications, with much of its work focusing on the IoT and smart cities. Central to this is SAREF – our Smart Applications REFerence ontology that

allows connected devices to exchange semantic information.

2019 saw finalization of SAREF V3 and SAREF Communication Framework V2. Other publications included SAREF extensions in smart city, industry/manufacturing and agrifood domains; a Technical Specification and two Technical Reports concerning smart energy aware systems; four Technical Reports (with EC support) regarding SAREF extensions in automotive, wearable, e-health/ageing well and watering domains; and seven Technical Reports (developed with EC support and in cooperation with AIOTI) considering security/privacy and semantic interoperability of standardized IoT platforms and industrial IoT.

Our guidelines on IoT security, privacy and interoperability were approved in December and subsequently issued. Under the leadership of our Centre for Testing and Interoperability, SmartM2M contributed and maintained a set of standardized conformance test specifications (Test Suite Structure and Test Purposes and Abstract Test Suite) for oneM2M architecture and core protocols.

The committee progressed development of an open portal to improve interaction within the SAREF community of users and developers. This resource will allow stakeholders to share their specific requirements and give direct feedback on their use of ontologies.

Semantics, experiences and security: ETSI IoT Week

ETSI IoT Week in October attracted 200 attendees and speakers, from manufacturers, policy makers and city representatives to academics. An IoT Workshop updated delegates on the status of IoT standardization, demonstrating how complementary ETSI, 3GPP and oneM2M standards support an overall IoT chain. Participants shared real-world experiences from IoT applications in domains including smart cities and manufacturing, discussing how 5G will empower these sectors. Our Developers Tutorial explored the use of oneM2M open source solutions, while IoT Standard Sho cases allowed delegates to interact with real-life implementations of standard-based technologies applied to IoT services. Critical issues of security and privacy were also addressed.

"Sharing information among different application environments will unlock the full potential of IoT, creating more IoT services and opportunities to exploit digital transformation. oneM2M provides a very good basis for data exchange and management: it also offers a significant foundation for semantic interoperability."

Enrico Scarrone, Chairman of ETSI TC SmartM2M

Smart Cities and Communities

We continued to address standardization requirements for smart cities and communities, with this work reflected in the activities of several ETSI technical bodies - including SmartM2M, HF, OEU and ATTM – as well as in oneM2M.

During the year our Human Factors committee progressed a Technical Report examining the standards landscape relating to requirements of inhabitants and visitors to smart cities or communities. In December an early draft was presented in Brussels at ETSI's Open Meeting on Smart Cities and Communities that explored how standardization can meet the needs of citizens and consumers.

Context Information Management

From digitizing industrial processes to creating smart services for citizens, it's essential to record data together with contextual information about its source, meaning and accuracy – and transfer these unambiguously to other systems. Our Industry Specification Group on cross-cutting Context Information Management (ISG CIM) develops specifications for publishing, accessing and updating contextual information across domains, from smart cities to agriculture, to manufacturing and more.

In January we issued specifications for our NGSI-LD API (Application Programming Interface), which aims to make it easier to find and exchange information with open databases, mobile apps and IoT platforms. The group continued its collaboration within the ETSI community (notably SmartM2M, CYBER, ATTM SDMC and oneM2M).

Interaction was also maintained with several H2020 IoT/Smart Cities Projects, the GSMA, W3C, ITU-T and TM Forum.

eHealth

eHealth has the potential to improve the quality of healthcare by giving citizens wider access to services such as telecare and telemonitoring. Standards have a key role in enabling interoperability to assist the development of eHealth products and the growth of telemedicine.

In 2019, our ETSI Project on eHEALTH published a Technical Report on 'Standardization use cases for eHealth'. The study covers aspects of network interconnectivity, semantic and syntactic interoperability and security. The group also launched investigations into use of AI (Artificial Intelligence) in eHealth.

"Smart cities will be the first to benefit from this work, as the NGSI-LD API is used to glue together existing databases across many services for citizens."

Dr Lindsay Frost, Chair of ISG CIM

Smart Body Area Networks

An enabler for many eHealth applications – and also applicable to wellness, leisure, sport and other domains – Smart Body Area Networks (SmartBANs) use low-power sensors, wearables or embedded devices to collect and monitor vital data of an individual and their environment. For example the medical history of a patient coming into an emergency room would already be available to clinical staff, allowing faster and better-informed intervention.

In April our Smart BAN Technical Committee published a Technical Specification to establish service and application interfaces and facilitators, APIs and infrastructure for interoperability management and 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 also offers cross-functional components allowing non SmartBAN environments to interoperate with SmartBAN and addresses network, syntactic, informational and semantic interoperability.

Digital Inclusion and Accessibility

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).

In 2019 we revised our European standard on accessibility requirements for ICT products and services that include the design of websites and mobile applications. Aligning requirements with W3C's Web Content Accessibility Guidelines, this serves as a primary document to show conformance with essential requirements of the European Web Accessibility Directive (WAD).

We also updated our ETSI Guide on user-centred terminology for ICT devices, services and applications.

BUILDING CONFIDENCE

Making our digital world safer

The increasing complexity of ICT infrastructures and an increasingly sophisticated spectrum of cybersecurity threats present big challenges to the operators of today's hyper-connected networks and systems. Information security standards are essential to ensure compliance with legislation, safeguard the privacy of individual users and create a more secure industrial and commercial environment.

Cybersecurity

Security and privacy are inescapable aspects of our digital lives, and standardization plays a key role in protecting the communications and business we depend on. A trusted centre of expertise, our Cybersecurity Technical Committee (TC CYBER) offers market-driven standardization solutions as well as guidance to regulators, users, manufacturers and network operators.

Connected devices are already present in many homes, tempting hackers who may exploit fundamental vulnerabilities to access other devices and data on the same household networks or launch large-scale DDoS (Distributed Denial of Service) cyber-attacks. Anticipating enactment of the EU Cybersecurity Act (CSA), in 2019 TC CYBER released a Technical Specification that sets a baseline for the security of Internet-connected consumer products.

We published a Technical Report offering guidelines for improved smart meter security. We also updated our middlebox security protocol, and issued a practical introductory guide to technical standards for privacy.

Permission Distributed Ledger

Distributed ledger technologies record transactions and their details in multiple places at the same time, eliminating the need for a centralized data store or administration

functionality as with traditional databases. Our ISG on Permissioned Distributed Ledger (PDL) formally started work in January 2019, exploring application scenarios, functional architecture, interfaces/APIs and data models. A landscape document identifying current standardization activities was completed, alongside an investigation into trust, security and conformity assessment issues. A Framework for PDL Proof of Concept demonstrations was also approved. The group invites Proof of Concept proposals.

Quantum Safe Cryptography

Quantum computers pose a major challenge to conventional cryptographic techniques, where information such as bank account details become subject to potential discovery and misuse. In 2019 CYBER QSC published a Technical Report that explores how Identity Based Encryption operates within the confines of quantum-safe requirements. Organized by ETSI in partnership with Institute for Quantum Computing (IQC) in Canada and Amazon Web Services (AWS), the 7th ETSI/IQC Quantum Safe Cryptography Workshop took place in November at the Amazon Headquarters in Seattle, USA.

Quantum Key Distribution

Quantum Key Distribution (QKD) enables digital keys to be shared privately without relying on computational complexity, resisting advances in brute-force computational power or quantum computers. In 2019 our Industry Specification Group on QKD published two Group Specifications. The first defines a REST-based key delivery API for a QKD network to supply cryptographic keys to an application. The second specifies device and communication channel parameters for QKD deployments.

Electronic Signatures

Our Electronic Signatures and Infrastructures committee (TC ESI) develops standards for electronic signatures to protect electronic transactions and ensure trust with business partners.

During 2019 we issued protocols for remote digital signature creation and validation, while updating specifications relating to signature validation and payment services.

"Our specifications represent an important step forward for security in deploying digital signatures which takes into account the move to cloud-based services and mobile devices. These standards enable a new way of implementing Trust Services which greatly simplifies their use and provides an important toolset to counter growing Internet fraud targeting online business and government."

Nick Pope, Vice-Chair of TC ESI

Further Technical Specifications addressed: policy and security requirements for long-term preservation of digital signatures; and requirements for conformity assessment bodies assessing EU qualified trust service providers and auditing trust service providers that issue publicly-trusted certificates. We also published further deliverables under the scope of STF 523, including policy documents for Electronic Registered Delivery Providers and Registered Electronic Mail (REM) Providers.

During the year we hosted workshops in Dubai, Tokyo, Mexico City and New York as part of an ETSI study to investigate existing PKI-based trust services schemes. In January the TC ESI Vice Chair spoke alongside the TC CYBER Chair and Vice Chair at a second workshop in Brussels on the Cybersecurity Act and its link with standardization, jointly organized by ENISA, CEN, CENELEC and ETSI.

Lawful Interception and Retained Data

The work of our Lawful Interception committee (TC LI) supports common international requirements for law enforcement agencies (LEAs). In 2019 we continued to update our LI and Retained Data (RD) standards. This included revisions to part of our specification on Handover Interface and Service-Specific Details (SSD) to consider requirements for Instant Messaging services. We completed our multi-part standard for internal network LI interfaces, and published a specification on the dynamic triggering of interception required by the diversification of service and network architectures.

Collaborating with ETSI's Centre for Testing and Interoperability, in July we hosted the first Inter Law Enforcement Monitoring Facility (LEMF) Handover Interface (ILHI) interoperability Plugtests™. Attracting Law Enforcement Authorities and LEMF vendors, the event focused on use of ETSI standards for cross-border exchange of electronic evidence relating to European Investigation Orders.

Smart Cards and the Secure Element

ETSI's Smart Card Platform committee (TC SCP) develops and maintains specifications for the Secure Element (SE) used in telecommunication systems including the Internet of Things (IoT) and Machine-to-Machine (M2M) applications. TC SCP develops 'agnostic' specifications that can find their way into other applications such as ID management, ticketing and ID cards with contactless interfaces used in financial services.

In 2019 we upgraded nearly half of the 48 specifications for UICC, the world's most widely deployed secure element platform.

During the year, however, our main focus was on the next-generation Smart Secure Platform (SSP). Addressing crucial market drivers of trust and privacy, SSP offers an open platform for multiple applications, a choice of physical interfaces and form factors to adapt to market needs, a new modern and flexible file system, built-in capabilities to support multiple authentication methods, while maintaining common features with the UICC platform. In 2019 we published the first four specifications for SSP, addressing requirements, general technical characteristics, the SSP integrated into a System on Chip (iSSP), and the SPI interface.

Securing Artificial Intelligence

Our Industry Specification Group on Securing Artificial Intelligence (ISG SAI) was launched in October 2019 with a mission to mitigate threats from the deployment of AI across ICT-related industries. These include threats to AI systems from both conventional sources and other AIs. The group's activities anticipate decisions made by autonomous mechanical and computing entities that may act against the relying parties either by design or as a result of malicious intent.

ETSI Security Week

Hosted in June at our Sophia Antipolis headquarters, ETSI Security Week attracted over 250 attendees and speakers including cybersecurity experts from industry, universities, governmental bodies and national security agencies. Topic included the cybersecurity landscape; policy actions; security aspects of AI, cloud and IoT deployments; and how security can keep pace with changes in technology and society. A concurrent Hackathon event focused on our Middlebox Security Protocol.

> *"The cybersecurity challenges we face come from disparate sources whose motivations range from commercial and economic, through political, to simply mischief making. If we are to address these challenges successfully we must all work in unison, and the best way to achieve this is by laying down appropriate standards. The work of ETSI's members continues to play a key role in progress towards a more secure and safe future for us all."*
>
> *Tony Rutkowski, Rapporteur, TC CYBER*

RADIO ACTIVITY

Wireless devices, services and spectrum

ETSI creates standards that define many radio technologies and systems, including those used for mobile phones, broadcast radio and television, broadband networks, satellite communications, smart grids, short-range devices and cordless technology. We also provide standards used by regulatory authorities in Europe and elsewhere to manage the use of radio spectrum, and to ensure safe co-existence of systems competing for use of limited spectrum resources.

Harmonised Standards and the Radio Equipment Directive

ETSI's Harmonised European Standards are developed by our technical committees, with much of this work being conducted in our committee for Electromagnetic compatibility and Radio spectrum Matters (TC ERM).

Now in force across Europe, the Radio Equipment Directive (RED) has required the revision or replacement of ETSI's existing related Harmonised Standards and the development of new ones.

In 2018 the EC incorporated new consultants to help progress in the citation of standards in the OJEU. In 2019 we maintained a close dialogue with the EC to help the incorporation of the consultants in the process and make it fit into EC's requirements.

Development of new and updated standards covered numerous areas. These included digital TV and audio, Digital Mobile Radio, Short Range Devices (SRDs), hearing aids, wireless microphones, Radio Frequency Identification (RFID), robotic mowers, network-based SRDs, Nuclear Magnetic Resonance (NMR) equipment, radiodetermination equipment, metal sensors and avalanche beacons.

Much of our work focused on standards relating to UWB (Ultra Wide Band) applications. These include Ground- and Wall- Probing Radio determination (GPR/WPR) devices, keyless entry, Tilted Level Probing Radar, Ground Based Synthetic Aperture Radar, material sensing devices for security scanning, ground humidity sensors and vehicular sensors. Work also progressed on standards for Ultra Low Power Active Medical Membrane Implants and Animal Implantable Devices.

In the area of road transportation, our standards on ITS and Dedicated Short Range Communication (DSRC) transmission equipment were developed further, while studies were initiated on ITS receiver requirements and co-channel co-existence between ITS-G5 and LTE-V2X. See pages 16-17 for more information on our standardization activities for road, rail, maritime and aviation transportation systems.

During 2019 we published a number of System Reference documents. These variously considered fixed and in-motion Earth stations; Wireless Power Transmission systems; critical infrastructure utility operations requirements for smart grid systems, radiodetermination applications; Multiple Gigabit Wireless Systems; Level Probing Radar; and DECT systems. We also issued or updated several of our standards relating to Electromagnetic compatibility (EMC).

Throughout the year we maintained co-operation with the European Committee for Electrotechnical Standardization (CENELEC), particularly in the area of smart/connected devices – including smart domestic appliances and some industrial machinery – where electromagnetic compatibility (EMC) requirements for the base machine must be reconciled with corresponding requirements for the radio elements providing the connectivity.

Reconfigurable Radio Systems

Reconfigurable Radio Systems (RRS) are intelligent radio devices that can react to their environment. This offers an opportunity to support the needs of our connected world – including the Internet of Things (IoT) – by sharing spectrum among multiple services and radio networks. Sharing will also play a key role in the development of 5G. In ETSI our Technical Committee on RRS is responsible for the standardization of these systems.

In 2019 we published four deliverables as part of an activity to develop a generalized reconfigurable Radio Equipment framework. Part 1 of a multi-part Technical Specification addresses requirements for the Radio Interface Engine. These embrace KPIs for the acquisition and management of context information, and suitable equipment reconfiguration in a heterogeneous and distributed radio environment which may include satellite, mobile broadband and the IoT.

The first part of a Technical Specification on evolved Licensed Shared Access (eLSA) covers system requirements for providing spectrum access for local high-quality wireless networks. A further Technical Specification defines reconfiguration requirements for Radio Equipment (RE). This was accompanied by revisions to our Technical Report on Radio Equipment reconfiguration use cases.

Highlighting the value of ETSI standards, the Radiocommunications Agency Netherlands confirmed its decision to implement Licensed Shared Access (LSA) technology, based on specifications developed by TC RRS that offer a solution for spectrum access between multiple services. The Netherlands is now likely to be the first European country to deploy a permanent LSA service based on ETSI specifications in the 2,3 – 2,4 GHz frequency band.

Broadband Radio Access Networks

Our Broadband Radio Access Networks committee (TC BRAN) continued to produce and maintain standards and specifications for current and future Broadband Wireless Access technologies operating in different frequency ranges. In 2019 we published

a Technical Report on characteristics of Wireless Access Systems including Radio Local Area Networks (WAS/RLANs) in the band 6 725 - 7 125 MHz. The report also lists possible techniques for sharing with incumbent services.

DECT™

ETSI's Digital Enhanced Cordless Telecommunications (DECT) specification is the leading standard around the world for digital cordless telecommunications with over 1 billion devices installed worldwide. DECT is now being enhanced to include Ultra Low Energy (ULE) systems that will help drive the success of 5G and the IoT in smart homes and a range of vertical markets.

In 2019 our DECT Technical Committee published a new Technology Roadmap. In parallel, we continued to focus on DECT Evolution, addressing applications for DECT/ULE using existing silicon and RF implementations. The first phase of DECT Evolution was completed with updates to all parts of the DECT base standard, plus publication of a specification on the Low Complexity Communication Codec LC3plus. We also revised the standard on audio and speech test specifications.

A major new standardization activity, DECT-2020 is part of a proposal from ETSI to ITU-R for a new IMT-2020 radio interface technology. We accordingly published a Technical Report focusing on MAC, DLC and higher layers for the DECT-2020 New Radio (NR) interface.

Millimetre Wave Transmission

Currently a largely untapped resource, spectrum in the 30 - 300 GHz range will be a major enabler for future mobile communications, including 5G and IoT that will make unprecedented demands on radio access networks and backhauling.

In 2019 our Industry Specification Group (ISG) on millimetre Wave Transmission (mWT) published a Group Report (GR) that examines spectrum, license schemes and network scenarios in the W-band.

The first ETSI Millimetre Wave Transmission (mWT) PlugtestsTM event in January trialled SDN solutions for microwave and millimetre-wave transport applications.

Satellite Communications

The applications of satellite communications technology range from direct-to-home TV to location services and high-speed Internet access in outlying regions or onboard aircraft and ships. During 2019 our Satellite Earth Stations and Systems technical committee (TC SES) continued its work on the development and revision of Harmonised Standards covering all aspects of satellite earth station fixed terminals or terminals on the move, whether in an aircraft, on board a ship or in a vehicle.

During the year we pursued compliance of our Harmonised Standards with the Radio Equipment Directive as part of the ongoing consultation process with the EC. Work also progressed on deliverables relating to Global Navigation Satellite System based location systems and the integration of satellite and HAPS (High Altitude Platform Station) systems into 5G.

Mobile Standards

Our Mobile Standards Group (TC MSG) works alongside MSG TFES – our joint Task Force with TC ERM working on the IMT system – to create regulatory standards supporting the deployment of GSM, UMTS, LTE and 5G NR networks in Europe.

In 2019 major progress was made in TFES on revisions to our Harmonised Standards that consider access to radio spectrum in IMT cellular networks, including support for 5G. We also published a Technical Report exploring the possibility of sharing the 6 GHz band between incumbent services and Mobile/Fixed Communication Network services.

GOING PLACES

Making every journey more rewarding

Information and Communication Technologies are revolutionizing the transport sector, increasing the efficiency, reliability and safety of transportation infrastructures while reducing energy consumption. As these networks become smarter and more complex, ETSI creates technical specifications to address the needs of road, rail, aeronautical and maritime operators and users.

Road Transport

Co-operative Intelligent Transport Systems (C-ITS) allow road users and traffic managers to share information and use it to co-ordinate their actions. These systems can improve traffic efficiency and road safety, helping drivers make better-informed decisions and adapt to prevailing road conditions.

Our ITS Technical Committee (TC ITS) develops global standards to support applications including road safety, traffic control, fleet management, 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 for ITS, we are also closely involved in radio spectrum requirements.

We updated various parts of the MirrorLink® specification that allows drivers to interact safely with their smartphones while at the wheel.

Our Working Group on ITS applications and services updated standards for CAM (Cooperative Awareness basic service) and DENM (Decentralized Environmental Notification basic service). Other publications included a pre-standardization study on

Cooperative Adaptive Cruise Control (CACC), a Technical Specification on Multimedia Content Dissemination (MCD), and Technical Reports exploring Collective Perception Service (CPS) and the needs of Vulnerable Road Users (VRUs).

Our Working Group on architecture and cross layer issues published a revision to its standard for Services Announcement (SA).

Our Working Group on data transport and network protocol aspects updated various standards and specifications on the Geonetworking Basic Transport Protocol to incorporate support for LTE-V2X.

Our group developing system reference documents for ITS published a pre-standardization study on methodologies for in-the-field ITS testing. This was accompanied by a Technical Report defining channel models for the 5,9 GHz frequency band. ITS WG5 published specifications covering interoperability test descriptions, conformance test specifications for ITS PKI management and security (privacy and trust management).

Cooperation continued with our Rail Telecommunications committee (TC RT) on Road ITS and Urban Rail applications in the 5.9 GHz frequency band, resulting in publication of a Technical Report on extension of the band for safety related ITS.

In March our ITS workshop saw industry stakeholders and the European Commission review worldwide deployment of C-ITS. Major topics included the C-Roads platform established to coordinate European Member States' deployment activities using ETSI and other standards. The event also discussed autonomous vehicles, harmonized spectrum for ITS and security/privacy.

Held in December, our first C-V2X Plugtests™ event in Malaga allowed vendors to assess interoperability of their own C-V2X implementations based on ETSI TC ITS and 3GPP standards. Over 300 test scenarios included road hazard signalling, road works warning and collision risk warning.

Railway Communications

Our Rail Telecommunications committee (TC RT) continued to maintain the GSM-R (GSM™ for railways) standard, enhancing it with new features specific to the railway environment.

Working closely with the rail industry in Europe and worldwide, we also continued our close liaison with 3GPP to standardize the Future Railway Mobile Communication System (FRMCS), the successor to GSM-R. Among other aspects, this work considers train speeds up to 500km/h and the integration of 3GPP radio technologies with a main focus on 5G NR.

In 2019 we published a Technical Report presenting a system architecture for FRMCS. We also revised part of our Technical Report on radio performance simulations and evaluations in a rail environment relating to LTE.

We established a new partnership with the Shift2Rail Joint Undertaking, a body of the European Union that provides a platform for key stakeholders in the European rail system to drive innovation by implementing a comprehensive and coordinated research.

Aviation

The activities of our Aeronautics group 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 Regulation (EU) 2018/1139 of the European Parliament; and the evolution of DataLink – a key pillar in the SESAR (Single European Sky ATM Research) project and a crucial aspect of the Single European Sky.

During the year we published or updated various Harmonised Standards, addressing surface movement radar sensors and Traffic Control (ATC) PSR sensors operating in X band, and VHF air-ground Digital Link (VDL) radio equipment. Work also progressed on revisions to a number of other specifications.

Maritime

Our Marine group develops standards for all aspects of marine communications and radiolocation, including of safety of life at sea (SOLAS) and non-SOLAS radio systems. Along with 'man overboard' devices, the group covers other safety related equipment such as survival craft radios, transceivers for use in distress situations and signalling/homing beacons.

We published an update to our Harmonised Standard specifying technical characteristics and measurements methods for low power maritime personal locating/survival devices.

We also updated Harmonised Standards relating to technical characteristics and measurement methods for radiotelephone equipment used for generation, transmission and reception of Digital Selective Calling (DSC) in the maritime MF, MF/HF and/or VHF bands.

FRESH CONNECTIONS

Bringing intelligence to tomorrow's networks

Consumers, businesses and industrial users are increasingly dependent on reliable, feature-rich communications services that can be accessed anytime, anywhere and on any device. In response networks are becoming smarter and more agile. At ETSI we provide a comprehensive set of standards to increase the utility and efficiency of today's access networks – and tomorrow's.

Network Functions Virtualisation

A key enabler for the success of 5G – and equally relevant to other telecoms network architectures – Network Functions Virtualisation (NFV) consolidates heterogenous hardware-based IT infrastructures onto standard servers, switches and storage, simplifying roll-out of new services while reducing deployment and operational costs.

2019 saw NFV Release 3 enter 'maintenance mode' while our Industry Specification Group (ISG) on NFV focused on development of Release 4. This considers recent advances such as such as 5G, cloudification, service-based architectures and novel fixed access network deployments. The group continued co-operation with other ETSI groups including ISG MEC and ISG ZSM, while maintaining links with 3GPP SA5, OASIS Tosca and ITU-T SG11, and with other open source projects.

Supported by our Centre for Testing and Interoperability, the first totally remote NFV API Plugtests® event ran from February to April. The successful event attracted participation from the whole NFV ecosystem, including suppliers, operators and several open source projects. Participants interacted remotely through the NFV HIVE, our Hub for Interoperability and Validation. Meanwhile our 4th NFV Plugtests in June saw over 200 engineers from solution providers and open source projects assessing interoperability of NFV and edge specifications and APIs.

> *"NFV and cloud-based deployment practices will bring the biggest technological and business transformation of the industry since the creation of mobile communication infrastructures."*
>
> *ETSI White Paper 'Network Transformation (Orchestration, Network and Service Management Framework)', published October 2019.*

Open Source MANO

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. Our Open Source MANO group (ETSI OSM) is a community-driven initiative to deliver a production-quality open source MANO stack aligned with ETSI NFV Information Models.

Unveiled in December 2019, OSM Release SEVEN brings cloud-native applications to NFV deployments to simplify the development of complex end-to-end telecom services. It also delivers major enhancements to improve overall user experience and interoperability choices. It was preceded by June's Release SIX that gives new capabilities for end-to-end orchestration across heterogeneous networks and cloud technologies. These include support for edge platforms, enabling the delivery of service and slice orchestration from the edge to the core – a critical enabler for 5G networks.

The power of OSM to 'orchestrate' 5G networks was brought vividly to life in March, when the University of Bristol's Smart Internet Lab conducted a unique multi-site live music concert. Performers in Bristol and London were linked in real time via low latency, high capacity 5G connections orchestrated by ETSI Open Source MANO.

> *"OSM Release SEVEN is at the forefront of Edge and 5G operations technology. Complete lifecycle management, automated integration and ongoing workload operations make OSM the leading multi-vendor, multi-cloud MANO solution."*
>
> *Arno Van Huyssteen, Director of Telco Field Engineering, Canonical*

Multi-Access Edge Computing

A key enabler for 5G, Multi-Access Edge Computing (MEC) shifts processing away from remote data centres and closer to end users at the 'edge' of the access network, MEC thus supports IoT and mission-critical vertical solutions, from gaming and Virtual Reality to Intelligent Transport Systems and the industrial Internet. Satisfying the throughput and latency requirements of these applications on emerging 5G and existing 3G/4G systems, MEC also offers greater privacy and security.

Following completion of Phase 1 core work, our Multi-access Edge Computing Industry Specification Group (ISG MEC) pursued its Phase 2 activities. Extending the applicability of MEC beyond 3GPP to other mobile access networks, this focuses on implementation issues including charging, regulatory compliance and mobility support. March saw the announcement of the first set of Phase 2 specifications: these widen the applicability of ETSI MEC to any access technology and take into account integration with network functions virtualization (NFV).

In September the second series of ETSI-endorsed MEC Hackathons took place simultaneously in London and Shenzhen, inviting teams to develop mobile applications for advanced services in MEC-enabled 5G networks using ETSI MEC technologies.

The automotive industry is just one sector where MEC is considered to be a key technology to allow interoperability of data exchange, especially in multi-vendor/multi-operator environments.

In October, the ISG MEC Vice Chair addressed delegates at TU-Automotive Europe in Munich with an update on MEC standards, APIs and engagement with the MEC ecosystem.

Zero Touch Networks

Tomorrow's 5G operators will be faced with increasing complexity, new services and support for more devices. Maximizing the efficiency of end-to-end network operations will require increased automation of functions – such as configuration and capacity management – that are currently administered with direct human intervention. The ultimate target is to create autonomous networks capable of self-configuration, monitoring and optimization without manual supervision.

"With this latest Release, the group continues to strengthen the leadership role that ETSI has played in edge computing since day one. I am proud of the quality of the work this team keeps delivering, making sure that the MEC marketplace evolves to an efficient, interoperable and open environment."

Alex Reznik, Chair, ISG MEC

In October our Industry Specification Group on Zero touch network and Service Management (ISG ZSM) announced two major specifications. The first describes business-oriented scenarios and the related automation challenges faced by operators and other industry players. The second presents a modular, flexible and scalable service-based architecture to satisfy these requirements, designed for closed-loop automation and optimized for data-driven machine learning and algorithms.

Augmented Reality

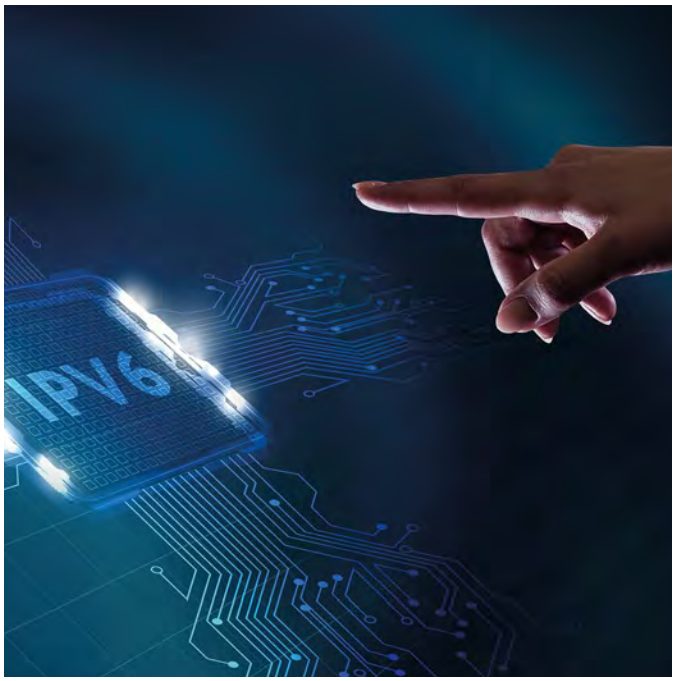
Our Industry Specification Group on Augmented Reality Framework (ISG ARF) is creating a framework for the interoperability of Augmented Reality applications and services that will define an overall functional architecture. Allowing components from different providers to interoperate through defined interfaces, this will avoid vertical silos and market fragmentation, enabling players in the eco-system to offer parts of an overall AR solution.

In April the group's first published output was a Group Report on the Augmented Reality standards landscape, including an analysis of current standardization work relating to AR in various standards setting organizations and industry fora. This was complemented by a second report published in July that considers industrial use cases for Augmented Reality (AR) applications and services, seeking a deeper understanding of typical AR use cases with an initial focus on industry 4.0.

Future Networks

ETSI's Network Technologies committee (TC NTECH) is responsible for the standardization of protocols for use in networks, spanning service interconnection and network interconnection as well as future networks technologies. In 2019, TC NTECH revised its Technical Report addressing additional deployment solutions beyond those based on Enum. The committee subsequently entered dormant mode, while continuing to act as ETSI contact point for the Electronic Communications Committee (ECC) of the CEPT with regards to numbering, naming, addressing and routing.

Also in the area of future networks, our ISG on IPv6 Integration (ISG IP6) progressed its report on the integration of IPv6-based Vehicular Networking (IPv6 V2X). Developed to tackle the problem of IPv4 address exhaustion, IPv6 is a key technology to enable the deployment of billions of new devices in the Internet of Things (IoT), while offering enhanced features and enabling new Internet services in need of end-to-end connectivity and security.



Next Generation Protocols

The TCP/IP protocol suite has driven the evolution of connected computing since the 1970s. Today it cannotoffer the scale, security, mobility and performance needed for current and future applications. In 2019 our Next Generation Protocols Industry Specification Group (ISG NGP) published three Group Reports to support network operators' future requirements. 'Preferred Path Routing for Next Generation Protocols' describes the development of PPR technology to optimize new and existing data planes. 'Recommendations for Network Layer Multi-Path Support' presents a gap analysis for new Internet architectures, focusing on

multi-path solutions for 5G and beyond. 'Large-Scale Deterministic Networks' describes a framework enabling a Layer 3 deterministic service.

Experiential Networked Intelligence

Software Defined Networking (SDN) and NFV technologies are making networks more flexible, more powerful – and harder to manage. The use of Artificial Intelligence (AI) techniques can address some of the challenges of future network deployment. Our Industry Specification Group on Experiential Networked Intelligence (ISG ENI) accordingly develops standards that use AI mechanisms to assist in the network management and orchestration.

In 2019 we published two reports, considering category definitions for AI application to networks and terminology for main ENI concepts. These were complemented by Group Specifications covering ENI system architecture, user cases and requirements. The ENI Chair also contributed with ENI members – along with the Chairs of our ZSM, MEC and NFV Industry Specification Groups – to a joint white paper titled 'Network Transformation (Orchestration, Network and Service Management Framework)'.

Cable

Our Integrated Broadband Cable Telecommunication Networks committee (TC CABLE) continued its work on standards addressing the evolution of broadband cable networks. During 2019 we made further updates to Data Over Cable Service Interface Specification (DOCSIS) 3.1 – a core technology for cable access networks, and published a multi-part specification for fourth-generation transmission systems for interactive cable TV services (IP cable modems DOCSIS 3.1). We also launched further work items relating to energy efficiency in broadband cable networks.

SUSTAINING INTEREST

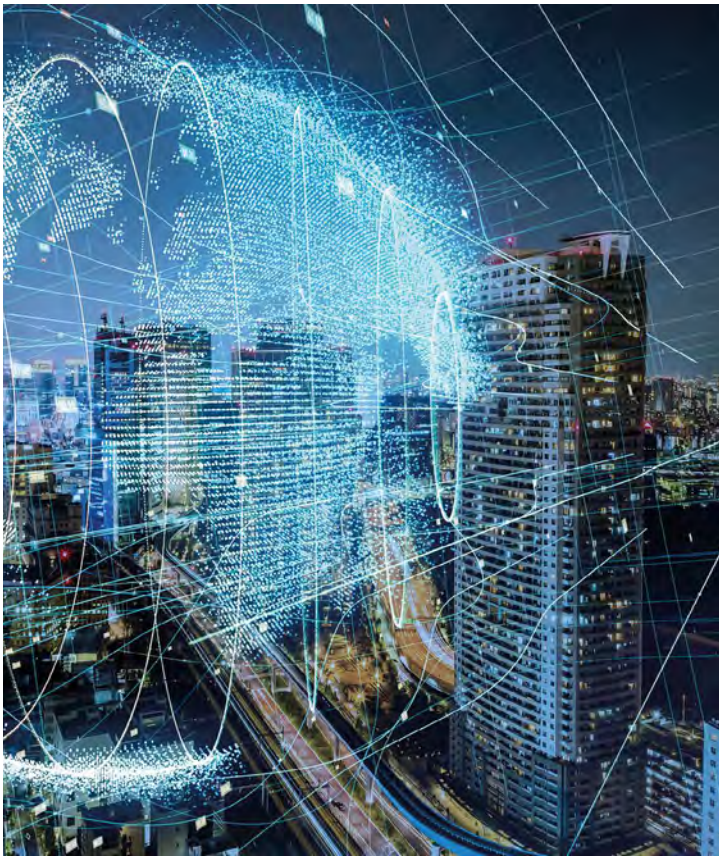
Standards for a greener, safer, more accessible planet

Technology affords exciting possibilities to connect people, data and processes in new ways. However its benefits must be considered within a wider social and environmental context. At ETSI we're working to make products and services simpler to use, safer and more energy efficient. By identifying solutions that can mitigate the impact on climate change of the growing use of Information and Communications Technologies (ICT), our ultimate goal is improve the quality of life for all.

Enabling Energy Efficiency

Cooperating with ETSI's Access, Terminals, Transmission and Multiplexing and Cable Committees – and with CENELEC – our Environmental Engineering Committee develops standards to support EC Mandate M/462 on efficient energy use in fixed and mobile networks. In 2019 our activities centred on three key areas: measurement methods for the energy efficiency of ICT equipment (with a focus on 5G); standardization terms and trends; and energy-aware networking measurement methods.

We published standards defining energy efficiency measurement metrics and KPIs: one for server equipment and the other for Network Function Virtualization (NFV) applications. The latter was accompanied by a new standard to measure NVF energy efficiency in a laboratory environment. A Technical Report explored the challenges of developing Product Environmental Footprint Category Rules for smartphones. We revised a further part of our standard for a monitoring and control interface for power, cooling and building environment systems used in telecommunication networks. In addition we revised standards covering power supply interfaces for ICT equipment.



Based on work with ITU-T SG5, we published the first part of a Technical Specification exploring energy storage technology solutions for environments such as sustainable smart cities. We also published a Technical Specification considering liquid cooling solutions for ICT infrastructures.

Sustainable Networks

ETSI's Access, Terminals, Transmission and Multiplexing committee (TC ATTM) addresses the operational and physical aspects of Information and Communications Technologies (ICT).

In 2019, the committee continued to focus on sustainable smart cities, smart rural areas and the green needs of operational networks and sites, as well as the energy management efficiency of broadband systems and physical networks. Progress was made on a set of global Key Performance Indicators (KPIs) to define green sites and networks for industrial and commercial users.

We published a Harmonised Standard on broadband deployment and lifecycle resource management for end-of-life ICT equipment, based on a position paper produced by ISG OEU. We published a Technical Specification on single mode optical fibre systems for home cabling. Work also continued to align the content and the terminology of our existing specifications for optical building cabling with recently published CENELEC standards.

In June we released specifications for the provision of interoperable Ethernet and Power over Coax solutions for IP video surveillance. These enable a sustainable, energy-efficient transition from legacy analogue CCTV to IP systems that transmit data over coaxial cable infrastructures.

Towards Efficient ICT

Aligning its activities with TC ATTM, our Industry Specification Group on Operational energy Efficiency for Users (ISG OEU) addresses eco-efficiency issues. These include power consumpt¬ion and greenhouse gas emissions related to equipment and so¬ftware within sustainable smart cities and ICT ne¬tworks, and sites such as data centres and central offices.

In 2019 we published a Group Report on energy efficient IP video surveillance systems, plus a Group Specification on energy consumption measurement of operational IT storage units. We also continued to develop a number of further reports and specifications. These addressed: a lifecycle analysis comparison between internal hosting solution and cloud hosting solutions; guidelines for the study of green smart transportation in cities; and the definition of CO2 equivalent emission levels for ICT sites.

During the year we supported ETSI's participation in CEN-CENELEC-ETSI Coordination Groups on Smart Metering and Smart Energy Grid.

User Perspectives

Our User Group special committee works with other ETSI committees to ensure that our standardization work reflects the needs of all users of ICT products and services, including consumers and businesses, network operators, service providers and individuals with special needs. It also liaises with external organizations such as the International Telecommunications Users Group (INTUG).

2019 saw completion of deliverables relating to a user-centric approach in the digital ecosystem. These define the specifications of a smart interface that leverages AI to anticipate customer needs based on the user's location, agenda and profiles. In cooperation with TC INT, the group also revised its specification on the quality of ICT services and associated metering/billing processes.

ON AIR

More satisfying pictures and sound

The worlds of radio and television broadcasting, the Internet and mobile communications are converging fast. ETSI plays a leading role in creating specifications for media and content services delivered via cable, IP and cellular networks, and by terrestrial and satellite transmission. We collaborate with other partners in the broadcast domain, notably EBU (European Broadcasting Union), DVB (Digital Video Broadcasting), WorldDAB (Digital Audio Broadcasting), DRM (Digital Radio Mondiale), RadioDNS Hybrid Radio, TV-Anytime and HbbTV (Hybrid broadcast broadband TV).

Broadcasting

Our standardization work on 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 CENELEC. Alongside our 'traditional' standardization activities, in 2019 the committee focused on topics related to Ultra High Definition TV, including High Dynamic Range (HDR), Next Generation Audio and hybrid radio. During the year we updated existing DVB specifications to add refinements including Service Information (SI), extensions to CI Plus and MPEG implementation guidelines. We revised a number of audio-related specifications, and also published a specification addressing the DAB Filtered Information Service.

Media Quality

Our Speech and Multimedia Transmission Quality committee (TC STQ) creates standards relating to speech and end-to-end media quality performance for terminals and networks. With our Working Group STQ Mobile we liaise with 3GPP and other standards organizations to support the development of equipment for use in existing and future network telecommunications services, both fixed and mobile.

In 2019 the committee published two new Technical Specifications. The first covers objective assessment of listening effort for normal and hearing-impaired listeners. The second addresses subjective and objective methodologies for qualification of the new ETSI LC3plus speech codec that has been developed in cooperation by TC STQ and TC DECT.

Meanwhile our STQ Mobile Working Group published two Technical Reports. The first offers service quality evaluation guidelines for OTT video streaming services. The second proposes QoS testing and scoring benchmarks for telephony, video streaming and data throughput, as well as more interactive applications such as browsing, social media and messaging. In parallel, STQ and STQ Mobile also published updates to a large number of existing deliverables.

A SENSE OF URGENCY

Supporting public safety and security

Efficient, resilient communications – running over public networks or platforms such as Professional Mobile Radio – play a vital role in enhancing public safety in a wide range of scenarios, ranging from traffic accidents to passenger train crashes, terrorist incidents or natural disasters. In ETSI our activities also embrace standards for maritime safety equipment, Personal Locator Beacons to alert emergency rescue services and mechanisms for road safety.

TETRA and Critical Communications

TETRA (Terrestrial Trunked Radio) is the leading choice for critical communications users. With a projected 5.3 million terminals in use by 2021 and an installed base growth rate of 6,1%, its use in security, transportation, military, commercial and utilities sectors is forecast to grow strongly up to 2023.

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 services. In 2019 we continued to develop specifications for the detailed interfaces between mission-critical broadband systems and TETRA, as well as the required security between them. To optimize this, existing standards for technologies such as LTE (and later 5G) will be enhanced by interfaces and applications making them suitable for mission-critical applications.

During the year we published fifteen specifications to maintain and develop the TETRA standard and the move to broadband critical communications. In support of this, cooperation continued with 3GPP WG SA6 MCPTTC (Mission Critical Push to Talk) and with The Critical Communications Association. Within

this framework, our 4th MCX Plugtests™ validated interoperability in a range of scenarios based on Mission Critical Services described in 3GPP Release 14. Held in September at the Savonia University of Applied Sciences in Finland, the event hosted over 1,800 tests between different vendors in more than 210 test sessions.

Emergency Calling and Alerting

Our Emergency Communications Special Committee (SC EMTEL) is focused on ensuring the interoperability and integration of applications for smartphones, next generation networks and IoT devices in the provision of emergency situations and in the context of the European Public Warning System (EU-ALERT).

In particular, our current attention includes the architecture and corresponding technical interfaces for network-independent access to Next Generation 112 (NG112) emergency services.

Already featured in many smartphones and implemented in some countries, Advanced Mobile Location (AML) uses Wi-Fi and GNSS (Global Navigation Satellite System) to locate the user's location and send an alert message to the appropriate authorities when 112 is dialled. During the year work progressed on development of an architecture and corresponding specification for AML, with publication taking place in December. This was accompanied by a Technical Specification on NG112 architecture, considering core elements and interfaces. Our third NG112 Emergency Communications PlugtestsTM event took place in January.

5G and the IoT (Internet of Things) present significant possibilities to enhance the efficiency of mission-critical communications in a range of public safety scenarios. For example, emergency alerts to relevant authorities could be triggered by fire sensors in buildings, flood warning sensors or wearable health monitors. Drawing on previous work in oneM2M and 3GPP, in July we published a Technical Report giving recommendations on the use of IoT devices in various use cases, such as providing information to 'blue light' services or triggering other actions in the event of an emergency.

> ***"This report prepares the requirements for communications involving IoT devices in all types of emergency situations; It also leverages the benefits of IoT with data gathering without human interaction, objectivity of IoT data, fast and fail-safe information sharing, translation of human languages not required, real-time data transmission and operation in dangerous environments."***
>
> *Michelle Wetterwald, expert, SC EMTEL*

IN ABSOLUTE CONFIDENCE

Ensuring trust in new technologies

Interoperability between products, systems and services is crucial in a multi-vendor, multi-network and multiservice environment. Driven by market demand, it gives users greater choice while allowing manufacturers to benefit from the economies of scale of a wider addressable market. Interoperability is therefore a crucial factor in the successful introduction of new technologies.

Testing and Interoperability

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 covers include 5G mobile, safety and mission critical communications, intelligent transport, electronic signature, network virtualization and the Internet of Things.

During the year we provided ongoing support for the development of conformance test specifications for 3GPP and SmartM2M/oneM2M. Keeping pace with 3GPP's own release schedule, this work included test specifications for LTE/5G user equipment connecting to the network, including smartphones and IoT devices.

The CTI team also led ETSI's 'New Working Methods' (NWM) project. Inspired by working practices and tools used in Open Source software projects – and driven by needs of ETSI and 3GPP standards development processes – the project aims to develop an innovative framework for the collaborative drafting of documents. As well as helping ETSI technical groups to work as efficiently as possible, NWM will support the highest editorial and technical quality of our deliverables. It will also facilitate closer integration with member working practices while optimizing throughput by our Secretariat. Extended trials of NWM are planned with user groups in ETSI while development continues in 2020.

CTI meanwhile contributed to the setup and launch of ETSI's new Testing Task Force process that

supports enhanced planning for future test activities.

We continued the rollout of FORGE, our open source repository for managing code used for developments of various APIs, standards and test specifications that's used in ETSI committees including our MEC and NVF Industry Specification Groups.

Interoperability Events

The ETSI Events team collaborates with our Centre for Testing and Interoperability to deliver a busy programme of events headed by our industry-leading Plugtests™. These allow organizations to connect standards-based equipment – ranging from prototypes to production implementations – to assess mutual interoperability and identify inconsistencies in an implementation or the standard itself.

2019 saw a busy schedule of 16 PlugtestsTM, Hackfests and Hackathons attract a total of 1,130 participants. We have enabled remote access to some PlugtestsTM events, further widening the popularity of this successful programme with participants around the world.

See the full programme of ETSI interoperability events on pages 40-41.

Methods for Testing and Specification

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

In 2019 we continued to evolve and maintain our successful testing language, TTCN-3, along with its tool conformance test suites. Besides enhancing the core language we improved TTCN-3 extensions for Configuration and Deployment Support, Advanced Matching and Object Oriented Features.

The growing user community for ETSI's Test Description Language (TDL) is supported by TC MTS in continuously evolving and maintaining the language, where this growth can be seen within our membership and outside. Providing a toolset for the TDL user community, the TDL Open Source Project (TOP) is a key driver for this upsurge in interest. TDL fills the gap between the simple expression of what needs to be tested and the concrete coding of executable tests using existing languages such as TTCN-3. Exploiting the benefits of model-based software engineering, it offers higher quality tests through better design and by making review easier by non-testing experts.

Held in Bordeaux in October, the seventh ETSI UCAAT User Conference on Advanced Automated Testing (UCAAT) was supported by our MTS committee and the CTI. Dedicated to all aspects of automated testing, the event has drawn rapidly increasing interest from the user community in testing Artificial Intelligence (AI) and using AI in testing. This valuable input encourages our extension of work on the topic.

The conference reported on successful applications of methodologies and test languages standardized in ETSI, such as our own TTCN-3 and TDL languages. The event also gave users, service providers and vendors visibility of cutting-edge testing and automation methodologies across domains including telecommunications, transportation and automotive, healthcare, finance, broadcasting, smart grids, smart cities and industrial IoT.

SPREADING THE WORD

White Papers

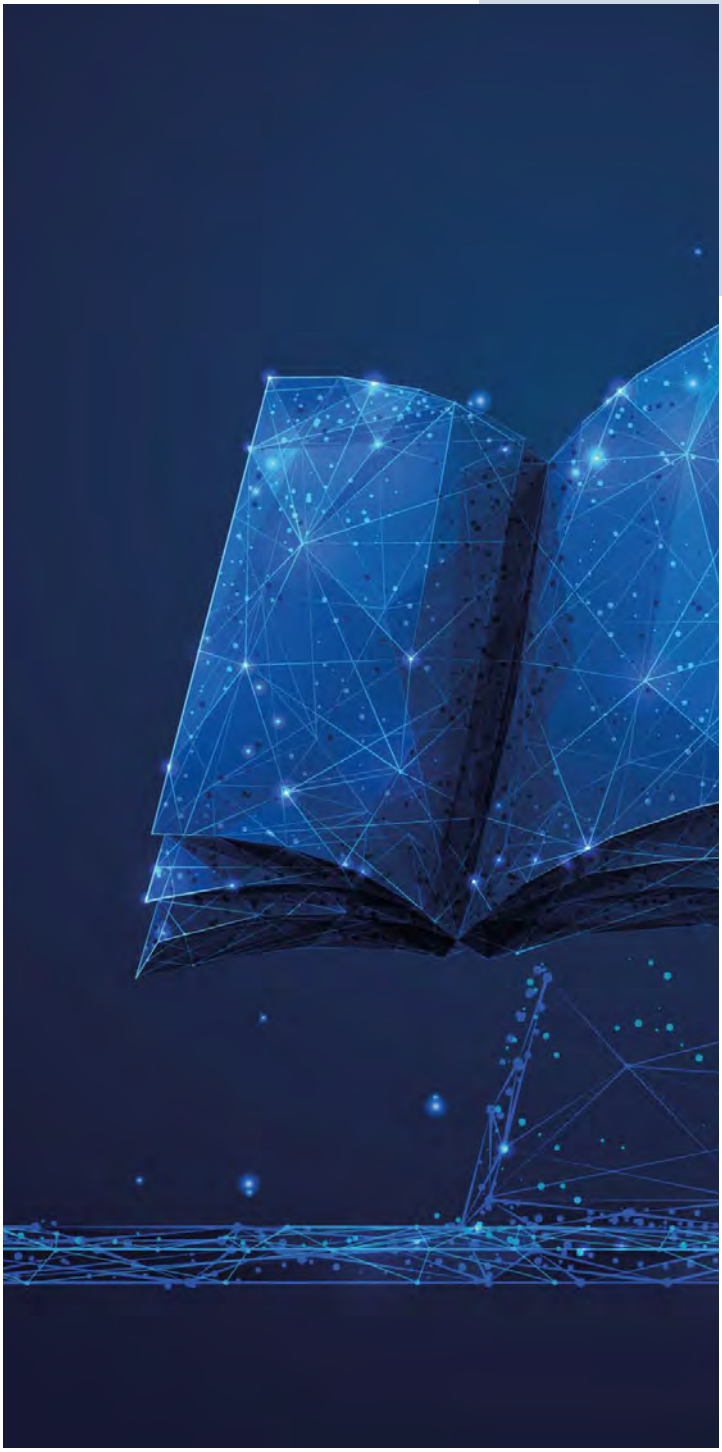
Offering an informal overview of the work of ETSI and other organizations, our White Papers also highlight broader issues related to the successful deployment of various technologies and services related to our own standardization activities.

Published in January 2019, 'NGSI-LD API: for Context Information Management' explains key concepts behind our data exchange protocol that aims to make it easier to find and exchange information with open databases, mobile Apps and IoT platforms.

Issued in February, 'Software for Multi-Access Edge Computing' provides guidance for software developers on architecting and developing applications with components that will run in edge clouds, such as those compliant with ETSI's MEC standards.

Published in October, 'Network Transformation - Orchestration, Network and Service Management Framework' was authored by the Chairs of our ENI, MEC, NFV and ZSM Industry Specification Groups (ISGs) that have released specifications on key building block technologies for next-generation networks, and in turn feeding the 5G specifications of 3GPP. The paper offers insights into how ETSI is tackling network transformation challenges.

Also in October, ETSI collaborated with AIOTI, ISO/IEC JTC1, oneM2M and W3C to issue two



joint white papers on semantic interoperability – titled 'Semantic IoT Solutions: a Developer Perspective' and 'Towards Semantic Interoperability Standards' – based on ontologies in conjunction with organizations closely tied to the advancement of the IoT ecosystem.

Other publications

Issued in October, the report 'Calling the Shots: Standardization for EU Competitiveness in a Digital Era' was produced at the request of ETSI by an independent panel of experts led by Carl Bildt, former Prime Minister and Foreign Minister of Sweden. Designed to provide policy makers with essential information as they develop a new industrial strategy for the EU, the report's release coincided with new five-year mandates of the European Commission and the European Parliament.

ETSI Events

Our own ETSI-branded workshops, seminars, summits, conferences and fora are designed to bring communities together, present an overview of our work and invite input for future activities. These popular events also provide a platform for researchers to share latest results and identify next steps for standardization.

The subject of our high-level annual ETSI Summit in April was 'Artificial Intelligence - Opportunities, Challenges and Risks of AI Applications in the Industry and in Society'. Elsewhere in this report you'll find details on other flagship events, including ETSI Security Week and ETSI IoT Week.

ETSI Seminars

Held in June and November, our ETSI seminars offered an immersive introduction to our organization, structure and ways of working, helping new members navigate their way in ETSI and realize the full benefits of membership.

Webinars

Ranging from high-level overviews to more detailed exploration of individual technologies, our webinars highlight particular aspects of ETSI's work.
In 2019 we held seven webinars. These covered a user-centric approach in a digital ecosystem; developing software for MEC; a cybersecurity overview; trust services; consumer IoT security; ZSM architecture and the Smart Secure Platform.

VISIBLE AROUND THE WORLD

In 2019 we continued to engage with a wide range of external audiences through our presence – either hosting, as an active participant or through our endorsement – at conferences, fora, summits and other events around the world.

01 02 03 04

JANUARY

- India m2m + iot Forum, *New Delhi*
- 3rd MCX Plug-testsTM, *remote*
- 1st mWT PlugtestsTM, *Sophia Antipolis*
- ENISA ESO Conference, *Brussels*
- European 5G Conference, *Brussels*
- 3rd NG112 Emergency Communications PlugtestsTM, *Sophia Antipolis*

FEBRUARY

- 5th OSM Hackfest, *Barcelona*
- NFV API PlugtestsTM, *remote*
- 6th ITS CMS PlugtestsTM, *Sophia Antipolis*
- Mobile World Congress, *Barcelona*

MARCH

- 10th ETSI ITS Workshop, *Sophia Antipolis*
- TCCA Critical Communications Europe, *Coventry*
- India Smart Utility Week, *New Delhi*
- FutureNet World, *London*
- 5G Briefing, *Frankfurt*
- Zero Touch & Carrier Automation Congress, *Madrid*

APRIL

- ETSI Summit on Artificial Intelligence, *Sophia Antipolis*
- MPLS + SDN + NFV World Congress, *Paris*
- 5G Realised, *London*
- Smart Transportation & Mobility, *London*
- Smart to Future Cities, *London*
- Network Transformation Congress, *San Jose*

05

MAY

- OM2M Hackathon, *Wollongong*
- 6th OSM Hackfest, *Santa Clara*
- 5G Huddle, *Tokyo*
- Network Virtualization Europe, *Berlin*
- DSP Leaders Forum, *Windsor*

06

JUNE

- 4th NFV PlugtestsTM, *Sophia Antipolis*
- London Tech Week, *London*
- ETSI Security Week, *Sophia Antipolis*
- Telco AI Summit Asia, *Kuala Lumpur*

07

JULY

- 1st ILHI PlugtestsTM, *Sophia Antipolis*

08

AUGUST

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

09

SEPTEMBER

- 7th OSM Hackfest, *Patras*
- Network Virtualization & SDN Asia, *Singapore*
- NFV & Carrier SDN, *Dallas*
- Edge Computing Congress, *London*
- 4th MCX Plug-testsTM, *Kuopio*

10

OCTOBER

- SDN NFV World Congress, *The Hague*
- e-SIM Connect, *London*
- Broadband World Forum, *Amsterdam*
- ETSI IoT Week, *Sophia Antipolis*
- TU-Automotive Europe, *Munich*
- Smart Cities Summit, *Atlanta*
- Digital Signature Validation PlugtestsTM, *remote*

11

NOVEMBER

- 7th ITS CMS PlugtestsTM, *Sophia Antipolis*
- 7th ETSI/IQC Quan-tum Safe Cryptography Workshop, *Seattle*
- 10th FOKUS FUSECO Forum, *Berlin*
- Telco AI Summit Europe, *London*
- Software-Driven Operations, *London*
- 5G Transport & the Edge, *New York*
- 5th IEEE NFV SDN, *Dallas*
- Akraino 5G MEC Hackathon, *San Diego*
- 8th OSM Hackfest, *Lucca*
- 5G Techritory Forum, *Riga*

12

DECEMBER

- Telco AI Summit Americas, *San Francisco*
- 1st C-V2X PlugtestsTM, *Malaga*
- The Great Telco Debate, *London*
- Edge Computing World, *Santa Clara*
- Open Meeting on Smart Cities and Communities, *Brussels*

UNITED IN OUR GOALS

Working with the European Commission

ETSI highly values its partnership with the European Commission (EC) and the European Free Trade Association (EFTA). As a European Standardization Organization (ESO), we provide world class standards and specifications to support European Union (EU) legislation and public policies.

A major mandated activity in 2019 was the continuation of the development and production of candidate Harmonised Standards under M/536 in support of the Radio Equipment Directive, where a new mechanism has been in place with the EC since 2018 to improve overall efficiency of the process.

We also continued to follow a number of existing EC Standardization Requests such as M/552 for Harmonized European Standards (ENs) in support of the new Electro Magnetic Compatibility (EMC) Directive, and M/554 in support of the Directive on the accessibility of the websites and mobile applications of public sector bodies. No new standardization requests were accepted in 2019.

The Annual Union Work Programme for European Standardization is used as a planning tool to prepare for possible future standardization requests and actions. The 2019 issue was released in October and ETSI has considered in its work programme the areas where support to Union policies and legislation could be provided.

We participated in all 2019 meetings of the EC's Committee on Standards, as well as all meetings of the Information and Communications Technologies (ICT) Multi-Stakeholder Platform. We regularly took part in meetings of the Task Force on the Rolling Plan for ICT Standardization and contributed to the drafts and final outcome for the anticipated ICT Rolling Plan 2020. We attended as an observer

at various Member State committees and their working groups.

3SI Programme

We continued our engagement with the Annex III organizations (ANEC, ECOS, ETUC and SBS), with a view to ensure that their visibility within ETSI is addressed in compliance with EU regulations.

During two 3SI roundtables in 2019, Annex III organizations and ETSI leadership reached consensus on topics to ensure improved identification of the topics relevant for SMEs and societal stakeholders, as well as to use appropriate channels for comments by Annex III organizations regarding ENs proposed for approval. This resulted in an update of the work item form used by the technical bodies as well as in an update of EN development process. 2020 will see the implementation of these changes and the guidance will be included in the Chairman's guide as well in the Rapporteur's guide.

While the roundtables are milestones where the ETSI Leadership and the Annex III organizations meet, it should be noted that work carries on in between with the 3SI Advocate, who is invited twice a year at the Board to report on progress on inclusiveness matters.

Seconded Experts

ETSI is party to two cooperation projects that have established a presence in China and India, thanks to a seconded standards expert in cooperation with the European Commission and EFTA.

SESEC (Seconded European Standardization Expert in China)

Building on previous phases, SESEC IV entered its second year in 2019, focusing on these priorities:

- **Political:** China standards 2035, BRI, reform standardization and implications, Made in China 2025, institutional changes in PRC government, certification and CCC, China and international/ global standards.
- **Technical:** 5G, IoT, ITS, AI, energy efficiency, the environment and medical devices/healthcare.

In January, a webinar on 'China's Regulations and Standards on Cyber Security' featured Mr. Yenjie Ho, Director of the Review Department of CESI Information Security Research Centre and Secretary of SAC TC 260 (National Information Security Technical Committee). The successful presentation attracted more than 150 registrants.

In April, a mission to China led by the ETSI Director General afforded opportunities for knowledge sharing and collaboration in the wake of standardization reforms in the country. A series of high-level meetings deepened ETSI's understanding of the policy and regulatory context in China, as well as offering an overview of developing initiatives such as China Standards 2035.

In October SESEC supported a further mission to China with twofold objectives to:

- Feed continuous discussions with institutional partners in China;
- Identify and/or validate actions for the InDiCo project.

Meetings were also organized with SAC, CCSA, CESI, CAICT, EUCCC, MIIT and CNIS.

SESEC newsletters (bi-monthly) and subject specific reports are available on request from the Secretariat, or directly at **www.sesec.eu/ or www.sesec.eu/resources/sesec-newsletter/.**

SESEI (Seconded European Standardization Expert in India)

ETSI continued to manage the project and related action grant during 2019, chairing meetings and providing the secretariat for the SESEI Steering Committee. Theproject's benefits range from raising awareness in India of the European standardization system to the delivery of information in Europe on Indian standardization, regulatory initiatives and on the chosen priority sectors. The partners unanimously supported the proposal to move to a fourth phase of SESEI, and ETSI consulted with the project partners to elaborate a technical proposal for SESEI IV, which was signed in Q1 2019 and led to a seamless transition between phases III and IV. The project team under the lead of Mr. Dinesh Chand Sharma was confirmed for this new phase, leveraging experience from the previous phase.

International outreach projects

International Digital Cooperation on ICT Standardization (InDiCo)

The InDiCo project targets six geographies (Brazil/ LATAM, China, India, Japan, South Korea and the United States), with the aim of fostering alignment on ICT policies, regulations and standards. The technical areas of the IoT, 5G, cloud computing, big data and cybersecurity as well as other priority topics such as Intelligent Transport Systems, and Distributed Ledger Technologies are its main focus.

2019 saw implementation of the first activities. The bulk will be executed in 2020, with a strong focus on support to the action of the EC in the partner countries, as well as the promotion of the global standards developed in the context of the 3GPP and oneM2M partnership projects. The project will also foster exchanges with the partner countries in order to share information on respective frameworks for ICT security certification, with a view to facilitate work towards mutual recognition and avoid unnecessary efforts for market access by the industry.

India-EU Cooperation on ICT-Related Standardization, Policy and Legislation

ETSI is a partner in the project, together with its Indian counterpart TSDSI and the European Commission. The project has engaged in active and practical promotion of oneM2M in India, organizing a series of tutorials and hackathons with partners in India as well as enabling the creation of Centres of Excellence on oneM2M.

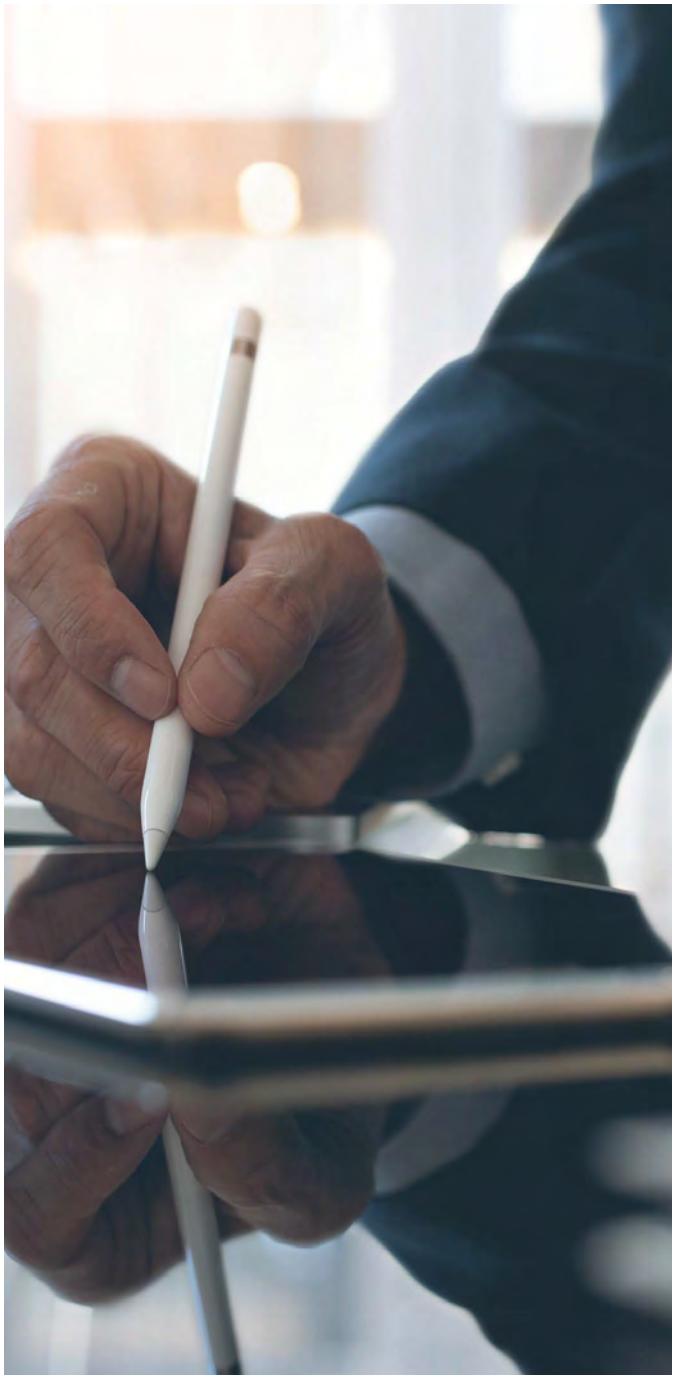
The project has also fostered interactions between Indian and European players, supporting the travel of industry and government experts to understand the European approach to market access and conformity, in the context of the setup of the Mandatory Testing and Certification of Telecom Equipment in India.

ETSI has been involved in the project by acting as a relay in Europe and connecting with European experts in order to best support the events and activities organized in India.

National Standards Organizations (NSOs)

The NSOs and ETSI use the NSO meetings to review common procedures and documentation. ETSI has engaged a revision of the NSO MoU, which in its current form refers to outdated approval procedure. The goal is to provide a text which is aligned with the ETSI Directives and which provides enhanced readability as well as better legal certainty. The NSOs and ETSI have reached consensus on a revised agreement which will be

signed early in 2020.The NSO meetings provide the opportunity to review the production of ENs by ETSI and the related transposition effort by the NSOs.



Partnership Agreements

Interoperability is crucial to enabling a smart, connected society. Co-ordination between our standardization activities and those of other global players avoids duplication of effort while ensuring that our own deliverables are widely implemented. Partnerships with fora, consortia and international and regional SDOs around the world is one of the key mechanisms ETSI has adopted in working with others. By the end of 2019 our partnership portfolio numbered over 110 active agreements.

In 2019 ETSI refreshed one of its most enduring partnerships, originally forged in 1995. Renewal of our agreement with the International Electrotechnical Commission (IEC) allowed both organizations to review common technical activities and identify new areas of co-operation, particular in relation to the IoT. Agreements with IEEE, CCC and TTA were also renewed.

The year saw signature of new agreements with other bodies. In the area of transportation, we partnered with the 5G Automotive Association (5GAA) to work on Intelligent Transport Systems. We also partnered with the Big Data Value Association, reflecting the importance of data for ICT applications. We signed a MoU with the Linux Foundation, demonstrating our efforts to strengthen connection with open source communities. Further agreements were established with the Cloud Signature Consortium, DASH Industry Forum and MIPI Alliance.

SPECIALIST TASK FORCES AND OTHER FUNDED PROJECTS

EC/EFTA Funding

The EC budget line for standardization remained roughly stable for 2019, hence the amount available for the Operating Grants of the European Standardization Organisations did not see any reduction. We were also able to successfully report and achieve a 99,98% payment of the 2018 Operating Grant.

All standardization action grants are operated under a lump sum financing system. The lump sum unit value is updated every year based on an index agreed with the EC and 2019 has seen this value slightly increased compared to 2018.

In 2019, the actions signed at the end of the year (0.8 M€) aimed at covering activities related to electronic signature and intelligent transport services. The EC standardization budget for ICT is shared among the three ESOs, and evidently the proposals related to standardization requests and to the ICT standardization Rolling Plan have the best chance of achieving success.

Technical areas where funded resources were spent in 2019

Technical area	Financial Investment (k€)	%
3GPP	817	25,4%
Smart M2M	394	12,3%
Intelligent Transport Systems (ITS)	229	7,1%
Methods for Testing & Specification (MTS)	203	6,3%
Human Factors (HF)	173	5,4%
Centre for Testing and Interoperability (ETSI CTI)	170	5,3%
Access, Terminals, Transmission and Multiplexing (ATTM)	158	4,9%
Electronic Signatures and Infrastructures (ESI)	142	4,4%
Digital Enhanced Cordless Telecommunications (DECT)	124	3,9%
Core Network and Interoperability Testing (INT)	116	3,6%
Others (NFV, MEC, EMTEL, STQ, ERM, MSG, USER)	322	10,0%
Voluntary 3GPP, oneM2M & H2020	366	11,4%
TOTAL	**3 215**	

Figures are rounded to the nearest k€.

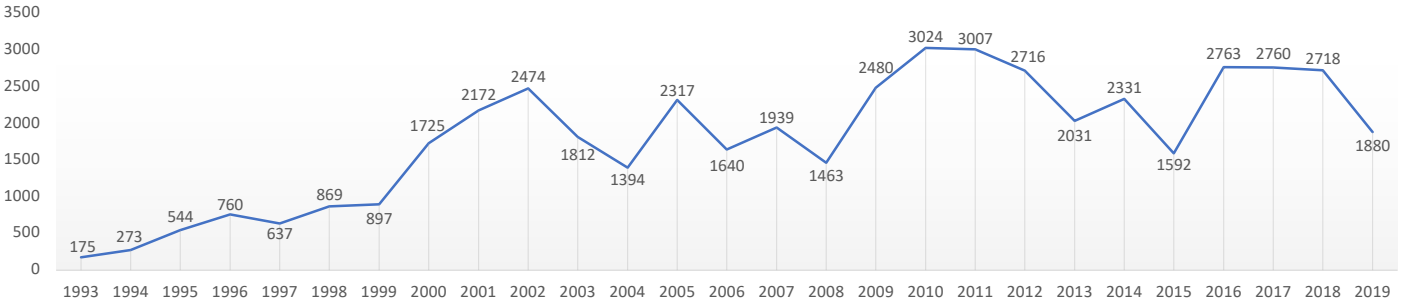
Funding sources in 2019

EC/EFTA	20,9%
ETSI Funding	42,3%
3GPP Partners	25,4%
3GPP Members	9,7%
oneM2M	1,2%
EC H2020	0,5%

STANDARDS PRODUCTION

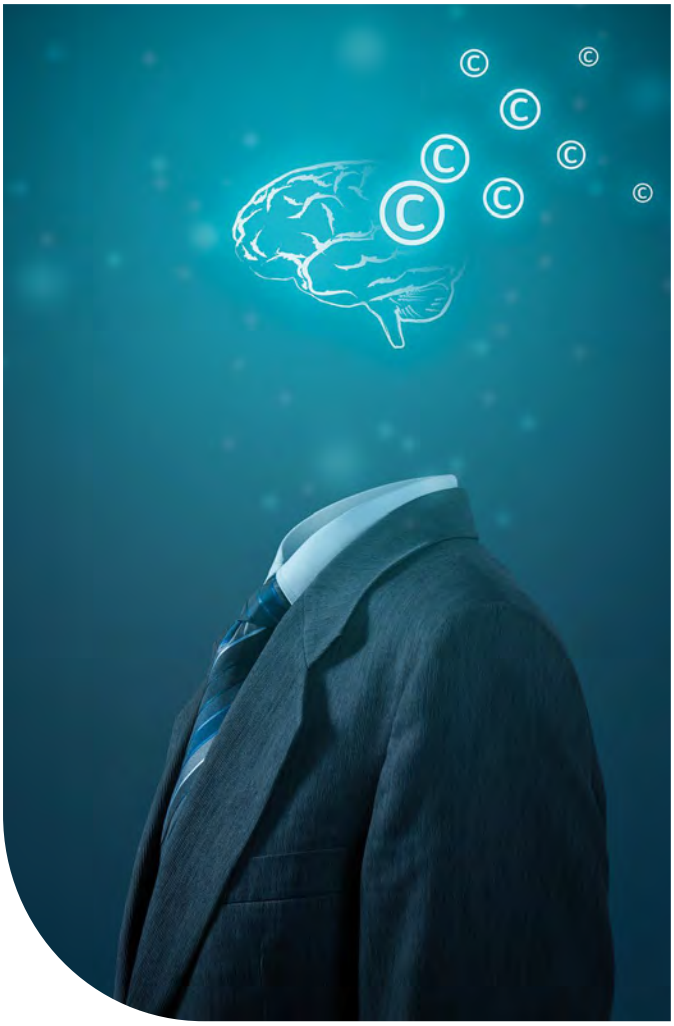
In 2019 we published 1 880 standards, specifications, reports and guides, bringing the total published since our establishment in 1988 to over 48 000.

Number of deliverables published, for each of the years 1993 – 2019



Distribution by type of published document

	In 2019	Total since 1988
Technical Specification (TS)[1]	1 615	38 055
Technical Report (TR)[2]	88	3 937
ETSI Standard (ES)	14	834
European Standard (telecommunications series) (EN)[3]	60	5 047
ETSI Guide (EG)	2	255
Special Report (SR)	3	106
Group Specification (GS)	77	315
Group Report (GR)	21	88
TOTAL	**1 880**	**48 637**



Intellectual Property Rights

Our Intellectual Property Rights (IPR) Policy continues to be widely referenced in the international standardization environment.

ETSI is in ongoing discussions with different stakeholders – including close dialogue with the European Patent Office – to identify improvements in the process for providing accurate information to the public.

Over the last two years we have worked actively to enhance our tools that are offered to make SEP (Standard-Essential Patent) declarations. In January 2019 we introduced a bulk upload feature, making it quicker and easier for ETSI members to submit large declarations.

Building on this, we have made significant enhancement to reporting made around our IPR Database. The Special Report includes now all declaration/disclosure information in a single file. This now features reports and graphs providing an overview of current status of the IPR Database, together with other information including aggregate numbers for declarations/disclosures, standards, patents and patent families.

1- Includes GSM™ Technical Specification (GTS)
2- Includes old deliverable types: Technical Committee Reference Technical Report (TCR-TR), Technical Committee Technical Report (TC-TR) and ETSI Technical Report (ETR)
3- Includes amendments and old deliverable types: European Telecommunication Standard (ETS), Interim ETS (I-ETS) and Technical Basis for Regulation (TBR)

FINANCIAL SITUATION

The management of the finances of ETSI is described by:

- the budget report
- the financial statements (balance sheet and income and expenditure statement) which are established according to French laws and regulations.

Mr Anis Nassif, CONCERTAE, whose auditor's mandate was approved at General Assembly 68th, has audited the 2019 ETSI accounts and certified that the annual financial statements are true, sincere and give a fair view of the activities carried out during the past financial year.

Budget Maintenance

In total, compared with 2018, income increased 2% or roughly 462 k€ while expenditure rose by 2,1% or 504 k€. After having made provision of roughly 24 k€ for Income Tax to be paid and of 1000 k€ in credit notes to be issued to Members to offset the excess of income over expenditure, the net surplus of the year is 50 k€. This compares with a net surplus of 92 k€ in 2018.

Key points of the budget management are the following:

Income

Members' contributions (17,62 M€ before credit notes) were 3,8% over budget and increased by 3,8% compared with 2018. They funded roughly 73,2 % of the budget. European Commission (EC)/ European Free Trade Association (EFTA) funding amounted to 4,2 M€ to cover expenses related to the operation of the European standardisation platform, standardisation projects including International Digital Cooperation projects.

3GPP Partners have contributed their share to the project according to the funding formula in force and it represented 2,6 M€. Member companies of EF3GPP have granted 0,54 M€ in 2019 to fund their activities.

Expenditure

Secretariat costs were 6,1% under budget and higher by 2,1% compared with 2018. Staff resources were reinforced by a net addition of one headcount. In 2019 four staff members left the Institute to go on retirement and the associated legal indemnities have been accounted for in the 2019 accounts. The expenditure budget was closely monitored and delays in implementing some planned activities and projects contributed to the budget underspend.

3,8 M€ were spent for acquiring expertise for Specialist Task Forces and other standardisation-related technical expertise.

2019 Budget Statements

INCOME	(k€)	EXPENDITURE	(k€)
Members' contributions and Observer fees net of credit notes	16 617	Secretariat staff costs	13 493
EC/EFTA contracts	4 199	Other Secretariat costs	5 739
3GPP™ Partners	2 559	Special projects	514
Voluntary contributions	312	European Friends of 3GPP	360
European Friends of 3GPP	536	Provision and losses	179
Sales	108	Experts' costs	3 780
Financial income	58		
Other income/Carry Forward	-274		
TOTAL INCOME	**24 116**	**TOTAL EXPENDITURE**	**24 065**

In 2019, there was a net surplus of 50 k€.

Financial Statements forthe Year 2019

The final accounts and the balance sheet are summarized below.
The fiscal accounting period is 1 January 2019 – 31 December 2019.

Statement of Income and Expenditure Year 2019

	Income (€)	Expenditure (€)
Income	24 095 923	
Purchases		9 549 469
Expenses		14 494 081
Financial income and expenses	58 472	8 178
Extraordinary income & expenses	10 545	39 303
Income Tax		23 531
TOTAL	**24 164 940**	**24 114 562**

In 2019, there was a net surplus of 50 378 €.

Summary of the Balance Sheet

Assets

Net amounts at	31 Dec 2018 (€)	31 Dec 2019 (€)
Fixed assets	4 971 992	4 891 889
Debtors	16 555 013	17 257 705
Securities/cash	12 303 770	12 364 920
Prepaid expenses	222 207	245 360
TOTAL ASSETS	**34 052 982**	**34 759 875**

Liabilities

Net amounts at:	31 Dec 2018 (€)	31 Dec 2019 (€)
Equity	8 778 326	8 895 696
Provisions	276 087	303 296
Balance carried forward	117 370	92 468
Surplus of the year	92 468	50 378
Creditors	7 504 531	7 030 287
Deferred revenue	17 284 200	18 387 750
TOTAL LIABILITIES	**34 052 982**	**34 759 875**

Figures are rounded to the nearest €.

DISTINGUISHED SERVICE

Recognizing an outstanding contribution

The ETSI Fellowship Programme recognizes individuals who have made an outstanding personal contribution to ETSI, either by building on our own work, or by raising ETSI's reputation in specific sectors of standardization.

Any individual representative of an ETSI member may propose a candidate for an ETSI Fellowship. Fellowships are awarded each year by an Award Committee composed of the ETSI General Assembly Chairman and Vice-Chairmen, the ETSI Board Chairman and the ETSI Director General.

In April 2019 we honoured David Chater-Lea, Friedhelm Hillebrand and Roberto Macchi on the occasion of our 73rd General Assembly.

"Our Fellowship programme awards key contributors to ETSI's work. We are really proud to be able to reward three individuals who have been instrumental in building ETSI's reputation in technologies that are used around the world today."

Luis Jorge Romero, Director General

David Chater-Lea

David has been a key member of the TETRA standards community since 1994, when he joined what was then ETSI RES6 WG6, who designed the TETRA security standards. David has spent over 35 years of his career in mission critical communications and has tirelessly supported the development of ETSI standards and needs of the industry in other standards bodies and industry fora. In ETSI TCCE, David is leading the effort to develop interoperability between TETRA and 3GPP standards so that the TETRA standards are ready in time for the user communities' needs for interoperability between existing TETRA systems and users operating on 3GPP systems. A respected member of the critical communications community globally, he is probably the person who has done the most to evolve the standards from TETRA into critical communications over broadband.

Friedhelm Hillebrand

Fred began his career at Deutsche Telekom, where he became project manager for the German public packet switching network. From 1984 to 1992, Fred and his team contributed to the GSM standard and led the implementation of Deutsche Telekom's GSM network. Fred chaired a Working Party for non-voice services of GSM. Notably, he proposed inclusion of SMS that would be supported by all networks and native on every mobile device.

From 1996 to 2000 he was Chairman of ETSI's Technical Committee SMG (Special Mobile Group) which included 11 sub-committees and 50 working groups. SMG elaborated the GSM evolution and the basic parameters of 3G, integrating contributions from partners around the globe. Fred successfully initiated the creation of 3GPP as future global standardization body for mobile communication. Since 2004, he has provided consulting services concerning patents in mobile communication.

Dr Roberto Macchi

Roberto Macchi has been involved in ETSI for more than 20 years in the fixed radio systems working group of the ETSI Technical Committee on Access, Terminals, Transmission and Multiplexing (TC ATTM) as an active member and a Chairman.

As an internationally recognized expert in fixed radio systems, he was also involved in interdisciplinary issues and interworking activities with ITU-R, CEPT or administrations. Thanks to his globally recognized expertise, ETSI Harmonised Standards for fixed radio services and microwave point-to-point and point to multipoint systems are considered as the worldwide reference by non-European telecommunication authorities and microwave equipment manufacturers.

Roberto currently works as a Standards and Regulations expert in SIAE Microelettronica. As a Chairman, and beyond his technical competencies, he has proved to be a very good mediator.

MEMBERSHIP

Overall ETSI membership increased by roughly 6% in 2019. At the end of the year, we had a total of 923 members, drawn from 65 different countries and provinces across five continents. This was made up of 755 full members drawn from 43 European countries, 155 associate members drawn from 22 non-European countries and 13 observers. 144 of our members are Small and Medium-sized Enterprises (SMEs) and 95 are Micro-Enterprises. Small organization members now represent roughly 27% of the overall membership. There were 50 resignations received during the year that were effective as of 1st January 2020.

The European Commission and the European Free Trade Association Secretariat, which hold the role of Counsellors, attend the General Assembly and the ETSI Board and continue to play an active part in our work.

The mechanism for approving applicant members via online polls was successfully and efficiently held at each quarter of 2019 allowing new Members to engage more rapidly in ETSI operations.

The Membership administration team continues to pay the highest attention to the overall quality of data to ensure that the information registered in the database is accurate and that Members' situations are compliant with the ETSI Directives.

In 2019 the Membership team supported the creation of three Industry Specification Groups (ISGs):

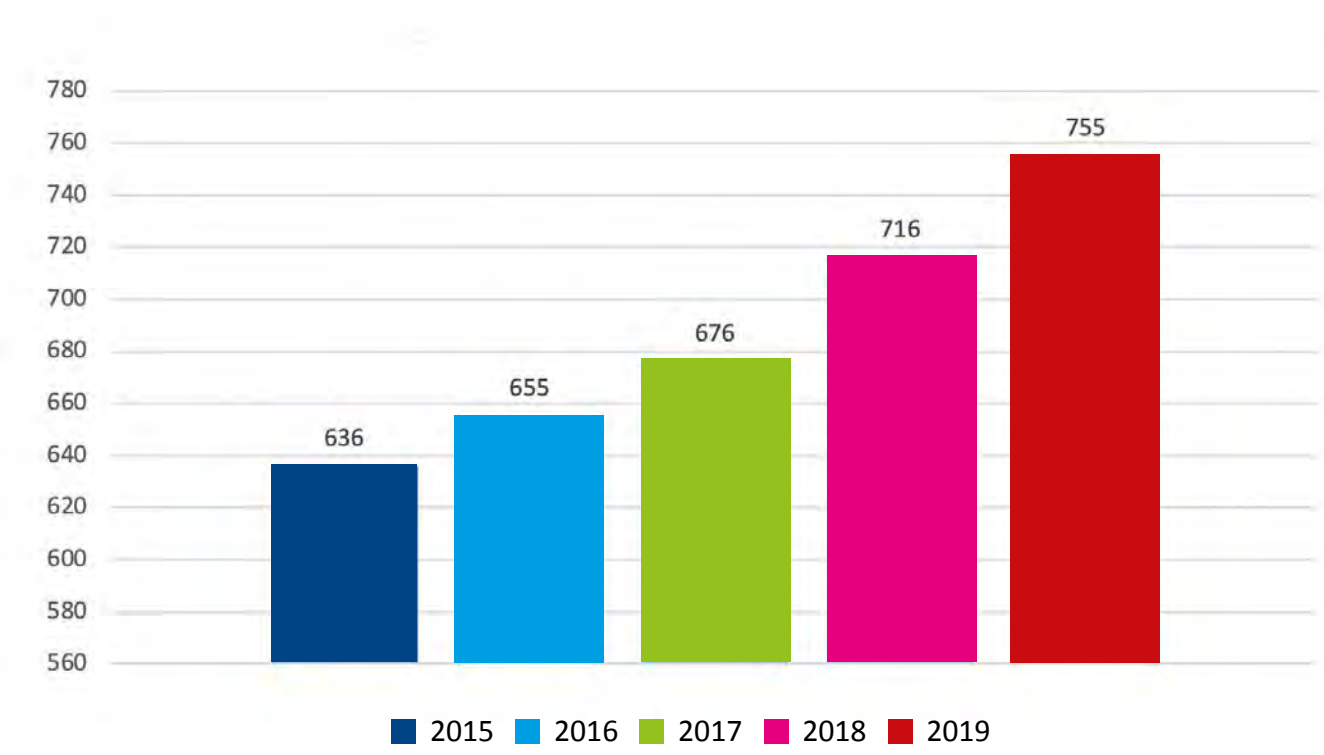
- CDM (european Common information sharing environment service and Data Model)
- SAI (Securing Artificial Intelligence)
- F5G (5th Generation Fixed network)

The extension of five ISGs (IP6, CIM, ENI, ARF and ZSM) was granted for an additional 24 months of activity, alongside the closure of two ISGs (ISI, CDP).

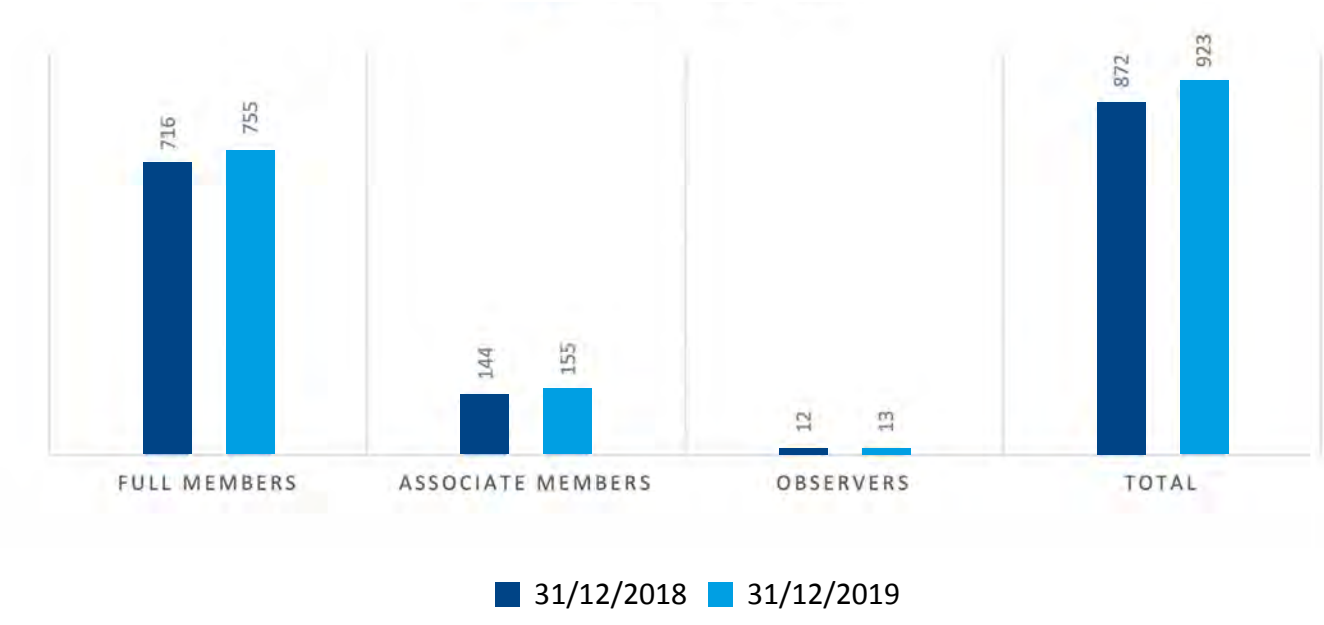
At the beginning of 2018, the ETSI Board approved and promoted the creation of a fee credit incentive for ISG participants who decide to become ETSI members. This resulted in two ISG participants being converted in 2019 into ISG members, as well as two OSM participants.

Collection of contribution invoices in 2019 was performed with a recovery rate of 99,59%, the highest ever achieved.

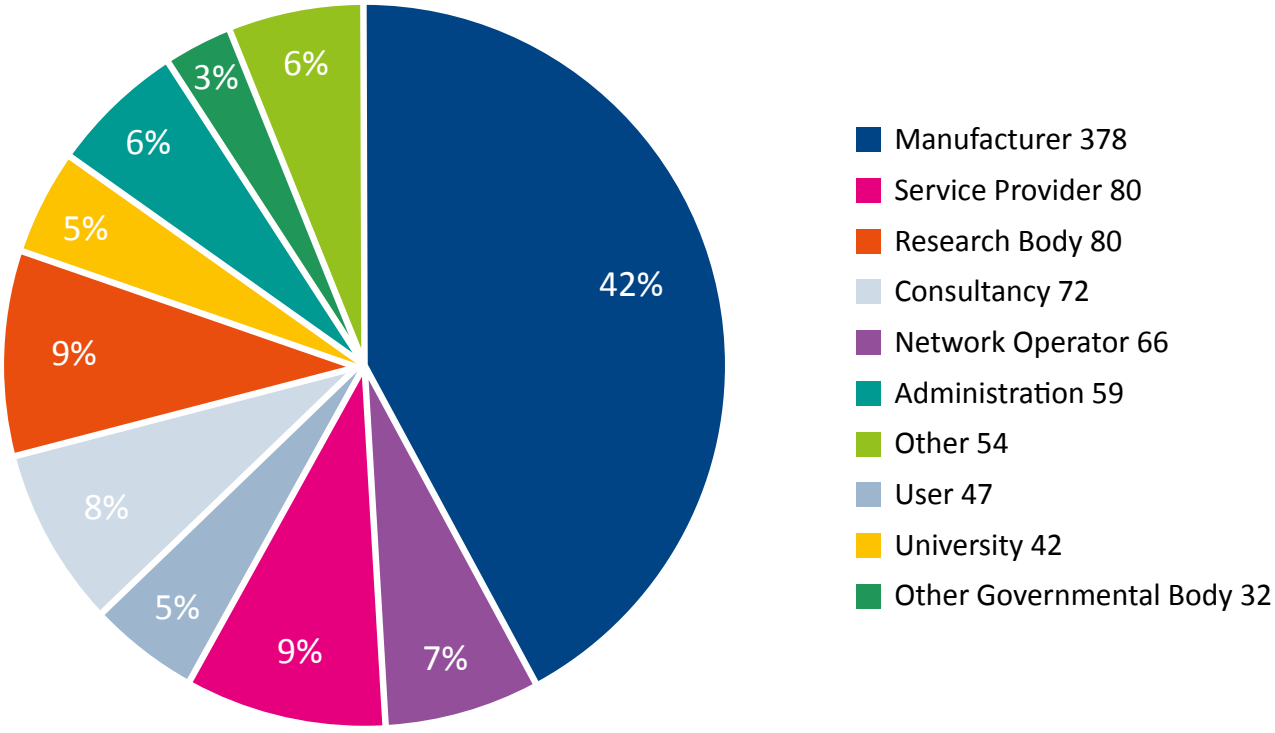
Evolution of ETSI Full Membership



Membership by type



Full and Associate Membership by category



Realize the benefits

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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The Standards People