Standards that Shape our Future

ANNUAL REPORT 2021

ETSI
The Standards People

WE ARE STANDARDS

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 948 members drawn from 64 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 a few of our many achievements during 2021. 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 current and planned activities in the ETSI Work Programme 2022-2023.

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01 THE YEAR AT A GLANCE

January

- New group on IPv6 Enhanced Innovation launched
- First report on securing Artificial Intelligence
- Launch of MEC sandbox for edge app developers
- MoU with Agricultural Industry Electronics Foundation

February

- First reports from Permissioned Distributed Ledger group
- ETSI, CEN, CENELEC and ENISA host cybersecurity standardization conference
- First report on worldwide Covid-19 contact tracing systems
- ETSI CTO honoured by World Wireless Research Forum

March

- Intercontinental emergency communications interoperability test event
- Specification for securing digital signatures
- Second part of Middlebox Security Protocol announced

April

- ETSI 2021 Fellows announced
- First reports on non-IP networking
- ETSI Technology Radar White Paper launched

May

- 'Designing Tomorrow's World' new ETSI strategy announced
- Report on mitigation strategy for securing AI

June

July

948
ETSI members (27% SMEs)

100+
Partnerships

19 256 845
Standards downloads

1817
Publications

64
countries

14
Plugtests™ interoperability events

ETSI Secretariat:
124 people
19 nationalities

59 618
Online participants

2153
E-meetings

August

- White Paper on Fibre Development Index

September

- ETSI/CEN/CENELEC workshop on industrial data
- First specification on 5th generation fixed network
- First report on Encrypted Traffic Integration

October

- 14th-18th 2021 ETSI Virtual Security Week attracts participants from over 70 countries
- OSM Release TEN
- White Paper on MEC security
- First interop event on future railway communications

- Report on MEC deployment in multi-operator environment
- Results of FRMCS Plugtests™ announced

- ETSI DECT-2020 NR approved by ITU-R as first non-cellular 5G technology
- New group on Reconfigurable Intelligent Surfaces launched
- First IPv6 Enhanced Innovation report
- Test specification for consumer IoT security standard
- 19th-21st User Conference on Advanced Automated Testing

November

- OSM Release ELEVEN
- MoU with Asia PKI Consortium
- 6th MCX Plugtests™ event

December

- Global standard for securing smartphones
- NFV Release 5 work launched

02 FROM OUR OFFICERS

In retrospect

Neviana Nikoloski
Chair of the General Assembly

As this Annual Report illustrates, ETSI's standardization activities are closely aligned with the policies and ambitions of the European Union, whose recently updated data strategy is central to ensuring the EU's leadership in tomorrow's data driven society.

With billions of sensors and other devices already connected in the Internet of Things, we are entering a new data-driven era. Effectively managed, this enormous volume of industrial data will play a pivotal role in the next phase of Europe's digital transformation. It can give businesses the opportunity to dramatically improve their productivity and overall efficiency by supporting core processes or delivering powerful new insights.

Industrial data is undoubtedly key to the continued success of a harmonized Single Market that will reinforce Europe's competitiveness in the global market. What's more, it is critical to supporting the twin transition – green and digital – at the heart of the EU policy agenda. Maximizing the value that industrial data can bring to European businesses and other stakeholders demands a common approach to ensure trust, quality and interoperability throughout the entire data value chain. In September 2021 ETSI accordingly held a joint workshop with ESO partners CEN and CENELEC to examine the fundamental role of standards in enabling a flourishing industrial data ecosystem within the context of the EU's New Legislative Framework.

The strength of ETSI's relationship with CEN and CENELEC was further underlined earlier in the year when we joined forces in February with ENISA, the European Union Agency for Cybersecurity, to host the 2021 Cybersecurity Standardization Conference. As well as discussing the status of security standardization in the realm of connected consumer products, the conference explored cybersecurity requirements under the scope of the Radio Equipment Directive (RED), where the European Commission is preparing delegated acts and a corresponding standardization request to the ESOs.

Another highlight of 2021 was the update of the EU Industrial strategy, aiming at strengthening the economic resilience and accelerating the twin transition by learning from the lessons of the Covid-19 crisis. One of the actions from this update, was setting up a joint Task Force between the ESOs and the European Commission, to address the challenges for the European Standardization System hindering it from an agile and efficient functioning in areas and technologies of strategic importance for the EU. Together with representatives from CEN and CENELEC, ETSI's Director-General and General Assembly Chair are participating in the Task Force and contributing to the analysis and possible improvements of the standard-setting process in Europe.

Dirk Weiler
Chair of the Board

Like every forward-thinking organization, ETSI is always evolving. Despite the ongoing restrictions on international travel, we have continued to show exceptional resilience in adapting our practices to support more than 100 technical groups where our core standardization work takes place.

A case in point is the continuing roll-out of our New Working Methods platform. Developed entirely in-house, NWM was able to help in reducing one of the biggest bottlenecks to effective decision-making in the wake of the pandemic. A single e-meeting such as a 3GPP TSG RAN or a RAN Working Group meeting can trigger tens of thousands of emails, putting huge demands on officials and delegates to keep track of complex discussions. This situation is compounded by time zone differences that only allow an effective 2-3 hour window each day for discussions in real time. The progressive implementation of NWM in 2021 has helped consolidate ETSI's position as a truly world-class environment for the development and delivery of technical standards, regardless of the challenges we continue to face. We will continue to invest in this innovative platform during 2022.

What does tomorrow hold? It's a question that is never far from the minds of ETSI and its members. Demonstrating our strategic vision to lead the development of a sustainable, securely connected society, we are broadening our focus to investigate technological, legislative, and socioeconomic trends that may shape future standardization activities. You'll find some of the intriguing results in the first ETSI Technology Radar – published in April 2021 – that has been developed by Board members, OCG and ETSI Secretariat representatives with inputs from our members, technical groups and other stakeholders.

Luis Jorge Romero
Director General

The unprecedented events of the last two years have given every organization ample opportunity for introspection and change. In ETSI's case we reacted swiftly to the global pandemic in 2020, pivoting rapidly away from a reliance on physical meetings to accommodate the collaborative working methods of our technical bodies where our standardization activities take place.

While this situation continued throughout 2021, it also highlighted some important home truths. We've found that virtual meetings can be a highly effective way to share information and progress work. Equally, we have learned that bringing people together in the same room has benefits that a teleconference can't reproduce. Going forward, we are now implementing a 'hybrid' strategy for our own meetings and interoperability events, blending physical with virtual proximity to maximize the contribution of our own members and other parties in a way that suits them best.

One welcome consequence of the pandemic is significantly greater engagement in ETSI's webinars, training sessions and other online events. These provide a platform for our own experts to interact virtually with a viewing audience from around the world. It's a clear win/win situation, expanding the reach of our activities while delivering significant time and cost savings for our members by reducing the need for international travel. What's more, it is an approach that's kinder on the environment.

In alignment with ETSI's bold new strategy – see more on page 8 – in 2021 we've made a significant commitment to amplify the external visibility of our standardization activities on a global stage. As you'll see in this Annual Report, we are making strides forward in sharing our success stories through educational programmes, social media, and other channels.

While we are proud to tell the world what ETSI is doing, the true value in our activities lies in the tireless work of our technical bodies. This collaborative process is frequently enriched by inputs from non-members and other external partners, whose contribution ensures that our own publications anticipate and address real-world market needs. As a valued participant in today's fast-moving ICT ecosystem I invite you to get involved with our community – and play an exciting role in shaping tomorrow's technology landscape.

03 ETSI STRATEGY

Designing tomorrow's world

Enabling our ambitious future vision

'Designing tomorrow's world' is ETSI's new strategy that recognizes the global importance of ICT for society's sustainable digital transformation. Our vision is to be at the forefront of Information and Communication Technology, and to lead development of standards that enable a sustainable, securely connected society.

The context around our new strategy takes a high-level view of the main socioeconomic, policy-making and technology trends characterizing the ecosystem where ETSI operates and that may impact our activities. Building on this classification we have considered a range of factors, including climate change, the circular economy, energy efficiency and the UN's Sustainable Development Goals, the role of SMEs, European policy initiatives and the EC's industrial strategy. From a technology perspective, we have also considered innovations in ICT, ranging from Artificial Intelligence and Machine Learning to developments in cloud, photonics and quantum computing.

In addition, we have re-examined the changing role of ICT in society manifested through digital transformation and the evolution to a data-driven society, the increasing roles of virtualization and cloud computing as well as issues related to security and privacy. Finally, we have explored the roles of the main players in the ICT ecosystem, the importance of standardization in different industry sectors, and the importance of learning, education and skills.

To deliver our vision ETSI will follow a path marked by five Key Strategic Directions that express the journey to achieve our ambitions:

Being at the Heart of Digital
As the preferred point of call for ICT related standardization, ETSI enables comprehensive end-to-end ICT architectures and technologies including devices, network, and cloud.

Being an Enabler of Standards
ETSI provides support and tools to enable the identification of the needs and requirements for standards and their production and adoption. We are the enabler of standards in response to regulatory, legislative, policy and market needs.

Being Global
ETSI creates standards intended for global use, with a membership from across the world and partnerships covering all regions and relevant sectors for ICT. We tailor our processes to influence worldwide standards and builds on its ESO status to contribute to the European economy.

Being Versatile
ETSI innovates in its working methods, creating room for wide participation, rapid deployment and global acceptance of its standards. We work with developer communities and supports the creation and maintenance of test suites and tools plus additional standards-related software material.

Being Inclusive
ETSI's membership represents real market and societal needs, from local to global, leveraging the digitization of business and industry, circular economy, and the sustainable development of modern society. ETSI comprises large and small companies and research organizations, as well as other business, consumer, societal and environmental stakeholders.

Learn more at etsi.org/about/our-strategy

04 3GPP AND 5G

Advanced thinking

Mid-generational enhancement and extension

As a founding partner of The Third Generation Partnership Project, our standardization activities in ETSI cover a full range of advanced cellular communication technologies. These include radio access, core network and service capabilities that together offer a complete system description for mobile network operators, vendors and service providers. 3GPP specifications also provide hooks for non-radio access to the core network, and for interworking with other networks. Established in 1998, 3GPP brings ETSI together with six other regional standardization organizations in Asia and North America, plus market associations and several hundred individual companies.

2021 saw the maturing of 3GPP Release 17. This enhances earlier 5G work in key areas such as the requirements of vertical market applications, NR operation in unlicensed frequency bands, NR MIMO and vehicle-to-everything (V2X) communications. Formal completion of Release 17 – marked by a Stage 3 functional freeze – is scheduled for March 2022, followed by a coding freeze in June 2022.

Meanwhile several Release 18 studies and workshops were already underway during the year. Heralded by the appearance of the mid-generational marker '5G-Advanced', Release 18 sees an evolution in terms of three key dimensions:

- Mobile broadband evolution versus further vertical domain expansion
- Immediate versus longer-term market needs
- Device evolution versus network evolution

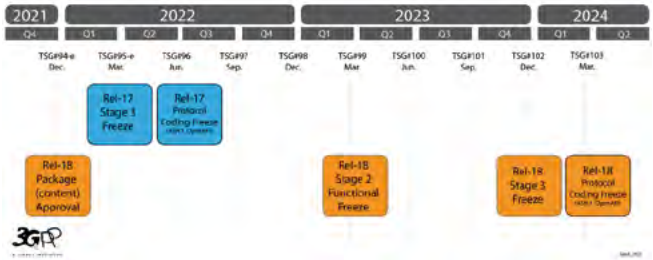
Equally, Release 18 will play a significant role in helping lay the early foundations for future work on 6G technologies. Areas being developed include tactile and multi-modality communication services, access to localized services, enhanced access to and support of network slice, timing resiliency system, smart energy and infrastructure, ranging-based services, residential 5G, personal IoT networks, performance requirements for AI/ML model transfer and guidelines for extra-territorial 5G systems.

By the end of 2021 the majority of the Release 18 content prioritization process was complete, with group activity on the agreed work set to ramp up during the first quarter of 2022. The Release 18 Stage 3 functional freeze is scheduled for December 2023.

Despite the ongoing challenges of the global pandemic – and the continuing suspension of face-to-face meetings due to travel limitations – 3GPP membership maintained steady growth during the year, with an increasing representation of players from vertical industries such as automotive manufacturing.

At the end of 2021, of the 773 member organizations of 3GPP, 454 (58.7%) were via their membership of ETSI.

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



05 MACHINE-TO-MACHINE COMMUNICATIONS AND THE INTERNET OF THINGS

Valuable connections

Linking devices, data and experiences

Connections between billions of devices are driving exciting new applications and fresh sources of business value. The Internet of Things (IoT) brings together technologies including Machine-to-Machine (M2M) service platforms and wireless sensor networks. IoT use cases span smart cities, connected vehicles, eHealth, home automation, energy management, public safety and logistics.

oneM2M

OneM2M is the global standards initiative (OneM2M oneM2M.org) oneM2M.org that covers requirements, architecture, API specifications, security solutions and interoperability for Machine-to-Machine and IoT technologies. As a founding partner, ETSI helps produce standards and specifications that simplify connection between devices and services, regardless of the underlying technology.

In July 2021 oneM2M confirmed that it was close to finalizing specifications for Release 4 of the standard, in parallel with work accelerating on development of Release 5. Key focus areas include Artificial Intelligence (AI) for IoT systems, advanced semantic discovery, tools for data licensing, interworking with 3GPP networks and controls to support data protection regulations.

The industrial Internet of Things (IoT) is predicted to add $14 trillion of economic value by 2030 [Source: World Economic Forum 'Guidelines for Sustainability']. However, its side effects – including wasteful usage patterns and 'throwaway' technology – threaten to undermine these gains. In April oneM2M announced a new initiative to promote the benefits of industrial IoT systems and the significance of the oneM2M standard in improving the sustainability of IoT deployments. Published in September, a white paper titled 'IoT for Sustainability' encourages stakeholders to apply responsible IoT system design principles as they chart a pathway to achieving global sustainability goals.

Running from 26-30 April, ETSI Virtual IoT Week focused on the role of standards in supporting the digitalization of society, businesses and industry. An introduction to IoT semantics and ontologies was complemented by sessions covering service experiences and best practices, IoT in the face of the pandemic: digitalization and countermeasures, IoT cybersecurity: consumers, smart cities, e-Health and SMEs: the standards, Artificial Intelligence in IoT: AI adoption and standards.

Smart Machine-to-Machine Communications

In coordination with oneM2M, our SmartM2M Technical Committee produces specifications to simplify the connection of devices and services via the exchange of information through SAREF, our Smart Applications REFerence ontology that specifies core concepts in the smart applications domain and the relationships between them. In response to the global pandemic, in 2021 the committee published a Technical Specification that describes an Asynchronous Contact Tracing (ACT) system to track an IoT connected object that may have

been infected by Covid-19 or future pandemic viruses. A further specification published on IoT systems for Smart Lifts discusses information models including signals, alarms and commands, as well as the mapping to the semantic model of oneM2M and ETSI's own SAREF ontology.

Context Information Management

Digital transformation requires interoperable and reliable sharing of information together with its provenance, accuracy information and unambiguous definitions of its content. During the year our Industry Specification Group on cross-cutting Context Information Management (ISG CIM) published incremental release versions of the NGSI-LD API, together with related deliverables on NGSI-LD testing. Other Work Items in progress address an NGSI-LD information model; security & privacy; the chain of trust from content sources to consumers; digital twins; handling of provenance information; and guidelines for deployment of smart city data platforms.

Smart Body Area Networks

Our technical committee on Smart Body Area Networks (TC SmartBAN) develops standards to support the development of technologies including Wireless BAN, Personal BAN and Personal Networks in a wide range of domains including eHealth/telemedicine, wellness, leisure, sport and personal safety. Applications typically feature the use of small, low power sensors, wearables or embedded devices to collect, monitor and exchange data about an individual and their environment.

Scope of the committee's interests includes communication media, and associated physical layer, network layer, security, QoS and lawful intercept. TC SmartBAN also serves as a focal point for the coordination of ETSI's activities in the Health ICT domain including telemedicine. In April we published a report on using ultra-low power, ultra-wideband technology (UWB) for swallowable pill-type wireless camera medical devices. We also updated our report on modelling of the SmartBAN Radio Frequency (RF) environment and revised the Enhanced Ultra-Low Power Physical Layer specification.

eHealth

eHealth represents the application of ICT across a range of functions that affect the health sector. Examples include electronic health records, telemedicine services, personal wearable and portable communicable systems including those for medical implants, health portals, and other tools to assist disease prevention,

diagnosis, treatment, health monitoring and lifestyle management.

In 2021 the ETSI Board approved conversion of the former ETSI Project (EP) eHEALTH to a Technical Committee (TC), with a continuation of its existing work programme. The committee published an ETSI Special Report on the role of ICT to enable health crisis management and recovery in response to the Covid-19 pandemic. Examining the standardization actions of ETSI and other groups, the report discusses where ICT standards may play a role in future mitigations.

Following completion of its mission, ETSI's Industry Specification Group on Europe for Privacy-Preserving Pandemic Protection (ISG E4P) group closed in 2021. Its deliverables were subsequently taken over for maintenance by TC eHEALTH.

Digital Inclusion and Accessibility

Understanding human capacities and limitations to make products and services easy for everyone to use is a key factor for success in the digital networked economy. In ETSI we are helping to achieve these objectives through the work of our Technical Committee on Human Factors (TC HF). During 2021 the committee coordinated work with CEN/CENELEC on the draft Standardization Request related to the European Accessibility Act, in anticipation of a mandate from the European Commission that's expected in early 2022. Our Harmonised Standard on 'Accessibility requirements for ICT products and services' addresses people with limited cognition, vision issues, hearing or vocal disabilities as well as those with limited manipulation, strength or reach capabilities. Following the standard's transposition in Australia, Japan and Morocco, the Bureau of Indian Standards prepared its adoption with an adaptation of requirements to Indian regulation and languages.

06 CYBERSECURITY AND PRIVACY

Universal protection

Staying safe in a connected world

The Internet is critical to our everyday lives, and so too is its security. With growing dependence on networked digital systems comes an inevitable increase in the variety, scale and sophistication of threats and cyber-attacks targeting businesses, organizations and private individuals. Standards have central role in strengthening our cyber security, protecting the Internet and everyone who relies on it.

Cybersecurity

A trusted centre of expertise, our Cybersecurity Technical Committee (TC CYBER) develops standardization solutions to meet strategic high-level needs, as well as offering guidance to regulators, users, vendors and network operators.

In August 2021 we issued a specification that details scenarios for assessing the cybersecurity of consumer IoT products against the provisions of ETSI's world-leading consumer IoT security standard. Allowing manufacturers and distributors to assess compliance of their devices, the specification will also be used as input into work on IoT assurance schemes under the EU Cybersecurity Act and Radio Equipment Directive (RED).

A vital component of modern networks including 5G, middleboxes provide strengthened protection against sophisticated new cyberattacks. Expanding TC CYBER's previous work, February saw publication of Part 2 of ETSI's Middlebox Security Protocol (MSP). This was followed by publication of a further part addressing enterprise security aspects.

MIKEY-SAKKE is an identity-based authenticated key exchange protocol designed for building secure, highly scalable cross-platform multimedia communications services. 2021 saw approval by TC CYBER of its first PAS (Publicly Available Specifications), with the submission by Secure Chorus of their own specifications for connecting products using the protocol.

We also published the first part of a new report that offers SMEs guidelines for reducing cybersecurity risks using standards and frameworks.

Quantum Safe Cryptography

Quantum computers pose a major challenge to conventional cryptographic techniques, where information such as bank account details becomes subject to potential discovery. The focus of our CYBER QSC Working Group is on the practical implementation of quantum-safe primitives, including performance considerations, implementation capabilities,

protocols and architectural considerations for specific applications. During 2021 we issued and updated reports that variously address: a comparison of various proposals in academic literature for quantum-safe signature schemes; a discussion of security issues around the implementation of Stateful Hash-Based Signature (S-HBS) schemes; and a description of Key Encapsulation Mechanisms selected by the National Institute of Standards and Technology (NIST) for Round 3 of its post-quantum standardization process.

Quantum Key Distribution

Quantum Key Distribution (QKD) enables digital keys to be shared securely over optical links via the transfer of quantum states. Unlike conventional methods that assume the difficulty of certain mathematical operations, quantum cryptographic protocols should be resilient to advances in computing. Their first applications are likely to be those requiring long term secrecy, such as encryption of sensitive government or corporate data. In 2021 our Industry Specification Group on QKD published a specification that defines management interfaces to integrate QKD with disaggregated network control plane architectures, notably with Software Defined Networks.

Securing Artificial Intelligence

Our Industry Specification Group on Securing Artificial Intelligence (ISG SAI) is developing specifications to mitigate threats arising from the deployment of AI – and threats to AI systems – from both other AIs and conventional sources. In 2021 the group published an analysis of existing and potential mitigation strategies against threats for AI-based systems. It was complemented by a further report that summarizes methods used to source data for training AI along with regulations, standards and protocols that can control the handling and sharing of that data.

Permissioned Distributed Ledgers

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

In 2021 we released a suite of Group Reports to support industry and government institutions' needs for PDL solutions. These variously address: a reference architecture for smart contracts and their planning, coding and testing; an overview of the worldwide PDL research and innovation landscape; use case scenarios; and an exploration of challenges related to data storage and ledger operations when PDL nodes are operating in offline mode. These were complemented by a Group Specification on architecture requirements to enable the efficient, error-free deployment of smart contracts.

Electronic Signatures

Our committee on Electronic Signatures and Infrastructures (TC ESI) addresses the requirements of digital signatures, including formats and procedures and policies for their creation and validation. Its work supports eIDAS (electronic ID, authentication and signature) regulation, as well as general requirements of the international community to provide confidence in electronic transactions.

Alongside maintenance of its existing Harmonised Standards and other deliverables, in 2021 the committee published the first part of a new Technical Specification on JAdES digital signatures. Developed in close cooperation with Open Banking Europe, this represents a landmark for interoperability of digital signatures for a range of applications in today's digital economy. Publication was accompanied by successful Plugtests™ event to test interoperability between various implementations of the new standard.

Lawful Interception and Retained Data

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

Alongside revisions to various deliverables, in 2021 we updated our Technical Specification that defines handover details for LI functionality in OTT (Over-The-Top) messaging services delivered over HTTP/XML. Development of this specification has represented a major collaborative project, with inputs from several ETSI members from the non-traditional telecoms world including providers of OTT messaging services.

We also published a Technical Report that presents a library and mapping for LI and LD (Lawful Disclosure) that describes national parameters and implementations in the context of the Inter LEA Handover Interface and cross-border data exchange in criminal matters – for example through bilaterally agreed legal assistance or using the secure European Judicial Network.

Smart Cards and the Secure Element

ETSI's Smart Card Platform technical committee (TC SCP) has been responsible for developing and maintaining specifications for the Secure Element (SE) used in telecommunication systems including the Internet of Things (IoT) and Machine-to-Machine (M2M) applications.

In 2021 the committee continued the process of upgrading specifications for both the UICC – the world's most widely deployed Secure Element – and the new Smart Secure Platform (SSP) that can be adapted to multiple products and markets while maintaining a common set of features and some characteristics of the UICC platform. Reflecting the committee's evolving mission, from the start of January 2022 TC SCP has been officially re-named as TC SET (Secure Element Technologies).

Encrypted Traffic Integration

While encryption protects traffic flowing through networks from unauthorized inspection, it does not in itself protect the communicating end points from attack and reduces the ability of firewalls, in combination with other network management systems, to remove malicious traffic. Our Industry Specification Group on Encrypted Traffic Integration is exploring impacts on network resilience and on security where attackers may take advantage of encryption to spread malicious code or exfiltrate protected customer or sensitive data. Published in June 2021, the group's first report identifies problems arising from pervasive encrypted traffic in communications networks and the consequences for various stakeholders.

ETSI Security Week 2021

Taking place from 14-18 June, ETSI Security Week attracted more than 1,000 online registrations in over 70 countries. Featuring presentations, panel discussion and live Q&A sessions, the event's virtual format encouraged a wide range of stakeholders to debate five key aspects of cybersecurity: Securing Artificial Intelligence, IoT, NFV, MEC and Cyber Security Policy.

07 RADIO AND WIRELESS SYSTEMS

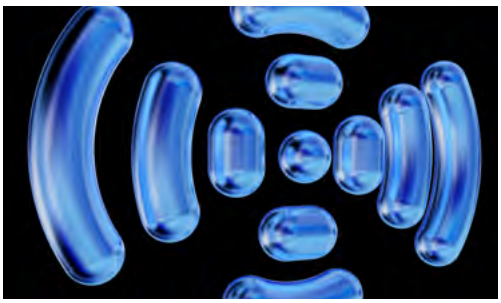
Making waves

Standards for wireless devices, systems 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 develop standards used by regulatory authorities to ensure safe co-existence of systems competing for use of limited spectrum resources.

Harmonised Standards and the Radio Equipment Directive

ETSI develops Harmonised Standards and other deliverables in response to Standardization Requests received from EC/EFTA. Much of this work is conducted in our committee for Electromagnetic compatibility and Radio spectrum Matters (TC ERM) that deals with requirements for a broad range of industries and applications. These include standards for wide band and ultra-wide band data systems, Short Range Devices (SRDs), wireless medical devices, RFID devices, Intelligent Transport Systems, digital mobile radio, aeronautics, maritime and TV/radio broadcast systems.



Now in force across Europe, the Radio Equipment Directive (RED) has established a regulatory framework for placing radio equipment on the market. A new approval procedure for our Harmonised Standards has necessitated a change in ETSI's working methods to ensure compliance with legislative requirements. In 2021 TC ERM continued to co-operate closely with the EC to optimize the efficiency of this process, exemplified by our participation in several bi-lateral events.

Reconfigurable Radio Systems

Reconfigurable Radio Systems (RRS) are smart entities or functions that can react to their environment and/or have their radio parameters updated via software. This offers an opportunity to support the needs of our connected world by sharing spectrum among multiple services and radio networks. Our Technical Committee on RRS is responsible for the standardization of these systems, including reconfigurable equipment architecture and cognitive radio, with scope of its work encompassing Software Defined Radio (SDR) and Cognitive Radio (CR).

In 2021 we published the second part of our Technical Specification on the Radio Interface Engine (RIE) that details RIE system architecture. Work meanwhile continued on temporary spectrum access for local high-quality wireless networks in dedicated licensed and leasing scenarios, referred to as evolved Licensed Shared Access (eLSA). This included publication of the third part of our Technical Specification that considers information elements and protocols for the interface between eLSA Controller (eLC) and eLSA Repository (eLR). We also neared completion of a new Technical Specification defining a format for the Radio Application Package (RAP).

Reconfigurable Intelligent Surfaces

Reconfigurable Intelligent Surfaces (RIS) leverage smart radio surfaces with thousands of small antennas or metamaterial elements to dynamically shape and control radio signals in a goal-oriented manner. The technology will effectively turn the wireless environment into a service, inspiring a host of new use cases. These include enhancing key-performance-indicators for various systems such as coverage and capacity, as well as enabling new applications such as localization and sensing. Thanks to its associated characteristics, RIS is expected to serve as a key technology in future wireless systems, including for 6G. October 2021 marked the launch of our new Industry Specification Group on Reconfigurable Intelligent Surfaces (ISG RIS) that has been created to review and establish global standardization for RIS technology.

Broadband Radio Access Networks

Our Broadband Radio Access Networks committee produces and maintains specifications for current and future Wireless Access in different frequency ranges. In July 2021 TC BRAN revised its Harmonised Standard on access to spectrum for equipment operating in the 60 GHz band to consider the inclusion of receiver sensitivity requirements, anticipating citation in the Official Journal of the EU.

DECT™

Developed by ETSI as a European standard in the early 1990s, DECT™ (Digital Enhanced Cordless Telecommunications) features in over a billion short-range communication devices. Interacting closely with the DECT Forum and ITU-R (WP5D), our DECT Technical Committee's recent activities have been focused on development of the DECT-2020 NR ('New Radio') system. This culminated in October 2021 with approval of DECT-2020 NR by ITU-R Working Party 5D as fulfilling the requirements for new 5G IMT-2020 radio interface technology (RIT). This decision marks the world's first non-cellular 5G standard being included as part of ITU-R's IMT-2020 technology recommendation.

Millimetre Wave Transmission

4G/5G deployments – and the needs of massive machine-type communications in the IoT – are making unprecedented demands on radio access networks and backhauling. Under-utilized frequencies in the microwave and millimetre-wave ranges provide more spectrum for radio transmissions with a wider channel bandwidth and fibre-like capacity. In 2021 our Industry Specification Group on millimetre Wave Transmission published an analysis of spectrum, license schemes and network scenarios in RF bands above 174,8 GHz, plus a detailed description of use cases under a 'close-to-implementation' approach for wireless backhaul networks.

Satellite Communications

Applications of satellite communications technology range from direct-to-home TV and mobile links to location services and high-speed Internet access, especially for rural regions or onboard aircraft and ships. During 2021 our Satellite Earth Stations and Systems committee (TC SES) continued to develop and revise 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 (RED) as part of the ongoing consultation process with the EC to ensure our standards are well positioned to achieve listing in the Official Journal of the EU.

Mobile Standards

Our Mobile Standards Group (TC MSG) works alongside MSG TFES, our joint Task Force with TC ERM responsible for identifying European regulatory requirements and creating harmonized standards supporting the deployment of IMT family networks in Europe.

In relation to the Radio Equipment Directive (RED) – and to align with different 3GPP releases – in 2021 TC MSG continued to revise the multi-part Harmonised European Standard on access to radio spectrum for IMT cellular networks, variously addressing base stations, repeaters, user equipment and conformance testing. In the domain of regulatory requirements for IMT cellular network base stations, we published a new Technical Specification addressing additional requirements arising from EC/CEPT spectrum regulation in certain geographical areas. We also issued an evaluation report to ITU-R WP 5D regarding the DECT-2020 NR component of ETSI's successful technology proposal to IMT-2020.

08 TRANSPORTATION SYSTEMS

Accelerating innovation

Transformed experiences on land, sea and air

At ETSI we're driving to make transport networks safer and more reliable while reducing energy consumption. We develop standards to accelerate the introduction of Intelligent Transport Systems (ITS) services and applications, based on experience gained from market deployments. We also address rail, aeronautical and maritime transportation, and the use of satellite communications standards for high speed Internet access on board aircraft, ships or in vehicles.

Road Transport

Intelligent Transportation Systems (ITS) enable smarter, more coordinated and efficient use of transport networks. In ETSI our ITS Technical Committee (TC ITS) is developing global standards for the communication architecture, management and security aspects of Co-operative ITS (C-ITS), where vehicles exchange information with other road users and the surrounding infrastructure. Applications include road safety, traffic control, fleet management and location-based services, driver assistance, hazard warnings, support for emergency services, and ultimately the realization of fully autonomous driving.

In 2021 we published or updated various Technical Specifications and Technical Reports. These variously addressed: Interference Management Zone Message (IMZM); communication architecture for Multi-Channel Operation (MCO); Infrastructure Vehicle Information (IVI); Basic Transport Protocol (BTP); communication congestion control; test specifications; security aspects; vehicular communications applications; GeoNetworking; and awareness of Vulnerable Road Users (VRU).

Railway Communications

In June 2020 ETSI was requested by the European Commission to draft new European Standardization deliverables – and revise existing standards – for the Future Railway Mobile Communication System (FRMCS), the successor to the GSM-R (GSM™ for railways) standard. This has driven an intensive Work Programme that sees our Rail Telecommunications technical committee (TC RT) liaising closely with 3GPP and the International Union of Railways (UIC) in the development of an extensive suite of new specifications for FRMCS.

Complementing the first part of its Technical Report on radio performance simulations of 3GPP LTE as an access technology candidate for FRMCS, in 2021 TC RT published the report's second part that addresses simulations of 5G New Radio (NR) in 900 MHz FDD and 1900 MHz TDD spectrum. Together, these studies will assist with understanding which radio technology could be more suitable for FRMCS, considering users' needs as well as available bandwidth.

Held in June 2021, ETSI's Future Railway Mobile Communication System (FRMCS) Plugtests™ event saw 100 worldwide participants validate interoperability of various implementations using different test scenarios based on the 3GPP Mission Critical Services framework

with a focus on rail specific features. Also, in June ETSI Director-General Luis Jorge Romero underlined the importance of standardization in the context of FRMCS at an online event hosted by the Official College of Telecommunications Engineers (COIT).
In cooperation with ETSI's Intelligent Transport Systems committee, the RT JTFIR continued to investigate solutions for shared usage of the 5,9 GHz spectrum band between Road ITS and Urban Rail ITS application requirements.

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.
In 2021 we published updated Harmonised European Standards on access to radio spectrum for Air Traffic Control PSR (Primary Surveillance Radar) sensors and meteorological radars.

Maritime

Our Marine group develops standards for all aspects of communications and radiolocation equipment and systems for maritime and inland waterways. Along with 'person overboard' devices, the group covers other safety related equipment such as survival craft radios, transceivers for use in distress situations and signalling/homing beacons.

In 2021 we published European Standards for radio links in maritime radio location systems operating in the X band and navigation radar for inland waterways. A revision of our Harmonised European Standard on access to spectrum for broadband radiolinks for ships and off-shore installations achieved citation in the OJEU. We also revised the first part of our European Standard on Digital Selective Calling (DSC) equipment in the maritime MF, MF/HF and VHF mobile service.

09 NETWORKS

Essential connections

Towards a smarter networked experience

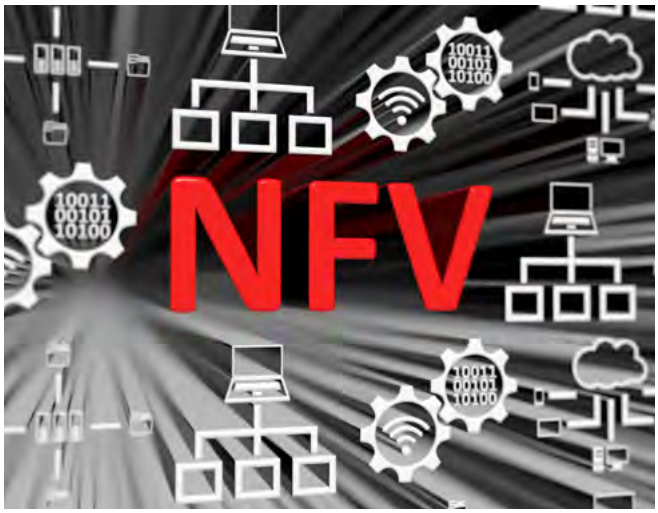
Consumers and business users expect communications services to be easily accessible and available everywhere, on the device of their choosing. To meet this need networks are rapidly becoming smarter and more agile. At ETSI we provide a comprehensive set of standards to increase the utility and efficiency of today's convergent access networks – and tomorrow's.

Network Functions Virtualization

A key enabler for the success of 5G – and equally relevant to other telecoms network architectures – Network Functions Virtualization (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. As NFV-based deployments gather pace worldwide, work accelerated in 2021 on NFV Release 4 that considers recent technological advances such as 5G, containerization, cloud-native design, service-based architectures and data analytics.

In November ISG NFV announced the start of technical work on Release 5 – a programme that will consolidate the NFV framework while expanding its applicability and functionality set. Aspects of NFV concepts and functionalities addressed in previous Releases are subject to further development in Release 5. In parallel it embraces wider industry needs – for example extending the NFV framework to address telecom use cases in the radio access network (RAN) domain.

Held from 1-15 October, the ETSI NFV&MEC Plugtests™ remote event afforded solution providers and open-source projects the opportunity to meet online and assess interoperability of NFV and MEC solutions, while validating their implementation of latest NFV and MEC specifications and APIs.



Open Source MANO

In ETSI our work on NFV explores synergies between the worlds of open source and standardization. Two key components of this architectural framework are the NFV Orchestrator and the Virtualized Network Function (VNF) manager, referred to collectively as NFV Management and Orchestration, or MANO. Open Source MANO (OSM) is an ETSI-hosted initiative to deliver a regularly updated reference implementation of the MANO stack, aligned with ETSI NFV Information Models and meeting the requirements of production NFV networks. To date code for OSM Releases ONE to TEN has been downloaded over 45 000 times from more than 85 countries.

Delivered in June 2021, OSM Release TEN marked a major step towards production OSM deployments. Release TEN features a new design that allows OSM modules to be decoupled and distributed across the network for higher resilience, facilitating edge and geo-redundant deployments. As well as enhanced public cloud support, scalability and subscription management features, Release TEN brings numerous other optimizations based on live OSM deployments.

The subsequent announcement in December of OSM Release ELEVEN underlines the OSM vision of a vibrant NFV ecosystem, reflecting real-world market needs while being closely aligned with ETSI's standardization activities. Adopting two new ETSI NFV specifications, Release ELEVEN features significant functional extensions in areas such as interoperability with public clouds (Google Cloud Platform), finer interaction with cloud-native environments and tighter integration of network functions of different natures alongside various refinements in stability and usability.

Multi-access Edge Computing

Multi-access Edge Computing (MEC) shifts processing closer to end-users at the 'edge' of the network to enable a wide range of IoT and vertical solutions, from gaming and Virtual Reality to Intelligent Transportation Systems and the industrial Internet. ETSI's Industry Specification Group on MEC is standardizing an open environment to enable integration of applications from infrastructure and edge service providers across MEC platforms and systems. Crucial to this is the creation of a consistent set of Application Programming Interfaces (APIs) for developers to build services and applications.

Anticipating widescale industry adoption of MEC solutions, the group maintained its focus in 2021 on 'Phase 3' activities that consider a complex heterogeneous cloud ecosystem. This embraces security enhancements, expanded traditional cloud and NFV Life Cycle Management (LCM) approaches, and mobile or intermittently connected components and cloud resources.

A Group Report issued in June presents a study of inter-MEC system deployment and MEC-Cloud system coordination, with an analysis of use cases requiring inter-system coordination, including those in multiple Mobile Network Operators' (MNOs) environments.

January 2021 marked official launch of the ETSI MEC Sandbox (try-mec.etsi.org) that allows developers to interact with an implementation of ETSI MEC APIs while testing their own applications. Hosted virtually by ETSI, the Sandbox offers a choice of scenarios combining different network technologies (4G, 5G, Wi-Fi) and terminal equipment such as vehicles, pedestrians or connected objects. The ETSI MEC Hackathon 2021 took place during the Edge Computing World event from 12-15 October, where the winning team presented a 'flex drone' concept featuring edge AI autonomous

flights compliant with ETSI standards.
Focused on accelerating development of the MEC ecosystem, ISG MEC Working Group DECODE (Deployment and ECOsystem Development) remained highly active in 2021. Our popular MEC ecosystem wiki was re-styled and enriched with further content.

Zero Touch Network and Service Management

Maximizing the efficiency of end-to-end 5G network operations requires increased automation of functions that are currently administered with direct human intervention, such as configuration and capacity management. The goal of our Industry Specification Group on Zero Touch Network and Service Management is to provide an end-to-end solution where all operational processes and tasks – including delivery, deployment, configuration, assurance, and optimization – are executed automatically, without manual supervision.

In June we published a Group Specification defining an architecture blueprint and solutions for zero-touch management and orchestration of end-to-end, cross-domain network slicing. We issued the first part of a multi-part specification on 'closed loop' automation that can be empowered by advanced machine learning and artificial intelligence. This specifies governance services that allow the creation, execution and life-cycle management of a closed-loop, as well as the steering of its behaviour. A Group Report published in July 2021 identifies potential security threats related to the ZSM framework and solutions: it proposes mitigation options that should be considered by the ZSM specifications to ensure that automated processes are secured and deliver intended business outcomes.

Augmented Reality

Augmented Reality (AR) blends real-time spatially registered digital content with our experience of the real world. Transparent and reliable interworking between different AR components is key to the successful roll-out and wide adoption of AR technologies and services. Our Industry Specification Group on Augmented Reality Framework (ISG ARF) is defining a framework for the interoperability of Augmented Reality components, systems and services. Allowing components from different providers to interoperate through defined interfaces, this framework avoids vertical silos and reduce market fragmentation – and thus enables players in the ecosystem to offer parts of an overall AR solution.

In 2021 ISG ARF published its multi-part report and specification on interoperability requirements for AR components, systems and services. In October the group attended the ISMAR 2021 conference, participating in the tutorial 'Introduction to Augmented Reality Interoperability and International Standards'. During the year ISG ARF continued its close collaboration with external bodies The AREA, Khronos Group and the Open AR Cloud Association (OARC) to support the development of a thriving eco-system with a diverse range of technology and solution providers. The group also maintained its active liaison exchange with ETSI groups (e.g. ISG MEC) and 3GPP SA WG4.

IP version 6

As more devices including vehicles, sensors and home appliances become connected, 'IP on Everything' is becoming a significant industry trend. In January 2021 ETSI announced the launch of its Industry Specification Group on IPv6 Enhanced innovation (ISG IPE) to tackle increasing industry needs for IP version 6 adoption in a wide range of scenarios. Published in August, the group's first report analyzes requirements created by new use cases and services such as 5G and cloud. It identifies specific gaps and advantages of IPv6 in IP link, multicast, security, O&M solutions and IPv6-only networks and thus accelerating IPv6-based innovation.

In September two webinars on 'IPv6 Enhanced Innovation: the IPv6-Only Future in the 5G, IoT & Cloud Era' saw experts from government institutions, operators, manufacturers and research institutes sharing industry development and progress to date within ISG IPE.

Non-IP Networks

Mobile operators are increasingly challenged by the limitations of decades-old TCP/IP networking protocols. Security, quality of service and other aspects have triggered fixes and workarounds: these have incurred their own penalties in terms of greater cost, latency and power consumption.

ETSI's Industry Specification Group on Non-IP Networking (ISG NIN) is standardizing protocols that will better suit today's use cases than TCP/IP. In particular the group is dedicated to specifying alternative networking protocols to support 5G applications, as well as being more efficient and easier to manage with lower capex/opex.

ISG NIN's initial suite of Group Reports was published in March 2021. The first is a problem statement detailing the limitations of TCP/IP for today's mobile networks and how an alternative system could overcome those shortcomings. The second offers guidelines for testing and implementing non-IP networking on 3GPP cellular access networks, specifically LTE and 5G. The third illustrates how the technology initially identified by ETSI's previous Next Generation Protocols Industry Specification Group can form the basis of a 'Flexilink' networking model to support new and existing protocols.

Experiential Networked Intelligence

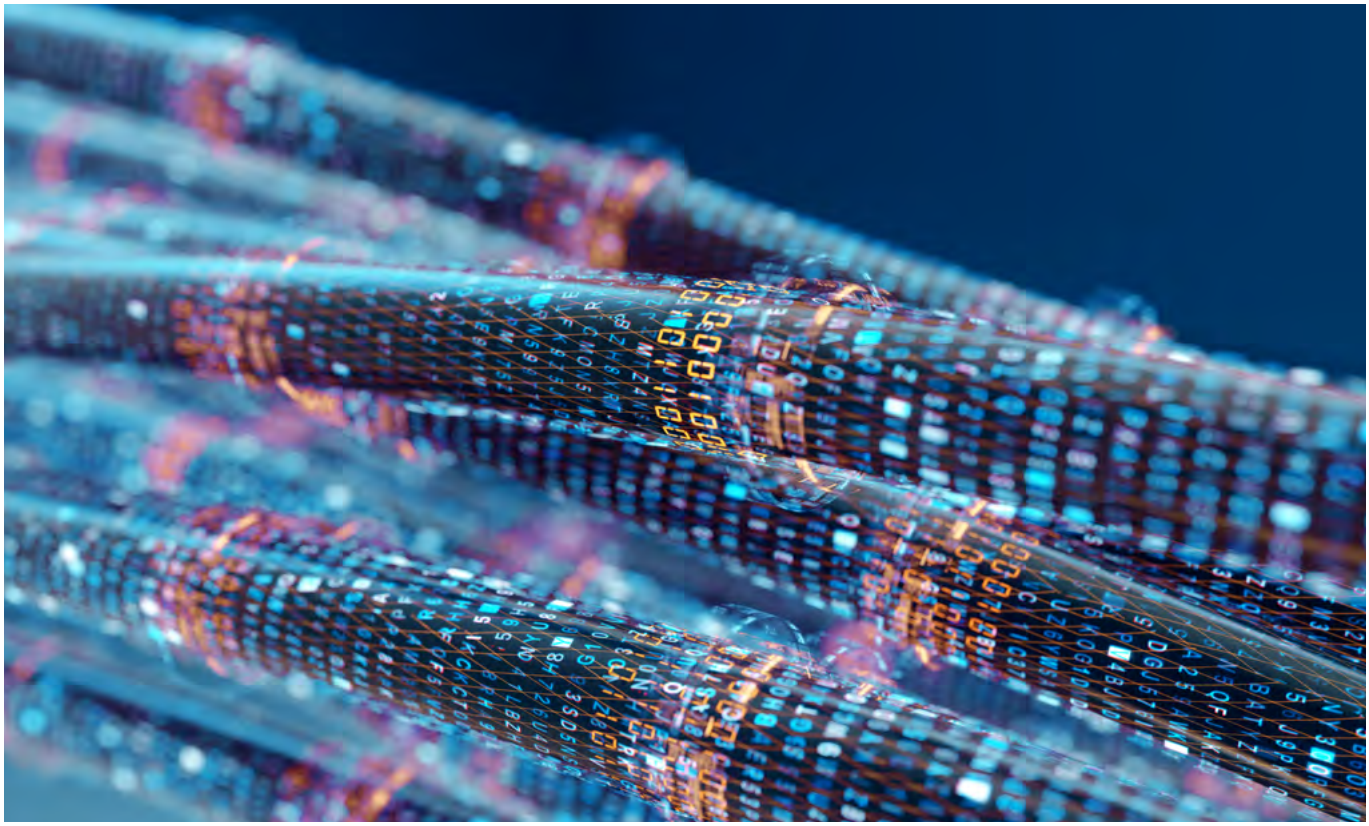
Technologies such as Software Defined Networking (SDN), Network Functions Virtualization (NFV) and network slicing are making networks more flexible and powerful. However, these same innovations are also making them harder to deploy and manage efficiently. Our Industry Specification Group on Experiential Networked Intelligence (ISG ENI) develops standards that use Artificial Intelligence (AI) mechanisms in the network supervisory and management system to address some of these challenges. By the end of 2021 work was largely completed on ENI Release 2 that specifies enhanced use cases, requirements and Proof of Concept (PoC) specifications. During the year we issued or updated several Group Reports, alongside a revised description of the ENI system architecture. Meanwhile significant progress was made on several Work Items relating to Release 3.

Fixed Network Evolution

Our Industry Specification Group on the fifth generation of Fixed Network (ISG F5G) is studying the evolution in fixed networks required to match and enhance the benefits that 5G has brought to mobile communications. In September we published a landscape document that explores technology requirements, existing standards and gaps for various use cases. Representing a cornerstone in the group's work, this Group Specification forms the basis for future F5G standards on architecture, end to end management, security and other aspects. A further Group Specification defines a framework to coordinate public demonstrations of Proof of Concepts (PoC) to validate key technical components developed within ISG F5G. These deliverables were complemented by a Group Report that discusses use cases for both consumers and enterprise organizations.

Cable

Our Integrated Broadband Cable Telecommunication Networks committee (TC CABLE) addresses the evolution of broadband cable telecommunications network infrastructure and devices. During 2021 the committee's work included the development of a new multi-part standard covering the sixth generation transmission systems for interactive cable television services. Based on specifications for DOCSIS® 4.0, this standard will enable multi-Gbps symmetrical services in the cable access network.



10 SUSTAINABILITY AND USER NEEDS

Positive impact

Standards for a greener, safer planet

Technology has given us powerful new opportunities to stay connected in ways we could have scarcely envisioned a generation ago. However while reaping its benefits we must minimize its negative impact on individuals, society and our plane. Part of our work involves making products and services simpler to use, safer and more efficient. We are also committed to identifying energy efficiency solutions that mitigate the impact on climate change of the growing use of Information and Communications Technologies (ICT).

Energy Efficient Product Deployment

Our Environmental Engineering Committee (TC EE) manages various engineering aspects of telecommunication equipment in different types of installation, including energy performance measurement and assessment methods for different parts of radio access networks including data centres.

The committee's work also embraces innovative energy storage technologies for ICT equipment – for example to provide resilience in sustainable smart cities. Much of the committee's work supports EC policies and legislation on eco-design aspects, where we liaise with the European Committee for Electrotechnical Standardization (CENELEC) and the European Committee for Standardization (CEN) to develop relevant standards.

During 2021 our activities focused 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. This work was reflected in updates to various standards and specifications on topics including measurement of standby power consumption for household and office equipment, environmental testing for telecommunications equipment, power supply interface requirements and cooling solutions for ICT infrastructure and equipment, the evolution of battery technology for ICT equipment, and sustainable power feeding solutions for 5G networks and equipment.

Sustainable Networks

Our Access, Terminals, Transmission and Multiplexing committee (TC ATTM) addresses the operational and physical parts of Information and Communications Technologies, including broadband transmission

networks, equipment and sites. The committee's work aligns closely with ETSI's European SDO peers CEN and CENELEC in areas of shared interest, including the operational sustainability and energy efficiency of smart cities and communities.

Publications during the year included: a report on quick construction and management solutions for Optical Distribution Networks (ODN); the second part of our specification on reverse powering of remote access equipment; and revisions to various European Standards and accompanying Harmonised European Standards, including deliverables in response to the M/536 under the Radio Equipment Directive (2014/53/EU).

Organized by TC ATTM's Working Group on Sustainable Digital Multiservice Communities (SDMC), a successful online event on standardization perspectives in smart cities and communities was held in April in collaboration with the EUROCITIES network and the Montrouge area in Grand Paris.

Towards Efficient ICT

Working with ETSI's ATTM and EE committees, our Industry Specification Group on Operational energy Efficiency for Users develops standards to minimize power consumption and greenhouse gas emissions of infrastructure, utilities, equipment and software within ICT networks and sites such as data centres and central offices. This includes the measurement of energy usage by servers, storage units, broadband fixed access and mobile access with a view to developing global Key Performance Indicators. Our work also embraces the management of end-of-life ICT equipment.

In cooperation with ICT users (eG4U) and video surveillance specialists PowerEoC Alliance, in 2021 the group continued development of a new report that describes a test plan for IP and Power over Coax Plugtests™. Work also progressed on recommendations to support reuse and full efficiency of ICT networks and services.

User Perspectives

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

In 2021 the committee continued to develop three Technical Reports. The first presents an analysis of user requirements for the Smart Interface and a definition of 'digital clone'. The second demonstrates feasibility of the Smart Interface with a Proof of Concept (PoC). The third offers results of a survey conducted to assess the impact on users of ICT products and services due to the Covid-19 lockdown.

11 BROADCAST, MEDIA AND CONTENT DELIVERY

Smooth transmission

Enhanced content experiences

The worlds of mobile communications, the Internet and broadcasting are already inextricably interlinked. But the standardization of these different areas has traditionally followed different paths, so they do not always interoperate smoothly across. We are addressing the need to align the diverse specifications for content delivery in a converged environment supporting IPTV, mobile TV and broadcast TV to benefit industry and end users.

Broadcasting

ETSI plays a leading role in the development of specifications for technologies that are used globally for radio, television and data broadcasting. Our standardization work in relation to broadcast systems, programme transmission and reception equipment is managed by JTC Broadcast – the Joint Technical Committee that brings us together with the European Broadcasting Union (EBU) and the European Committee for Electrotechnical Standardization (CENELEC). As well as assessing work performed within other organizations, the committee considers broadcast systems (emission and reception) for television, radio, data and other services via satellite, cable and terrestrial transmitters.

In 2021 we accordingly continued to produce and maintain standards and specifications for relevant broadcast platforms and systems. During the year work concluded on development of the Publicly Available Specification (PAS) DASH-IF Content Protection Information Exchange Format that was published as a Technical Specification in April.

Meanwhile we issued revisions to a number of existing standards, Technical Specifications and Technical Reports, variously addressing topics including DVB, DRM, HbbTV and HDR systems for use in consumer electronics devices.

Media Quality

ETSI's technical committee on Speech and Multimedia Transmission Quality (TC STQ) creates and maintains 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, ITU-T and other organizations to support development of specifications for test methods, equipment and performance requirements for use in fixed and mobile telecommunications services.

In 2021 TC STQ published a Technical Report that presents a framework for time-slicing KPIs for RTP (Real-time Transport Protocol) based speech transmission. Describing measurement methodologies and metrics assessing characteristics of RTP-based speech transmission for fixed duration time intervals, this approach can be used to evaluate aspects of speech transmission based on the observed media volume in terms of time units.

We issued a revision of the Technical Specification 'Characterization Methodology and Requirement Specifications for the ETSI LC3plus codec'. This specifies the subjective and objective methodologies developed in cooperation between TC STQ and TC DECT for the characterization of the Low Complexity Communication Codec Plus (LC3plus) speech codec.

Revisions were also published to a number of other specifications, addressing transmission requirements for mobile wireless terminals from a QoS perspective as perceived by the user.

12 PUBLIC SAFETY AND MISSION CRITICAL COMMUNICATIONS

Actionable intelligence

Supporting public safety in every event

At ETSI our standardization work supports public safety via secure, resilient public networks or platforms such as Professional Mobile Radio, as well as the ubiquitous smartphone. Our activities also embrace standards for maritime safety equipment, Personal Locator Beacons to alert emergency rescue services and mechanisms for road safety through the use of Intelligent Transport Systems.

TETRA

Developed to meet the needs of Professional Mobile Radio (PMR) users in public safety, security, transportation, military, governmental, commercial and utilities applications, TETRA (Terrestrial Trunked Radio) is the leading technology choice for critical communications users. The work of our TETRA and Critical Communications Evolution committee (TC TCCE) is principally driven by the requirements of Public Protection, Disaster Relief and other mission-critical services. In 2021 we continued to maintain and further develop TETRA with user-driven standards for authority-to-authority secure voice and data communication services over broadband and narrowband air interfaces. Accordingly, the committee published updates to several Technical Specifications, including revisions to the TETRA air interface standard and testing specifications.

Emergency Calling and Alerting

Our Emergency Communications Technical Committee (TC EMTEL) is focused on users' access to emergency services through different media, data transmission to public safety answering points, networks and IoT (Internet of Things) devices in the provision of emergency situations and in the context of the European Public Warning System.

Much of the committee's work is centred on Next Generation 112 (NG112) services, involving communications between IoT devices in emergency situations. The scope of this activity includes the architecture, core elements and technical interfaces for network-independent access to emergency services. During 2021 we accordingly issued a revision of the NG112 architecture.

Developed in response to the needs of conformance test specifications for vendors, we completed a Technical Specification describing test purposes of the AML (Advanced Mobile Location) for handset equipment. Its publication anticipates enforcement in early 2022 of the Delegated Regulation (EU) 2019/320 to include caller location in emergency communications from mobile devices.

In November we published a Technical Specification, representing complementary specifications to The Pan-European Mobile Emergency Application (PEMEA) specification with PEMEA Instant Message Extension.

Conducted from 22 February - 5 March, the fourth NG112 Emergency Communications remote Plugtests™ gave vendors the opportunity to assess compatibility of products for mission-critical public safety services against different implementations and scenarios, the virtual event was conducted in cooperation with ETSI, EENA, the European Emergency Number Association and NENA, the 9-1-1 Association. Held as a hybrid event from 8-19 November, the 6th ETSI MCX Plugtests™ saw 150 participants execute 1 300 test cases to verify interoperability as defined in 3GPP MCX standards.

13 TESTING AND INTEROPERABILITY

Quality assured

Broadening market opportunities

Technical excellence lies at the heart of ETSI and is central to our members' aspirations. Interoperability is driven by market demand. It is crucial in a multi-vendor, multi-network and multiservice environment and is one of the reasons why we develop standards. It gives users much greater choice of products and allows manufacturers to benefit from the economies of scale of a wider market. Interoperability is therefore a crucial factor in the success of modern technologies – especially in the introduction of new technologies.

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

During 2021 we continued our ongoing support for the development of conformance test specifications for 3GPP. Keeping pace with 3GPP's own release schedule, this work included test specifications for 5G user equipment including smartphones and IoT devices. Similar work took place for oneM2M and our Technical Committee for Intelligent Transport Systems (TC ITS).

CTI oversees ETSI's Testing Task Force process, planning future testing activities and developing a multi-annual roadmap of testing activities requiring ETSI funding. We continued the rollout of the Forge, our repository for managing code used for development of various APIs, standards and test specifications in ETSI committees. We used our experience of Hackathons to help organize four such events for oneM2M, one of which involved thirteen Universities from around the world.

CTI works closely with ETSI's Technical Committee on Methods for Testing and Specification (TC MTS), putting into practice the methodologies and languages developed in TC MTS, such as the TTCN-3 testing language, or TDL, the Test Description Language.

Methods for Testing and Specification

Working with ETSI's Centre for Testing and Interoperability (CTI), our Methods for Testing and Specification committee (TC MTS) creates standards and guides for testing and specification languages.

Providing frameworks and methodologies that enable other ETSI committees to produce documents that are easy to understand and use, our work is critical to the market success of many technologies.

During 2021 TC MTS continued to evolve and maintain our enormously successful testing language, TTCN-3, along with its tool conformance test suites. This was complemented by updates to our Test Description Language (TDL) that fills the gap between the simple expression of 'what needs to be tested' and the concrete coding of executable tests with existing test specification languages such as TTCN-3. We also continued to evolve the associated TDL Open source Project (TOP). This provides a platform to ensure the consistency of TDL standards and accelerate their adoption.

In June the committee announced completion of a set of seven standards addressing the testing of the IoT MQTT and CoAP messaging protocols, and the foundational security IoT-Profile. Together, these new standards fill the gaps for the quality assessment of some of the most relevant communication protocols and system requirements of today's industrial IoT systems using our standardized testing techniques.

Core Network and Interoperability Testing

Interoperability is crucial to ensuring Quality of Service and Quality of Experience in complex end-to-end systems such as Voice over LTE (VoLTE) that bring together Internet Protocol (IP) Multimedia Subsystem (IMS™), packet and circuit switched networks. In ETSI our Technical Committee on Core Network and Interoperability Testing (TC INT) develops core network test specifications for interoperability, conformance, performance and security.

During 2021 work progressed on various deliverables, include network interoperability test descriptions for emergency services over 5G and VoLTE, and E2E (end-to-end) testing and validation of vertical applications over 5G networks and beyond.

In November we published a Technical Report titled 'Federated GANA Knowledge Planes (KPs) for Multi-Domain Autonomic Management and Control (AMC) of Slices in the NGMN(R) 5G End-to-End Architecture Framework'. This provides a mapping and evaluation of architectural components for autonomic network management and control implemented in the EU-funded SliceNet Project to the ETSI AFI Generic Autonomic Networking Architecture (GANA) reference model.

We also issued revisions to various Technical Specifications, including protocols for ISDN/SIP interworking and Diameter conformance testing for Sh/Dh interfaces.

Plugtests™

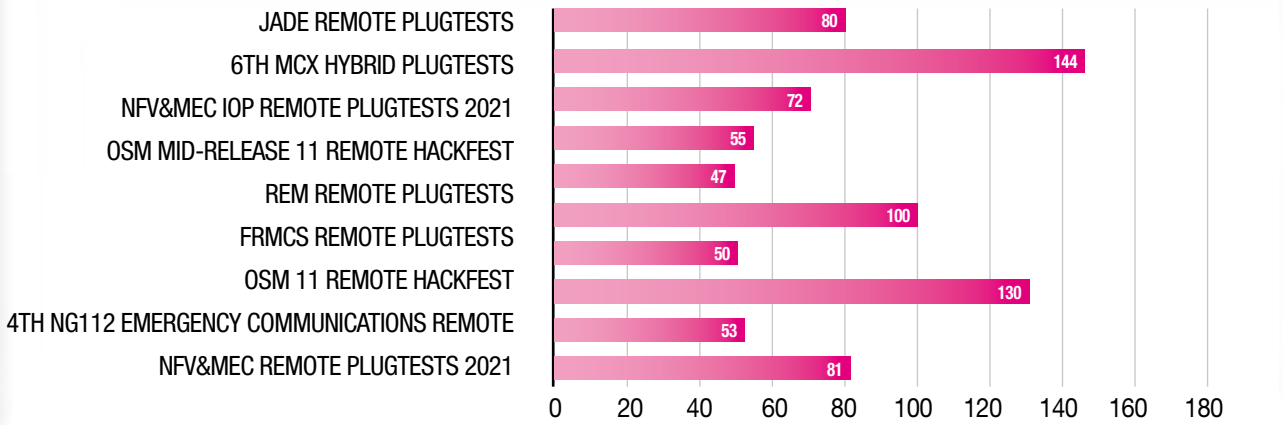
Our industry leading Plugtests™ events allow organizations to connect standards-based equipment –from prototypes to production implementations – to test for mutual interoperability. Plugtests™ provide a practical, cost-effective means of identifying inconsistencies in either an implementation or the standard itself.

Plugtests™ events continued to be held remotely during 2021. While we maintained almost all our planned Plugtests™, the technical scope of some events was necessarily reduced where participants could not travel, notably for events where all equipment needed to be on the same site.

Holding events remotely reduced some barriers to participation. This was reflected in an increased participation level and a broader geographic spread of delegates. In total ten interoperability events were held in 2021, attracting a total of around 1 000 participants. We anticipate continuing to feature remote events in the ETSI Plugtests™ programme alongside our physical events.

Notable firsts in 2021 included the first Plugtests on the Future Railways Mobile Communication System (FRMCS); the first events on Registered Electronic Mail and on JAdES Electronic Signature technology; and the first Hybrid Plugtests, where participants sent equipment to a central location to be connected on a local network while being remotely operated.

Number of participants at the ETSI interoperability events in 2021



Testing to the Edge

Hosted by ETSI from 19-21 October as a virtual event, the 8th User Conference on Advanced Automated Testing (UCAAT) provided a platform for the testing community – including users, vendors, service providers and researchers from different application domains – to share experiences and learn about latest advances in the industrial use of test automation. Titled 'Testing to the Edge', the event included sessions on 5G, AI, security and more.

14 R&D AND INNOVATION

Research and innovation through standards

Fostering cooperative exchange with R&D communities

The implementation of published standards to create new solutions is the output of a process that often starts with grass-roots technological research, conducted in university campuses and research facilities funded by governments, the private sector or the EU.

Today, universities and public/private research institutes represent almost 15% of our 900-strong membership – the highest proportion in ETSI's 30-year history. A central pillar in the ETSI Strategy is the focus on strengthening our close links with academic and research communities. In turn, this provides a continuous path for innovative ideas and research output through to ETSI's pre-standardization activities and onward into standards work in both ETSI and 3GPP. It is this continuous exchange that ensures exciting cutting-edge innovation will be captured in tomorrow's standards – notably for technologies such as 6G – allowing industry to meet the challenging performance requirements that customers can expect from future networks and services.

At ETSI, our own work has always been enriched by close links with the R&D and academic communities. Accordingly, we offer a range of tools and resources to make researchers aware of our activities and to meet their specific needs in support, tools and services.

2021 saw an expansion of our initiatives to deepen connections with innovation communities in Europe and worldwide. We are currently extending our outreach programme to engage with universities and research projects, highlighting the value of standardization and encouraging their participation in our work.

Published in April as a White Paper, the first ETSI Technology Radar describes the most relevant emerging trends which can also identify technologies in support of the innovation community – either through our existing committees and Industry Specification Groups or, if needed, through the creation of new activities in ETSI. The paper has been shared with several global SDOs and associations as well as our own Technical Groups in order to receive input on potential technology trends.

In parallel with this we have continued to monitor the status of EU funding projects such as Horizon Europe, including the newly launched European Smart Networks and Services Joint Undertaking (SNS JU) that aims to ensure industrial leadership for Europe in 5G and 6G. ETSI has also participated in several global B5G/6G conferences and workshops in order to promote the continual exchange and activities with technology innovators, research bodies and universities.

15 PUBLICATIONS, EVENTS AND EDUCATION

Spreading the word

Education about standardization

Highlighting ETSI's lead as the premier body for education and awareness in ICT standardization – and continuing our role in encouraging the new generation of standards people – in 2021 we developed a second edition of our successful textbook and teaching materials. 'Understanding ICT Standardization' has been drafted by university experts in Europe, with content structured to allow modules to be readily used in engineering, business and law courses. The new edition also meets latest accessibility requirements. The first edition has already had more than 1 000 downloads, and the accompanying slide set has been used by over 40 European universities.

Our teaching materials are available online in PDF format at etsi.org/standardization-education. PowerPoint versions are also available on request for those wanting to use them in the context of their own training courses or educational materials.

ETSI continues to follow the activities of the EURAS, SIIT and ICES community. We have provided presentations on request to the TU Berlin. We also provided presentations to the TeamUp5G project, and will be working with the University of Luxembourg for their Masters course.

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. Complementing our other published deliverables, White Papers express the viewpoint of the authors, and do not constitute an official position of ETSI or its members. In 2021 we published six White Papers: all are available for download from our website..

July

#47 Fibre Development Index: Driving Towards an F5G Gigabit Society

May

#46 MEC Security: Status of Standards Support and Future Evolutions

April

#45 ETSI Technology Radar

March

#44 ENI Vision: Improved Network Experience using Experiential Networked Intelligence

#43 Redefining Network Security: the Standardized Middlebox Security Protocol (MSP)

#42 Guidelines for Modelling with NGSI-LD

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.

In 2021 we continued to engage in external events of relevant topics, typically via speaker placements, event endorsements where appropriate, and maintained a virtual stand presence. As in the preceding year, most external events in 2021 were held virtually due to the ongoing pandemic.

See details on events organized, attended and supported by ETSI in 2021 at etsi.org/events/past-events

Webinars

Our successful programme of interactive webinars highlights various aspects of ETSI's work, with high-level overviews complemented by more in-depth exploration of individual technologies. 'Top Ten' webinars during 2021 were:

- DECT 2020: New connectivity standard for industrial IOT
- New era of UWB standards for the European market
- New 3GPP RAN Chair in conversation
- Radio Reconfiguration: ETSI's new approach and related RED regulation
- IPv6 Enhanced Innovation: the IPv6-Only future in the 5G, IOT & Cloud era
- EU Regulatory Over-the-Air RF Performance of mobile phones
- Getting started with the ETSI MEC sandbox
- OSM Release NINE – Achieving the ETSI NFV vision
- ETSI Standards for Radar – Challenges & Learnings
- Welcome to the exciting world of management and charging standardization

Recordings of all webinars can be accessed free of charge via our ETSI BrightTalk channel. If you're not already registered, creating a new account takes just a few moments. See more at etsi.org/events/webinars

Enjoy!

Published four times annually, Enjoy! is the official ETSI magazine. Available free of charge to members and non-members alike, it features news, interviews and opinion from ETSI members, our officials and invited contributors.

Videos

We have expanded our series of promotional videos that offer a fresh, visually appealing perspective on ETSI and its activities. A new video addressing MEC (Multi-Access Edge Computing) was published in July 2021 and has already gained nearly 3 000 views. All videos are easily accessible in the Media Library area of the ETSI website and on our dedicated YouTube channel, along with our Corporate Video that has attracted approximately 50 000 views over the last two years. (https://www.etsi.org/media-library/videos)

ETSI Seminar

Run annually, the ETSI Seminar provides an immersive introduction to ETSI, its organization, structure and ways of working. We have held the 1-day seminar virtually during the pandemic and have also recorded short webinars covering a range of topics for members to enjoy on demand. See etsi.org/events/etsi-seminar

16 PARTNERSHIPS

Achieving success together

Partnership Agreements

To overcome the growing challenges of fragmentation and establish global interoperability, co-operation and collaboration are the best way to ensure alignment between ETSI's own standards and those of other global players. Such collaboration avoids duplication of effort and helps ensure that ETSI's deliverables are widely accepted and implemented. The establishment of partnership agreements with fora, consortia and international and regional Standards Developing Organizations around the world is one of the key mechanisms we have adopted in working with others. By the end of 2021 our partnership portfolio numbered over 100 agreements.

In 2021 ETSI renewed co-operation agreements with the 5G Automotive Association (5GAA), GSM Association (GSMA), NGMN Alliance (NGMN), Society of Cable Telecommunications Engineers (SCTE) and TCCA Ltd. Memoranda of Understanding were also renewed with the Accredited Conformity Assessment Bodies' Council (ACAB'c), Augmented Reality for Enterprise Alliance (AREA), Broadband India Forum (BIF), DECT Forum, Digital Mobile Radio Association (DMR Association), Global Certification Forum (GCF), OBE S.A.S., ULE Alliance and Wireless Innovation Forum (WInnForum).

Beyond renewing and nurturing existing partnerships, ETSI established new relationships with actors in the ICT market as well as industry sectors leveraging ICT. These included co-operation agreements with O-RAN Alliance (with an intent from O-RAN to offer some of their specifications for ETSI adoption through the Publicly Available Specification process) and China Communications Standards Association (CCSA) (replacing the former Memorandum of Understanding between the two organizations) and a Memorandum of Understanding with the Asia PKI Consortium (APKIC) as both organizations work on PKI schemes and need to be able to exchange information and drafts to foster harmonization of PKI practices.

Working with the European Commission and EFTA

ETSI 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.

Strategic Dialogue with the EC and EFTA

The concept of a strategic dialogue with the EC and the European Free Trade Association (EFTA) was formalized a few years ago by DG GROW and ETSI. It was decided to discuss standardization subjects with a policy and institutional focus, and more generally the role of ETSI as an ESO. This dialogue evolved in 2021 to include the Chairs of ETSI's General Assembly and Board, as well as DG CONNECT on the EC side. This dialogue includes topics such as: policy and regulatory initiatives (for example, how ETSI can contribute to policy areas such as the twin transition, or the upcoming standardization strategy); the financing of ETSI (FPA, operating grant, action grants); Harmonised Standards - international cooperation/ETSI global role and cooperation with CEN-CLC.

Committee on Standards

ETSI participates as an observer in meetings of the Committee on Standards (CoS). Highlights of the July 2021 meeting included a statement by DG GROW that the CoS is key for Standardization Requests, but that the EC would like to discuss more strategic subjects and the functioning of the European Standardization System. Information was also provided on the status of publication of Harmonised Standards in the OJEU and functioning of the HAS Consultants system.

Multi-Stakeholder Platform

The European Commission's ICT Multi-Stakeholder Platform (ICT-MSP) held meetings in January, April and September 2021. Meetings were mostly focused on presentations from the EC of policy and regulatory initiatives and follow up discussion on the status and planning of the ICT Rolling Plan, the status and planning of Stand-ICT, presentations from members and discussions on Standardization Requests.

3SI Programme

Through its 3SI (Societal Stakeholders and SMEs inclusiveness) Programme, ETSI's GA and Board Chairs, Director-General and Secretariat met with representatives of the EC, EFTA and the organisations recognized in the context of Annex III of EU Regulation 1025/2012. The Annex III organizations receive financing from the EU and EFTA to represent the interests of Consumers, Environment and Labour as well as those of the SMEs. Naturally in ETSI there is also direct involvement of such stakeholders, but the Annex III organisations can provide an additional channel about inclusiveness. An Advocate for such matters has been nominated, helping push for the enhancement of ETSI tools for use by societal stakeholders and SMEs. In the context of the Board Strategy group focusing on Regulation, Policies and the Landscape and Ecosystem of Standardisation (REGPOLES), ETSI and the Annex III organisations reviewed the 3SI programme in the first half of 2021, the implementation of which is currently being prepared in REGPOLES.

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)

Despite continuing challenges of the Covid-19 pandemic, the SESEC team led by Betty Xu remained focused on the fast evolving regulatory and standardization landscape in China. SESEC monitored and analyzed different pieces of legislation such as the Data Security Law (June 2021), the Personal Information Protection Law (August 2021), the Regulations on Security and Protection of Critical Information Infrastructure (August 2021) and the National Standardization Development Outline (September 2021). SESEC also contributed to the studies on Association standards carried in the scope of the InDiCo project. Webinars to provide information and trainings were held on EU standardization. A new website was launched in January. covid The SESEC Steering Committee has focused on the planning for the last year of operations and the architecture of SESEC 5, which should be running from 2022 to 2025, after an extension (at no cost) of 6 months was triggered. The SESEC participated in two sessions of the Board in January and October, where she proposed focus subjects for SESEC 5.

SESEC Newsletters and subject specific reports are available from the Secretariat or directly at sesec.eu.

SESEI (Seconded European Standardization Expert in India)

The SESEI project is currently in its fourth iteration, with continued support to the five partners in the project: EC, EFTA, CEN, CENELEC and ETSI. The SESEI team led by Dinesh Chand Sharma is a cornerstone in the EU's ability to connect with Indian players, within the government as well as within the industry, to promote European standardization in India. The SESEI Steering Committee met virtually in March and in September 2021. As a consequence of the Covid-19 pandemic the budget is underspent to some extent: project partners are thus evaluating the possibility of a no-cost extension of the project, building on the 2020 and 2021 savings. This takes place in the broader context of the preparation of a fifth phase of the project, aiming at a seamless continuation of activities until August 2023. The Steering Committee is also considering results of a stakeholder survey in summer 2021 to shape technical proposals for this fifth phase. Monthly newsletters and quarterly reports giving a detailed overview of SESEI activities are available at sesei.eu

International Digital Cooperation on ICT Standardization (InDiCo)

As part of its Foreign Policy Instrument, ETSI manages a project on International Digital Cooperation for ICT standards (InDiCo) under a grant from the European Commission. The project's scope covers a wide geographical area: Brazil, China, India, Japan, South Korea and the United States. It aims to build bridges between technical communities and policy makers on topics relating to the Digital Single Market and related ICT standardization priorities as defined in the 2016 EC Communication – 5G, IoT, Cloud, Big Data and Cybersecurity – as well as ITS and Distributed Ledger Technologies. A goal is to enhance cooperation on ICT standards and align policies and regulations, leading to wider adoption of common standards. As project coordinator, ETSI gathers and involves stakeholders in Europe and in the partner countries for events and exchanges. In 2021 the team delivered several events and activities in virtual format due to ongoing

constraints of the pandemic.
The further extension agreed over Summer 2021 led to the creation of an extended work programme based on stakeholders' inputs and consistent with previous activities, with the project now anticipated to run until end of May 2022. In 2021, the project delivered 6 research studies, 10 conferences and workshops, 9 industry and technical events, 1 training module on standards and 2 videos.

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

ETSI maintained its presence in India, both as a partner in the India-EU project on ICT standardization collaboration and in the SESEI project where ETSI, TSDSI and the Delegation of the European Union in India are the three main stakeholders. The EU-India project on ICT standardization collaboration (indiaeu-ictstandards.in) was extended until February 2023, retaining its focus on capacity building through the establishment of Centres of Excellence. Two webinars were held in the first part of 2021, on visible light communications and on Open Air Interface. All previous sessions can be viewed on the project website. Together they are enabling visibility of technology standards answering the needs of India by leveraging work performed at a global level as well as in Europe. Urging the need to avoid fragmentation in the 5G space with a single and global standard, ETSI highlights the benefits of 5G for industry sectors.

National Standards Organizations (NSOs)

The NSOs and ETSI use their meetings to review common procedures and documentation. These meetings present the data regarding the production of ENs by ETSI and the related transposition effort by the NSOs.

In 2021 ETSI's support team produced an updated version of the NSO guide to include information to the IT and data tools provided to assist the NSOs in their role.

17 SPECIALIST TASK FORCES AND OTHER FUNDED PROJECTS

Specialist Task Forces and Testing Task Forces

Specialist Task Forces (STFs) are expert teams established under the direction of an ETSI committee to work together for limited periods on specific technical work. In this way, STFs are therefore able to accelerate the development of urgently needed standards or support strategic activities required by our members or by the European Commission (EC) and the European Free Trade Association (EFTA.

A similar mechanism has been adopted to support 'Funded Projects' for the Third Generation Partnership Project (3GPP™) and oneM2M partners.

Funding sources in 2021	
ETSI	36.1%
3GPP Partners	20.6%
EC/EFTA	34.1%
3GPP Members	9.2%

At last some resources are also allocated from ETSI budget to fund projects aiming at reviewing and streamlining internal processes.

Technical areas in which funded resources were spent in 2021		
Technical Areas	**Financial Investment (k€) In 2020**	**%**
3GPP Partners	703	28.2%
Centre for Testing and Interoperability	336	13.5%
Intelligent Transport Systems (ITS)	280	11.2%
Railway Telecommunications (RT JTFIR))	251	10.1%
Human Factors (HF)	149	6.0%
Smart M2M	117	4.7%
Multi-access Edge Computing (MEC)	114	4.6%
EMC and Radio spectrum Matters (ERM)	77	3.1%
Electronic Signature (ESI)	49	1.9%
Network Functions Virtualization (NFV)	48	1.9%
Speech and multimedia Transmission Quality (STQ)	30	1.2%
Voluntary	338	13.6%
TOTAL	**2493**	

Figures are rounded to the nearest k€

Altogether, 30 STFs and other funded projects were active in 2021, involving 80 service providers for a total spend of about 2,49 M€. Voluntary contributions equivalent to 0,34 M€ were provided by 3GPP Members.

Testing Task Forces (TTF) are teams established to support the Reference Bodies and accelerate the production of testing and methodology standards.
TTFs give ETSI a competitive advantage by making readily available the technical competences necessary to quickly develop testing and methodology standards needed by the market.

TTFs are established and managed by the ETSI Secretariat under the authority of the Director General, based on a technical roadmap and a multi-annual plan developed and maintained by ETSI's Centre for Testing and Interoperability (CTI), in consultation with the ETSI Board and OCG.

Testing Task Forces are 100% funded via ETSI budget.

Technical areas in which funded resources were spent in 2021

Technical Areas	Financial Investment (k€) In 2020	%
Methods for Testing and Specification (MTS)	154	22.7%
Smart Card Platform (SCP)	142	20.9%
Speech and multimedia Transmission Quality (STQ)	71	10.4%
Digital Enhanced Cordless Telecommunications (DECT)	65	9.6%
Core Network and Interoperability Testing (INT)	53	7.8%
Multi-access Edge Computing (MEC)	48	7.1%
Network Functions Virtualization (NFV)	43	6.3%
Network Functions Virtualization (NFV)	37	5.4%
Cross-cutting Context Information Management (CIM)	35	5.2%
Intelligent Transport Systems (ITS)	35	5.2%
Emergency Communications (EMTEL)	31	4.6%
TOTAL	**679**	

Figures are rounded to the nearest k€

EC/EFTA Funding

In 2021, substantial organizational changes were implemented at the EC level. One of the most impacting modifications introduced is the EC having entrusted the European Innovation Council and SMEs Executive Agency (EISMEA) to manage actions grants starting 1st of April 2021.

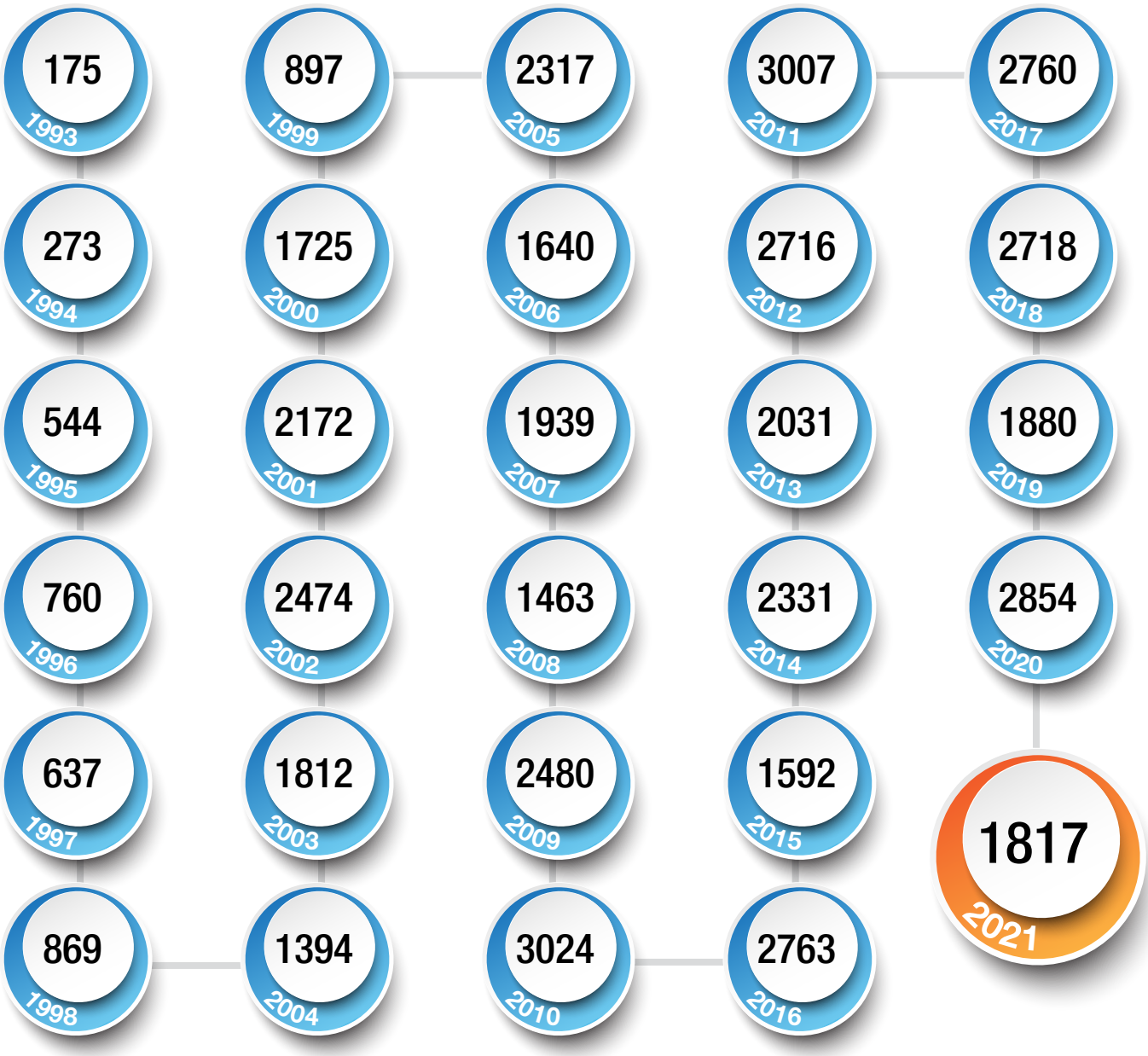
The agreements already in progress were transferred to EISMEA during April, whereas the framework and conditions for sending new technical proposals were not set up until the very end of 2021. After months of discussions, the EC services concluded that no Framework Partnership Agreement would be signed for Actions Grants funding.

The standardization action grants already signed before 2021 continued to be operated under the lump sum financing system, still based on the 2020 index as the Commission Financing decision on lump sum expired on 31st December 2020, and no new model replaced it. It is expected that the future action grants will be executed under the actual cost model as before 2015.
Though one proposal was positively evaluated by the EC in early 2021, because of the new split of responsibilities between EISMEA and the EC, this proposal could be sent to EISMEA evaluation under the new required format only at the end of November.
Apart from this proposal for which the evaluation by EISMEA was pending at the end of the year, no technical work could be EU-funded in 2021.

Concerning the financing of ETSI operations as a standardisation platform eligible to Operating Grant, a new Framework Partnership Agreement was signed at the end of June. It has a four-year duration.
After the deadlines for submission and evaluation were extended several times by the EC, ETSI could formally submit its Work Programme for a 2021 Operating Grant at the end of June. It was positively evaluated by the EC/EFTA at the end of September, and the eligible costs were accepted, and the funding rate allows ETSI to receive a maximum of 1830 k€ subsidy in 2021.

We reported and achieved 87% payment of the 2020 Operating Grant initially allocated after the negative impact of some underachieved KPIs.

18 STANDARDS PRODUCTION AND IPR



Technical areas in which funded resources were spent in 2020		
Technical Specification (TS)[1]	1 566	42 074
Technical Report (TR)[2]	64	4 232
ETSI Standard (ES)	12	868
European Standard (telecommunications series) (EN)[3]	60	5 227
ETSI Guide (EG)	0	257
Special Report (SR)	4	113
Group Specification (GS)	69	455
Group Report (GR)	42	153
TOTAL	**1 817**	**53 379**

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)

Intellectual Property Rights

The ETSI Intellectual Property Rights (IPR) Policy continues to be widely referenced in the international standardization environment. ETSI maintains a public database of patents as well as patent applications that are disclosed by their owners in the belief that these patents or applications may be or may become essential to an ETSI standard. This IPR database is recognized as unique, and one of the most complete in the ICT sector. ETSI is constantly enhancing the database for greater accuracy and completeness. Consequently, ETSI is renewing its fruitful cooperation with the European Patent Office (EPO), and also liaising with other organizations to improve the transparency and fluidity of access to these Standard Essential Patents (SEP).

The bulk upload of SEP in the database is in place, and is widely used worldwide by the declarants, easing the declaration process. Declarants have also now the possibility to make electronic declarations. As already mentioned, the Special Report includes all the reflected declarations/disclosures information in a single file. Additionally, it features reports and graphs giving a status overview of the IPR database, together with other information including aggregate numbers for declarations/disclosures, standards, patents and patent families, tables and charts – for example about patent families declared over mobile generations and age distribution. This Special Report is updated every month.

19 BUDGET REPORT AND FINANCIAL STATEMENTS

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 68, has audited the 2021 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 2020, income remained relatively stable (+ 70k€) while expenditure increased by 2,1 % 447 k€. After having made provision of roughly 33 k€ for Income Tax to be paid and of 2 175 k€ in credit notes to be issued to Members to offset the excess of income over expenditure, the net surplus of the year is 83 k€. This compares with a net surplus of 86 k€ in 2020.
The key points of the budget management are the following:

Income

Members' contributions (18,28 M€ before credit notes) were 5,3 % over budget and increased by 0,7% compared with 2020. They funded roughly 83% of the budget. European Commission (EC)/European Free Trade Association (EFTA) funding amounted to roughly 3 M€ to cover expenses related to the operation of the European standardization platform, and standardization projects including International Digital Cooperation.

3GPP Partners contributed 1,7 M€ corresponding to their share to the project according to the funding formula in force and taking also into account the impact of the significant 2020 carry-forward.

Expenditure

Secretariat costs were 13,3% under budget and higher by 2,1% compared with 2020. The significance of this cost reduction mostly stems from the Covid-19 pandemic that prevented from holding any activity requiring physical presence. Since October 2020 and until August 2021 the buildings were in lockdown, generating significant underspend. The 2021 events and meetings were all held virtually reducing their overall cost. Only few travels resumed in the 4th Quarter.

Staff resources were reinforced by a net addition of one permanent headcount, and two temporary contracts. In 2021 four staff members left the Institute to go on retirement and the associated legal indemnities have been accounted for in the 2021 accounts.

3,4 M€ were spent acquiring expertise for Specialist Task Forces and other standardization-related technical expertise.

2020 Budget Statements

2021 Budget Statements INCOME	
Income	k€
Members' contributions and Observer fees net of credit notes	16 102
EC/EFTA contracts	3 024
3GPP™ Partners	1 702
Voluntary contributions	338
European Friends of 3GPP	0
Sales	85
Financial income	22
Other income/carry forward	814
TOTAL INCOME	22 088

In 2021, there was a net surplus of 83 k€.

2021 Budget Statements EXPENDITURE	
Income	k€
Secretariat staff costs	13 791
Other Secretariat costs	4 056
Special projects	568
European Friends of 3GPP	0
Provision and losses	221
Experts' costs	3 368
TOTAL EXPENDITURE	22 005

In 2021, there was a net surplus of 83 k€.

Financial Statements for the Year 2021

The final accounts and the balance sheet are summarized below.
The fiscal accounting period is 1 January 2021 – 31 December 2021.

Statement of Income and Expenditure Year 2021		
	Income (€)	Expenditure (€)
Income	22 173 198	
Purchases		7 196 145
Expenses		14 882 897
Financial income and expenses	22 345	3 601
Extraordinary income & expenses	3 850	1 432
Income Tax		
TOTAL INCOME	22 199 393	22 116 745

There was a net surplus of 82 648 € in 2021.

Summary of the Balance Sheet

Assets		
Net amounts at:	31 Dec 2020 (€)	31 Dec 2021 (€)
Fixed assets	4 928 683	5 222 956
Debtors	15 408 567	13 617 188
Securities/cash	16 878 031	18 072 800
Prepaid expenses	359 216	403 273
TOTAL ASSETS	37 574 496	37 316 216

Figures are rounded to the nearest €.

Liabilities		
Net amounts at:	31 Dec 2020 (€)	31 Dec 2021 (€)
Equity	8 988 164	9 038 542
Provisions	303 296	367 801
Balance carried forward	50 378	85 613
Surplus of the year	85 613	82 648
Creditors	7 865 978	10 584 752
Deferred revenue	20 281 067	17 156 860
TOTAL LIABILITIES	37 574 496	37 316 216

Figures are rounded to the nearest €.

20 ETSI FELLOWSHIP PROGRAMME

Distinguished service

Recognizing an outstanding personal contribution

Our 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 a member organization may propose a candidate for an ETSI Fellowship. Candidates must have been proposed by representatives of at least two members. Fellowships are awarded each year by an Award Committee composed of the ETSI General Assembly Chair and Vice Chairs, the ETSI Board Chair and the ETSI Director General.

In 2021 we honoured Gabrielle Owen, Charles Brookson, Nurit Sprecher, Hans Wilhelm Gierlich, Jamshid Khun-Jush and Anthony Wiles as ETSI Fellows for their outstanding personal contributions.

Gabrielle Owen

Dr. Gabrielle Owen is Coordinator Engineering for Spectrum Management, Radiocommunications Agency NL, Ministry of Economic Affairs and Climate, the Netherlands and an ETSI Board member. More than 400 deliverables were published during her chairship of TC ERM, including many Harmonized Standards under the Radio Equipment Directive and documents which were submitted to CEPT/ECC relevant group to request the use of radio spectrum.

Nurit Sprecher

Nurit Sprecher, Head of Management, Virtualization & Application Enablement Standardization, Nokia, initiated and led the ETSI ISG MEC, successfully positioning the multi-access edge computing technology as a key building block and enabler for 5G, IoT and mission-critical, vertical solutions. She has driven a powerful industry effort with the ETSI MEC and 3GPP SA6 groups to create a synergic edge computing architecture, to avoid industry fragmentation and to accelerate time-to-market.

Charles Brookson

Charles Brookson OBE CEng FIET FRSA is Director of Zeata Security. He has been involved in security since the late 1970s. Within ETSI he helped set up TC SEC, then TC LI, and became Chair of OCG Security to coordinate security within ETSI. He was the first Chair of TC CYBER and continues to participate in security initiatives, meetings and workshops.

Hans Wilhelm Gierlich

Dr.-Ing. Hans Wilhelm Gierlich, Managing Director Telecom Division, HEAD acoustics GmbH, Germany, is mainly involved in acoustics, speech signal processing and its perceptual effects, QoS & QoE topics, measurement technology and speech transmission quality. He is active in ITU-T, 3GPP, GCF, IEEE, TIA, CTIA, DKE and VDA. He is currently Vice Chair of ETSI TC STQ. He holds five patents.

Jamshid Khun-Jush

Dr. Jamshid Khun-Jush is Vice President, Technical Standards, Qualcomm CDMA Technologies GmbH, Germany and an ETSI Board member. As the chair of ETSI TC BRAN he was the key driver behind the global harmonization of OFDM technologies for broadband wireless LANs and MANs. He has also actively contributed to Harmonised Standards for Radio LANs as well as for Intelligent Transportation Systems and spectrum sharing techniques.

Anthony Wiles

Anthony Wiles, former Director of the ETSI Centre for Testing and Interoperability, was deeply involved in the development of the widely used testing methodology ISO/IEC 9646. He was leader of the ETSI Task Force that developed the test specification language TTCN-3, which became the cornerstone of 3GPP RAN5 UE conformance testing. His legacy is an ETSI Secretariat resource that is unique in the world of standardization.

During the 45th meeting of the Wireless World Research Forum, in 2021 ETSI Chief Technical Officer Adrian Scrase was honoured for his contribution to the development of mobile communications standards, and for his longstanding support of the work of WWRF. In his leading role at ETSI Adrian has played a central role in the development of 3GPP and its acceptance as a global standard.

21 MEMBERSHIP

Membership

Overall ETSI membership decreased by roughly 1% in 2021. At the end of the year, we had a total of 948 members, drawn from 64 different countries and provinces across five continents. This was made up of 773 full members drawn from 42 European countries, 165 associate members drawn from 19 non-European countries and 10 observers from 1 European and 1 non-European country. 144 of our members are Small and Medium-sized Enterprises (SMEs) and 84 are Micro-Enterprises. Small organization members represent roughly 25% of the overall membership. 50 resignations were received during the year and are effective 1st January 2022.

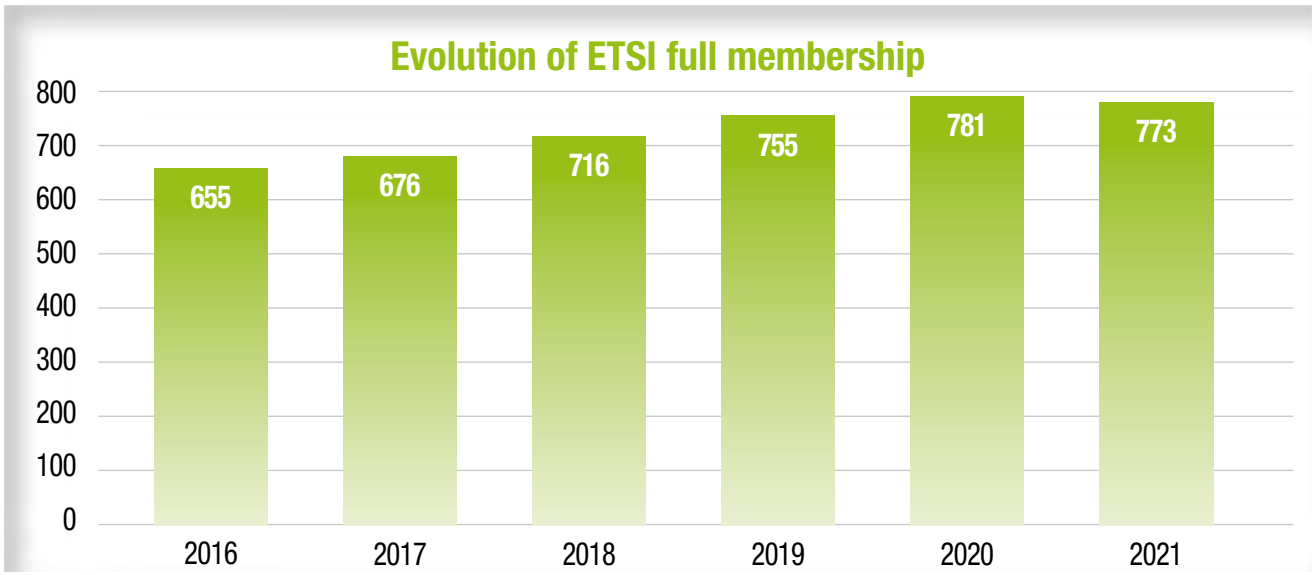
The European Commission and the European Free Trade Association Secretariat, which hold the role of Counsellors, attend the General Assembly and the ETSI Board and continue to play an active part in our work.

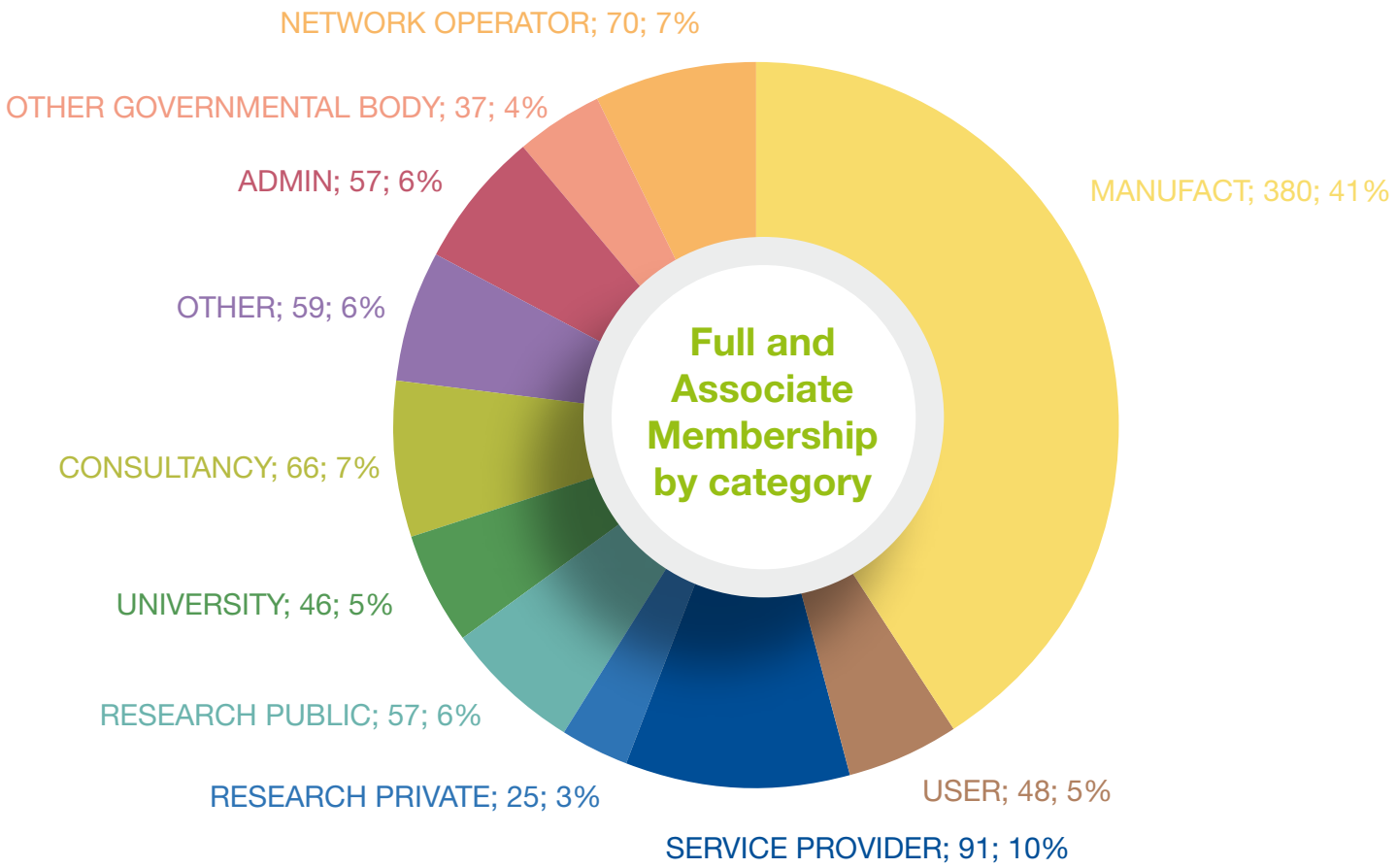
Collection of contribution invoices in 2021 was performed with a rate of 99,36% of recovery.

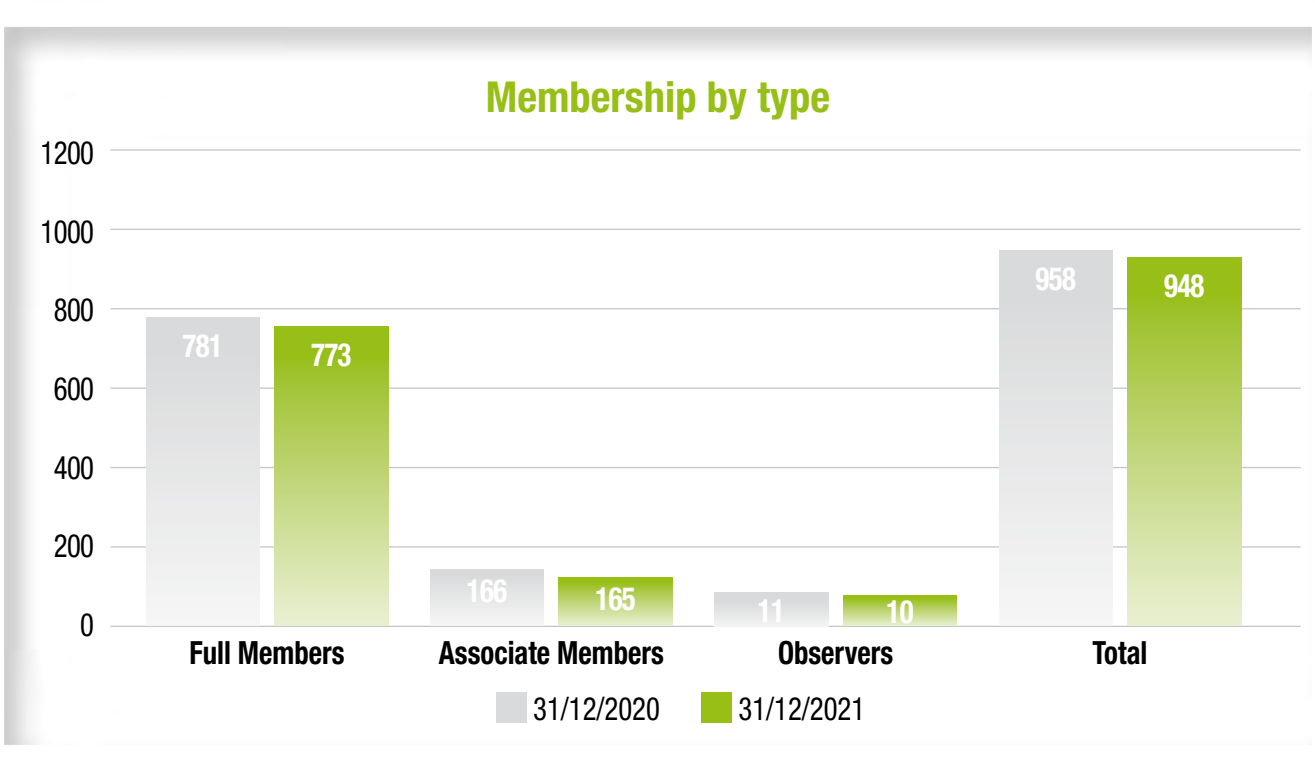
One of the utmost priorities is the development of the ETSI Membership base, gathering a diverse, vast and innovative community for the development of world-class ICT standards by reaching out to different vertical sectors.

It is also in the DNA of ETSI to respect the broad diversity of the ICT players and offer as much inclusiveness as possible. A specific module 'Key benefits for small organizations' for the newly created online ETSI Seminar has been produced. See more at etsi.org/events/etsi-seminar

To ensure that the Members can enjoy a quick start when joining ETSI, a new on-boarding programme has been deployed in 2021. This aims to improve new ETSI members' experience and to inform them of the tools, working methods and benefits of ETSI facilitating their first steps within the ETSI community.




NETWORK OPERATOR; 70; 7%
OTHER GOVERNMENTAL BODY; 37; 4%
ADMIN; 57; 6%
MANUFACT; 380; 41%
OTHER; 59; 6%
Full and Associate Membership by category
CONSULTANCY; 66; 7%
UNIVERSITY; 46; 5%
RESEARCH PUBLIC; 57; 6%
RESEARCH PRIVATE; 25; 3%
USER; 48; 5%
SERVICE PROVIDER; 91; 10%


Membership by type
1200
1000
800
600
400
200
0
781
773
166
165
11
10
958
948
Full Members
Associate Members
Observers
Total
31/12/2020
31/12/2021

22 JOIN OUR COMMUNITY

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.

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ETSI
The Standards People

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