ANNUAL REPORT 2022

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 938 members drawn from 63 countries (end 2022). These include world-leading companies from the manufacturing and service sectors, regulatory authorities and government ministries, as well as small/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 excellence of our work and our open approach sees ETSI's influence extend beyond Europe to the whole world.

This Annual Report highlights a few of our many achievements during 2022. 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 see more about our current and planned activities in the ETSI Work Programme 2023-2024.

DESIGNING TOMORROW'S WORLD

'*Designing tomorrow's world*' is ETSI's 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. To deliver this vision ETSI follows 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 support 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.

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01 THE YEAR AT A GLANCE

2022 in brief

ETSI MEMBERS:
938 from
63 countries,including
22% SME/micro-enterprises and
13% universities/researchers

TECHNICAL GROUPS:
100+

EMEETINGS:
2 291,
representing
37 017
eParticipants

January

- OSM#12 Hackfest
- 2nd EU-Japan workshop on beyond 5G standards
- White Paper 48 – An Introduction of Permissioned Distributed Ledger (PDL)
- MoU with PKI Consortium

February

- Launch of new education programme for next generation of ICT standards professionals

March

- ETSI, CEN, CENELEC and ENISA host 6th cybersecurity standardization conference
- ETSI celebrates International Women's Day

April

- 2022 ETSI Fellows announced
- oneM2M celebrates 10th anniversary
- C-V2X Plugtests event achieves 93% interoperability success rate

May

- Official launch of Open Source Group TeraFlowSDN
- ENISA/ETSI joint workshop on EU requirements for identity proofing
- First specification released on F5G network architecture
- MoU with Bureau of Indian Standards

June

- OSM Release TWELVE published
- ETSI, ITU and UN Environment Programme celebrate EU Green Week
- White Paper 49 - MEC Federation

PLUGTESTS™ INTEROPERABILITY EVENTS:
9

PARTNERSHIPS:
100+

PUBLICATIONS:
3 359

STANDARDS DOWNLOADS:
16 091 344

ETSI SECRETARIAT:
129 people /
24 nationalities

July

- eSignature validation Plugtests event

September

- First O-RAN specification published
- Second edition of White Paper 46 - Multi-Access Edge Computing security
- White Paper 50 on Fixed 5th generation advanced
- MoU with OpenID Foundation
- 9th ETSI UCAAT conference, Munich

October

- ETSI IoT Week
- MoU with Bureau de normalisation ferroviaire (BNF)
- First TeraFlowSDN Hackfest
- ETSI Security Conference
- ETSI Workshop on Education about Standardization

November

- Establishment of Software Development Groups
- Mission Critical Plugtests™ event reports 96% success rate
- Speech and multimedia transmission quality workshop, Bratislava
- New Chair and Vice Chairs of General Assembly elected

December

- Industry Specification Group on Terahertz launched
- White Paper 52 on ETSI Activities in Artificial Intelligence and forthcoming EU legislation
- OSM Release THIRTEEN published
- Milestone of over 3 300 ETSI publications in 2022 – highest yearly figure in three decades

02 FROM OUR OFFICERS

In review

Neviana Nikoloski
Chair of the General Assembly

The commercial and societal success of the European standardization system is recognized globally. Its influence is evident in the thousands of standards and specifications that are implemented – both in Europe and further afield – in a huge range of technologies and applications, from mobile, wireless and fixed networks to transportation systems, machine-to-machine communications, cybersecurity and much more. Of direct benefit to European citizens through the availability of interoperable, reliable, affordable and energy-efficient products and solutions, these same standards mark the outputs of a unique partnership between the European Commission, Member States, National Standards Bodies and other stakeholders.

Recognized by the European Union as one of three European Standards Organizations (ESO) under Regulation 1025/2012, ETSI's work supports the policies of the EU and the European Free Trade Association (EFTA). This is manifested in the production of standards to support European legislation as defined in EU Regulations, Directives and Decisions.

The enduring strength of any relationship depends on regular review and continuous improvement by all parties. In February 2022 with the presentation of the EU Standardisation Strategy, the European Commission announced its intention to improve the governance in the European Standardisation System and to amend Regulation 1025/2012, notably in regard to the process via which standardization requests are responded to.

Formally adopted in December 2022 as Regulation (EU) 2022/2480, this amendment starts application in July 2023. Therefore, a primary focus of ETSI's energies in 2022 has been to ensure that own organizational structure and operating procedures are improved where needed for ensuring full compliance with the requirements of Regulation (EU) 2022/2480. These initiatives are reflected in the ongoing ETSI action plan – under the direction of our Board and General Assembly – to examine and optimize our own rules, procedures and corporate governance to address the newly introduced requirements to the ESOs.

Equally, ETSI continued its work within the Task Force established by the EC, EFTA and the three European Standardisation Organisations (CEN, CENELEC and ETSI) in May 2021, on the development of solutions and process improvements of the European standardisation system enabling timely delivery of European standards for a green, digital and resilient single market. I am personally delighted by the progress already achieved by this Task Force in enhancing the responsiveness, quality, agility and speed of standards development through an enhanced collaboration and improved process efficiency. A tangible output of this work will be the acceleration in the citation of standards produced by all ESOs in the Official Journal of the European Union.

Dirk Weiler
Chair of the Board

It's almost impossible to ignore the prevailing ICT industry journey toward 'softwarization', where system functionality is performed by computer code rather than physical hardware. Telecoms operators and infrastructure providers have been quick to embrace the agility and cost efficiency of this paradigm. Indeed, it is the driver for innovations such as network virtualization that are central to the design, orchestration and management of today's – and tomorrow's – mobile and fixed networks that are increasing exponentially in their size and complexity. This inescapable industry shift raises far-reaching questions about the role of standardization, the blueprint for industry agreement between customers and suppliers on the specification and performance of software-based solutions.

In ETSI many of our members write code rather than building hardware to meet their customers' requirements. You'll see this reflected in the growing number of APIs and other totally software-based entities within our own portfolio of standards, technical specifications and related deliverables.

This process of software development is often a collaborative effort, frequently drawing on open source techniques to ensure a product's quality, demonstrable interoperability and market timeliness.

In 2022 a number of ETSI members expressed their interest in setting up an Open Source Group to implement the results of the EU-funded TeraFlow 5G PPP research project, leading to the creation in May of our OSG TeraFlowSDN. Based on extensive discussion and consultation, we have created the necessary rules in our directives for the establishment and governance of such Software Development Groups. Approved by our General Assembly at the end of 2022, these rules now enable our members to create collaborative as well as open source software within ETSI in line with our IPR policy.

As reflected in our strategy, ETSI aims to maintain and strengthen its strategic position through a number of Key Strategic Directions, which demands continual examination and optimization of our own internal procedures and governance. Building on our and the European Commission's Standardisation Strategy, the Board started an extensive review of ETSI's governance and inclusiveness, leading to first results like the approval of an ETSI Accessibility Policy by the General Assembly and expected changes to our governance in 2023.

Luis Jorge Romero
Director General

The inspiring spark of an idea that leads to the development of a new technology standard can happen within the privately-funded research labs of a commercial company. Equally, it frequently occurs in the science and engineering faculties of our universities.

At ETSI we take pride in our close links with the academic world. This is exemplified by our rewarding cross-fertilization of ideas and innovation with R&D communities, including many leading universities and teaching institutes in Europe and further afield.

As a centre for excellence in standardization, we recognize the importance of taking concrete actions to help nurture the next generation of standards professionals. This commitment was emphasized in February 2022 by the launch of ETSI's new suite of digital teaching materials, intended to introduce students to the theory and practice of ICT standardization.

A centrepiece of this initiative is a radically revised edition of our textbook, originally published in 2018 with the support of the European Commission and the EFTA Secretariat. Recognizing that standardization is essential fuel for the ICT industry's commercial success, these materials are also accessible to students studying science and engineering as well as law, business and other non-technical subjects. Removing barriers to wider understanding of what's often regarded as an opaque discipline – and to convey our own passion as standards practitioners – this unique resource draws on the deep technical expertise of ETSI members and respected European academics. In October we celebrated this landmark resource with a special workshop at our Sophia Antipolis headquarters, attracting an audience of standards organizations, professors and IP experts.

Underlining our role in fostering a new generation of standards people, in 2022 we also created a series of online lectures for students at the University of Luxembourg who are pursuing a newly-created Master's degree programme that embraces smart ICT, standardization and digital trust.

Elsewhere in this Annual Report you'll find ample demonstration of ETSI's enduring role in channelling raw inspiration into robust standards that benefit citizens with more reliable, secure and affordable products to enhance their daily lives. Reflecting the energy and commitment of our members, this is reflected in the publication of over 3 300 ETSI standards, specifications, reports and other deliverables in 2022 – the highest number in our 30+ year history.

03 3GPP AND 5G

Always advancing

Release 18 activity intensifies

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.

The functional freeze of Release 17 in March 2022 marked the first – and only – 3GPP release to be completed remotely in its entirety. With travel restrictions still widespread in the aftermath of the Covid pandemic, work was conducted exclusively via email discussions and online meetings. Release 17 highlights include:

- Sidelink enhancements
- Reduced capability NR devices
- NR operation extended to 71GHz
- Further enhancements on MIMO for NR
- NR over Non-Terrestrial Networks (NTN)
- IoT over NTN
- UE power saving enhancements for NR
- Enhancements to integrated access and backhaul for NR
- Enhancement of RAN slicing for NR
- RF requirements enhancement for NR FR1
- RF requirements for NR FR2
- Coverage and positioning enhancements
- NR and slicing QoE
- Enhanced support of non-public networks
- Support for uncrewed aerial systems
- Support for edge computing in 5GC
- Proximity-based services in 5GS
- Access traffic steering, switch and splitting
- Network automation for 5G (Phase 2)

Meanwhile work on Release 18 intensified during the year, with the first official 5G-Advanced release becoming the main focus of 3GPP activity from June onwards. Following the completion of content definition and prioritization in December 2021, Working Groups were able to proceed with Release 18 Stage-2 work from February 2022.

Release 18 Stage 3 functional freeze is scheduled for December 2023. While detailed Release 19 work will not begin until after TSG workshops in mid-2023, Stage-1 groups are now in the study phase, where new functionality and items not already completed in Release 18 are being considered for inclusion and prioritization.

The return of physical face-to-face meetings culminated in November 2022 with the largest standards gathering since the Covid-19 pandemic took hold, with over 2 000 delegates attending a 'mega-meeting' of Working Groups in Toulouse.

At the end of 2022, of the 817 member organizations of 3GPP, 460 (56%) were via their membership of ETSI.

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

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

Deepening 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

Celebrating its 10th anniversary in 2022, oneM2M (onem2m.org) is the global standards initiative that covers requirements, architecture, API specifications, security solutions and interoperability for Machine-to-Machine and IoT technologies. As a founding oneM2M partner, ETSI helps produce standards and specifications that simplify connection between devices and services, regardless of the underlying technology.

Responsible design and sustainability are crucial considerations in the context of massive numbers of connected IoT devices, networks and systems. Published in September 2022, oneM2M's second 'IoT for Sustainability' White Paper presents practical methods to address these challenges, focusing on reducing energy consumption, increasing system longevity and minimizing e-waste in IoT deployments.

The official ratification of oneM2M Release 4 in December 2022 represents a major milestone for oneM2M, reflected in a significant body of work that includes 23 Technical Specifications and 7 Technical Reports. Included in this activity, ETSI publications of note during the year included a specification on oneM2M and Modbus interworking, and a study on oneM2M and public warning services.

The 8th oneM2M Interoperability testing event was held from 5-7 December 2022 in Pangyo, South Korea, organized by ETSI in cooperation with TTA. Giving organizations the opportunity to assess the level of interoperability of their own implementations and verify the correct interpretation of oneM2M standards, testing was based on the latest specifications of oneM2M Releases 2, 3 and 4.

A BETTER WORLD THROUGH INNOVATION: ETSI IOT WEEK 2022

The potential for IoT technologies to enhance the lives of people across Europe through digital, green and eHealth revolutions was a focus of ETSI IoT Week, held from 10-14 October at our premises in Sophia Antipolis. A globally respected annual event for stakeholders interested in the service and operational areas of IoT, ETSI IoT Week offers an up-to-date overview of major trends in IoT services, technology innovations and deployments. Speakers at this year's conference included regulators, academics and practitioners from commercial organizations across Europe. A technology demonstration section included presentations showing how IoT can be used for public protection and disaster relief, and its use in supporting unmanned aircraft management.

> *« Offering an up-to-date overview of latest global trends and innovations in IoT technologies, this gathering is a must-attend event for anyone who understands the importance of standard-enabled technologies for IoT service deployments. »*
>
> ***ENRICO SCARRONE,*** *ETSI SMART M2M TECHNICAL COMMITTEE CHAIR*

Smart Machine-to-Machine Communications

In coordination with oneM2M, our SmartM2M Technical Committee (TC SmartM2M) 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 2022 we published a Technical Specification detailing requirements and guidelines for cross-domain data usability of IoT devices, together with a set of guidelines for the use of SAREF over oneM2M for vertical industry sectors. These were complemented by a Technical Report on Smart Device Template interoperability and oneM2M base ontology alignment. Complementing our existing deliverables relating to Smart Lifts, we also published a Technical Specification that considers standardization of the IoT system for Smart Escalators.

Context Information Management

From the digitizing of industrial processes to creating smart services for citizens, it is essential to accurately record data together with its context information and to transfer these without misinterpretation to other systems. Single-purpose solutions work well within a known context but are not suitable for multi-system interoperability.

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

During the year ISG CIM issued a further incremental release version of the NGSI-LD API that enables close to real-time update/access to information from many different sources.

Other publications variously addressed: a NGSI-LD/oneM2M interworking proxy proposal, using existing oneM2M features; an examination of the usage of external data models with NGSI-LD API; guidelines for the deployment of Smart City and Communities data platforms; handling of provenance information in NGSI-LD; enabling a chain of trust from Content Sources to Content Consumers; CIM security and privacy issues, and an investigation into the feasibility of using the NGSI-LD information model and API for 'digital twins' applications.

Smart Body Area Networks

Our 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: eHealth/telemedicine, wellness, leisure, sport and personal safety. Applications typically feature the use of small, low power sensors, wearables, embedded or implanted communications devices to collect, monitor and exchange data about an individual and their environment. The committee's interests includes communication media, and associated physical layer, network layer, security, QoS and lawful intercept. In 2022 we published an update to our Technical Specification on Low Complexity Medium Access Control (MAC) for SmartBAN. Applying to short range wireless communication between wearable sensor devices and the hub coordinator, this specification describes radio channel structure as well as MAC frame formats and functions.

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. During 2022 our eHealth Technical Committee (TC eHEALTH) neared completion on revisions to its previously published analysis of use cases that is intended to drive forward future standardization. Its scope includes examples from existing and completed EU Research projects, and from current eHealth and health industry practices. Meanwhile work was launched on a new ETSI Guide that explores the role of Artificial Intelligence (AI) as an accelerator for eHealth processing, including discussion of ethical, security and privacy aspects. Further progress was also made on a new report describing a presence preserving proximity function trigger (3PFT). Its goal is the design of a multi-input privacy protected presence-aware function triggering framework for use on smartphones and other IoT-devices to allow widespread deployment for a variety of eHealth uses.

Digital Inclusion and Accessibility

Understanding human capacities and limitations to make products and services easy for all to use is key to success of 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). In 2022 we published a new version of the ETSI Guide on user-centred terminology for ICT devices, services and applications. Now providing reference terminology for ICT users in 19 major official languages of the EU/EFTA, the guide provides recommended terms for commonly used ICT-related objects and activities.

05 CYBERSECURITY AND PRIVACY

Protecting everyone's interests

Staying safe and secure in a hyper-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 a central role in strengthening our cybersecurity, 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.

Originally issued in March 2022 and subsequently updated in September, our 'Guide to Cyber Security for Consumer Internet of Things' augments TC CYBER's pioneering suite of deliverables on consumer IoT (Internet of Things) security. It serves to help manufacturers and other stakeholders to meet the provisions defined for consumer IoT devices as detailed in existing ETSI standards and specifications. Also published as an output on the committee's consumer IoT work, we issued a Technical Specification that details testable security requirements for home gateways. Covering the complete lifecycle from development to decommission and subsequent end-of-life, it considers security aspects of the device architecture in terms of hardware, software, interfaces and data. A complementary report presents a security threat analysis on carrier-grade network routers deployed in IP metropolitan area networks (MANs) and IP backbone networks. Published in January, the committee's Guide to Coordinated Vulnerability Disclosure is aimed at organizations wishing to implement a vulnerability disclosure process, offering examples of policy, action plans and generic advice on responding to a disclosure. Giving an overview of the technologies, use-cases and properties for Identity Based Encryption (IBE), we published a Guide to Identity-Based Cryptography that allows engineers to develop and adopt IBE solutions for encryption and digital signature applications.

2022 also marked the issue of updates to a number of existing TC CYBER deliverables. Expanding the committee's work on middleboxes – a vital component of modern networks including 5G – we revised the second part of ETSI's Middlebox Security Protocol (MSP), a specification that defines a protocol for fine-grained access control to communications traffic.

WORKING WITH ENISA

In March, European Standards Organizations (ESOs) CEN, CENELEC and ETSI joined forces in Brussels with ENISA, the European Union Agency for Cybersecurity, to organize their 6th annual conference. The virtual/hybrid event focused on 'European Standardization in support of the EU cybersecurity legislation' and attracted over 900 attendees from Europe and around the world.

Critical to building trust in digital services, remote identity proofing is the process where an online user proves they are the owner of a claimed digital identity. In May ENISA and ETSI organized a workshop as part of their joint effort and collaboration to support EU requirements for identity proofing. The event was addressed to EU companies and other public organizations that are running or planning their own remote ID solutions. Crucial topics of testing, audit, standardization and regulation were covered, including certification requirements for AI based Identification services and possible moves towards EU harmonization in this area.

Quantum Safe Cryptography

Quantum computers pose a major challenge to conventional cryptographic techniques, where information such as bank account details become subject to potential discovery and misuse. The focus of our CYBER QSC Working Group is on the practical implementation of quantum-safe primitives, including performance considerations, implementation capabilities, protocols, benchmarking and practical architectural considerations for specific applications. During the year work continued on various deliverables, notably: a Technical Report presenting recommendations on a QSC migration strategy for ITS and C-ITS use cases; an extended CYBER QSC roadmap; and revisions to an existing specification on quantum-safe hybrid key exchanges.

Quantum Key Distribution

Quantum Key Distribution (QKD) enables digital keys to be shared securely over optical links via the transfer of quantum states. The first applications of this technology are likely to be those requiring long term secrecy, such as encryption of sensitive government or corporate data.

In 2022 our Industry Specification Group on QKD (ISG QKD) published a new Group Specification that defines orchestration interfaces between SDN Orchestrator(s) and SDN Controller(s) of QKD networks. This covers abstraction models and workflows including resource management, system configuration management, performance management, alarm, service provisioning and management of multi-domain QKD networks.

A new Group Specification that provides a Protection Profile for pairs of prepare and measure QKD modules was approved for publication. This provides a basis for the security evaluation of point-to-point QKD systems under the Common Criteria scheme.

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. A Group Report published in January 2022 presents an AI Threat Ontology, defining what an Artificial Intelligence (AI) threat is and how it can be distinguished from non-AI threats. Published in March, a further report explores the role of specialised and general-purpose hardware in the security of AI. It addresses the mitigations available in hardware to prevent attacks and also the general requirements on hardware to support SAI. It also considers vulnerabilities introduced by hardware that may amplify attack vectors on AI, as well as strategies to use AI for protection of hardware.

Permission Distributed Ledger

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 2022 the group released a further suite of specifications and reports to support the rapidly expanding need for PDL solutions. These variously address key elements of interoperability to exchange information between different ledgers, and to mutually use the information that has been exchanged; a PDL reference architecture framework; the use of PDL to support distributed data management; and non-repudiation challenges in Permissioned Distributed Ledgers, presenting various non-repudiation strategies/technologies and their viability. The group also updated its existing architectural and functional specifications for smart contracts, including potential security threats and solutions.

In January ISG PDL members contributed to the ETSI White Paper #48 'An Introduction of Permissioned Distributed Ledger (PDL)'. Presenting a brief introduction on blockchain and distributed technology, the White Paper describes use cases where PDL technologies can be applied, and also discusses advanced distributed ledger technologies (DLT) that have future standardization potential.

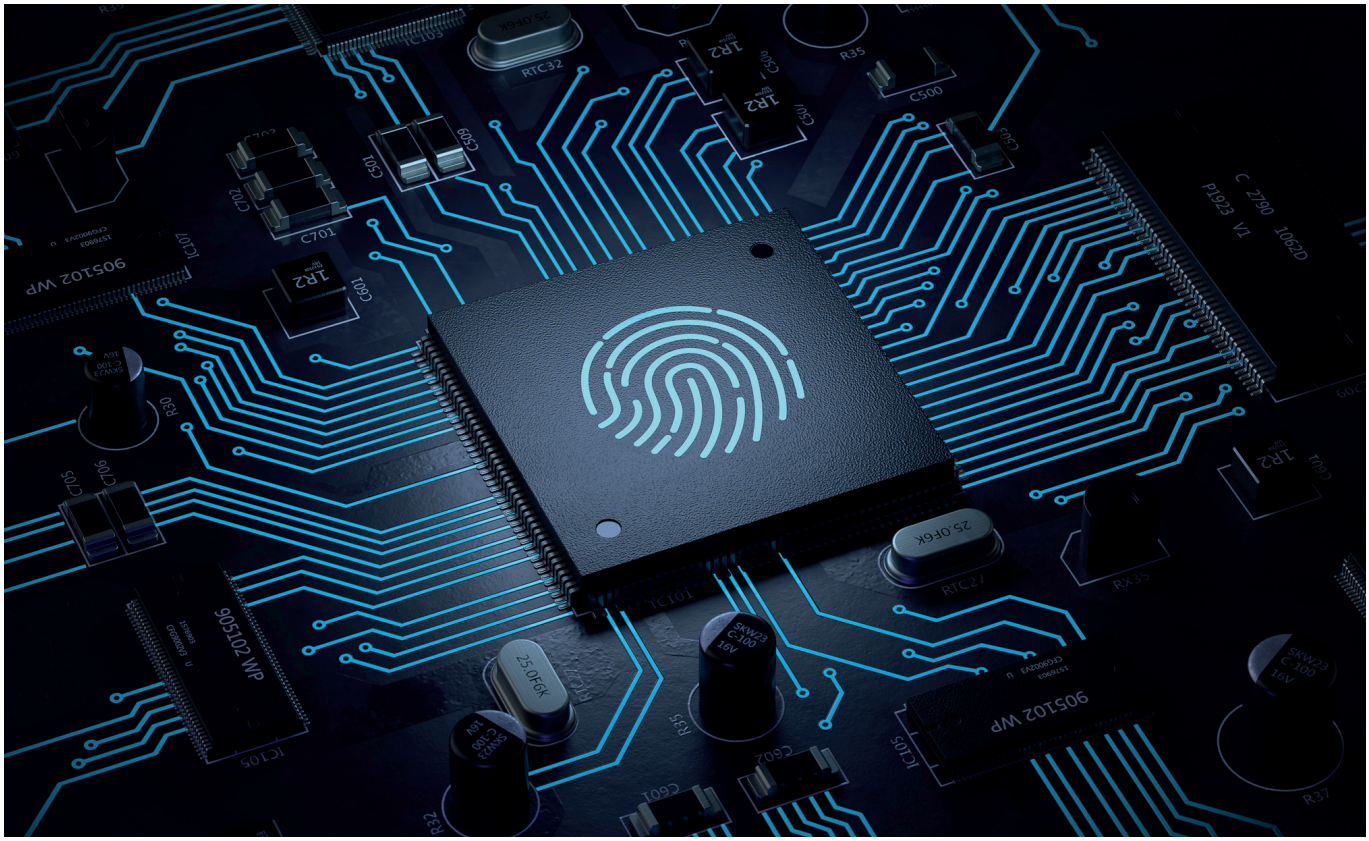
> *« It is widely recognized that the blockchain-based distributed ledgers that people associate with cryptocurrencies have clear drawbacks associated with them in the context of smart contracts. They require large processing overheads and are therefore very expensive to operate. PDL will provide the scalability and cost-effectiveness needed to support the widespread proliferation of smart contracts across a broad range of different industry sectors. Through the pioneering work at ETSI, we will be able to demonstrate the viability of PDL for this purpose. »*
>
> ***DIEGO LOPEZ,***
> *CHAIR OF ETSI ISG PDL AND ETSI FELLOW*

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.

Activities in 2022 included revisions to the committee's existing standards and specifications, variously addressing Registered Electronic Mail (REM) Services, cryptographic suites, XAdES digital signatures, certificate profiles and TSP policy requirements for open banking. Other deliverables included guidelines for the coexistence of web browser and EU trust controls, and the publication of a schema for machine-readable cryptographic algorithms and cipher suites catalogues.

Running from May to July, a successful Plugtests™ interoperability event drew participation from 111 different organizations from 37 countries. Participants tested their digital signature validation tools and cross-validated electronic signatures/seals relying on EU Member States' trusted lists that are based on ETSI specifications. ETSI will be taking the findings of the Plugtests™ event into account in further updates to relevant standards.



Lawful Interception and Retained Data

Bringing together the interests of governments and law enforcement agencies (LEAs) 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.

During 2022 the committee continued to revise its suite of deliverables, including updates to its multipart specification on Handover Interface and Service-Specific Details (SSD) for IP delivery. Other publications included two new Technical Reports: one on IP address retention and traceability, and the other on lawful disclosure of vehicle-related data.

Smart Cards and the Secure Element

Known prior to January 2022 as TC SCP (Smart Card Platform), ETSI's Technical Committee on Secure Element Technologies (TC SET) is responsible for developing and maintaining specifications for the Secure Element (SE) used in telecommunication systems including the Internet of Things (IoT) and Machine-to-Machine (M2M) applications. TC SET creates 'agnostic' specifications that can find their way into other applications such as ID management, ticketing and cards with contactless interfaces used in financial services.

The mobile telecom industry has been facing an increasing demand for applications running on mobile devices like banking, payments, transport and identity for some time. These new specifications address this demand by adding the possibility to host and address several 'virtual secure elements' into the same UICC. This allows multiple virtual secure elements to coexist logically separated, whilst having the ability to be addressed independently through the same physical interface. A highlight of the committee's activities in 2022 was the release of specifications that enable multiple subscriptions and identities to exist in the same smartphone handset without needing several SIM cards to be within the device. This new feature also paves the way to supporting applications such as digital identity in the eSIM, as requested by the EU.

During the year TC SET also published successively updated versions of various Technical Specifications in line with incremental 3GPP Releases. Similarly, specifications by TC SET's Working Group on TEST Secure Element (UICC) were upgraded to cover new releases of respective core specifications.

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 (ISG ETI) 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.

In October 2022 the group published a Group Report that offers guidance to support implementation of the EU Council Resolution on Encryption – adopted in December 2020 – that recognizes the complexity of the technology's application in ICT networks and the variety of needs it services. Progress was also made on a further Group Report that presents a requirements definition and analysis, identifying requirements for enabling integration of trusted encrypted network traffic.

ETSI SECURITY CONFERENCE 2022

Running over three days in October, the ETSI Security Conference 2022 (previously 'ETSI Security Week') attracted nearly 200 physical attendees from 27 countries. Speakers from the European Commission, government representatives, standards bodies and various industry sectors discussed a broad spectrum of cyber-related issues, including EU and Global Cyber Security Regulation, Policy, Security Innovation and Standardization. Topics included 5G, AI, the Cyber Security Act (CSA), IoT/connected device security, security in a post-quantum era and Co-ordinated Vulnerability Disclosure (CVD).

06 RADIO AND WIRELESS SYSTEMS

Spectrally efficient

Standards for wireless devices and systems

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, PMSE and TV/radio broadcast systems.

The Radio Equipment Directive 2014/53/EU (RED) has required the revision or replacement of all ETSI's existing related Harmonised Standards and the development of new ones. The EC's improved approval procedure for our Harmonised Standards has thus necessitated a change in ETSI's working methods to ensure compliance with legislative requirements. TC ERM continues its close co-operation with the EC to optimize the efficiency of this process. During 2022 further progress was accordingly made by the committee's various Working and Task Groups in creating new Harmonised Standards and updating existing publications.

Reconfigurable Radio Systems

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

In ETSI our Technical Committee on RRS (TC RRS) is responsible for the standardization of these systems, including reconfigurable equipment architecture and cognitive radio. TC RRS develops technical standards to meet stakeholders' needs, with scope of the committee's work encompassing Software Defined Radio (SDR) and Cognitive Radio (CR).

Activity in 2022 included publication of a revision to the first part of specifications on the Radio Interface Engine (RIE), plus a new specification defining the Radio Application Package (RAP). During the year TC RRS continued its participation in the RED EC Expert group, exchanging information with other ETSI bodies in view of the European Commission delegated acts concerning Radio Equipment Directive articles 3.3i and 4.

Reconfigurable Intelligent Surfaces

Expected to be a key technology in future wireless systems including 5G-Advanced and 6G, RIS (Reconfigurable Intelligent Surfaces) describe a new type of system node that leverages smart radio surfaces – with thousands of small antennas or metamaterial elements – to dynamically shape and control radio signals in a goal-oriented manner. RIS technology will effectively turn the wireless environment into a service, inspiring new use cases that include enhancing coverage and capacity, as well as enabling new wireless applications such as localization and sensing.

Our Industry Specification Group on Reconfigurable Intelligent Surfaces (ISG RIS) gives ETSI members the opportunity to streamline and coordinate their pre-standardization research efforts on RIS technology, paving the way for future standardization in 3GPP. Activity in 2022 centred on development of the group's first reports that consider: the definition of RIS use cases, with corresponding general Key Performance Indicators and deployment scenarios; the technological challenges in deploying RIS as a new network node; and RIS communication/channel models, including KPIs and the methodology for evaluating RIS performance in application to wireless communications.

Broadband Radio Access Networks

Our Broadband Radio Access Networks committee (TC BRAN) produces and maintains standards and specifications for current and future Wireless Access System (WAS) and Radio Local Area Network (RLAN) technologies in different frequency ranges. Publications delivered to the EC in 2022 included a Harmonised Standard on access to radio spectrum, addressing Wideband Data Transmission Systems (WDTS) for Fixed Network Radio Equipment operating in the 57 - 71 GHz band, and a revised Harmonised Standard on access to radio spectrum, addressing TV White Space Devices operating in the 470 - 694 MHz TV broadcast band. Originally published in 2021, our Harmonised Standard on access to radio spectrum for Multiple-Gigabit radio equipment operating in the 60 GHz band achieved OJEU listing in March 2022. In June we published a Technical Specification describing performance test cases for Multiple Access Point (MAP) networks.

DECT™

ETSI's Digital Enhanced Cordless Telecommunications (DECT) specification is the leading standard for digital cordless telecommunications. Originally developed by ETSI as a European standard in the early 1990s, DECT™ (Digital Enhanced Cordless Telecommunications) is implemented in more than a billion short-range communication devices around the world.

Interacting with the DECT Forum and ITU-R (WP5D), our DECT Technical Committee's (TC DECT) recent activities have been primarily focused on development of the DECT-2020 NR ('New Radio') system. 2022 saw ITU-R approving and publishing a first revision of IMT-2020 Recommendation ITU-R M.2150, including 'DECT 5G - SRIT' technology as proposed by ETSI. This has led to the DECT-2020 New Radio (NR) component now being officially recognized as an IMT-2020 technology. During the year maintenance updates meanwhile continued on the first release of DECT-2020 NR specifications.

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 2022 our Industry Specification Group on millimetre Wave Transmission (ISG mWT) published a Group Specification titled 'Definition of a Wireless Transport Profile for Standard SDN Northbound Interfaces'. Intended for use in conjunction with IETF Data Models used to implement SDN, this profile recommends which models to use from the library available from IETF, and the selection of YANG sub-trees within models that are necessary to manage microwave and millimetre-wave 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. In 2022 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 positioned to achieve listing in the Official Journal of the EU, including revisions to various standards for access to radio spectrum. We also initiated a comparison study between the DVB-S2/RCS2 and 3GPP NR radio protocols in GSO systems.

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 – and to align with different 3GPP releases including support for 5G – TC MSG has been revising ETSI's multi-part Harmonised European Standard on access to radio spectrum for IMT cellular networks, variously addressing user equipment, base stations and repeaters. In 2022 five parts of the standard – originally published in 2021 – achieved citation in the Official Journal of the EU.

The O-RAN Alliance is an industry grouping working to transform the Radio Access Networks into a truly open, intelligent, virtualized and fully interoperable RAN. In September ETSI announced its formal adoption of the first O-RAN specification – addressing fronthaul control, user and synchronization planes – after review by TC MSG's team of experts, including the incorporation of more than 60 ETSI Members' comments. This represents a major step forward in enabling the wide adoption of Open RAN, with ETSI's adoption significantly enhancing the appeal of O-RAN technical specifications across a broader global market. The O-RAN Alliance is now preparing to submit further specifications relating to the O-RAN architecture for recognition as ETSI publications.

Terahertz Communications
NEW

Several European and international initiatives promoting 6G research and development activities anticipate that Terahertz communications will play an important role in the next generation of cellular networks. In December 2022 ETSI's Industry Specification Group on Terahertz (ISG THz) held its kick-off meeting to set work priorities for this 6G candidate technology. The new group will initially focus on two categories of use cases. The first includes mobile applications with high data rate requirements, such as virtual and augmented reality, applications for in-flight and in-train entertainment, and vehicular and satellite communications. The second includes applications requiring both communication and sensing functionalities, such as holographic telepresence, and interactive and cooperative robotics.

> *« ISG THz provides an opportunity for ETSI members to coordinate their pre-standards research efforts on THz technology across various European collaborative projects, extended with relevant global initiatives... a move towards paving the way for future standardization of this technology. »*
>
> ***THOMAS KÜRNER,***
> *CHAIR OF ETSI ISG THZ*

07 TRANSPORTATION SYSTEMS

Travelling forward

Transforming every journey by 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) has primary responsibility for the development and maintenance of standards, specifications and other deliverables to support ITS service provision for transport networks, vehicles and transport users. This work covers interface aspects and multiple modes of transport and interoperability between systems, as well as radio matters and EMC.

2022 marked an important milestone in the deployment of ITS services in many world regions, with ETSI standards playing a significant role in making our roads safer. During the year the committee and its five working groups published or updated a wide range of ITS-related Technical Specifications and test specifications, variously addressing application requirements and services, architecture and cross layers, transport and network, security and media/medium-related aspects.

Railway Communications

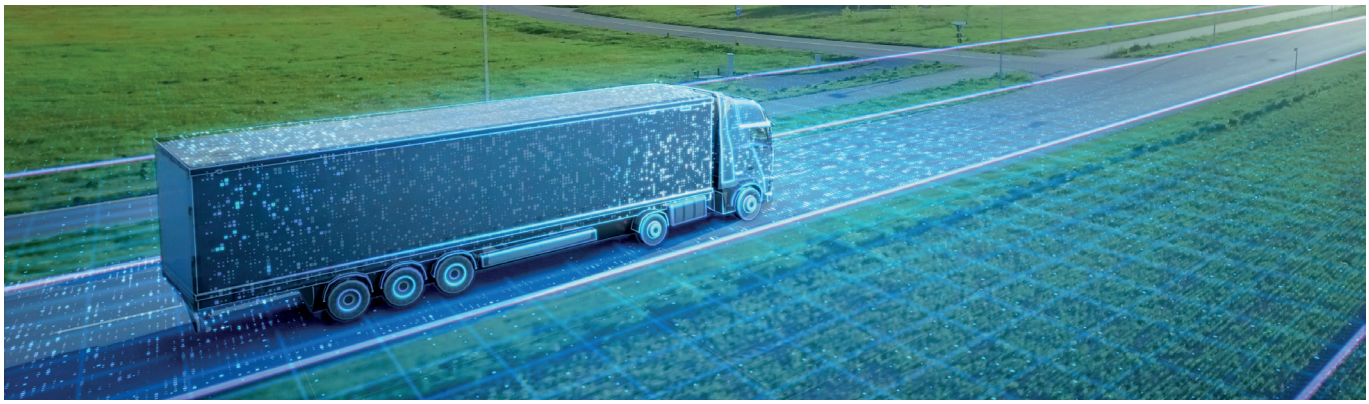
In 2020 ETSI was requested by the European Commission to draft new European Standardization deliverables – and revise existing standards – for the Future Railway Mobile Communication System (FRMCS), the successor to the GSM-R (GSM™ for railways) standard. This has driven an intensive ongoing Work Programme that sees our Rail Telecommunications technical committee (TC RT) liaising closely with 3GPP and the International Union of Railways (UIC) in the development of an extensive suite of new specifications for FRMCS. Numerous standards, specifications and reports currently in development address areas including system architecture, transport and service strata, on-board and trackside functions and interfaces, radio characteristics and user equipment capabilities as well as interworking.

In September 2022 TC RT issued an update to an existing Technical Specification on Usage of Session Initiation Protocol (SIP) on the Network Switching Subsystem (NSS) to Fixed Terminal Subsystem (FTS) interface for GSM-R. The update adds clarifications and corrections for usage of SIP-URI and update of call transfer notification with additional options. The committee also published a Technical Report presenting a preliminary analysis of potential interworking scenarios between FRMCS and legacy GSM-R systems. This will guide development of a corresponding specification on FRMCS/GSM-R interworking, an important constituent of the set of ETSI specifications supporting the FRMCS industrial plan.

In the domain of spectrum sharing for Urban Rail ITS and Road ITS applications, in May 2022 the committee's JTFIR (ITS/RT Joint Task Force) Working Group published a Technical Report – developed in cooperation with ETSI's Technical Committee on Intelligent Transport Systems – that details a measurement campaign to validate interference simulation results, and to confirm simulation parameters used to define the proper mitigation area to protect communications in the 5 915 - 5 925 MHz band.

Held in May, ETSI's second Future Railway Mobile Communication System (FRMCS) Plugtests™ was held as a remote event, with 60 test sessions based on 3GPP Release-17 being executed between vendors.

In October ETSI and the Bureau de normalisation ferroviaire (BNF), the French organization for railway standardization, signed a Memorandum



of Understanding to structure and strengthen their relationship. The agreement reflects the common objectives of ETSI and BNF to perform and promote regional and international standardization in the area of ICT for railway and transport applications.

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 2022 the first part of ETSI's Harmonised European Standard on access to radio spectrum for Secondary Surveillance Radar (SSR) achieved citation in the Official Journal of the European Union, alongside the second part of our standard covering Air Traffic Control (ATC) PSR sensors in the frequency band 2 700 - 3 100 MHz (S band), and a sub-part of our standard on Advanced Surface Movement Guidance and Control System (A-SMGCS). Three revised parts of our Harmonised European Standard on access to radio spectrum for meteorological radars operating in S, C and X bands (originally published in 2021) were also cited in the OJEU.

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.

A revision of our Harmonised European Standard on access to radio spectrum for maritime VHF survivor locating devices using DSC Class M was published and delivered to the EC in anticipation of publication in the OJEU. Meanwhile a revision of our Harmonised European Standard on access to spectrum for VHF radiotelephone equipment using DSC Class D achieved citation. We also published two further parts of our European Standard on Digital Selective Calling (DSC) equipment in the maritime MF, MF/HF and VHF mobile service, and a Technical Report on voice and data services for digital VHF maritime radio using FDMA.

Cross-border Information Exchange

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

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

2022 saw publication of an update to the Group's report on CDM use cases for the CISE and EU-funded ANDROMEDA land border control project as an example for the multipurpose capabilities of CISE.

08 NETWORKS

Enhancing interconnectivity

Bringing intelligence to our networked world

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 for tomorrow.

Network Functions Virtualization

A key enabler for the success of 5G and beyond – and relevant to other telecoms network architectures – Network Functions Virtualisation (NFV) consolidates heterogeneous network equipment types onto standard IT servers, switches and storage. NFV is an essential aspect of modern network design, simplifying roll-out of new services while reducing deployment and operational costs. With the support of tens of organizations worldwide, the goal of ETSI's Industry Specification Group on NFV (ISG NFV) is to create specifications that can accommodate today's and tomorrow's network requirements.

In 2022 the group continued to maintain core Release 3 specifications. It also completed the protocol and data model specifications of Release 3 features, and conformance testing specification for NFV-MANO APIs.

With NFV-based deployments triggered by the introduction of 5G systems – especially in the core network – technical work on Release 4 accelerated to consider technological advances such as containerization of applications, 'cloud-native' concept and data analytics. Release 4 aligns with other current industry trends in network transformation, motivated by the need to simplify NFV deployments by leveraging advances in cloud computing and network management technologies.

Technical work on Release 5 meanwhile continued to drive ETSI NFV's work into two main directions: consolidating the NFV framework, while expanding its applicability and functionality set. Ongoing studies included enhanced container networking, network connectivity integration and operationalization, multi-tenancy enhancement for NFV-MANO, service based architecture for NFV-MANO and VNF generic management functions.

In September the group commenced work to identify the need for Release 6, starting to collect topics and the process to identify major technical areas the new release should focus on.

Open Source MANO

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

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

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

Delivered in June 2022, OSM Release TWELVE is the second Long Term Support release of ETSI Open Source MANO. One of the most prolific iterations to date, Release TWELVE key features include: long term support (bug fixes and security patches); healing of network functions (manual and automated) in any cloud; network function upgrade capabilities; network service modifications during runtime; support for interaction with third party orchestrators; and support of anti-affinity groups.

This was followed by the December publication of OSM Release THIRTEEN that introduces a new scalable architecture for service assurance and closed-loop operations, leveraging cloud-native versions of Apache Airflow and Prometheus. This architecture is prepared to cover the most demanding service assurance scenarios, such as auto-healing and auto-scaling in large clouds and multiple edge sites. Meeting the established schedule of two OSM releases per year, Release THIRTEEN incorporates new workflows for obtaining the state of Network Functions (NF), Network Services (NS) and VIM, and will gradually incorporate new capabilities in subsequent releases.

TeraFlowSDN

NEW

In May ETSI announced the launch of TeraFlowSDN (TFS), a new Open Source Group that will support the development of autonomous networks and cybersecurity use cases. Hosted by ETSI and based on results of the European Union-funded TeraFlow 5G PPP research project, the group provides a 'toolbox' for rapid prototyping and experimentation with innovative network technologies.

Modelled on the success of ETSI's OSM (Open Source MANO) initiative which has already been adopted by over 30 EU-funded research projects, TFS will develop an open-source, cloud-native SDN controller for high-capacity IP and optical networks. Supporting use cases such as autonomous networks and cybersecurity, it will help service providers and telecommunication operators to meet the challenges of future networks. Software developed by the group will also be a valuable tool for other ETSI groups working on network transformation, enabling the alignment of goals and helping to accelerate standardization cycles. Just six months after its launch, in December 2022 ETSI TFS was named 'Upstart of the Year' at the Layer123 Network Transformation Awards ceremony in London.

> *« Over the last two years, ETSI has grown its relationship with the research community. We have developed the means to help them identify research topics for standardization at an early stage, so that the required standards are available to the industry when they are needed. TeraFlowSDN will help to promote and facilitate the adoption of ETSI standards among software development communities and open-source projects. It will also provide building blocks for other 5G PPP and SNS JU research projects. »*
>
> ***LUIS JORGE ROMERO,*** *ETSI DIRECTOR-GENERAL*

Multi-Access Edge Computing

Multi-access Edge Computing (MEC) is a central building block in the evolution of mobile broadband networks. Complementing NFV & SDN, it is a key enabler for vertical solutions and one of the key architectural concepts and technologies for 5G. Shifting processing away from remote data centres and closer to end-users at the 'edge' of the network, MEC supports a wide range of IoT and mission-critical vertical solutions – from gaming and Virtual Reality to Intelligent Transportation Systems and the industrial Internet. Supporting increasing QoS requirements for these applications and use cases, MEC also offers improvements in privacy and security.

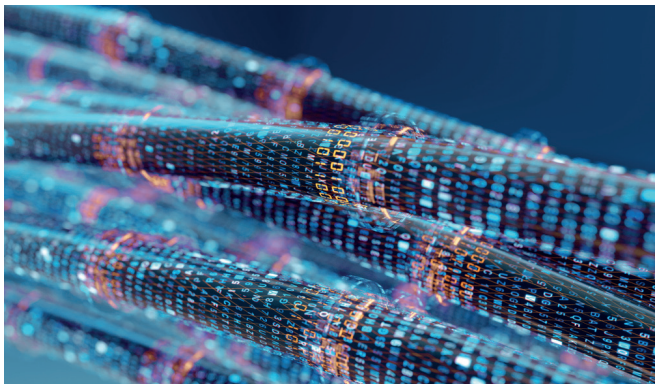
Anticipating widescale industry adoption of MEC solutions, in 2022 our Industry Specification Group on MEC (ISG MEC) maintained its focus on Phase 3 activities

(2021-2023) that expand its scope from previous Phase 2 (2018-2020) by considering a heterogeneous cloud ecosystem. Among other topics, this Phase 3 work embraces MEC federation, MEC security, expanded traditional cloud and NFV Life Cycle Management (LCM) approaches, and mobile or intermittently connected components and consumer-owned cloud resources.

During 2022 members of the group also contributed to two ETSI White Papers titled 'MEC security; Status of standards support and future evolutions' and 'MEC federation: deployment considerations'.

Focused on accelerating development of the MEC eco-system, ISG MEC Working Group DECODE (Deployment and ECOsystem Development) published revisions to a multi-part API Conformance Test Specification and accompanying guidelines on MEC interoperability testing.

The ETSI/LINUX Foundation Edge Hackathon was held remotely from June to September, with short-listed teams being invited to a Hackathon 'pitch-off' at the Edge Computing World Global event in Santa Clara, USA in October 2022.



Zero Touch Network and Service Management

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

In 2022 we published two new Group Specifications. The first is a normative document that defines management processes during the lifecycle of E2E services. The second - part of a multi-part Group Specification on 'closed loop' automation that can be empowered by advanced machine learning and artificial intelligence – presents solutions for automation of E2E service and network management use cases. We also updated our ZSM Proof of Concept (PoC) framework and revised our landscaping document that surveys ZSM activities in other SDOs, fora and open source communities.

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 2022 the group published a Group Specification – provided in OpenAPI format – for the 'World Anchors' and 'Reference Objects' reference points of the AR framework architecture developed by ETSI.

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 technology ecosystem. The group also maintained its liaison with ETSI groups (including 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. ETSI's Industry Specification Group on IPv6 Enhanced innovation (ISG IPE) addresses increasing needs for IPv6 adoption in multiple use cases and scenarios.

2022 saw publication of six Group Reports, augmenting the first phase of deliverables since the group's inauguration in 2021. 'IPv6 based Data Centres, Network and Cloud Integration' illustrates Network-Cloud convergence architecture, and the requirements to the underlying network. A report titled 'IPv6-based Blockchain' outlines how IPv6 can be utilized by blockchain networks to secure direct peer-to-peer payments between end users, as well as the potential future role of IPv6 as vital infrastructure, supporting the blockchain. They were complemented by other reports titled '5G Transport over IPv6 and SRv6', 'SRv6 based Service Function Chaining

for value-added service in an operator network', 'IPv6 and Cloud using DataBlock Matrix for Food Supply Chain Tracking and Tracing', and a proof-of-concept framework to encourage development of an open IPE ecosystem by integrating components from different players.

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 defining protocols that will better suit today's use cases than TCP/IP. The group is dedicated to specifying alternative protocols to support 5G applications, as well as being more efficient and easier to manage with lower capex/opex.

A Group Specification published in 2022 considers signalling messages and protocols, specifying procedures and packet formats for network functions. These include setting up packet flows; modifying, re-routing and clearing down; exchanging information on timing and synchronisation; and conveying user messages that are not part of a flow. Work also neared completion a further Group Specification that describes procedures and packet formats for the carriage of 'Flexilink' flows over the DECT 2020 New Radio interface.

Experiential Networked Intelligence

While technologies such as Software Defined Networking (SDN), Network Functions Virtualization (NFV) and network slicing are making networks more flexible and powerful, these innovations are also making networks harder to manage efficiently. Our Industry Specification Group on Experiential Networked Intelligence (ISG ENI) develops specifications that use Artificial Intelligence (AI) mechanisms to assist in the management and orchestration of the network.

With completion of Release 2 specifications marked by publication of an ENI system architecture, the focus of the group's technical work in 2022 was on ENI Release 3 and beyond. This centred on the development of a new Group Specification, detailing APIs, reference points and Policy models with a number of functional descriptions of external interfaces.

Titled 'Reactive in-situ Flow Information Telemetry', a Group Report published in May describes the requirements and challenges of using flow-oriented on-path telemetry techniques that provide relevant measurement or event reports to AI-enabled network entities.

> *« ENI will have an important part to play in how next generation networks are managed, making them contextually aware and giving them greater inherent flexibility. With Release 2 we have provided a framework upon which operators and their technology partners can implement ENI into their infrastructure. »*
>
> ***Dr RAYMOND FORBES,***
> *CHAIR OF ETSI ISG ENI*

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 support new services and applications, and to match and enhance the benefits 5G has already brought to mobile communications. In 2022 the group published its first version of an end-to-end F5G network architecture that describes features and related network devices/elements' requirements for F5G, including on-premises, access, IP and transport networks. Other deliverables published during the year variously address an end-to-end network management and control architecture and related interfaces, quality of experience, security, use cases, and a telemetry framework with specific requirements for the access networks. During the year group members also contributed to ETSI White Paper #50 – published in September – that describes the drivers, development directions and technologies of F5G Advanced networks and beyond.

Cable

Our Integrated Broadband Cable Telecommunication Networks committee (TC CABLE) addresses the evolution of broadband cable telecommunications network infrastructure and devices. In 2022, the committee completed a new multi-part standard covering the sixth generation transmission systems for interactive cable television services (IP cable modem). Published in September, the multi-part standard is based on the specifications for DOCSIS® 4.0 that enables multi-Gbps symmetrical services in the cable access network.

09 SUSTAINABILITY AND USER NEEDS

Sustaining innovation

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 the benefits we must minimize its negative impact on individuals, society and our planet. 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 equipment in the network including radio access networks and 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 2022 the committee's activities continued to address three key areas: measurement methods for the energy efficiency of ICT equipment with a focus on 5G; standardization on eco-design aspects of servers and storage products; and requirements for power supply interfaces of ICT equipment.

Working Group EE 01 issued a revision to the introductory sub-part of our multi-part European Standard on environmental conditions and environmental tests for telecommunications equipment.

Working Group EE 02 continued to update our multi-part European Standard on power supply interface at the input of ICT equipment, publishing revision to parts covering AC power interface and -48 V DC operation. It also published a new ETSI Standard that offers solutions for the progressive migration of ICT sites to 400 V DC sources and distribution.

Our EEPS Working Group published updates to two existing ETSI Standards, relating to mobile network energy efficiency and energy efficiency measurement of wireless access network equipment, and a European Standard on methods for assessment of material efficiency aspects of ICT network infrastructure goods in the context of the circular economy.

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.

ATTM Working Group AT2 is responsible for the creation, development and maintenance of standards and specifications covering cabling, installations, communications systems and network services implementation. In 2022 the group revised Technical Specifications on optical external network testing, and general engineering of optical building cabling.

ATTM Working Group TM4 develops specifications for point-to-point and multipoint radio systems in the fixed service, used in core and access networks, including mobile service backhauling. During the year the group updated 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 physical event on 'Responsible digital at the service of the sustainable city' was held in Bordeaux from 7-9 June in collaboration with Bordeaux Métropole and the EUROCITIES network. Exploring standardization perspectives in smart cities and communities, the successful event attracted more than a hundred participants.

Towards Efficient ICT

Working with ETSI's ATTM, EE and Smart M2M committees, our Industry Specification Group on Operational energy Efficiency for Users (ISG OEU) 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.

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 2022 the committee issued the first in a set of two Technical Reports that consider a user-centric approach in the digital ecosystem. This first deliverable presents an analysis of user requirements and various use cases and describes the model of smart ID (Smart Identity) as a user 'digital clone'. It also explores the different possibilities of using new technologies including Artificial Intelligence to achieve a smart identity, and the development of a Proof of Concept for future implementation.

10 BROADCAST, MEDIA AND CONTENT DELIVERY

See, hear, experience

Bringing quality content to every audience

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. 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 2022 we accordingly continued to produce and maintain standards and specifications for relevant broadcast platforms and systems. We published the first version of a multi-part specification describing the transmission system for 'Next Generation' digital terrestrial and hybrid broadcasting to handheld terminals (DVB-NGH). Revisions were also published to existing deliverables addressing topics including DVB, HbbTV and Hybrid Radio. These were complemented by the publication of a Technical Report on Unit Test Descriptions for Hybrid Broadcast Broadband TV.

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.

During 2022 the committee continued its programme of regular additions and revisions to its suite of deliverables. Standards and specifications published or updated variously addressed telephony equipment for hearing-impaired users; transmission requirements for VoIP terminals; noise cancelling headsets and earphones; and a methodology for reproducibly generating 'realistic' background noise while testing the speech quality performance of communications equipment.

Hosted by Amazon, the ETSI STQ Workshop took place on 21-22 November 2022 in Bratislava. Focusing on user-centred perspectives of the Quality of Emerging Services for Speech and Audio, the successful event was attended by organizations across industry, regulators, and academia.

11 PUBLIC SAFETY AND MISSION CRITICAL COMMUNICATIONS

Absolutely critical

Supporting public safety in every eventuality

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 2022 the committee continued to develop and maintain TETRA with user-driven specifications for authority-to-authority secure voice and data services over broadband and narrowband air interfaces.

With more than 120 countries using TETRA (Terrestrial Trunked Radio) networks to support energy, utilities and other critical public infrastructures, work in 2022 focused on ensuring that ETSI's TETRA technology standard remains robust in the face of evolving threats. To adapt to technology innovations and potential cybersecurity attacks – including from quantum computers – the committee completed work on new algorithms designed to secure TETRA networks for at least the next 20 years. This was reflected in new specifications developed in collaboration with experts from ETSI's SC TSA (TETRA secure algorithms) group. Work was carried out with the support of TCCA, the global representative organization responsible for enhancement of the TETRA standard.

> *« It is vital to keep the TETRA cryptography updated with the latest cybersecurity algorithms when you realize the variety of sensitive organizations and applications TETRA systems serve. The EU Parliament and Commission for instance use a secure TETRA system to protect their building and communication networks, a scenario where failure or security compromise is unthinkable. »*
>
> ***BRIAN MURGATROYD,***
> *CHAIR OF ETSI TC TCCE*

Emergency Calling and Alerting

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

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

in revisions to conformance test specifications for core elements for network independent access to emergency services. The committee also published a new Technical Specification that details the Shared Services between PEMEA and ESInets.

Accurate caller location is one of the most significant pieces of information for emergency call takers. Caller location can have a huge impact on the safety of citizens and helps reduce response times. Since March 2022 all smartphones sold in Europe have been required to comply with Advanced Mobile Location (AML) for emergency communications that was originally standardized by ETSI in 2019. EMTEL's continuing work on AML was reflected in publication of an updated Technical Specification on transporting handset location to PSAPs for emergency communications. This was accompanied a specification providing the Test Purposes to develop AML test descriptions for handsets. This will help in assessing the compliance of manufacturers' smartphones with AML.

« The entry into application of this legislation is a major step for people's safety in Europe, as it ensures certainty that smartphones in Europe will continue to integrate this life-saving technology. The ETSI specification makes it easy for countries to implement AML and requires minimum investment. For users, as AML is not an app, there is no need to download anything: just dial 112. »

CRISTINA LUMBRERAS, *CHAIR OF ETSI TC EMTEL*

MCX PLUGTESTS™

The capabilities of Mission Critical Push-to-Talk (MCPTT), Mission Critical Data (MCData) and Mission Critical Video (MCVideo) were tested during the seventh MCX Plugtests™ event, held from 07-11 November 2022 at the University of Malaga (UMA).

Using 4G and 5G test networks, over 1200 use cases were executed between more than 150 delegates and vendors, based on 3GPP Release-17 – achieving a success rate of 96% interoperability of the 3GPP mission critical services executed tests.

Besides the MCPTT, MCData and MCVideo Application Servers and Clients, testing also included devices, railways-oriented features, interworking with ETSI TETRA, IMS (IP Multimedia Subsystem), eMBMS (Evolved Multimedia Broadcast Multicast Services) components, Server to Server and inter-MCX communication. The event was organized by ETSI with the support of the European Commission, EFTA, TCCA, 5G-EPICENTRE project and UIC.

Public Safety

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

The role of SAFETY is quite distinct from other ETSI Technical Committees. While it does not normally write standards, the primary role of the committee is as an information exchange, collecting information from other bodies including CENELEC, IEC, ITU and WHO, as well as the EC for any work on Directives related to Safety in order to provide information for ETSI members.

The committee's continuing focus in 2022 has been in relation to implementation of changes in ITU documents and the Radio Equipment Directive (RED). Here TC SAFETY works with CENELEC – the body responsible for the development of Harmonised Standards for EMF in Europe – to revise current EMF standards in the light of changes brought about by the RED and its impact on many ETSI groups.

12 TESTING AND INTEROPERABILITY

Quality control

Maximizing 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.

Continuing our ongoing support for the development of conformance test specifications for 3GPP and following 3GPP's own release schedule, in 2022 we have delivered initial tests for 3GPP Release 17 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, developing a multi-annual roadmap of testing activities requiring ETSI funding. We support the use of the Forge, our GitLab™ repository for managing code used for development of various APIs, standards and test specifications in ETSI committees. We have recently extended its use to 3GPP.

In 2022 we supported the establishment of a new open source software group at ETSI, TeraFlowSDN.

Inspired by this, we have finalised a proposal for ETSI to establish Software Development Groups which has been adopted by ETSI's members into our rules and working procedures.

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, and the TDL test description language.

Methods for Testing and Specification

Working with the Centre for Testing and Interoperability, 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 2022 TC MTS continued to evolve and maintain ETSI's enormously successful testing language, TTCN-3, along with its tool conformance test suites. This work has been complemented by further updates to our Test Description Language (TDL) that fills the gap between the simple expression of 'what needs to be tested' and the concrete coding of executable tests with existing test specification languages such as TTCN-3. This activity has expanded in recent years, and now embraces new conformance tests, addressing Core Standard test cases, XML test cases, Object Oriented extension test cases and JSON test cases.

UCAAT 2022

Organized by TC MTS with the ETSI Events team, the 9th User Conference on Advanced Automated Testing – titled 'Testing of Trustworthy Systems' – was hosted by Siemens in Munich from 13-15 September. Featuring tutorials, keynotes and presentations, the physical event gave a unique opportunity for industry practitioners, tool vendors, test service providers and researchers from different application domains to come together. Addressing the challenges of testing and test automation faced by industry today, the conference focused on the trustworthiness of systems and how it can be best tackled by testing.

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.

In 2022 the committee revised its Technical Specification on network integration testing between SIP and ISDN/PSTN network protocols; it also revised its multi-part specification on VoLTE/ViLTE interoperability testing over 4G/early 5G in physical/virtual environments (3GPP™ Release 15). Meanwhile three new Technical Reports were published during the year. These cover E2E testing and validation of vertical applications over 5G and beyond networks; the use and benefits of AI technologies in testing; and autonomicity and self-management in the IMS architecture.

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 are co-financed by the European Union (EU) and the European Free Trade Association (EFTA). In 2022 we welcomed receipt of a new Plugtests™ contract with the EU and EFTA.

2022 saw the welcome return to physical Plugtests™ events when health conditions permitted. We still continued with remote events where this format was useful. We expect to continue with a mix of physical and remote events, depending on the technical scope or expected participants for each event. Nine interoperability events were held in 2022, attracting a total of around 1 000 participants. Notable events in 2022 included the return of our intelligent transport Plugtests™ to an outdoor test track in March, and in October the first Hackfest for our TeraFlowSDN project.

13 R&D AND INNOVATION

Research and innovation through standards

Enriching dialogue with R&D communities

The implementation of published standards to create new technology 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+ membership. 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 to be taken through ETSI's pre-standardization activities and onward into standards work in both ETSI and 3GPP. This continuous exchange ensures exciting cutting-edge innovation is captured in tomorrow's standards – notably for the technologies that may constitute what becomes 6G – allowing industry to meet the challenging performance requirements that private and business 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.

2022 saw continuation of our initiatives to forge 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. During the year we embarked on updates to the ETSI Technology Radar (ETR) that was originally issued as White Paper #45 in 2021. This document tracks emergent trends in the tech innovation space that are potentially relevant to ETSI's goal to be at the forefront of ICT standardization – either through our existing committees and Industry Specification Groups – or, if needed, through the creation of new activities in ETSI. With the first edition already shared with several global SDOs and associations as well as our own Technical Groups, we are planning to publish a revised edition of the ETR in 2023.

Preparations were launched for the ETSI Research Conference, taking place in February 2023 at our headquarters in Sophia Antipolis. Titled 'Maximizing the Impact of European 6G Research through Standardization', the face-to-face event provides an exceptional opportunity for the research community to come together with industry representatives and standardization experts to discuss future technology research and links to standardization developments.

During the summer of 2022 we issued a questionnaire to over 150 ETSI member organizations with interests in the research, innovation and academic sectors. The objective of the survey was to assess awareness of ETSI's value proposition within the R&D community, in order to improve our own offering of services, tools and support provided to researchers, innovators and academics. Results of the survey are being translated into a further programme of activities and engagement in 2023.

In June ETSI participated in a special research session at the 2022 EuCNC (European Conference on Networks and Communications) & 6G Summit, taking place in Grenoble, France. Jointly hosted by ETSI and the 6G-IA Pre-Standardization Working Group, the session offered delegates a demonstration of ETSI's value as a vehicle to bridge the research/innovation 'standardization gap' for projects that may be selected for SNS-JU (Smart Networks and Services Joint Undertaking) funded activities.

During the year we meanwhile 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. This activity was reflected in participation at several global B5G/6G conferences and workshops to promote the continual exchange and activities with technology innovators, research bodies and universities.

14 PUBLICATIONS, EVENTS AND EDUCATION

New learnings

Education about Standardization

ETSI has continued with efforts to strengthen our role as the leading standards organization for education and awareness in ICT standardization. In February we published the second edition of our successful textbook and teaching material on "Understanding ICT Standardization" (etsi.org/education/teaching-material). This resource has been drafted by academic experts in Europe and the Secretariat and also reflects latest accessibility requirements. This second edition and the accompanying slides are already used by more than 75 European universities, and we continue to promote this resource within the academic and research community.

ETSI hosted the event 'Forming the Next Generation of Standards People – A Day of Teaching Standardization' which took place on 6th October 2022. The ETSI Director-General and the authors of the textbook provided presentations on the different chapters along with proposed teaching methods from their experience. Following positive feedback we intend to conduct a similar event in 2023.

ETSI has also provided enriched educational materials for TU Berlin and the EC TeamUp5G project. In parallel, we have continued to work with the University of Luxembourg for their Masters course by providing a series of six webinars. We are now in discussion to provide further input to a second course taking place in 2023/2024.

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 2022 we published five White Papers, including an updated edition of a previously-published paper. All are available for download from our website.

> #46 *MEC Security; Status of Standards Support and Future Evolutions (second edition)*
>
> #48 *An Introduction of Permissioned Distributed Ledger (PDL)*
>
> #49 *MEC Federation: Deployment Considerations*
>
> #50 *Fixed 5th Generation Advanced and Beyond*
>
> #52 *ETSI Activities in the field of Artificial Intelligence: Preparing the Implementation of the European AI Act*

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 2022 we continued to engage in a wide range of external events addressing relevant topics, typically via speaker participation and/or endorsements. In the wake of the global pandemic, an increasing number in 2022 were held as 'face to face' physical meetings.

See details on events organized, attended and supported by ETSI in 2022 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 2022 were:

- Status update on Radio Equipment Directive, Cyber Resilience Act and AI Act
- Part 1: IPv6 Enhanced Innovation Global Vision
- Part 2: IPv6 Enhanced Innovation - Major Industry Scenarios
- The new F5G fibre network – a future proof architecture
- OSM Release ELEVEN overview
- What's new in the ETSI MEC Sandbox
- Intent-driven cloud management for VDI and 5G-slicing services
- OSM Release TWELVE overview
- Making the edge sharp and safe: update on MEC security
- Towards an interoperable world representation for XR

Recordings of all webinars can be accessed free of charge via our ETSI BrightTalk channel that currently has more than 18 000 registered followers. If you're not already registered, creating a new account takes just a few moments. See more at etsi.org/events/webinars.

Enjoy!

Issued four times yearly, Enjoy! is the official ETSI magazine. Available free to members and non-members alike, it features news, interviews and opinion from ETSI members, our officials and invited contributors. A diverse range of topics explored in 2022 editions includes AI-powered vehicles, smart lifts, ICT accessibility, equality and diversity, data usability of IoT devices and platforms, links between R&D and standardization, and the voice of consumers in standardization.

Videos

New video uploads to the Media Library area of our website in 2022 included 'Artificial Intelligence Made Simple', a friendly guide to the importance of standardization in AI, and an introduction to interoperable, secure and simple-to-deploy services for the IoT ecosystem based on oneM2M open standards. Meanwhile additions to our dedicated YouTube channel youtube.com/@EtsiOrgstandards included an overview of Reconfigurable Intelligent Surfaces (RIS).

ETSI Seminar

Held in 2022 as a face-to-face event, the ETSI Seminar followed a new format and featuring a wider variety of speakers. This allowed participants to become more familiar with the ETSI environment, structure and ways of working, and to meet staff members as part of an enriched 'onboarding' experience. It also aimed to facilitate the orientation and active participation in ETSI, 3GPP or oneM2M technical activities.

Video tutorials are available as a series of complementary 10-minute clips which are available for viewing on demand, giving new members further opportunity to understand our organization as well as the ETSI Secretariat's work and tools. These online videos also serve as a helpful 'refresher' on a range of ETSI topics. See etsi.org/events/etsi-seminar.

15 PARTNERSHIPS

Success through cooperation

Partnership Agreements

Co-operation and collaboration are a highly effective way to overcome the growing challenges of fragmentation and establish global interoperability. Such collaboration avoids duplication of effort and helps ensure that ETSI's deliverables are widely accepted and implemented. By the end of 2022 our partnership portfolio numbered over 100 agreements.

During the year ETSI renewed Co-operation Agreements with the Broadband Forum (BBF), International Electrotechnical Commission (IEC), International Telecommunication Union (ITU) (under the name of MoU, following ITU's nomenclature), Open Mobile Alliance (OMA) and TM Forum. Memoranda of Understanding were also renewed with the Comité International Radio-Maritime (CIRM), European Cyber Security Organisation (ECSO), European Patent Office (EPO), International Marine Electronics Alliance (IMEA), Linux Foundation, Organization for the Advancement of Structured Information Standards (OASIS), Radio Technical Commission for Maritime Services (RTCM), SESAR (Single European Sky ATM Research) Deployment Manager and Wireless World Research Forum (WWRF).

Beyond renewing and nurturing existing partnerships, ETSI has established several new relationships. These include Co-operation Agreements with the 6G Smart Networks and Services Industry Association (6G-IA), Alliance for Telecommunications Industry Solutions (ATIS) and Information Technology Industry Council's (ITI) The Green Grid (TGG), as well as Memoranda of Understanding with the Bureau de normalisation ferroviaire (BNF), DirectTrust, FIDO Alliance, OpenID Foundation (OIDF) and PKI Consortium Inc.

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

A strategic dialogue between the European Commission (DG GROW and DG CONNECT) and ETSI (including the Chairs of ETSI GA and Board and ETSI's DG) takes place regularly. These meetings are called 'structured dialogue'.

Two of these dialogues took place in 2022. The meeting in March addressed follow-up of the EC Communication of 2nd February on the EU standardization strategy, with particular reference to:

- Improvement of governance
- Legal amendment
- The financing of standardization (Operating Grant, Action Grants)
- International cooperation in the context of the new EU strategy.

The June meeting dealt with the implementation of the standardization strategy (HLF, CSO, Excellence hub):

- ETSI submissions to implement the strategy in governance
- Preparation of EC's input to Board meetings
- Standardization Requests in the pipeline
- Financing standardization
- Information flow between the EC and ETSI.

ETSI highly values the exchange with the EC during these dialogues, especially in the light of the current changes taking place in the EU standardization system.

Committee on Standards

ETSI participates in meetings of the Committee on Standards (CoS) with the status of observer: in 2022 two meetings took place in June and November. In line with an earlier statement made by DG GROW, the nature of the CoS is evolving. While the Committee is crucial to agreeing Standardisation

Requests, the EC intends to put on the agenda more strategic subjects and the functioning of the European Standardisation System (ESS) in general.

The Commission presented a series of 'horizontal' items:

- Status of amendment to Regulation 1025/2012
- Follow-up on Commission Standardisation Strategy of February 2022
- Update on discussion in the TTC (Trade and Technology Council), focus on WG 1 on standardization
- Horizontal approach to technical specifications
- Output of the EC-ESOs Task Force on timely delivery of Harmonised Standards

The ETSI Secretariat prepares the meetings with a cross-departmental team (EU Affairs and ETSI Technical Organization). ETSI members may subscribe to the CoS briefing list to participate to the briefing calls organized prior to the Committee meetings.

Multi-Stakeholder Platform

The European Commission's ICT Multi-Stakeholder Platform (ICT-MSP) held meetings in March, June and October. Meetings variously focused on: information from the EC on policy and regulatory initiatives and international matters; status of the ICT Rolling Plan; presentation of Stand-ICT; and discussion on Standardisation Requests. The October meeting also featured a presentation on the work of ETSI's Cybersecurity Committee (TC CYBER) in relation to the Cyber Resilience Act.

The Task Force on revitalization of the MSP was active throughout the year. In June the EC announced that the MSP would be prolonged for a year, in time for the High-Level Forum (HLF) foreseen in the Standardization Strategy to become operational.

Prior to MSP meetings, the ETSI Secretariat holds a preparatory call for ETSI Members to input their views on agenda items. Members wishing to join are welcome to register via ICT_MSP_BRIEFING@list.etsi.org.

Rolling Plan on ICT Standardization

ETSI coordinates the inputs from the ETSI Technical Organization into the MSP ICT Rolling Plan Task Force. This involves circulating the base version of the Plan via the OCG list, requesting input and updates to the existing text. ETSI inputs are then coordinated into a joint contribution to each chapter of the Rolling Plan.

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 2022, the implementation of which is currently being prepared in REGPOLES. In 2022, a Board group dedicated to Inclusiveness was created ('Board-INCLU'). The group is chaired by the 3SI advocate. This ensures topics addressed both by the 3SI programme and Board-INCLU receive full attention.

Seconded Experts

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

SESEC (Seconded European Standardization Expert in China)

2022 saw the closure of SESEC 4 and the launch of work for the fifth iteration of the project. Mrs Betty Xu will continue heading the SESEC office in Beijing; CEN and CENELEC remain project managers for SESEC 5. During 2022 no travel to China was possible. As a result, events organized by the project were held exclusively online. The SESEC focused efforts on intelligence gathering in a rapidly-involving technology, regulatory and standardization landscape in China.

SESEC 5 launches at a time when the geopolitical context is distinctly different from previous iterations of the project. To ensure that the objectives of SESEC 5 are consistent with policy and industrial agendas, at the first Steering Committee of SESEC 5 (held in October), project partners (EC, EFTA, ESOs) resolved to organize a working session with EUCCC, EUD and DG Trade. This working session will be followed by a public workshop to present the workplan to a broader audience.

SESEC newsletters and subject specific reports are available from the ETSI Secretariat, or directly at www.sesec.eu or www.sesec.eu/resources/sesec-newsletter.

SESEI (Seconded European Standardization Expert in India)

As for the SESEC, the fourth phase of the project came to a conclusion in 2022, with the project being granted an extension until the end of February 2023.

The SESEI meanwhile continued to be proactive in linking ETSI and other partners to the project with Indian stakeholders in standardization. A particularly notable result was the adoption of the EU e-Accessibility standard as an Indian national standard, paving the way for increased collaboration between the EU and India on subjects relating to accessibility and inclusiveness.

Other notable results in 2022 included:

- Signature of MoU between ETSI and BIS, together with organization of a study trip in EU for BIS officers, including one-day training at ETSI premises;
- Participation of SESEI in several events, representing ESOs or ETSI;
- Response to queries from EU industry and associations.

Three Steering Committees took place in January, June and October in Sophia Antipolis, during the ETSI Security Week for which the SESEI helped invite Mr Narendra Nath, Joint Secretary of the National Security Council of India.

Monthly newsletters and quarterly reports give a detailed overview of the SESEI activities and are available from the SESEI website at www.sesei.eu.

International Digital Cooperation on ICT Standardization (InDiCo)

Between January 2018 and May 2022, ETSI has managed a project on International Digital Cooperation for ICT standards under a grant from the European Commission and as part of its Foreign Policy Instrument. Named InDiCo, the project has covered a wide geographical area, with six countries (and the surrounding region when relevant) being in the scope: Brazil, China, India, Japan, South Korea and the United States. Extended from its initial closing date of December 2020, the initiative focused on building bridges between technical communities as well as policy makers on topics relating to the Digital Single Market and related ICT standardization priorities. The relationships and work strands initiated during the project serve to enhance future cooperation on ICT standards and alignment in policies and regulations.

ETSI's role in the project has been that of a coordinator, gathering and involving stakeholders in Europe and in the partner countries. In 2022, the team delivered multiple events and activities, all held virtually due to ongoing travel constraints. During the closing meeting on 31 May the European Commission and Stakeholders representatives praised the achievements of ETSI over a challenging period of execution, and expressed their intent to leverage results from the project.

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

Overall objectives of the EU-funded efforts on 'India-EU Cooperation on ICT-Related Standardisation, Policy and Legislation' (established in 2015) have been to promote closer alignment between India and Europe with regard to the production and use of ICT standards and to harmonise the exchange of statistical data, thereby facilitating trade, increasing interoperability and the ease of doing business for companies, and adding additional weight to European and Indian ICT standardization efforts at the global level. The main cooperation partners are the Telecommunications Standards Development Society, India (TSDSI) and its members, and the Central Statistics Office of India (CSO); and on the European side ETSI and Eurostat. In 2022 three knowledge-sharing webinars focusing on oneM2M took place under the scope of the project. Formal closure of the project takes place in February 2023. See more at indiaeu-ictstandards.in.

16 WORKING WITH NSOs

Relationships with National Standards Organizations

ETSI works closely with each European country's national standards body or 'National Standards Organization' (NSO), at least half of which are full members of ETSI. All have a key role to play in our standards making process and in other areas of ETSI's work. This includes liaison at local level with ICT and other industry sectors, as well as responsibility for ensuring the transposition of ETSI-produced ENs into national standards. The NSOs and ETSI use dedicated online and hybrid NSO meetings to collaborate and share information. In anticipation of the amended regulation which comes into force in July 2023, we have been engaged in close dialogue with our NSOs to ensure that ETSI's own directives and procedures support the efficient handling of standardization requests, as well as meeting other priorities identified in the Commission's review.

The revised regulation was finally adopted as Parliament/Council Regulation 2022/2480 which was published in the OJEU on 19 December 2022. During the year six meetings were held involving close dialogue with the NSOs on general topics, how to better collaborate and to analyse the proposed changes to the ETSI Standardisation Request-related processes further to the EC proposed amendments to Regulation (EU) No 1025/2012. Several draft documents describing the proposed changes to the current processes were presented by the ETSI Director-General and discussed with the ETSI members and the ETSI NSOs and to collect their feedback, and an updated version (with more details) of the proposed changes to the ETSI Directives should be submitted to the same target audience during Q1 2023. Further work will be undertaken to finalise these changes prior to the amended regulation entering into force in July 2023. From this date the ETSI NSOs from the EU/EFTA will have the responsibility to accept Standardization Requests on behalf of ETSI as well as agreeing the requested work programme. Dialogue has also been undertaken to meet other priorities identified in the Commission's review.

There have also been discussions with the NSOs on how to enable closer work with them on outreach to National industry and to co-ordinate on broader strategic issues. ETSI aims at helping the NSOs bring the information gathered in the meetings and distributed by the ETSI Secretariat back to their national committees and potentially trigger an exchange with experts in the relevant ETSI committees. This is a common interest as ETSI's work on ICT standards is of interest to national players, who can then become involved in these activities.

During 2022 updates were made to the IT tools provided to NSOs to facilitate their task and quickly access the deliverables under approval. The NSO Guide was reviewed and published in April 2022. Following on some comments made during the meetings, the general information contained in the ETSI Portal NSO dedicated page was entirely reviewed to make the information more coherent and user friendly. General information given on the ETSI NSO Portal page was entirely reviewed to facilitate its consultation. A short video was produced in December that accompanied the new process to report on Regulation 1025/2012. Four webforms were developed to facilitate the reporting and analysis on answers provided by the NSOs.

17 SPECIALIST TASK FORCES AND OTHER FUNDED PROJECTS

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. Therefore, STFs can 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.

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

Altogether (EU, ETSI or Partners), 32 STFs (Interoperability events not included) and other funded projects were active in 2022, involving more than 80 service providers for a total spent of about 2,46 M€. 3GPP Members provided voluntary contributions equivalent to 0,34 M€.

TECHNICAL AREAS IN WHICH FUNDED RESOURCES WERE SPENT IN 2022

TECHNICAL AREAS	FINANCIAL INVESTMENT (K€)	%
3GPP Partners	710	29%
Centre for Testing and Interoperability	291	12%
Intelligent Transport Systems (ITS)	445	18%
Angmented Reality Framework (ARF)	100	4%
Human Factors (HF)	96	4%
Smart M2M	57	2%
Multi-access Edge Computing (MEC)	94	4%
EMS and Radio spectrum Matters (ERM)	43	2%
Cross-cutting Context Information Management (CIM)	118	5%
Network Functions Virtualization (NFV)	40	2%
Quantum Key Distribution (QKD)	23	1%
User Group (USER)	35	1%
Emergency Communications (EMTEL)	46	2%
Cyber Security (CYBER)	2	0%
Voluntary	361	15%
TOTAL	2460	

Figures are rounded to the nearest k€.

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.

TTF TECHNICAL AREAS IN WHICH FUNDED RESOURCES WERE SPENT IN 2022		
TECHNICAL AREAS	FINANCIAL INVESTMENT (K€)	%
Methods for Testing and Specification (MTS)	186	29%
Secure Element Technologies (SET)	88	14%
Speech and multimedia Transmission Quality (STQ)	74	12%
Digital Enhanced Cordless Telecommunications (DECT)	97	15%
Core Network and Interoperability Testing (INT)	88	14%
Multi-access Edge Computing (MEC)	13	2%
Network Functions Virtualization (NFV)	24	4%
Intelligent Transport Systems (ITS)	9	1%
Emergency Communications (EMTEL)	34	5%
Smart M2M	17	3%
Mobile Standards Group (MSG)	13	2%
TOTAL	643	

Figures are rounded to the nearest k€.

FUNDING SOURCES IN 2022	
ETSI	23%
3GPP Partners	29%
EC/EFTA	33%
3GPP Members	14%
Other ETSI Partners	1%

EC/EFTA Funding

2022 was a year of consolidation with regards to processes and working methods to be put in place in the context of the new tri-partite relations between DG GROW, the newly created European Innovation Council and SMEs Executive Agency (EISMEA since April 1st 2021) and ETSI.

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. The new action grants signed are now operated under the 'actual cost' model as before 2015.

ETSI received from EISMEA in 2022, three invitations to submit technical proposals on dedicated topics and to be funded out of the 2022 EU budget allocated to standardization.

The Agency positively assessed the three proposals sent by ETSI in response to the first call, and ETSI received 1,03 MEUR to fund activities proposed by ISG CDM, TC SmartM2M, and the ETSI CTI department for organising Interoperability events.

In reply to the second call, ETSI addressed in September seven of the proposed topics requesting a total funding of 1,7 MEUR. The outcome of the evaluation of these technical proposals was still expected at the end of the year 2022.

Eventually, a third invitation to submit technical proposals by January 2023 was received in November. This latest 2022 call included five topics of ETSI's interest. At the end of December 2022, ETSI intended to reply to four of these topics for total funding of 0,95 MEUR requested. EISMEA evaluation outcome is expected by the end of March 2023.

The Operating Grant destined to finance part of ETSI operations in its role of ESO and standardization platform is ruled by a new Framework Partnership Agreement signed in June 2021 for a four-year duration.

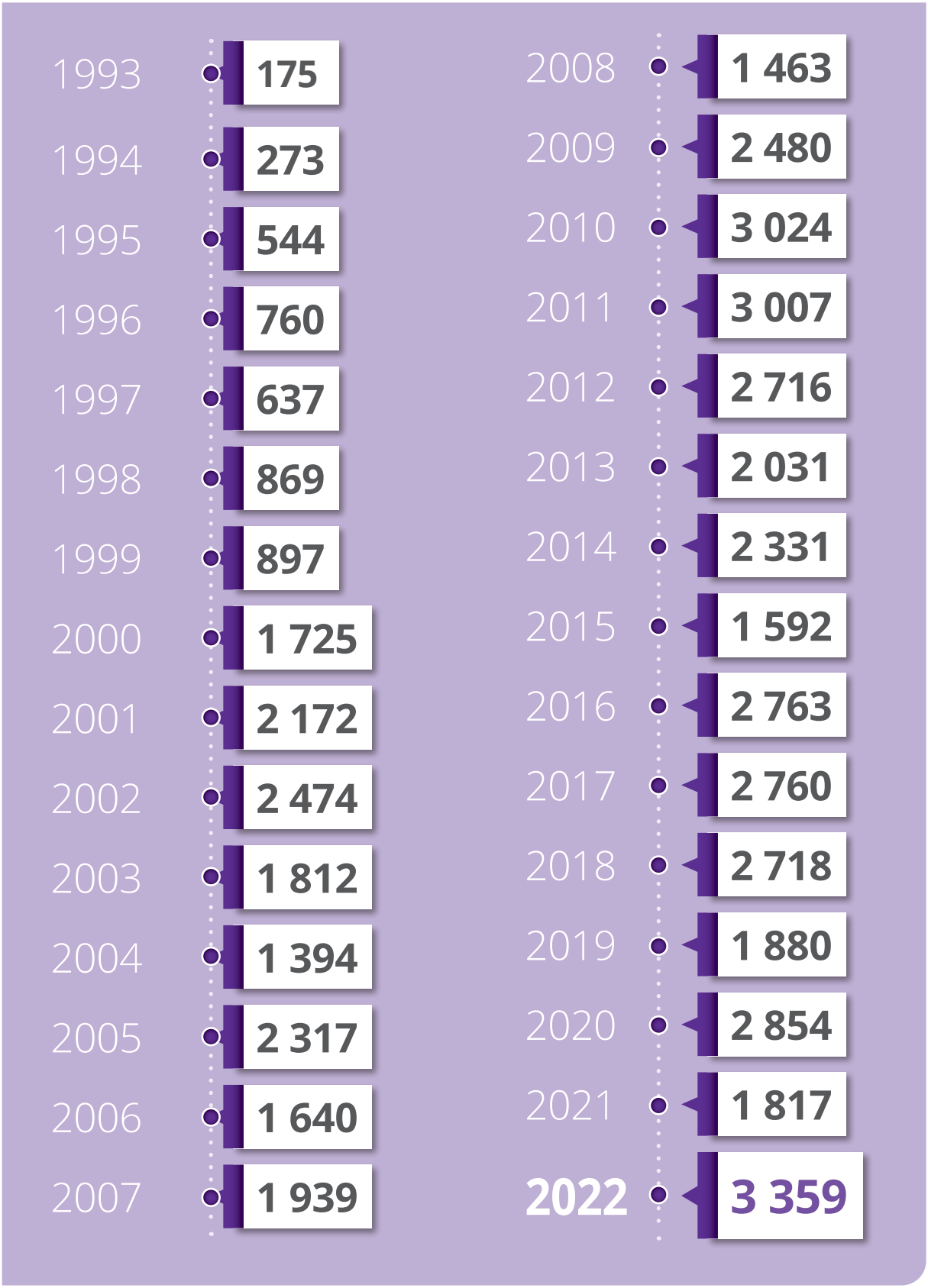
After the EC extended deadlines for submission and evaluation, ETSI could formally submit its Work Programme for a 2022 Operating Grant. Following its positive assessment by the EC/EFTA, the acceptance of the eligible costs and the funding rate, ETSI was granted a maximum of 0,95 MEUR subsidy in 2022, EFTA share included.

We reported and achieved 88,5% payment of the 2021 Operating Grant initially allocated due to budget items having been actually underspent. No actual costs were formally rejected.

18 STANDARDS PRODUCTION AND IPR

Standards Production

NUMBER OF DELIVERABLES PUBLISHED, FOR EACH OF THE YEARS 1993 – 2022



DISTRIBUTION BY TYPE OF PUBLISHED DOCUMENT		
	IN 2022	TOTAL SINCE 1988
Technical Specification (TS) [1]	2 899	44 973
Technical Report (TR)[2]	244	4 476
ETSI Standard (ES)	32	900
European Standard (telecommunications series) (EN) [3]	39	5 266
ETSI Guide (EG)	2	259
Special Report (SR)	2	115
Group Specification (GS)	109	564
Group Report (GR)	32	185
TOTAL	3 359	56 738

Intellectual Property Rights

As in previous years, 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. More and more analysts are using the revisited Special Report SR 000 314. It is a complete ETSI deliverable, entirely dedicated to information on IPRs which have been notified to ETSI as being Essential – or potentially Essential – to ETSI standards. This report is updated every month: accessible on demand, it offers the complete information contained in the ETSI IPR Online database as of the time it is generated. ETSI is constantly enhancing the database for greater accuracy and completeness.

The whole process of declaration of Standard Essential Patents (SEP) is now 100% electronic, and the Secretariat is working on solutions for a better accuracy regarding unpublished and provisional patent declarations that may create uncertainty regarding the possibility of being licensed.

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)

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 renewed at General Assembly 80, has audited the 2022 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 2021, income increased by 7% (+ 1 700 k€) while expenditure increased by roughly 13% (2 853 k€). Consequently at the end of 2022, the excess of income over expenditure has been significantly reduced compared to 2021. After having made provision of roughly 88 k€ for Income Tax to be paid and of 850 k€ in credit notes to be issued to Members in compliance with the ETSI Directives, the net result of the year is 255 k€. This compares with a net result of 83 k€ in 2021.

The key points of the budget management are the following:

Income

Members' contributions (18,71 M€ before credit notes) were 3,3% over budget and increased by 2,3% compared with 2021. They funded roughly 75% of the budget. European Commission (EC)/ European Free Trade Association (EFTA) funding amounted to roughly 2,7 M€ to cover expenses related to the operation of the European standardization platform, and standardization projects including International Digital Cooperation.

3GPP Partners contributed 2,2 M€ corresponding to their share to the project according to the funding formula in force and also taking into account the impact of the significant 2021 carry-forward.

Expenditure

Secretariat costs were 6,1% under budget and higher by 13% compared with 2021. The significance of this cost increase stems from the fact that the Institute's activities in 2022 could resume almost as before the pandemic and there were no longer lockdown measures. Only travels remained at a lower pace than in 2019 and very few intercontinental trips could take place.

Staff resources were reinforced by a net addition of one permanent headcount and one temporary contract.

IT developments accelerated in 2022 and the financial software was migrated to the latest version, introducing many process modifications.

3,2 M€ were spent acquiring expertise for Specialist Task Forces and other standardization-related technical expertise.

2022 Budget Statements

2022 BUDGET STATEMENTS	
INCOME	K€
Members' contributions and Observer fees net of credit notes	17 855
EC/EFTA contracts	2 655
3GPP™ Partners	2 205
Voluntary contributions	361
European Friends of 3GPP	1 331
Sales	100
Financial income	30
Other income	576
TOTAL INCOME	25 113

2022 BUDGET STATEMENTS	
EXPENDITURE	K€
Secretariat staff costs	14 681
Other Secretariat costs	5 049
Special projects	483
European Friends of 3GPP	1250
Provision and losses	229
Experts' costs	3 166
TOTAL EXPENDITURE	24 858

In 2022, there was a net result of 255 k€.

Financial Statements for the Year 2022

The final accounts and the balance sheet are summarized below.

The fiscal accounting period is 1 January 2022 – 31 December 2022.

Statement of Income and Expenditure Year 2022

	INCOME (€)	EXPENDITURE (€)
Income	25 034 996	
Purchases		9 010 145
Expenses		15 797 005
Financial income and expenses	35 976	6 516
Extraordinary income & expenses	108 528	21 341
Income Tax		88 696
TOTAL	25 179 500	24 923 703

There was a net result of 255 797 € in 2022.

Summary of the Balance Sheet

Assets

NET AMOUNTS AT:	31 DEC 2021 (€)	31 DEC 2022 (€)
Fixed assets	5 222 956	5 220 056
Debtors	13 617 188	14 864 577
Securities/cash	18 072 800	16 555 781
Prepaid expenses	403 273	329 272
TOTAL ASSETS	37 316 216	36 969 685

Liabilities

NET AMOUNTS AT:	31 DEC 2021 (€)	31 DEC 2022 (€)
Equity	9 038 542	9 124 155
Provisions	367 801	286 517
Balance carried forward	85 613	82 648
Result of the year	82 648	255 797
Creditors	10 584 752	10 488 654
Deferred revenue	17 156 860	16 731 913
TOTAL LIABILITIES	37 316 216	36 969 685

Figures are rounded to the nearest €.

20 ETSI FELLOWSHIP PROGRAMME

Distinguished service

Recognizing an outstanding personal contribution

Established in 2015, the ETSI Fellowship Programme honours those individuals who have made an outstanding personal contribution to ETSI, to building the work of ETSI, or raising its reputation in specific sectors of standardization. Any individual representative of an ETSI member may propose a candidate for an ETSI Fellowship. Candidates must have been proposed by representatives of at least two ETSI 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 2022 we honoured Diego López, Günter Kleindl, Larry Taylor and Lindsay Cornell as ETSI Fellows for their outstanding personal contributions.

Diego López

Head of Technology Exploration and Standards, GCTIO Unit of Telefonica, Spain

Diego Lopez has been active in ETSI's Network Transformation initiatives since being an original proponent of the seminal ISG NFV. He has acted as WG Chair, as Chair of the Technical Steering Committee, and chaired the group for four years. Diego also took active part in the foundation of ISG ZSM, where he has recently been appointed as Chair of, and is active in other related groups such as ISG ENI and ISG MEC. He is also active in other initiatives related to network transformation, especially as the current Chair of ISG PDL, part of the founding groups for ISG SAI and ISG ETI, and contributor to TC CYBER, ISG NIN and ISG QKD.

Günter Kleindl

Standardization Manager, OVE, Austria

Günter Kleindl has been a key member of the DECT standards community since 1987. In 1989 he oversaw development of the DECT base standard that was first published by ETSI in 1992. Günter has spent over 35 years of his career in wireless communications and has supported the development of ETSI standards and needs of the industry in other standards bodies and industry fora. In 2000 he managed the approval of DECT as a member of the IMT-2000 family, and in 2022 he helped achieve the ITU-R's approval of the DECT-2020 standard as an IMT-2020 technology.

Larry Taylor

Retired, Former Consultant, Discrete Time Communications, UK

Larry Taylor has spent much of his career working to obtain spectrum for new or emerging communications technologies, supporting spectrum requests with industry and international standards, participating in conferences, workshops and funded R&D programmes to promote the work and associated standards. The work on HIPERLAN in ETSI RES10 supported the initial designation of 5GHz spectrum on which today's professional WLAN market is built. His work in IEEE and industry standards bodies supported the FFC UWB ruling for spectrum below 10.5 GHz. His work on utility networks in IEEE, TIA, industry standards bodies and ETSI supported European spectrum designations at 870 MHz. A keen proponent of testability in standards and a supporter of cross-fertilization between SDOs, he has led many technical committees in a variety of SDOs.

Lindsay Cornell

Principal Systems Architect, BBC Design & Engineering, UK

Lindsay Cornell has been involved in radio broadcasting throughout his career and is a pioneer of digital broadcasting technologies. He began his involvement in ETSI as Chair of STF-84 in 1997, developing the standard interfaces for the nascent Digital Audio Broadcasting (DAB) transmission equipment. Lindsay has led the work to produce numerous digital radio standards, taking the role of Rapporteur in JTC Broadcast. He was instrumental in bringing the standards for Digital Radio Mondiale (DRM) and RadioDNS hybrid radio into ETSI and has contributed to the development of Harmonised Standards for the Radio Equipment Directive in TC ERM TG17 (PMSE and broadcast). Since 2014 he has chaired TG17 WG2 which has created the multipart deliverable for broadcast sound receivers and adapted and updated the R&TTED standards for broadcast sound transmitters. Lindsay continues to collaborate and develop deep relationships across industry, with an emphasis on spectrum and regulatory issues as Chair of CEPT FM51.

21 MEMBERSHIP

Membership

Overall ETSI membership decreased by roughly 1% in 2022. At the end of the year, we had a total of 938 members, drawn from 63 different countries and provinces across five continents. This was made up of 760 full members drawn from 40 European countries, 170 associate members drawn from 21 non-European countries and 8 observers from both European and non-European countries. 127 of our members are Small and Medium-sized Enterprises (SMEs) and 82 are Micro-Enterprises. Small organization members represent roughly 22% of the overall membership. 125 members are universities and research bodies; this represents roughly 13% of the overall membership.

26 resignations were received during the year and are effective 1st January 2023.

Collection of contribution invoices in 2022 was performed with a rate of 98,93% of recovery.

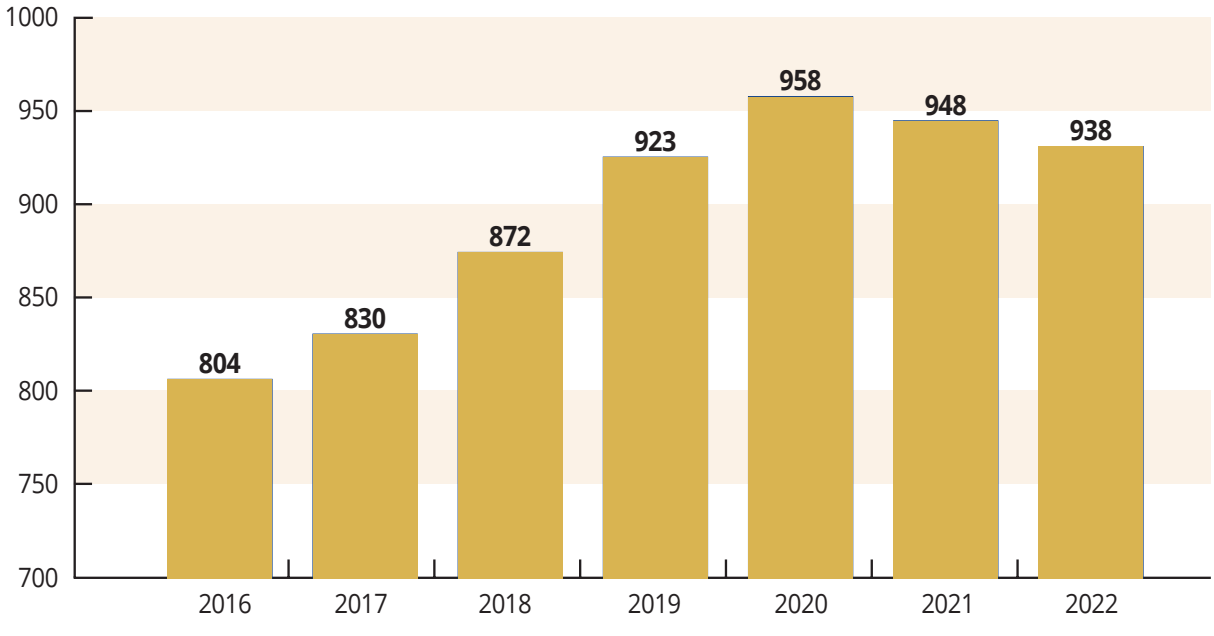
One of the utmost priorities is the development of the ETSI Membership base, gathering a diverse, vast and innovative community for the development of world-class ICT standards by reaching out to different vertical sectors, which ETSI can pride itself for achieving when listing the names of the organization being ETSI Members.

ETSI not only promotes inclusiveness but realizes it by having a high percentage of eminently innovative small organizations but also by the number of universities and research bodies.

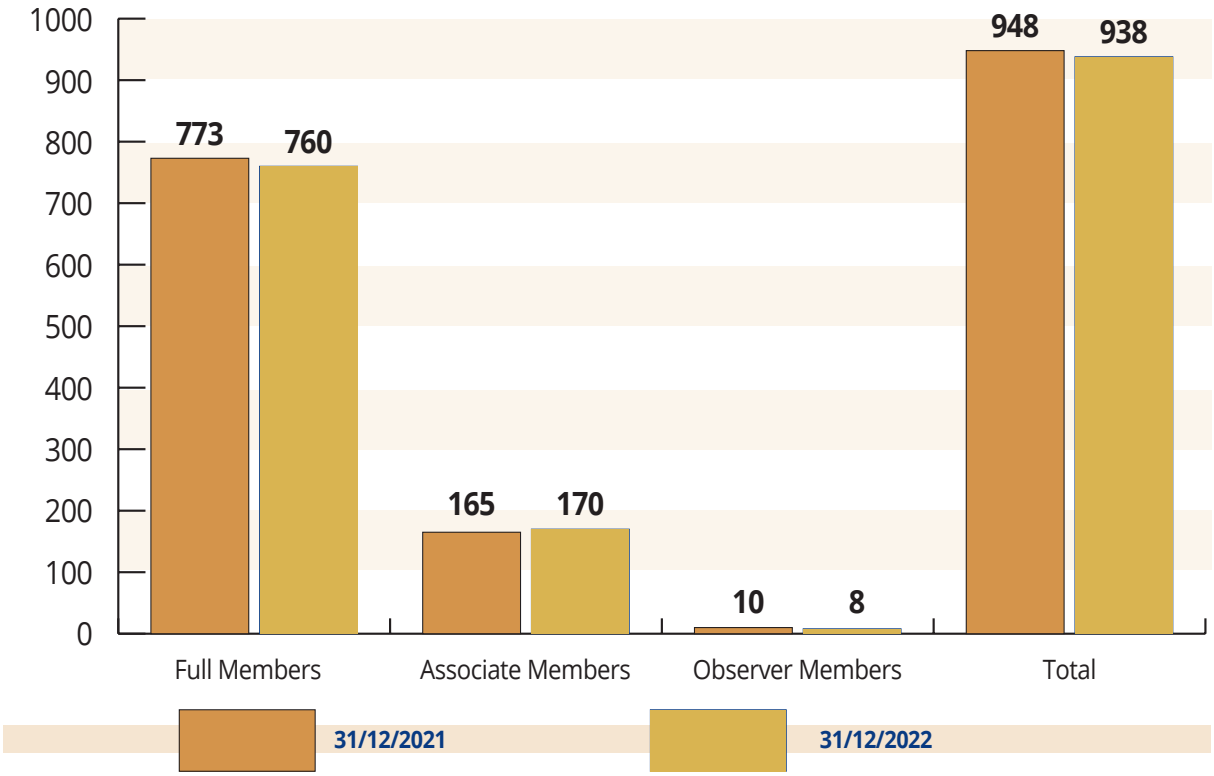
To ensure that Members can enjoy a quick start when joining ETSI, an on-boarding programme is available. This aims to improve new ETSI members' experience and to inform them of the tools, working methods and benefits of ETSI facilitating their first steps within the ETSI community. The onboarding programme is complemented by an online seminar and various guides and documentation specifically produced to assist each member within the ETSI environment. See etsi.org/media-library/ and etsi.org/events/etsi-seminar.

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.

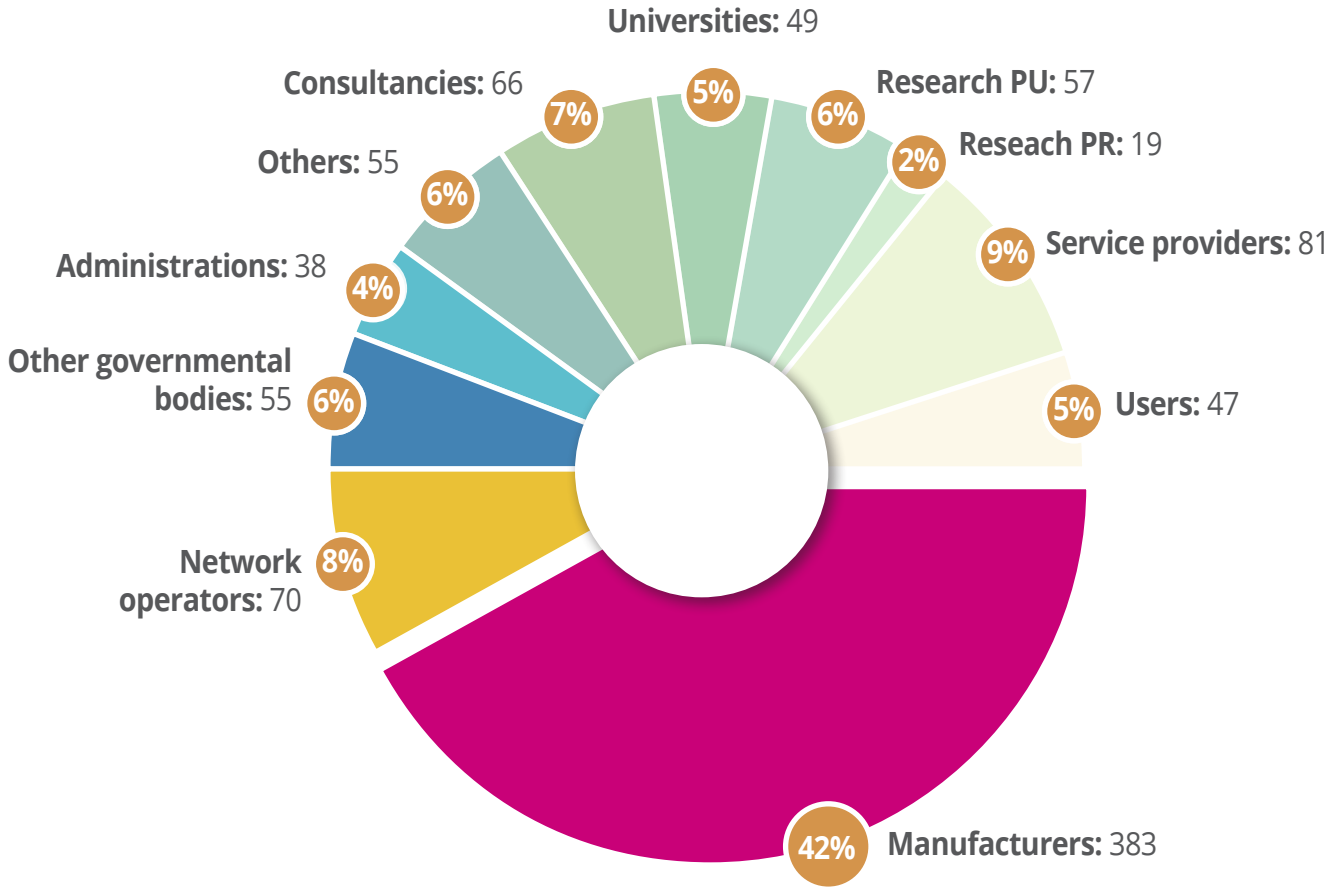
EVOLUTION OF ETSI MEMBERSHIP
(Full, Associate & Observer members)



MEMBERSHIP PER STATUS



FULL AND ASSOCIATE MEMBERSHIP BY CATEGORY 2022



22 JOIN OUR COMMUNITY

Take full advantage

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

ETSI provides the opportunities, resources and platforms for organizations to understand, shape, drive and collaborate on globally applicable standards. ETSI standards facilitate interoperability, security, and competitive advantage across all sectors of industry and society. Our international membership includes universities, research bodies, associations and public authorities, as well as industrial companies of all sizes: a quarter of ETSI's members are small or medium sized enterprises (SMEs).

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

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

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

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Published April 2023