ETSI

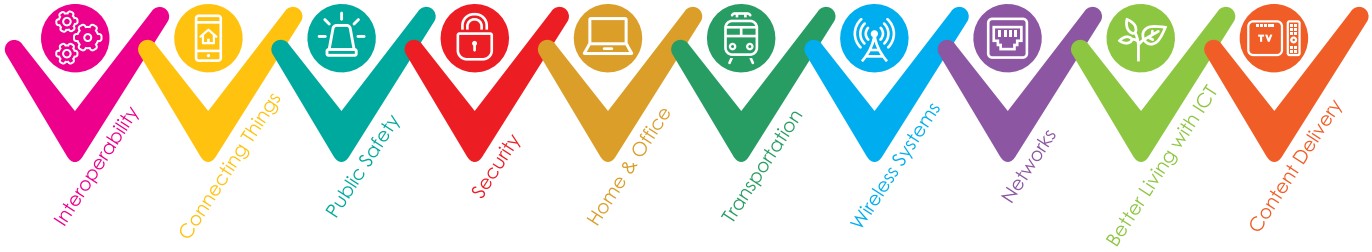
The Standards People

building the future

work programme
2018 - 2019

ETSI's Vision of a Connected World

ETSI's clusters provide a simple, easy to grasp overview of our wide range of activities in Information and Communications Technologies standardization, which, all together, help build a connected world. A new visual approach to the clusters has been developed in keeping with our branding.



ETSI is a producer of technical standards intended for global use for digital technologies, products and services. The high quality of our work and our open approach to standardization has seen our reach extend from European roots to the entire world.

ETSI is officially recognized by the European Union as a European Standardization Organization (ESO). Our activities are driven by time to market and our standards help ensure the free movement of goods within the single European market, allowing enterprises in the European Union to be more competitive.

ETSI is a not-for-profit organization created in 1988. We have over 800 member organizations worldwide, drawn from 66 countries and five continents. Our diverse membership includes some of the world's leading companies from the manufacturing and service sectors, regulatory authorities and government ministries, as well as Small and Medium-sized Enterprises and innovative start-ups, working alongside universities, R&D organizations and societal interest groups.

ETSI is a world-renowned organization with a solid 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.

ETSI is at the forefront of emerging technologies. We have close relationships with research communities and other innovative organizations, addressing the technical issues that will drive the economy of the future and improve life for the next generation.

The standards we produce truly respond to the needs of the ICT industry, as represented by our members. Join us – and have your say in the future shape of our industry.

Building the Future – Work Programme 2018-2019

Dirk Weiler
Chairman of the Board

We are currently executing our Long-Term Strategy for 2016-2021. Reinforcing ETSI's position as an enabler of standards that directly benefit the market and end users, this initiative underlines our role in supporting European Union (EU) policies around digitalization and Information and Communications Technologies (ICT) standards.

Mobile technology remains at the heart of our standardization activities as it has been for the last three decades. After a lengthy technological gestation – and much media speculation – 2018 heralds Europe's first 5G network trials. These depend on new radio specifications and a supporting system architecture defined by the Third Generation Partnership Project (3GPP™).

The delivery of the first 5G specifications, namely the completion last year of 'Non-Standalone' NR new radio specifications, now paves the way for chip design and network implementation by 2019. This timeframe is ahead of the nominal 2020 target proposed by the Radiocommunication sector of the International Telecommunication Union (ITU-R).

Realizing the ambitious vision for 5G demands a radical approach to all aspects of network architecture and protocols, operations and management. This is reflected in our work on Network Functions Virtualisation (NFV). In parallel, our Industry Specification Group on Multi-Access Edge Computing is exploring how the placement of computational functionality closer to the end user will reduce latency and improve user experience in a range of 4G and 5G applications.

Further ground-breaking work on 'zero-touch' networks will assist tomorrow's operators with automating a wide range of processes, while our group on Experiential Networked Intelligence will help operators leverage Artificial Intelligence (AI) techniques to address the challenges of future network deployment and operation.

The advent of 5G requires fresh approaches to the efficient use of finite spectrum resources. As well as ensuring compatibility between different uses in adjacent spectrum we continue to explore improvements in spectral efficiency and advances in spectrum-sharing techniques. We are also exploring the use of radio frequencies in the millimetre wave band that offer valuable extra capacity to meet projected demand for 5G services.

Another key technology for ETSI is the Internet of Things. As devices become smarter and more connected, standardization plays a crucial role in ensuring interoperability between equipment and applications. An illustration of this is our presence in oneM2M, the global standards initiative that covers requirements, architecture, Application Programming Interface (API) specifications, security solutions and interoperability for machine-to-machine (M2M) and Internet of Things (IoT) technologies. As a founding partner in oneM2M, we are helping produce specifications that enable users to build platforms by which devices and services can be connected, regardless of the underlying technology used. We are also investigating the needs of smart cities and wireless industrial automation, and we support the IoT with specifications for Digital Enhanced Cordless Telecommunications (DECT™) Ultra Low Energy and Low Throughput Networks.

Security and privacy are inescapable aspects of everybody's digital lives. Security standardization – sometimes in support of legislative actions – has a key role to play in protecting the communications and business carried over the Internet that we all depend on. Accordingly, our work on cyber security helps protect individuals and organizations in response to a dynamic, increasingly complex landscape of threat vectors.

Complementing our interest in new technologies, we continue to address well-established topics such as satellite communications, networks, energy efficiency for ICT, road, rail, air and maritime transportation, public safety, accessibility, broadcasting and media quality.

As an organization, ETSI is itself evolving. As our membership continues to grow, we are attracting growing interest in our work from a wide range of markets and communities, from automotive manufacturers to smart cities. Meeting the diverse needs of these groups brings its own opportunities and challenges. To enrich our standardization activities – while maintaining the integrity of ETSI's Intellectual Property Rights policy – we are actively exploring the use of Open Source methods, both inside ETSI with Open Source NFV Management and Orchestration (OSM) and in cooperation with external Open Source projects and platforms.

This Work Programme describes the varied activities we have planned for 2018-2019. Full details of all upcoming standards and specifications can be found at http://webapp.etsi.org/workprogram.

New Beginnings

Our Long-Term Strategy continues to guide our work. To maintain our position as a leading standardization organization for Information and Communications Technologies (ICT), we must attract new technologies and industries, strategically positioned at the heart of digital, responding to global as well as European needs. We are therefore adopting new approaches to collaboration, adapting our working methods in a versatile and inclusive manner.

From Research to Standards

Standardization can be crucial to the market success of a technology or a product, particularly if it can be applied early in the development process. Standards activities can also help bridge the gap between research and the industrial development of products and services, facilitating the commercialization of research results. At the same time, research and development (R&D) can trigger new standardization activities, enabling us to ensure that standards are in place when they are needed.

In 2018 we will seek to further encourage collaboration with researchers and innovators, to promote the smooth uptake of the output of research and innovation into standardization. We will continue to cultivate close relationships with academic institutions and we will participate in relevant conferences and other events where project results are being presented. We will maintain contact with European Technology Platforms, Public Private Partnerships and Joint Technology Initiatives, as appropriate. We will monitor activity related to Horizon 2020 (H2020), the EU research funding programme, and take part in relevant projects, as our resources allow. We are partners in the CREATE-IoT project, which supports five large-scale Internet of Things (IoT) pilot projects, and in the F-Interop project, where we are integrating a oneM2M interoperability test tool into the project's online interoperability and performance test tools. We participate in the European Union (EU) Joint Initiative on Standardization, which sets out a shared vision for European standardization. We will continue to collaborate with National Standards Organizations and Small and Medium-sized enterprises, which are often well-placed to advance specific technologies. In all these ways, we will seek to identify candidate technologies for standardization and support stakeholders in standards-related activities.

White Papers

We regularly publish ETSI White Papers that provide an informal overview of important technical topics related to our programme of activity. These papers summarize the work that we and other organizations have been conducting in a specific area. They also highlight broader issues related to the successful deployment of the technologies and services discussed. In 2018 we expect to produce White Papers on Multi-Access Edge Computing (MEC) in 4G and 5G Networks, Smart Cities, Quantum Key Distribution, Microwave and Millimetre Wave Transmission for 5G and eHealth.

Workshops

Every year we organize a varied programme of workshops. Bringing communities together, these events provide valuable opportunities to share news of our work and its progress, and stimulate new standardization activities. Our workshops also provide a platform for researchers to share their results and to identify next steps for standardization. They thus facilitate early consensus-building and fertilize our ongoing technical work.

In 2018 we will run globally recognized annual events including the ETSI Security Week in June and our IoT Week in October. Further events include the first ETSI MEC Hackathon (September); the ETSI User Conference on Advanced Automated Testing (UCAAT) in October; the sixth Quantum Safe Cryptography workshop, co-organized with the Institute for Quantum Computing and Chongqing University in Beijing (November); and our workshop on Intelligent Transport Systems (March 2018).

Supporting the Development of New Technologies

Industry Specification Groups

Our Industry Specification Groups (ISGs) provide a flexible platform that brings together a wide range of stakeholders including non-members of ETSI. They have proved highly successful in nurturing a number of innovations, with the outputs of these groups being developed further in other ETSI committees. A total of 17 currently active ISGs includes three freshly-established groups.

Our Augmented Reality Framework (ARF) ISG is exploring the combination of real-time digital content with the real world to enable context-rich new user experiences mediated through sensors, wearable computing, the IoT and Artificial Intelligence (AI).

Our City Digital Profile (CDP) ISG is developing standards and specifications to support the deployment and roll-out of smart city infrastructures.

Our ISG on Zero Touch Network and Service Management (ZSM) is examining use cases and requirements for tomorrow's 'zero touch' networks, with the goal of automating a wide range of operational processes from delivery and deployment to configuration, assurance and optimization.

Delivering 5G

Our work supporting the development of 5G continues, both as a partner in the Third Generation Partnership Project (3GPP™) and in our own committees.

At the end of 2017 3GPP delivered the first 5G specifications. Building on this foundation, the complete set of initial 5G specifications contained in 3GPP Release 15 has been successfully delivered in mid-2018. We continue to develop the 5G specifications, working towards delivery of 3GPP Release 16 in mid-2019.

A number of our activities – such as Network Functions Virtualisation (NFV) and MEC – are crucial building blocks for the realization of 5G. As such they are considered key components of the next generation of ICT platforms.

We are investigating the use of currently under-used spectrum resources in the millimetre range to help meet future demand for 5G services. We are developing standards for monitoring and controlling power consumption in 5G networks. These will be a significant factor in the viability of 5G, both economically and environmentally.

Supporting the Development of the IoT

As a partner in oneM2M, we are helping to produce specifications that enable users to build platforms by which devices and services can be connected, regardless of the underlying technology used. In our own Smart Machine-to-Machine Communications committee (TC SmartM2M), we are enabling connected devices to exchange information through SAREF, our smart appliances reference ontology. We are investigating the needs of smart cities, wireless industrial automation and Context Information Management, and we support the IoT with specifications for Digital Enhanced Cordless Telecommunications (DECT™) Ultra Low Energy and Low Throughput Networks.

Open Source

In 2018 we will continue to explore the benefits of Open Source methodologies and frameworks in ETSI. For example, collaboration with Open Source communities and foundations may help accelerate the development of innovative new digital technologies by working across traditional borders.

Our Centre for Testing and Interoperability is extending its use of Open Source-like software development approaches in the production of test specifications and platforms. We are also developing the Test Description Language (TDL) Open Source Project (TOP) to provide our committees, our Secretariat and external parties with an integrated Open Source toolset for TDL.

Some of our ISGs are also exploring the use of Open Source or Open Software. For example, Open Source has a crucial role to play in facilitating interoperability in software-intensive technologies such as NFV. Our Open Source MANO group (ETSI OSM) is developing a software reference implementation (code) for the ETSI NFV Management and Orchestration, or MANO, according to accepted Open Source working procedures and using a software development platform which we host and manage.

Hackathons and Developer Events

Inspired by Open Source collaborative approaches, our increasingly popular Hackathons and Hackfests provide a platform for the IT development community to validate ETSI specifications through a series of live demonstrations and practical challenges. Following a recent series of successful events for oneM2M, OSM and middlebox security, we plan the first ETSI MEC Hackathon in Berlin in September 2018.

Education on Standardization

Work progresses on an EC-funded project on the development of teaching materials for education on ICT standardization. By the conclusion of the project in December 2018, we aim to offer several teaching modules that can be integrated flexibly as part of curricula for engineering, business and law students. Results will be presented during October at a conference at ETSI.

Connecting Things

Integrating Objects to Create New Networked Services

A fast-growing number of everyday machines and objects are now embedded with sensors or actuators with the ability to communicate over the Internet. Collectively they make up the Internet of Things (IoT). This draws together various technologies including Radio Frequency Identification (RFID), Machine-to-Machine (M2M) service platforms and Wireless Sensor Networks. Potential applications and services include smart devices, smart cities, smart grids, the connected car, eHealth, home automation and energy management, public safety and remote industrial process control.

The IoT is transforming the way we live and work, with innovative new services that offer unprecedented opportunities for creating and commercializing new devices and applications. By 2020, the number of connected devices is forecasted to exceed 20 billion. As IoT devices continue to saturate society, standardization is key to achieving universally accepted specifications and protocols for true interoperability between devices and applications..

oneM2M

ETSI and oneM2M

ETSI is one of the founding partners in oneM2M, the global standards initiative that covers requirements, architecture, Application Programming Interface (API) specifications, security solutions and interoperability for M2M and IoT technologies. Formed in 2012, oneM2M brings together 12 partners including eight of the world's preeminent standards development organizations (SDOs), together with other industry fora or consortia and approximately 200 member organizations.

Learn more at onem2m.org

oneM2M draws together the many diverse IoT-related business domains including telematics and intelligent transportation, healthcare, utilities, smart grid, industrial automation, smart homes, public safety and health. The initiative is developing specifications that will enable users to build platforms by which devices and services can be connected, regardless of the underlying technology used, thus enabling interoperability across IoT applications. In this way, oneM2M's specifications will reduce complexity for application developers and lower costs for service providers.

Each oneM2M partner publishes oneM2M specifications as its own local specifications. This ensures there is one global set of specifications, recognized in each region.

During 2018, oneM2M expects to issue its third release of specifications. Release 3 will focus on the use of oneM2M for industrial IoT and will include interworking support for industrial technologies. It will provide improved support for mobile IoT technologies standardized by the Third Generation Partnership Project (3GPP™) such as Narrowband IoT. Smart cities will also be addressed. In addition, Release 3 will include support documentation and tools to assist developers.

Our work is augmented throughout the year with a series of interoperability events and hackathons that invite developers to demonstrate working oneM2M solutions.

Related to the work conducted in oneM2M, our Smart M2M Communications committee (TC SmartM2M) is developing a Technical Report (TR) on achieving interoperability and interworking of existing standardized IoT platforms via the oneM2M interworking framework.

ETSI IoT Week

The ETSI IoT Week is an evolution of our highly successful M2M/IoT Workshop series. Held in October at our headquarters in Sophia Antipolis, this year's event features an overview of the major IoT standardization activities in ETSI SmartM2M, oneM2M and 3GPP. Other 2018 highlights include SAREF and semantic interoperability, connectivity, security, wearables, IoT for industry and manufacturing, smart cities, smart energy, buildings and environment. A developers' tutorial is accompanied by oneM2M implementations and product showcases throughout the event.

Smart Appliances

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

During 2018 we are continuing to focus on SAREF, our smart appliances reference ontology that runs with oneM2M-compliant communication platforms. SAREF is designed to enable connected devices to exchange information with any energy management system.

We will conclude a series of investigations with a view to specifying semantic models to extend SAREF. This work considers the domains of smart cities, industry and manufacturing, smart agriculture and the food chain, water, automotive, eHealth/aging well and wearables.

In parallel, we are continuing work on six new parts for the Technical Specification (TS) which extends SAREF, adding semantic models for each of the domains investigated. Completion is expected by the end of 2018. We are considering how to consolidate SAREF with other reference ontology patterns used in other industry domains. We are also developing guidelines on semantic interoperability and a strategic/technical approach to achieving interworking between standardized IoT platforms.

In addition to our SAREF work, other ongoing activities include a landscaping study that explores privacy aspects of the IoT. We are investigating virtualized IoT architectures, identifying new elements that are required to support a virtualized IoT service layer. This will add dynamic scalability to IoT platforms. We are also producing a suite of teaching materials covering aspects of IoT security and privacy.

In the domain of building management, we are progressing a TR for the standardization of smart lifts. This considers data that might be exchanged between lifts and their relevant management applications.

Building Smart Cities

Tomorrow's smart cities will be characterized by new services that improve the appeal of these connected urban environments to residents, businesses, investors and tourists.

The enormous scope of smart city applications will span health and social care, building management and connected homes, energy efficiency, waste management, transportation, mobility and environmental issues such as pollution and resource optimization.

Following the recent publication of our white paper that presents a horizontal approach to integrated smart city standards, our City Digital Profile Industry Specification Group (ISG CDP) is developing standards to support the deployment and roll-out of smart city infrastructures, building on existing standards and specifications, including the work of oneM2M and TC SmartM2M. Focus areas in 2018 include a high-level architecture, together with a survey of smart city reports and deliverables by other Information and Communication Technology (ICT) standardization bodies

and research organizations. We are also capturing city needs and service scenarios for their citizens and infrastructure, including concrete examples that reflect the importance of environmental factors and sustainability objectives.

Our Human Factors committee (TC HF) continues to assess the needs of consumers and citizens that must be addressed by smart city standardization, including accessibility, usability, personalization, interoperability and personal data protection.

Our Access, Terminals, Transmission and Multiplexing committee (TC ATTM) is developing standards for sustainable digital multi-service cities to support the deployment and roll-out of smart city infrastructures. This work includes a TS detailing measures to ease the deployment of smart new services and their multiservice street furniture within the IP network of a single city or cluster of cities.

Related to spectrum usage in smart cities, we plan to finalize a new System Reference document on critical infrastructure utility operations, covering smart grid and smart metering systems.

Context Information Management

From digitizing industrial processes to creating smart services for citizens, it is essential to accurately record data together with its context information, the so-called metadata, and to transfer these without misinterpretation to other systems. Single-purpose solutions work well within a known context, but are not suitable for multi-system interoperability. Our ISG on cross-cutting Context Information Management (ISG CIM) is developing Group Specifications (GSs) for applications to publish, discover, update and access context information, initially for a broad range of smart city applications and later for other areas.

In 2018 we expect to complete a number of specifications and related studies. These include the collection and analysis of use cases, an assessment of security and privacy issues, a cross-domain information model, as well as an analysis of data publication systems. We are maintaining our API specification to enable almost real-time access to information coming from many different sources (in addition to the IoT). In addition, we continue to maintain a repository of relevant external sources of CIM-related information.

eHealth

In 2018 the work of our eHealth Project (EP eHEALTH) is focused on eHealth in the new environment created by the IoT. We aim to complete a Technical Report that considers a number of typical use cases in the eHealth domain, and from this analysis identifies gaps in standardization. The analysis covers aspects of link connectivity, network interconnectivity, semantic/syntactic interoperability and security. We will also publish a white paper on eHealth before the end of 2018.

Body Area Networks

Smart Body Area Network (BAN) technology uses small, low power devices to support a range of medical, health improvement, personal safety and wellbeing, sport and

leisure applications. Our Smart BAN committee (TC SmartBAN) addresses the pressing need for global standards to support the successful market roll-out of BAN technology.

In 2018 we are continuing our comparative analysis between SmartBAN and other short-range standards such as Bluetooth LE and IEEE 802.15.6. We expect to publish our findings as a TR this year.

We aim to complete the update to our TS on low complexity Medium Access Control (MAC) and routing for smart BANs, addressing relay and hub-hub communications.

We are preparing a new TS on a standardized infrastructure for interactions between SmartBAN entities, including data transfer and sharing mechanisms.

By the end of 2018 we expect to complete updates to our TS covering a unified data representation format, a semantic open data model and a corresponding ontology, by adding extensions for semantic interoperability.

Medical Devices

We are revising our Harmonised Standard on Ultra Low Power Active Medical Implants (ULP-AMI) and accessories (ULP-AMI-P) operating in the 9 - 315 kHz frequency range.

We plan to complete a System Reference document (SRdoc) that considers Short Range Device (SRD) equipment using Nuclear Magnetic Resonance (NMR) technology in the 1 - 50 MHz range.

We have also launched work on a new SRdoc discussing inductive loop systems to assist hearing impaired users in the frequency range 0 - 20 kHz.

Wireless Systems

Towards a Fully Connected Wireless World

Radio technology is an integral part of our daily lives. We use it for mobile phones, for broadcast radio and television, in Wireless Local Area Network and cordless technology, Global Navigation Satellite Systems (GNSS), Radio Frequency Identification (RFID) and Short Range Devices (SRDs). ETSI creates the standards which define many of these radio technologies and systems.

We also provide the standards which the regulatory authorities in Europe – and elsewhere – use to manage the radio spectrum environment and to ensure safe co-existence between all the systems which compete for use of limited spectrum resources.

Harmonised Standards and the Radio Equipment Directive

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

The Radio Equipment Directive (RED), which replaced the Radio and Telecommunications Terminal Equipment (R&TTE) Directive, was applied throughout the EU from June 2016 and compliance was mandatory with effect from June 2017. This new directive has necessitated the revision or replacement of all our existing Harmonised Standards and the development of new ones. At the start of 2018, we had published more than 200 Harmonised Standards in support of the RED, of which more than 150 were cited in the Official Journal of the European Union (OJEU).

The RED covers all products that deliberately use radio waves for communication or for determining their position, regardless of primary function. This includes, for example, any product which includes a satellite positioning system (e.g. Global Positioning System, Galileo), Bluetooth, RFID, Radio Local Area Networks (RLANs) or Near Field Communication functions. The RED puts specific requirements on the performance of radio receivers so that they do not use more of the radio spectrum than is necessary. For the first time, broadcast receivers, equipment operating at frequencies below 9 kHz and GNSS receivers are included.

ETSI's Harmonised European Standards are developed by our members in our technical committees, with much of the work being done in our committee for Electromagnetic compatibility and Radio spectrum Matters (TC ERM). We continue to revise our Harmonised Standards to take account of feedback from the European Commission and based on experience of their use. In particular, we are developing a Harmonised Standard covering radio equipment operating below 9 kHz.

We also co-operate closely with the European Committee for Electrotechnical Standardization (CENELEC), in particular in the area of 'smart' or 'connected' devices where the electromagnetic compatibility (EMC) requirements for the base machine need to be reconciled with EMC requirements for the radio elements providing the connectivity. This affects, for example, smart washing machines and other domestic appliances, radio-controlled light bulbs and some industrial machinery.

Managing Radio Spectrum

We are responsible for a range of issues relating to radio spectrum usage. Our standards enable administrations to ensure that users can use spectrum as widely as possible. We help the European Commission (EC) and the European Conference of Postal and Telecommunications Administrations (CEPT) to harmonize the use of spectrum throughout the EU and beyond (usually by producing System Reference documents (SRdocs)). We participate in CEPT, the Radio Spectrum Committee and the Radio Spectrum Policy Group (RSPG) to ensure full coherence between radio standardization and the developing policy framework.

In the area of measurement uncertainty, we aim to finalize a Technical Report (TR) on the use and effect of mathematical operations on relative measurement uncertainties. One practical application of this work will be the evaluation of measurement uncertainties associated with the measurement of the radiated output power of a base station already operating in a public network.

We are evaluating receiver requirements on signal interference handing, and the results will be published in a Technical Specification (TS) and an accompanying TR. We are also studying extending the upper limit of the range of radiated emissions requirements from 6 GHz up to 40 GHz.

We continue to update our TR providing detailed information on spectrum use and an overview of ETSI standards, reports and specifications, together with their applications and relevant frequency bands.

Reconfigurable Radio Systems

A significant amount of radio spectrum is allocated to organizations that do not take full advantage of it. For example, much is used only across certain areas or only at specific times. If this under-used spectrum could be shared, it could help free up spectrum resources to support the expanding needs of our connected world and meet the needs of, for example, Industry 4.0 and the Internet of Things (IoT). Spectrum sharing will also play a key role in the development of 5G.

Expected to be a key driver in the evolution of wireless communications, Reconfigurable Radio Systems (RRS) – intelligent radio devices which can characterize and act upon their environment – offer an opportunity for the sharing of unused spectrum among multiple services and radio networks.

We are concentrating our efforts on solutions for mobile device reconfiguration and related certification, in particular taking account of where the RED includes new features impacting on the certification of user devices and other entities (e.g. network nodes) that employ RRS.

We provide regular input to the European Commission Expert Group on Reconfigurable Radio Systems. We continue development of a TS to define requirements for the dynamic recertification of reconfigurable radio equipment.

Contextual information – whether it is a user's physical location, their activity or the quality of the radio environment at a particular instant – offers pointers that can determine how a terminal reconfigures its behaviour under those circumstances. Study has continued into a radio interface engine that will address the efficient acquisition and management of context information and suitable equipment configuration in a heterogeneous radio environment which might include satellite, mobile broadband and the IoT. The results will be published in a new TR.

Following our studies on Licensed Shared Access (LSA, the technology which allows for the co-existence of the original incumbent with a new cellular operator in the same frequency band) we are developing a TS covering RRS system requirements for spectrum access for local high-quality wireless networks. This is intended as a first step towards the definition of an evolved LSA system architecture specification for providing spectrum access for local high-quality wireless networks.

We are updating our TR that defines use cases for software-based radio equipment reconfiguration, to include additional use cases such as satellite applications.

We are developing a TS to extend our existing radio equipment reconfiguration requirements, which are limited to mobile device reconfiguration, to cover radio equipment in general. We also aim to complete a TR defining an architecture for software reconfigurable radio equipment.

Broadband Radio Access Networks

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

During 2018 we are updating various Harmonised Standards based upon early feedback. These include our Harmonised Standard for Radio LANs operating in the 5 GHz band, our Harmonised Standard for White Space Devices operating in the 470 - 790 MHz TV broadcast band and our Harmonised Standard for Wireless Access Systems (WAS)/RLAN equipment operating in the 60 GHz band.

In addition, we are developing an SRdoc describing the technical characteristics of multiple gigabit wireless systems in radio spectrum between 57 and 71 GHz.

Ultra Wide Band

We will progress a new TS to evaluate necessary changes for further revisions of the Harmonised Standard on measurement techniques for Short Range Devices (SRDs) using Ultra Wide Band (UWB).

We are preparing a new SRdoc on technical parameters, transmission characteristics and applications for tank level probing radar systems in the frequency range 75 - 85 GHz.

We are also developing a new SRdoc considering technical characteristics and spectrum requirements for High-Definition Ground Based Synthetic Aperture Radars (HD-GBSAR) operating in the 74 - 81 GHz range.

In addition, we are revising our TR on worldwide regulations for SRDs using UWB in the 3,1 – 10,6 GHz frequency range.

RFID

We are currently collecting input in preparation of further updates of our RFID Harmonised Standard.

Satellite Communications

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

In 2018 a primary focus of our Satellite Earth Stations and Systems committee (TC SES) will be the revision of Harmonised Standards for satellite earth station fixed terminals or terminals on the move, whether in an aircraft, on board a ship or in a vehicle.

We are revising our Harmonised Standard for GNSS receivers. In addition, we are revising a multi-part TS on GNSS based location systems, considering test specifications and minimum performance requirements.

We are continuing to study the integration of satellite and mobile communications in a series of TRs. We are close to completing a new feasibility study that examines operating the Third Generation Partnership Project (3GPP™) (Release 8) LTE™ radio interface over geostationary satellites. We are studying how to seamlessly integrate satellite or High Altitude Platform Station (HAPS) systems into 5G networks. We are examining how to configure satellite systems in order to optimize edge delivery in 5G networks via satellite multicast systems. Furthermore, we are undertaking a technical analysis of a reference Virtualized Network Function data model for satellite communication systems. This will allow a mobile network operator to orchestrate any satellite communication system along with any other access network technology.

Work continues on a TR to examine requirements and structure for a resource management interface between satellite operators and service providers.

Work is close to finalization on a technical analysis of radio frequency, modulation and coding options for the Telemetry, Command and Ranging (TCR) of communication satellites.

Advanced Mobile Communications Technologies – 3GPP™

ETSI and 3GPP

ETSI is one of the founding partners of the Third Generation Partnership Project (3GPP), in which we come together with six other regional standardization organizations worldwide, plus market associations and several hundred individual companies, to develop specifications for advanced mobile communications technologies.

Based on the evolution of GSM™, which was defined by ETSI, 3GPP has developed the Universal Mobile Telecommunications System (UMTS™), LTE, LTE Advanced/LTE-Advanced Pro and 5G technologies.

Learn more at www.3gpp.org

Following delivery of the first 5G specifications at the end of 2017, much effort focuses this year on completion of the full set of 5G specifications. This paves the way to chip design and network implementation by 2019, ahead of the nominal 2020 target proposed by the Radiocommunication sector of the International Telecommunication Union (ITU-R).

5G systems will use not only the NR access technology and next-generation core network, but also enhancements to LTE and implicitly the Evolved Packet Core (EPC). These are delivered as part of Release 15, the first 5G release from 3GPP, in mid-2018. The initial 5G specifications delivered in December 2017 enabled 'non-standalone' 5G, providing for 5G NR radio systems installed as part of an LTE network. The full set of 5G specifications delivered in Release 15 in June 2018 also covers 'standalone' 5G, with a 5G core network and 5G NR radio system operating together. A late drop of specifications is planned in December 2018 to add the final touches to Release 15.

In parallel, work has started in earnest on the first stage of Release 16, with around 25 studies already underway on topics as diverse as Multimedia Priority Service, Vehicle-to-everything (V2X) application layer services, 5G satellite access, Local Area Network support in 5G, wireless and wireline convergence for 5G, terminal positioning and location, communications in vertical domains and network automation and novel radio techniques. Further items being studied include security, codecs and streaming services, Local Area Network interworking, network slicing and the IoT.

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

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

3GPP Release 16 will be finalized at the end of 2019. At this point it will be submitted to the ITU for evaluation as a candidate technology for International Mobile Telecommunications for 2020 and beyond (IMT-2020), following earlier submissions of Release 15 specifications.

Mobile Standards Group

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

In 2018 we continue to develop our multi-part Harmonised Standard that considers access to radio spectrum in IMT cellular networks. We are nearing completion of three parts to cover requirements up to and including 3GPP Release 13, for Evolved Universal Terrestrial Radio Access (E-UTRA) User Equipment, Code Division Multiple Access (CDMA) Direct Spread (UTRA Frequency Division Duplexing (FDD)) User Equipment and Active Antenna System (AAS) base stations. We have also initiated work on a new part to cover 3GPP NR base stations, up to and including 3GPP Release 15.

A new technical report will explore the possibility of sharing the 6 425 - 7 125 MHz band between incumbent services and Mobile/Fixed Communication Network (MFCN) services.

Millimetre Wave Transmission

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

In 2018 our Industry Specification Group (ISG) on millimetre Wave Transmission (mWT) expects to complete two Group Reports (GR) on the W-band. The first explores scenarios, spectrum usage and proposed channelization of the W-band to facilitate deployment of future high capacity backhaul systems and decongest heavily-loaded networks. The second provides a performance management overview, detailing metrics needed to describe the error performance related aspects in radio equipment.

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

Multi-Access Edge Computing

Multi-Access Edge Computing (MEC) technology offers IT service and Cloud computing capabilities at the edge of the network. Shifting processing power away from remote data centres and closer to the end user, it enables an environment that is characterized by proximity and ultra-low latency, and provides exposure to real-time network and context information.

Our ISG for MEC is developing a set of standardized Application Programming Interfaces (APIs) giving access to a tightly-controlled set of services. These APIs let operators open their networks to authorized third parties, allowing rapid deployment of innovative new applications and services for use by subscribers and enterprises. MEC has been identified as a key enabler for the IoT and Mission Critical solutions, from interactive gaming and Virtual Reality to Intelligent Transport Systems and the industrial Internet. MEC also assists in satisfying the demanding low-latency requirements of 5G.

Following the completion of the API specifications in MEC Phase 1, we are now progressing with MEC Phase 2 This work is increasingly focused on operational and implementation issues. This spans topics such as charging, mobility, support for containers, network slicing, location-based services, support in Wi-Fi and non-3GPP mobile networks, testing and key use cases such as multi-vendor/ multi-network V2X automotive environments. We are also developing a Group Specification on MEC application mobility, as well as updating existing API specifications from Phase 1. We continue to work on the description of the MEC APIs using the OpenAPI specification.

We are investigating requirements for regulatory compliance of MEC in the areas of Lawful Interception and Retained Data when these functions are not provided by underlying networks.

The first ETSI MEC Hackathon takes place in Berlin in September 2018.

Security

Standards for Secure, Reliable Communications

Information Security standards are essential to ensure interoperability among systems and networks, compliance with legislation and adequate levels of security. They provide a means for protecting the user and creating a more secure and profitable environment for the industrial sector.

Cyber Security

Security lives everywhere, mediating all aspects of our digital lives. The rapid evolution and growth in the complexity of new systems and networks, coupled with the sophistication of changing threats, present demanding challenges for maintaining the security of Information and Communications Technologies (ICT) systems and networks. Security solutions must include a reliable and secure network infrastructure, but they must also protect the privacy of individuals and organizations. Security standardization, sometimes in support of legislative actions, has a key role to play in protecting the Internet and the communications and business it carries. Our Cyber Security committee (TC CYBER) is addressing many of these issues.

In response to European Commission (EC) Standardization Request M/530 on Privacy by Design, we continue work on a Technical Specification (TS) on mechanisms for privacy assurance and the verification of Personally Identifiable Information, together with a TS on identity management and naming schema protection mechanisms to help prevent identify theft and cybercrime. We also anticipate completion of a Technical Report (TR) providing a practical introductory guide to privacy.

Digital evidence plays a central role in an increasing number of criminal investigations and subsequent court cases. We are preparing a new TR on techniques for the assurance of digital material used in legal proceedings.

'White box' cryptography protects software applications running on open devices such as smartphones that may be particularly vulnerable to attacks. We are developing a new TR that explores various security techniques for protecting software within a white box model, including code obfuscation, anti-tampering, anti-reversing, anti-debugging and anti-cloning. We continue to develop specifications for an interface to enable a trusted domain to perform sensitive functions coming from another domain.

Following the publication in 2017 of the first part of an updated TS on security counter methods and protocols, addressing Threat, Vulnerability and Risk Analysis methods, we anticipate delivery of the second part in 2018. We are also updating our Technical Report on means for describing and exchanging cyber threat information in a standardized and structured manner.

Building on our previous work, we are developing a TS to define metrics for the identification and categorization of critical infrastructures.

Standards activities related to network gateway cyber defence have increased significantly due to an array of business and compliance obligations. Following the publication of a TR that gives recommendations on implementing 'middleboxes' into boundaries between networks, we continue work on a four-part TS to specify a middlebox security protocol that enables trusted, secure communication sessions between network end-points and one or more middleboxes between them using encryption.

Smart Cards and the Secure Element

Our Smart Card Platform committee (TC SCP) considers the development and maintenance of specifications for the Secure Element (SE) and its interface with the outside world for use in telecommunication systems including the Internet of Things (IoT). Our work considers the interface, procedures and protocol specifications between the SE and other entities used in its management. It also spans interfaces, procedures and protocol specifications between such entities for the secure provisioning and operation of services making use of the SE. The specifications we develop are generic and application-agnostic. As such they can be used for any application designed to reside within the SE. They have thus found their way into other applications, such as ID management and the contactless interface specified by TC SCP, that are used in financial services.

We maintain our focus on the next generation SE that is needed for the security functions provided by the Third Generation Partnership Project (3GPP™) for 5G. Trust and privacy in IoT and mobile applications are crucial market drivers. As such, our new-generation Smart Secure Platform (SSP) will contribute significantly to achieving these goals. Technical realization of the SSP consists of two deliverables, constituting the first parts in a multi-part specification. Our first deliverable addresses generic portions of the SSP, regardless of its form factor and the physical interfaces it supports. This first deliverable will form the input for a secure authentication platform for 5G Phase 1. The second will address a specific class of the SSP – the SSP integrated on a System on Chip (SoC).

Our specifications are widely used by the industry and certification bodies. The continuous maintenance and updating of test specifications to cover new features and functionality thus forms a significant part of our work. In 2018 we will explore IoT devices which make use of technologies specified by TC SCP. As these devices do not always implement the full feature functionality specified, this requires a review of existing test cases together with the definition of new test cases where required. The non-removability (or even integration) of a Secure Element sets new challenges: these will also be assessed in our testing work.

Electronic Signatures

Our Electronic Signatures and Infrastructures committee (TC ESI) maintains standards and specifications published in response to European Commission (EC) Standardization Request M/460 on Electronic Signature Standardization.

In 2018, we will progress new standardization activities. These include the definition of policy, security requirements and protocols for trust service providers offering long-term preservation of digital signatures or unsigned data using signature techniques.

Work continues on remote signature creation services to create new technical specifications covering policy requirements for trust service providers, protocols for creating digital signatures remotely, and an architecture for AdES digital signatures in distributed environments.

We are creating a new TS on signature policies, considering formats and a signature validation policy for European qualified electronic signatures/seals using trusted lists.

A further new TS examines policy and security requirements for trust service providers.

A new TS specifies policy requirements and protocols for signature validation: this encompasses electronic signatures and seals as defined in the eIDAS Regulation. We are also specifying an XML format for a signature validation report. In addition, we will develop a TS to specify the incorporation of Evidence Record Syntax into an XAdES signature.

We are updating our European Standard on procedures for the creation and validation of AdES digital signatures. We are also revising our European Standard on certificate profiles to specify how eIDAS minimum data set attributes should be included.

Other planned activities will address global acceptance of EU Trust Services, and a new signature format based on JavaScript Object Notation (JSON). We are also providing guidance on the use of Trusted Lists.

In parallel we are updating our framework for standardization of signatures. This collates all definitions used in the framework of European standards related to e-signatures and related trust services.

We are developing TSs to specify requirements for the auditing of trust service providers against Certification Authority Browser (CA/Browser) Forum requirements, and for assessing qualified trust service providers against the eIDAS regulation requirements.

We are creating TSs on testing conformance and interoperability of electronic registered delivery (e-Delivery) services. They are complemented by new TSs specifying testing conformance and interoperability of registered electronic mail (REM) services.

Lawful Interception and Data Retention

Bringing together the interests of governments and law enforcement agencies (LEAs) as well as mobile network operators and equipment vendors, our Lawful Interception committee (TC LI) develops standards supporting international requirements for LEAs, including the interception and retention of electronic communications data sent over public communication services.

In 2018 TC LI will continue to update its Lawful Interception (LI) and Retained Data (RD) standards, specifications and reports by adding new services as required. This includes maintenance of the seven-part TS on the handover interface and service-specific details for Internet Protocol (IP) delivery.

Work nears completion on a new specification of an interface for communication between authorized Law Enforcement Monitoring Facilities (LEMFs) to support (as a minimum) European Investigation Orders related to LI and/or RD. This specification – comprising an exchange protocol together with an associated data schema – is focused on the secure handling of real-time and stored data transfer between LEMFs.

Work continues on the definition of an electronic interface for the exchange of information between systems relating to the establishment and management of LI. Following the previous publication of a specification for an internal network interface X1 for LI-related messages over Handover Interface 1 (HI1), work continues in 2018 on further specifications for interfaces X2 and X3.

Service and network architectures are increasingly becoming non-monolithic, with multiple operators involved in supplying a service to a single user. In 2018 we aim to complete updates to a TS on the dynamic triggering of interception that is required as a result of this diversification of service and network architectures.

Security Algorithms

Our Security Algorithms Group of Experts (SAGE) is widely recognized for its work on authentication and encryption mechanisms for different technologies. We continue to develop security algorithms as needed to support our standardization activities.

SAGE awaits formal requests from 3GPP to provide a new 256-bit key for 5G systems. This could also be potentially retrofitted to previous-generation systems if required. While all the radio interface algorithms in 3G and 4G use 128-bit keys, it is likely that 5G will use (or at least support) 256-bit keys that offer greater resistance to Quantum Computing attacks. If necessary, therefore, we will adapt our existing algorithms, as well as the MILENAGE Authentication and Key Agreement algorithm, to support 256-bit keys. This potentially could also be retrofitted to previous-generation systems if required.

Quantum-Safe Cryptography

The emergence of quantum computing will present a serious challenge to current cryptographic techniques. Previously secure encrypted information – such as bank account details, identity information and military security – will become subject to discovery and possible misuse. New ‘quantum-safe’ cryptographic techniques have emerged in recent years that provide protection against quantum threats.

We are addressing these security issues and developing recommendations and specifications for the transition to quantum-safe Information and Communication Technology (ICT) applications through our Working Group on Quantum Safe Cryptography (QSC) within our TC CYBER. In 2018 work progresses on quantum-safe signatures and quantum-safe virtual private networks.

Our work continues in a number of areas. We are comparing proposals for quantum-safe signature schemes and also making recommendations on the impact of integrating quantum-safe algorithms into Virtual Private Network technologies.

We are developing a technical proposal for a quantum-safe hierarchical identity-based encryption scheme. This gives an overview of the functionality provided by hierarchical identity-based encryption, together with illustrative use cases.

We are also producing user guidelines for migration strategies to a quantum safe operating model from an existing non-QSC environment.

Quantum Key Distribution

Quantum Key Distribution (QKD) enables digital keys to be shared privately without relying on computational complexity. The security offered by QKD will not be vulnerable to future advances in algorithms, computational power or the emergence of a quantum computer. With QKD, security keys are shared over optical fibre or free space links encoded on single photons or weak pulses of light. Demonstrator networks are now being constructed in several locations around the world and standards are needed urgently to enable adoption of these new security technologies. Our Industry Specification Group (ISG) on QKD is leading activities to help fulfil this need.

We are specifying a vocabulary and ontology to properly define the concepts, metrics and labels commonly used in the QKD industry. We are creating a standardized description of the key characteristics of QKD devices and of the required communication channels in the context of QKD deployment on a point-to-point link.

We are also exploring security aspects of the design, construction, characterization and operation of QKD systems to safeguard against Trojan horse attacks.

We have launched new work to define management interfaces for the integration of QKD with disaggregated network control plane architectures, in particular with Software Defined Networks (SDN).

We aim to complete specifications for a REST (REpresentational State Transfer) key delivery API, allowing application developers to make simple function calls to a QKD network to request cryptographic keys, thus simplifying interoperability between equipment from different manufacturers.

We will complete revisions to the application interface in response to new developments in network architectures.

Further work this year includes the definition of procedures for characterizing the optical output of QKD transmitter modules under operational conditions.

Security Indicators

Our ISG on Information Security Indicators (ISG ISI) continues its work on new Group Specifications (GSs). These span an ISI-compliant measurement and event management architecture for cyber security and safety; guidelines for building and operating a secured security operations centre; and a description of a comprehensive security information and event management enterprise-wide approach involving IT, management and other stakeholders.

ETSI Security Week

An important industry landmark for over a decade, ETSI Security Week explores the cybersecurity challenges underpinning our digital world. Taking place in June 2018, this year's event covers latest cybersecurity policies, legislative actions, cyberattacks and hot technologies, together with the technical and standardization actions needed to overcome our underlying cybersecurity challenges. Topics including security and privacy for 5G and the IoT are complemented by our first Middlebox Hackathon.

Better Living with ICT

Technologies for a Better Life

Technological progress is transforming the way we communicate – at home, at work and on the move. While it has opened up exciting new opportunities, we must be careful to minimize any adverse social consequences. 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). The ultimate goal is to ensure that ICT improve the quality of life for all.

Energy Efficiency for ICT

Much of our work on energy efficiency supports European Commission (EC) policies, regulation or legislation, and we work closely with the European Committee for Electrotechnical Standardization (CENELEC) in the development of relevant standards.

Our Environmental Engineering (TC EE), Access, Terminals, Transmission and Multiplexing (TC ATTM) and Cable (TC CABLE) committees collaborate to develop standards in support of EC Standardization Request M/462 on enabling efficient energy use in fixed and mobile information and communication networks. Under this request, TC EE has initiated an update of its ETSI Standard (ES) on metrics and measurement methods for energy efficiency of wireless access network equipment, to add Key Performance Indicators for energy performance of 5G base stations. We are also updating our ES on assessment of mobile network energy efficiency to take account of 5G networks.

Work continues on measuring the energy efficiency of wireless access network equipment with dynamic traffic loads.

We continue to develop an ES to define appropriate measurement methods for energy efficiency of Network Functions Virtualisation (NFV) applications. We are developing an ES for a measurement method for energy efficiency of NFV in a laboratory environment. We will also extend our ES on the 'Green Abstraction Layer' to NFV applications, working in liaison with our NFV Industry Specification Group (ISG).

Reducing Environmental Impact

We have initiated work on an ES to specify sustainable power feeding solutions for 5G networks. We expect to complete a three-part Technical Specification (TS) on the evolution of battery technology for use with stationary ICT and telecommunication equipment. This work will have implications for smart cities and other applications which rely on batteries used in conjunction with alternative power sources.

We continue to work on our multi-part European Standard (EN) covering the power supply interface requirements of ICT equipment. We will complete the part covering a single interface for 400 V AC and DC power supplies and are revising the parts covering the 400 V DC and the 48 V DC power supply interfaces. We expect to finalize new versions of the two parts of our ES on transient voltages at the 400 V and -48 V DC interfaces. We are revising our EN on reverse powering of equipment in the access network to introduce requirements for 400 V DC remote powering and to introduce a voltage/current handshake protocol.

We will finalize a TS on liquid cooling for ICT equipment, and a Technical Report (TR) on test methods and the test severity of mechanical aspects for equipment installed on poles and towers.

We will complete the revision of our multi-part EN on environmental classification and tests for telecommunication equipment, updating the part covering stationary use of equipment at weather protected locations. This revision clarifies the applicability of tests and the performance criteria.

Operationally Sustainable Networks

TC ATTM maintains its focus on sustainable smart cities, the environmental demands of operational networks and sites and the energy efficiency of broadband transmission. The committee works closely with our ISG on Operational energy Efficiency for Users (ISG OEU), sharing the aim of improving the efficiency of ICT services and increasing energy efficiency in operational networks and devices, as well as improving the management of ICT waste.

In 2018 we expect to complete a set of global Key Performance Indicators (KPIs) on operational infrastructure for mobile access networks to support future regulatory objectives. We also expect to complete revisions to a multi-part standard on broadband deployment and energy management for single- and multiple-occupancy residential and commercial premises. Our work in this area supports EC Standardization Request M/462 on efficient energy use in fixed and mobile information and communication networks.

Our ISG OEU is developing a global KPI named Data processing Communication Energy Management (DCEM), which will be used in monitoring data centres. We are supporting monitoring of the carbon footprint of the ICT industry with a Group Specification (GS) to define the CO_2 equivalent emission level for ICT sites. We continue to develop our GS to define global KPI modelling for green smart cities.

We are making good progress on the measurement of energy consumption in memory units. Work also continues on the deployment of fire extinguishing and alarm systems in ICT sites.

We are developing a Group Report (GR) on functionalities in various domains including smart buildings, digital industry, the management of smart cities and smart connected vehicles in the city, in preparation for a forthcoming Plugtests™ event on Smart Energy Management Systems. We are also working on a GR on the interoperability of networking equipment manufactured by different vendors, for use in the organization of a Plugtests event on plastic optical fibre digital communications.

Usable ICT for All

Increasing the uptake of new technologies can benefit both individual members of society and industry. Accordingly, a goal of current research into human factors is to explore innovative approaches that extend digital inclusion to the widest possible range of users, irrespective of their abilities or impairments.

The Joint Working Group on eAccessibility, which brings us together with the European Committee for Standardization (CEN) and the European Committee for Electrotechnical Standardization (CENELEC), allocated to our Human Factors committee (TC HF) the majority of the standardization work required as a result of the European Union's new Directive on the accessibility of the websites and mobile applications of public sector bodies, commonly known as the Web Accessibility Directive (WAD).

The WAD aims to ensure that people with disabilities – especially those with vision, hearing or cognitive impairments – have better access to public websites, their contents and mobile applications. Accordingly, we continue to consider improvements to our EN on accessibility requirements for the public procurement of ICT products and services for incorporation into a future revision. In particular, we plan to update it in line with the latest Web Content Accessibility Guidelines (WCAG 2.1) from the World Wide Web Consortium (W3C) as well as other global accessibility standards. This EN recently has been revised to become a Harmonised Standard supporting the WAD.

Work continues on a TR addressing the expected impact, in terms of user experience and accessibility, of joint agile delivery for system development and service and application deployment in future telecommunication networks.

Our User Group continues its work on a user-centric approach to ICT, progressing a series of three TRs and an ETSI Guide (EG) characterizing this approach and providing guidance to users and service providers. We are also addressing the quality of ICT services, developing a TR on the evaluation of reference values for the quality of ICT services and a TS covering requirements for evaluation of metering and billing processes.

Media Quality

In 2018, our Speech and Multimedia Transmission Quality committee (TC STQ) continues its work on transmission requirements for terminals from a Quality of Service (QoS) perspective as perceived by the user. A new TS under development covers wearable wireless wideband terminals, while we are preparing revisions to the TSs covering super-wideband and fullband handsfree and conferencing terminals, narrowband wireless terminals (handset and headset), handsfree use of narrowband wireless terminals, wideband wireless terminals (handset and headset), and handsfree use of wideband wireless terminals. Also related to super wideband and fullband terminals, we are updating our TS on speech quality in the presence of background noise to add test methods for these types of terminals, as well as revising our TR on speech samples and their use for QoS testing.

In the domain of mobile systems, we continue to update and extend the scope of our multi-part TS on QoS aspects for popular services in mobile networks.

Work continues on a TS on the QoS aspects of Mission Critical applications. We are also progressing a TR on a framework for multi-service testing, a TR on the QoS aspects of Wi-Fi off-loading and Voice over Wi-Fi (VoWiFi), a TR on bandwidth calculations and prioritization in Voice over Internet Protocol (VoIP) systems, together with TRs addressing QoS aspects of services related to the Internet of Things (IoT) ecosystem, wearable devices, the 5G ecosystem and video services.

We expect to publish a new TR that considers best practices for throughput measurements, as well as a TR on best practices for robust network QoS benchmark testing and ranking. We are developing practical guidelines on evaluation procedures for video services, to be published in a TR.

We continue to make further updates to our EG on acoustic safety limits. Work also progresses on a TS to develop methods for the objective prediction of listening effort, a TS to specify methodologies for simulating reverberation conditions and a TS on Dual Tone Multi-Frequency transmission over VoIP using Real-time Transport Protocol telephony events. We are also progressing work on a TS relating to voice-controlled devices that employ speech recognition.

Studies have shown that people with impaired hearing may find transmitted speech unintelligible for a variety of reasons including background noise, transmission impairment, the shape of their receiver and coupling between earphones and hearing aids. Building on a TR finalized in 2017, this will form the basis of a new TS in 2018 aimed at improving listening quality for people with impaired hearing.

Safety

Our Safety committee (TC SAFETY) will continue to monitor developments in electromagnetic fields (EMF), electrical safety and safety in cable television systems, and to work with CENELEC on the updating of EMF standards for the Radio Equipment Directive.

Transportation

Bringing the Power of ICT to People on the Move

Information and Communications Technologies are revolutionizing the transport sector, increasing efficiency, reliability and safety and reducing energy consumption. ETSI supports road, railways, aviation and maritime transportation with activities which are carried out by key industry players and therefore reflect true market demand.

We continue our development of standards to accelerate the introduction of Intelligent Transport Systems (ITS) services and applications, based on experience gained from early market deployments. We also address rail, aeronautical and maritime transportation, and the use of satellite communications standards for high speed Internet access to fixed terminals or terminals on the move, in an aircraft, on board a ship or in a vehicle.

Road Transport

In the near future, vehicles on our roads will share information and interact directly with each other and with the road infrastructure through 'Co-operative Intelligent Transport Systems' (C-ITS). C-ITS are thus expected to significantly improve road safety, traffic efficiency and the comfort of driving. Within Europe, the target for the full-scale deployment of C-ITS enabled vehicles is 2019. Standardization has a key role to play in this, both providing the baseline standards and also reacting to feedback from practical deployments. Our Intelligent Transport Systems committee (TC ITS) is helping to accelerate the introduction of ITS services and applications – and to maximize their benefits – by developing common standards and technical specifications for interoperability.

Supporting C-ITS deployment

With a high number of stakeholders involved and the potential need for a regulatory framework, deployment will be a very complex task. To bring the different parties together, the European Commission (EC) created a C-ITS Deployment Platform. Its Phase 2 report was issued in September 2017. In addition, the Certificate Policy for Deployment and Operation of European C-ITS was issued in 2017. We have followed this work closely and are developing the standards necessary to support privacy and security, as well as providing a comprehensive set of test specifications to support C-ITS deployment.

We are updating our Technical Report (TR) on a Threat, Vulnerability and Risk Analysis (TVRA) for C-ITS. In 2018 we aim to complete two security-related pre-standardization studies, one on misbehaviour detection and one on adaptive certificate pre-distribution. We are working on communication messages for the support of security management services. We are developing test specifications for Public Key Infrastructure (PKI) management for C-ITS, as well as interoperability test descriptions for security. In 2018 we also expect to publish an update to our existing security test specifications for ITS.

Our work on ITS interoperability continues. In 2018 we expect to publish the architecture of our ITS interoperability validation framework in a TR, as well as a multi-part interoperability test specification. We have commenced work on a Performance Analysis Framework for ITS.

We aim to complete our definition of ITS test mode for operational devices in the field. This defines the way devices under test (DUTs) should be tested in the field, assuming ITS-G5 as the communication protocol.

Cellular V2X

We are analysing the impact on our C-ITS standards of the introduction of Cellular Vehicle to Everything (C-V2X) communication technology. This will involve the use of mobile radio technology to deliver C-ITS services. We expect

to publish the initial standards to support C-V2X in 2018. We are studying the architectural changes needed to support devices with multiple access technologies, including the advantages of utilizing multiple access layer technologies. We are also investigating how to ensure interoperability and backwards compatibility between existing and future ITS architectures.

New ITS features

In preparation for our second release of standards for C-ITS and automated driving, we aim to complete an initial set of studies into new ITS features. Once published, we plan to produce standards for each of these features.

In 2018, our studies cover items including the use of C-ITS to protect vulnerable road users such as cyclists and motor cycle riders, Co-operative Adaptive Cruise Control, manoeuvre co-ordination and platooning. We are studying changes to the GeoNetworking function for Release 2 of C-ITS. We also aim to complete a study on the use of the C-ITS architecture and V2X communication technology to enable new pollution control and management applications.

We are developing a new Technical Specification (TS) on the Cooperative Observation Service. This enables sensor information to be shared between road users so that even when their own view is obscured, a driver can 'see' – for example, pedestrians or older cars without C-ITS which are visible to another driver. These activities are being co-ordinated with the Institute of Electrical and Electronics Engineers (IEEE) and SAE International to achieve the harmonization of ITS deployment in different regions.

We are targeting completion of a pre-standardization study on payment applications for ITS that identifies potential requirements including positioning and security.

We aim to complete revisions to our use case descriptions for the Basic Set of Applications for ITS Release 1 in response to standards development and feedback from early deployments. We have also embarked on revisions to the use case descriptions for the Basic Set of Applications for Release 2 that describe additional use cases.

We are close to completing the facilities layer protocol and facilities layer algorithms for Decentralized Congestion Control in the ITS station management entity and the facilities layer, as well as a TS on the facilities layer function.

We expect to publish the basic service specification for Multimedia Content Dissemination. This will enable V2X exchange of multimedia information comprising video, audio, images and data.

We continue to update our set of test specifications for High Data Rate Dedicated Short Range Communication (DSRC) equipment in the 5,8 GHz band. In parallel, we are investigating proposals for the improvement of DSRC to achieve a more robust communication link.

Radio spectrum for road transport services

We are revising our Harmonised Standard for ITS equipment operating in the 63 - 64 GHz band to ensure compliance with the Radio Equipment Directive (RED). We are also updating our Harmonised Standard on ITS equipment operating in the 5 855 - 5 925 MHz band.

In the area of Transport and Traffic Telematics (TTT), we are revising the Harmonised Standard on DSRC Road Side Units operating in the 5 795 - 5 815 MHz frequency band.

Work is progressing on two new System Reference documents (SRdoc), one for vehicular radar in the 77 - 81 GHz band, the other for Wireless Power Transmission systems outside 79 - 90 kHz for ground-based vehicles, developed in close cooperation with the European Committee for Electrotechnical Standardization (CENELEC).

We are reviewing receiver technical requirements, parameters and measurement procedures for Automotive and Surveillance Radar Equipment, and will publish our results in a TS.

Aviation

Our main aeronautical work during 2018 will relate to the RED – notably the need to address the standardization of communications, navigation and surveillance equipment, such as radar, aspects of which were not covered under the previous Radio & Telecommunications Terminal Equipment (R&TTE) Directive.

We are producing a series of Harmonised Standards covering radar equipment. These include a Harmonised Standard for Multi-Static Primary Surveillance Radar (PSR), three Harmonised Standards for PSR in the L, S and X bands, and a two-part Harmonised Standard for Secondary Surveillance Radar equipment. In addition, we are preparing three Harmonised Standards for meteorological radars operating in the S, C and X bands.

We are developing a Harmonised Standard under the Radio Equipment Directive for Wide Area Multilateration systems. We are also developing a series of new or updated ENs for Advanced Surface Movement Guidance and Control Systems (A-SMGCS). These include five Community Specifications for application under the Single European Sky Interoperability Regulation, EC 552/2004, and three Harmonised Standards for the RED.

We are producing a Harmonised Standard for the Airport Surface Data Link (AeroMACS) communication system for airport ground-based, safety and air traffic control applications.

We are updating our Community Specification for Data Link Services for air-ground data link communications. In parallel, we are updating our three-part EN for VHF air-ground Digital Link (VDL) Mode 2, one part of which is a Harmonised Standard covering the essential requirements of the RED, as well as updating our Harmonised Standard on specific conditions for ground-based VHF aeronautical mobile and fixed radio equipment.

In 2018 we plan to complete a Technical Report defining use cases and exploring related spectrum considerations for professional unmanned aircraft systems in Europe for civil use such as by film crews, for aerial surveys and by the police.

Railways

Our Rail Telecommunications committee (TC RT) continues to maintain and develop the GSM-R (GSM™ for railways) standard, enhancing it with new features specific to the railway environment, including data and voice communications at speeds of up to 350 km/h and beyond. We collaborate closely with the railway industry in Europe and throughout the world in the course of our work.

In 2018 we are progressing a new TS defining a technical solution and related minimum requirements for shared use of the 5 855 – 5 925 MHz frequency band by ITS and urban rail applications.

Also in the area of spectrum usage, in 2018 we expect to complete a TR on Third Generation Partnership Project (3GPP™) LTE™ radio performance simulation and evaluation in the rail environment.

In the context of the Future Railway Mobile Communication System (FRMCS), we are studying the next generation end-to-end system architecture for rail transportation supporting multiple access technologies. At the same time, we continue to work closely with 3GPP, as well as the International Union of Railways (UIC), on the introduction of use cases for FRMCS within the normative specifications related to Mission Critical Communications.

Maritime

We are updating parts of the multi-part Harmonised Standard on the use of Digital Selective Calling (DSC) in the maritime mobile service, together with an update to the TS on interoperability testing for DSC radios.

Work progresses on a Harmonised Standard for maritime low power personal locating devices employing an Automatic Identification System (AIS), together with a Harmonised Standard on radar equipment used on vessels not covered by the International Convention for the Safety of Life at Sea (SOLAS).

We are developing a new Harmonised Standard for X-Band New Technology (NT) navigation radars used on inland waterways, as well as a Harmonised Standard covering specific conditions for maritime X-Band radar. We also expect to complete revisions to the existing Harmonised Standards on navigation radar and maritime VHF equipment used on inland waterways.

We are developing a new Harmonised Standard on Satellite Personal Locator Beacons (PLBs) used to alert search and rescue services in the event of an emergency.

We expect to complete a Harmonised Standard related to radiotelex equipment operating in MF and HF bands.

We are revising our Harmonised Standard relating to coastal surveillance, vessel traffic services and harbour radars.

We are also developing a new Harmonised Standard on radio link equipment for maritime location/positioning systems operating in the 9 200 – 9 300 MHz band.

Satellite Communications

Our Satellite Earth Stations and Systems committee (TC SES) continues to develop and revise Harmonised Standards for high speed Internet access to fixed terminals or terminals on the move – in an aircraft, on board a ship or in a vehicle.

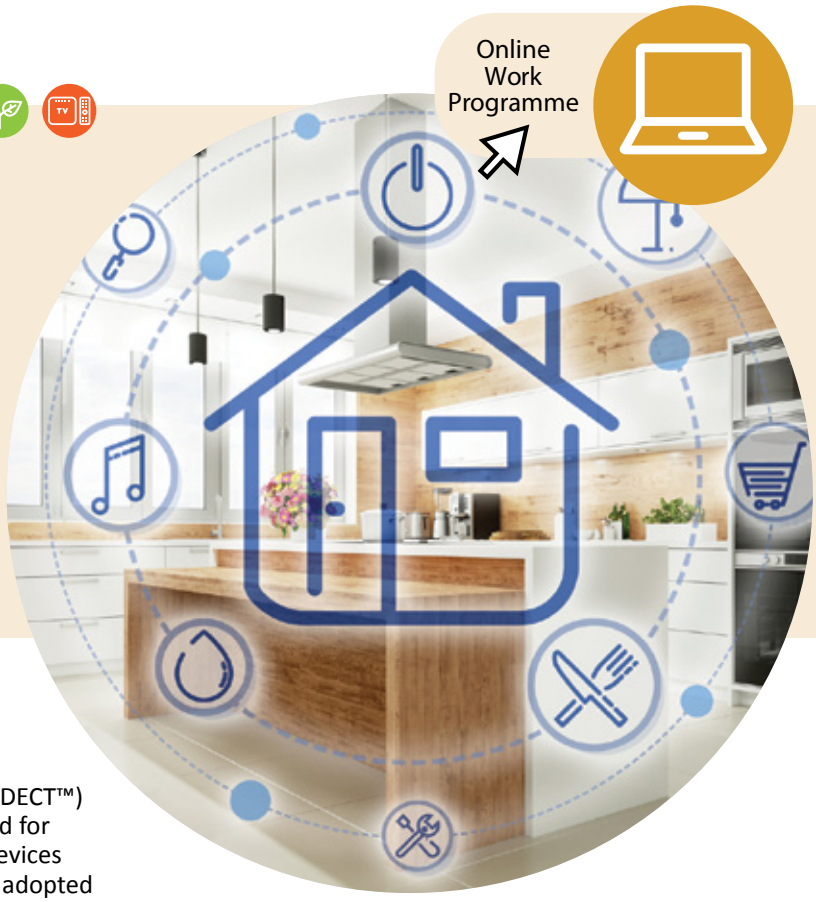
We are adding new clauses on receiver sensitivity and co-channel rejection to our Harmonised Standard on essential requirements for Global Navigation Satellite System (GNSS) receiver equipment operating in the 1 164 - 1 300 MHz and 1 559 - 1 610 MHz frequency bands.

We are also revising parts of our TS on GNSS based location systems, covering performance and test specification requirements.

Home and Office

Connecting Devices in the Home and Office

The variety of devices that need to be interconnected is growing rapidly and most require broadband. The new services being developed are creating a 'Connected Home' and a 'Connected Office'.



Cordless Voice and Broadband Communication

Our Digital Enhanced Cordless Telecommunications (DECT™) specification is the leading standard around the world for digital cordless telecommunications. Over 1 billion devices have been installed worldwide: the system has been adopted in over 110 countries and more than 100 million new devices are sold every year. The number one cordless system in Europe and the USA, DECT products now account for more than 90% of the world's cordless market. They are also sold in Japan, where a legislative change has provided more spectrum for license-exempt operation.

In 2018 work continues in several areas to support the development of DECT, headed by a Technical Report (TR) that defines technology roadmaps for DECT, DECT Ultra Low Energy (ULE), Ultra Reliable and Low Latency Communication (URLLC), New Generation (NG) DECT, DECT Evolution and DECT-2020.

Our current activities focus on two main areas – DECT evolution and DECT-2020 – that will both support home automation, industrial automation, the creative and culture industries (e.g. audio production), eHealth and conferencing.

DECT evolution is the shorter-term activity that aims to provide for lower end-to-end latency, higher data rates and higher reliability based on the current DECT physical layer. In consequence we continue to make ongoing revisions to our multi-part standard for the DECT common interface and our Generic Access Profile standard, addressing wideband speech services, support for new audio codecs, channel coding, support for asymmetric bearers, new low latency modes and the addition of several security improvements related to the operation of repeaters.

We continue to maintain and update our standards for NG-DECT, covering support for new audio codecs.

We are revising specifications for the use of DECT in the Unlicensed Personal Communications Services (UPCS) frequency band (1 920 - 1 930 MHz). New work has also been launched on revising ULE Phase 2 technical specifications to support Home Automation and machine to machine (M2M) communications.

The longer-term activity, DECT-2020, is a new radio interface supporting URLLC and Machine Type Communications (MTC) as specified for International Mobile Telecommunications for 2020 and beyond (IMT-2020) usage scenarios. The new DECT-2020 air interface will co-exist with the existing DECT system.

Our TR on the new radio interface for DECT-2020 is complemented by new standards in development to specify the physical, upper/lower Medium Access Control (MAC) and Data Link Control (DLC) layers.

Wireless Power Transmission

While consumers have taken wireless communications for granted for the last three decades, most users hunt for the nearest wall socket – and a power cable – when their devices need recharging. From smartphones to implanted medical devices and electric vehicles, wireless charging promises to 'cut the cable' for good. Following our completion of a Harmonised Standard on wireless power transmission (WPT), we are developing a new System Reference document on WPT systems operating below 30 MHz.

Home Equipment

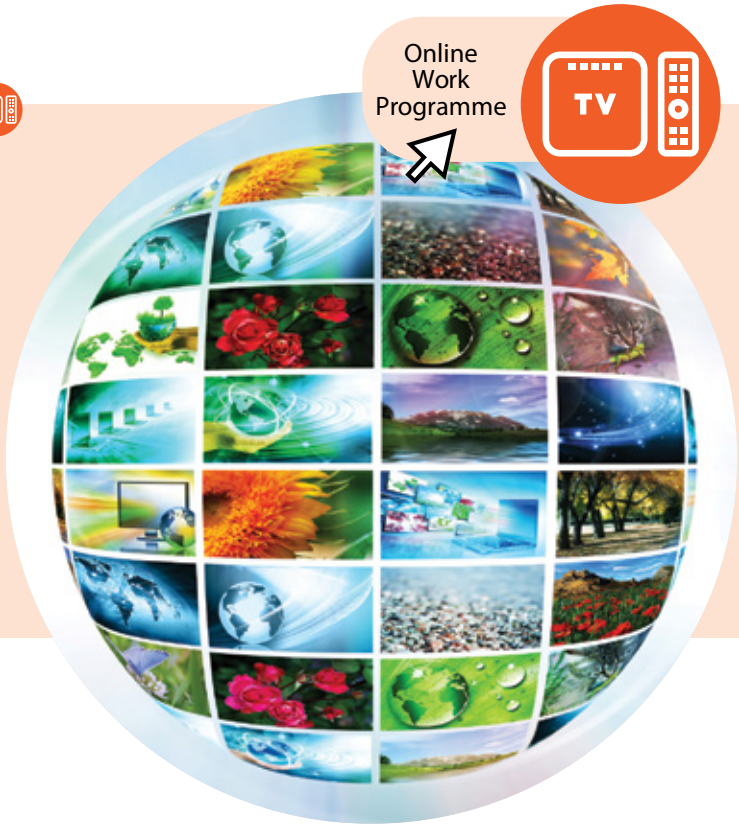
The scope of applications for connected devices in the home continues to expand. We are updating our Harmonised Standard for robotic lawn mowers.

Meanwhile, work also continues to align the content and terminology of our existing Technical Specification on the optical external network testing interface with new European Committee for Electrotechnical Standardization (CENELEC) standards.

Content Delivery

Facilitating Content Consumption on Every Platform

The Internet, mobile communications and broadcasting are converging. But the standardization of these different areas has traditionally followed different paths, so they do not interoperate across the same platforms. We are addressing the urgent need to align the diverse specifications for content delivery in a converged environment supporting Internet Protocol Television (IPTV), Mobile TV and broadcast TV – for the benefit of the industry and consumers alike.



Broadcasting

Our standardization of broadcast systems, programme transmission and receiving equipment is dealt with in a Joint Technical Committee which brings us together with the European Broadcasting Union (EBU) and the European Committee for Electrotechnical Standardization (CENELEC) – JTC Broadcast. More than 95% of inputs to JTC Broadcast are standardized by ETSI, with CENELEC responsible for the standardization of the functional requirements of radio and television receivers.

Over the years, the JTC has produced standards and specifications for interactive TV, terrestrial TV, radio (including hybrid radio), satellite TV, fixed line TV, mobile TV and audio technologies. Traditionally, broadcasting standards have often been developed on a national or regional basis. Nevertheless, JTC Broadcast's outputs have become the de facto standards in most parts of the world. For example, Hybrid Broadcast Broadband TV (HbbTV) and Digital Video Broadcasting (DVB) are being deployed globally and 70% of all digital broadcast TV receivers worldwide follow the DVB specification for satellite, cable or terrestrial delivery. This includes China, where DVB-C is deployed for cable systems, and North America which relies heavily on DVB satellite standards.

Television is a rapidly developing technology, and TV standards are expected to undergo significant changes in the near future.

In 2018 we will continue to update standards for DVB, addressing areas including Ultra High Definition TV (UHDTV), data broadcasting, service information and subtitling.

We have commenced work to specify the USB form factor for use with the second-generation Common Interface (DVB-CI Plus 2.0). This allows subscribers to view pay TV services without requiring a set-top-box.

We aim to complete a multi-part standard of the physical layer for DVB Next Generation broadcasting to Handheld (DVB-NGH), the next-generation broadcasting system for delivering content to handheld terminals via terrestrial and/or satellite transmission.

Also in the area of DVB, we will publish a new Technical Specification (TS) for the DVB Single Illumination System (DVB-SIS) that combines direct-to-home distribution and digital terrestrial television contribution in a single satellite beam. While satellite transmission is widely used for direct-to-home broadcasting (known as distribution) using the DVB-S set of standards, it is also used to feed television signals to the transmitters in digital terrestrial television networks (known as contribution), which commonly use the DVB-T set of standards. This new TS will enable the use of a single satellite beam to serve both purposes, where previously two incompatible signals were required.

In 2018 we expect to publish an update to our existing TS on HbbTV.

We plan to complete a multi-part TS which specifies a high-performance single layer High Dynamic Range (HDR) system with direct backwards compatibility for use in consumer electronics devices.

In the area of digital audio, we will update our TS on backwards-compatible object audio carriage using Enhanced AC-3, a widely used format for transmission of channel-based audio content.

The JTC will continue to maintain the digital radio standards for Digital Audio Broadcasting (DAB) and Digital Radio Mondiale (DRM). Digital radio continues to grow, extending its coverage in Europe and the rest of the world, with some countries moving towards analogue switch-off.

We are specifying an Open Mobile Radio Application Programming Interface (API) for DAB. This is an API which can be used by application developers to gain access to broadcast radio tuners in consumer electronics devices such as smartphones and tablets.

Digital Audio for Content Creation

Our Electromagnetic Compatibility and Radio Spectrum Matters committee (TC ERM) continues to address the spectrum aspects of broadcasting, including the needs of Programme-Making and Special Events (PMSE) devices (such as wireless microphones, in-ear monitors, talk-back links and audio links).

We expect to complete a new Harmonised Standard for Wideband Audio Links, as used by broadcasters to transmit high-quality sound from live in-the-field programme production.

In parallel with this, we are updating our Harmonised Standard for wireless microphones for PMSE applications using frequencies up to 3 GHz. We expect to complete revisions to our System Reference document (SRdoc) on audio PMSE systems in the frequency range 25 MHz – 3 GHz, to include conference and other systems.

We are revising a technical report containing an SRdoc for DECT in the 1 900 - 1 920 MHz band. This considers new application domains for DECT, including PMSE.

Spectrum Aspects

Our ERM committee continues to work on Harmonised Standards for broadcast receivers. In 2019 we expect to publish two new Harmonised Standards, one for AM broadcast sound receivers, the other for FM broadcast sound receivers. We also expect to publish an update to our Harmonised Standard for Digital Terrestrial TV broadcast receivers.

We plan to update our Harmonised Standard for wireless video links operating in the 1,3 – 50 GHz frequency band, for professional and semi-professional use.

Augmented Reality

Augmented Reality (AR) mixes real-time spatially registered digital content with the real world, enabling context-rich user experiences by blending sensors, wearable computing, the Internet of Things (IoT) and Artificial Intelligence (AI). Our Augmented Reality Framework Industry Specification Group is working to synchronize efforts and identify key use cases for developing an interoperable AR framework with supporting components and interfaces.

This year we continue our landscape analysis of standardization work around AR in various standards-setting organizations. We are also documenting and classifying industrial use cases for AR applications and services. This will support transparent interworking between different components.

Networks

Fulfilling the Promise of Unlimited Bandwidth

Today's consumers expect communications services to be easily accessible and available everywhere, on whatever devices they are using. Technically, this means networks must converge. We provide a comprehensive set of standards for access network technologies.

Network Functions Virtualisation

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

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

The goal of our Industry Specification Group (ISG) on NFV, involving some 300 organizations, is to create strong specifications that are flexible enough to accommodate current demands and emerging requirements. These specifications will enable network functions to be deployed dynamically and on-demand. In turn, they will allow organizations to be more agile in addressing customer needs and the new challenges facing network technologies.

With the first batch of NFV Release 3 specifications already delivered, we plan to deliver several more Release 3 specifications before the end of 2018.

This work addresses domains such as cloud-native implementation and Platform as a Service (PaaS) support in NFV, as well as security and identity management, error handling, multi-domain orchestration, ultra-low latency services and support of 5G network slicing.

We also expect to complete our industry roadmap, as well as a glossary of terms and definitions that aims to establish a common language across all our own NFV working groups, as well as for wider industry discussions.

In parallel with work on Release 3, we continue to maintain Release 2 specifications. This includes security aspects; protocols and data models; the addition of conformance testing specifications; and the availability of Representational State Transfer (REST) Application Programming Interface (API) formal descriptions that, together with the Unified Modelling Language (UML)-based information model descriptions, provide valuable mechanisms to ease the development of interoperable implementations and their validation.

Effective interoperability is the ultimate goal of any standardization activity. Collaborating with our Centre for Testing and Interoperability (CTI) team, ISG NFV will build on the success of previous well-attended Plugtests™ events with further meetings.

Open collaboration with other standardization bodies and with Open Source projects remains a priority. We will maintain our close collaboration between our NFV ISG and our Multi-Access Edge Computing (MEC) and Zero Touch Network and Service Management (ZSM) ISGs and other bodies dealing with 5G technologies. We also collaborate closely with the Open Source NFV Management and Orchestration (OSM) and Open Platform for NFV (OPNFV) Open Source projects. This collaborative approach is illustrated by our agreement to organize joint interoperability events with OPNFV during 2018. Other important Open Source projects with which we collaborate include OpenStack, the reference open source implementation for cloud management, and the Open Networking Automation Platform (ONAP).

Open Source MANO

Within ETSI we are leveraging synergies between the worlds of Open Source and standardization in our work on NFV. Two of the key components of the ETSI NFV architectural framework are the NFV orchestrator and the virtualized network function manager, known collectively as the NFV Management and Orchestration, or MANO. To enable accelerated standardization with a fast feedback loop to ISG NFV, our Open Source MANO group (ETSI OSM) is developing a software implementation example for the ETSI NFV MANO, according to accepted Open Source working procedures and using a software development platform which we host and manage.

ETSI OSM is a community-driven effort that aims to offer a production-quality Open Source MANO stack that meets the requirements of commercial NFV networks. Our working methods mean that we release regular versions of the code, approximately every six months. Following the delivery of our Release FOUR in May 2018, we continue to produce periodic updates of the code and to share updates of relevant activities with the NFV community and the telecommunications industry in general.

Network Access

Our Access, Terminals, Transmission and Multiplexing committee (TC ATTM) mainly addresses the operational and physical parts of Information and Communications Technologies (ICT).

Work on Very-high-bit-rate Digital Subscriber Line 2 (VDSL2) continues on an ongoing basis, including updates to the Technical Specification (TS) on European technical requirements. The committee maintains ongoing liaison with both the Telecommunication sector of the International Telecommunication Union (ITU-T) and the Broadband Forum on all aspects relating to xDSL technologies in the twisted pair copper access network.

We continue to monitor developments in the ITU-T in the area of G.Fast and the performance of new G.Fast frequencies on European telecommunications access networks.

We are creating test specifications to evaluate coexistence mechanisms between Power Line Telecommunications (PLT) and VDSL2/G.Fast systems.

Following last year's entry into full force of the Radio Equipment Directive (RED) we are revising our Technical Report on the derivation of receiver interference parameters for point-to-point equipment. We are also revising our Harmonised Standard for multipoint fixed radio systems to align with the RED.

Cable

In 2018, our Integrated Broadband Cable Telecommunication Networks committee (TC CABLE) continues to address the evolution of broadband cable network capabilities.

Much of our work is focused on updating and extending Data Over Cable Service Interface Specification (DOCSIS) 3.1 – one of the core technologies for cable access networks – into ETSI Standards (ESs). This spans the DOCSIS 3.1 physical layer; MAC and upper layer protocols; cable modem operations support system interface; converged cable access platform operations support system interface; and security aspects.

We are developing specifications relating to the performance characteristics of coaxial cables used for RF signal transmission in hybrid fibre-coax (HFC) telecommunication networks.

We expect to complete a new TS on measurement methods for the network performance of broadband data services. This will enable consumers to compare the performance of different service providers.

Work also continues on amending cable equipment and standards to ensure compliance with the RED, the European Commission's Electromagnetic Compatibility (EMC) Directive, and the Low Voltage Directive (LVD) that covers the safe operation of electrical equipment for consumer and professional use.

Numbering, Naming, Addressing and Routing

Currently, most of us have an email address and a separate telephone number. Replacing these in the future with a single alphanumeric address may be more convenient for end users – but it creates fresh interconnection challenges for network service providers.

This year our Network Technologies committee (TC NTECH) is revising a Technical Report that examines options other than telephone number mapping (ENUM) for number portability and considers actual use cases.

The Transition to IPv6

Upgrading the Internet with the provision of additional public Internet Protocol (IP) addresses is essential to maintain growth and allow new entrants to join. IPv6 was developed as a replacement for IPv4. Solving the problem of IPv4 address exhaustion, it provides enhanced features and enables new Internet services requiring end-to-end connectivity and security.

Our ISG on IPv6 Integration (ISG IP6) addresses the transition from IPv4 to IPv6, bringing together stakeholders from all over the world to work on pre-standardization in a neutral environment, defining requirements and use cases, outlining best practices, gathering support and creating awareness of the impact of IPv6.

We continue development of a series of Group Reports (GRs) outlining the motivation and best practices for the deployment of IPv6 in different areas, including cloud and fog computing, safety and emergency services, the industrial Internet (6TiSCH - IPv6 over the Time Slotted Channel Hopping mode of IEEE 802.15.4), the tactile Internet, security, privacy, root servers, as well as the challenges arising from the deployment of mobile IPv6. We will then identify best current practices and develop guidelines for mitigating any issues found.

Future Networks

In the area of autonomic management, during 2018 we plan to publish a Technical Report (TR) outlining the business drivers for autonomic networking, together with another TR providing guidelines to instantiating the ETSI Generic Autonomic Networking Architecture (GANA) reference model onto target implementation-oriented reference architectures. In relation to this, we are studying autonomicity and self-management in the IP Multi-media Subsystem (IMS) architecture, developing a TR on the instantiation of the GANA reference model onto the IMS architecture.

We are analysing the impact of new and emerging technologies such as cloud computing on the GANA reference model and its instantiations. We are studying design guidelines and testability in order to build confidence in autonomic functions. We will also provide an evaluation and a mapping to the GANA model of architectural components for autonomic network management & control developed in the EC-funded WISHFUL and ORCA projects. These studies will be delivered in a series of TRs.

Next Generation Protocols

The Transmission Control Protocol/Internet Protocol (TCP/IP) suite can no longer provide the scale, security, mobility and ease of deployment required for the connected society of the 21st century. Developments in the technology of local access networks will not deliver their full potential unless the communications and networking protocols evolve in parallel.

Our ISG on Next Generation Protocols (ISG NGP) is addressing the future requirements for Internet protocols, undertaking an analysis of relevant technologies, architectures and protocols being researched, together with an assessment of their maturity and practicality for implementation around 2020. Our findings will be provided to other Internet and telecommunications Standards Developing Organizations (SDOs) as inputs to stimulate standardization work.

In 2018 we aim to complete our survey of the principles that a Generic Network Protocol Architecture should follow.

We are developing a set of Key Performance Indicators (KPIs) which can be used to compare various properties of next generation protocols – including security, scalability and performance – against those of existing protocols.

We expect to complete an end-to-end network slicing reference framework and information model. We are also close to completion of a gap analysis and identification of the requirements of Third Generation Partnership Project (3GPP™) mobile networks towards deterministic networking capabilities for the Ultra Reliable and Low Latency Communication (URLLC) applications.

This is complemented by a set of recommendations for new transport technologies. This study presents a gap analysis of different TCP/User Datagram Protocol (UDP) variants for optimization and enhancement, focusing on new transport technologies that support ultra-high throughput and ultra-short latency applications.

We have begun work on a new study that considers user plane packet formats and forwarding mechanisms for 5G core and fixed and wireless access networks.

Experiential Networked Intelligence

The introduction of technologies such as Software Defined Networking (SDN), NFV and network slicing means that networks are becoming more flexible and powerful. These technologies transfer much of the complexity in a network from hardware to software, from the network itself to its management and operation. The use of Artificial Intelligence (AI) techniques in the network supervisory and management system can help solve some of the problems of future network deployment and operation.

Our ISG on Experiential Networked Intelligence (ISG ENI) develops standards that use AI mechanisms to assist in the management and orchestration of the network. This work will make the deployment of SDN and NFV more intelligent and efficient.

Following the completion of our foundation documents on terminology, use cases and requirements, we are preparing a Group Specification (GS) to define the ENI system architecture. We are also updating our use cases specification.

Zero Touch Networks

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

Our new ISG on Zero Touch Network and Service Management (ZSM) is examining use cases and requirements for tomorrow's 'zero touch' networks. The ultimate goal is 100% automation of all operational processes and tasks – from delivery and deployment to configuration, assurance, and optimization. A primary objective is to identify requirements on the necessary management architecture and interfaces required in a multi-vendor environment.

We are also facilitating coordination with relevant standardization bodies and open source projects. We recognize that while some partial solutions may already exist in the marketplace, it is essential to bring together different methodologies and approaches to enable truly end-to-end ZSM solutions. We are also investigating available standards and open source solutions for the zero touch management and orchestration of end-to-end network slicing.

Interoperability

Interconnecting in a Multi-polar World

Interoperability is driven by market demand. It is crucial in a multi-vendor, multi-network and multi-service 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.

An Innovative Approach to Technical Quality and Interoperability

Many years of experience has taught us that integrating validation and testing activities into the standards development process can contribute significantly to the production of interoperable standards and, ultimately, to the release of interoperable products based on those standards. Mutual feedback between the standardization process and the validation and testing activities helps to maximize the quality of both the implementations and the standards. Timely validation and testing can also reduce the overall development duration of a standard, leading to shorter time to market for interoperable products.

Our technical committees apply best working practices to ensure that our standards are well-specified and testable, and thus provide a solid basis for the implementation of robust and interoperable products. We also apply comprehensive validation of our standards through interoperability events, and we develop conformance test specifications to accompany a significant proportion of our standards.

Our Centre for Testing and Interoperability (CTI) is a centre of excellence, providing hands-on support and assistance to our technical committees, the Third Generation Partnership Project (3GPP™) and the oneM2M Partnership Project on the application of testing and validation techniques in standards-making. This includes supporting Proof of Concept programmes, organizing Plugtests™ interoperability events and hackathons, the development of test specifications and the application of 'best practice' specification approaches.

In 2018 we will continue to make use of tools commonly used in software development for our test suite repositories, bug tracking and quality control, as part of our strategic move towards more agile specification and testing approaches. Our CTI will continue to provide practical daily support to our Open Source initiatives – our Open Source NFV Management and Orchestration group (ETSI OSM), the Test Description Language (TDL) Open Source Project (TOP), and an Open Source demonstrator for multi-context Transport Layer Security (mcTLS) under our committee for cyber security (TC CYBER). We will also set up and maintain repositories, collaboration tools and dedicated development environments for application interface specifications and other code-like languages.

The popularity of Proof of Concept (PoC) demonstrations to facilitate early standardization activities and feedback is increasing. PoCs are being used with great success by our Industry Specification Groups (ISGs) on Network Functions Virtualisation (NFV) and Multi-Access Edge Computing (MEC), and by our Network Technologies committee (TC NTECH). We will continue to develop the use and the scope of PoCs in 2018, in particular with our Experiential Networked Intelligence (ENI) and Zero Touch Network and Service Management (ZSM) ISGs and our Open Source MANO group.

Plugtests Events

Our Plugtests events offer an opportunity for companies to interconnect prototype or production implementations of standards to test for interoperability and, where necessary, conformance to requirements. These events provide a highly cost-effective and practical way of identifying inconsistencies in either an implementation or the standard itself. We plan to run around 12 Plugtests events in 2018 – and a further three already scheduled in 2019 – of varying formats to meet the specific needs of our members and the industries we serve.

This year we will focus on the Internet of Things (IoT) and virtualization. We are organizing two hackathons for oneM2M in Toulouse and Dallas, Texas; our sixth oneM2M interoperability event – this time held in Washington DC; a series of oneM2M showcases at the ETSI IoT Week in October, at ETSI; and a 6TiSCH (IPv6 over the Time Slotted Channel Hopping mode of IEEE 802.15.4) Interoperability Event in Paris.

Hosted in Sophia Antipolis, our second and third NFV Plugtests events enable vendors and open source communities to meet and assess the level of interoperability of their implementations, and to verify the correct interpretation of ETSI's NFV specifications. Our first three OSM Hackfest events have already been held in 2018 in Sophia Antipolis, Spain and Norway.

Our third NG112 Emergency Communications Plugtests event will be held in Sophia Antipolis at the end of January 2019.

We are also hosting our first Millimetre Wave Transmission (mWT) Plugtests event in January 2019.

The sixth annual ETSI User Conference on Advanced Automated Testing (UCAAT) will be held in Paris in October 2018. Focusing on practical challenges, this event is dedicated to application aspects of automated testing including AI techniques, cloud testing, mobile testing, test methodologies, test management and standardized test specifications.

Held in partnership with ERTICO during February 2019, our sixth Cooperative-Intelligent Transport System (C-ITS) Plugtests event in Sophia Antipolis will test C-ITS security features.

Test Specifications and Frameworks

Our Core Network and Interoperability Testing committee (TC INT) produces specifications to facilitate the implementation of Internet Protocol (IP) based networks that can carry both fixed and mobile services simultaneously. We continue development of new test specifications related to the Diameter protocol profile for the Sh and Dh reference points, completing the set of Diameter test suites for internal and external Diameter message exchanges. We are adding to our set of conformance test specifications for services using the IP Multimedia Core Network subsystem.

We are finalizing a Technical Specification on a methodology for internet speed measurement for fixed and mobile networks. This work is being conducted in cooperation with the International Telecommunication Union (ITU).

During 2018 we will further develop conformance test specifications, including for our ITS and SmartM2M committees, oneM2M and the Third Generation Partnership Project (3GPP™). These oneM2M and the 3GPP test specifications will be used in third party certification schemes.

We continue to develop test specifications for the Constrained Application Protocol (CoAP), the Message Queuing Telemetry Transport (MQTT) protocol, as well as LoRaWAN™ security. We are developing a methodology to derive IoT security tests from an IoT vulnerability database. This work will be published in a Technical Report.

We also continue to maintain and evolve Testing and Test Control Notation version 3 (TTCN-3), and are developing further conformance test suites for TTCN-3 tools and the application of TDL. We are introducing Object Oriented features to TTCN-3 to widen acceptance of the language and support testing in new areas.

Public Safety

Mission-critical Communications to Rely on

Communication is a key factor in an emergency situation, from small incidents such as a person overboard to major natural disasters.

TETRA and Critical Communications

TETRA (Terrestrial Trunked Radio) is the leading technology choice for critical communications users. With a projected 5 million terminals in use by 2020, the use of TETRA in security as well as other business-critical markets such as the transportation, military, commercial and utilities sectors continues to increase.

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

Designed as a narrowband system, TETRA needs to evolve. This is to support the growing demands of emergency services and other 'blue light' users for mission-critical capabilities such as streaming high-quality video from the scene of an accident from their terminal - something that any member of the public can do with their smartphone. Reflecting these evolving needs – and an opportunity to benefit from the economies of scale of the mobile broadband ecosystem – the community of TETRA users has asked the Third Generation Partnership Project (3GPP™) to determine how this functionality can be realized using LTE™ or 5G systems running over public network operators' licensed spectrum.

In addition to the continuing development of the TETRA standard, TC TCCE is evolving specifications and reports towards the goal of a fully integrated and seamless information and communications technologies solution, providing critical and business narrowband/wideband/broadband wireless communications for mission-critical Private Mobile Radio (PMR) applications. Broadband will be crucial to this evolution, as it can supply the high data speeds required.

We continue to develop a Technical Specification (TS) specifying the means of encapsulating TETRA speech coding, packet format and rate and end-to-end encryption synchronization and secure key management messaging for use in 3GPP Mission-Critical Push-To-Talk (MCPTT) over LTE systems for the purpose of interworking with TETRA.

We are developing an architecture encompassing a range of application layer interfaces to LTE, defined in a set of TSs. Work is ongoing on the detailed specification for the mobile-to-infrastructure interface.

We are drafting a new Harmonised Standard covering the use of TETRA equipment using non-constant envelope modulation operating in a channel bandwidth of 25 kHz, 50 kHz, 100 kHz or 150 kHz. This draft will then be transferred to our Electromagnetic Compatibility and Radio Spectrum Matters committee (TC ERM) for completion and publication.

In the area of security, we are updating the standard for TETRA voice and data security to clarify behaviour in certain authentication failure cases.

Other activities include a revision of rules for management of the TETRA standard encryption algorithms that considers the relationship of supplier and manufacturer licence and related items.

Enabling Next Generation Mission-Critical Services

Providing a platform for Mission Critical (MC) services has been a key priority for 3GPP in recent years.

MC Push to Talk (MCPTT) was the first major step in a series of MC services and functionalities demanded by the market. This has been complemented by mission-critical voice and data services that have been specified in 3GPP Releases 13 and 14.

In Release 15, these MC services are further evolved. In addition, 3GPP is currently evaluating and studying additional MC related topics for Release 15 and beyond, including service requirements for the railway and maritime industries, interconnection between 3GPP defined MC systems, as well as interworking between the 3GPP defined MC system and legacy systems such as TETRA or P25, for voice and short data service.

Conformance test standards for MC Services are also being developed within 3GPP. Following development of an initial set of test specifications for Release 13 MCPTT, test specifications for Release 14 and Release 15 feature sets will be developed.

Private Mobile Radio

Private Mobile Radio (PMR) allows business users – such as taxi services – to keep in contact over relatively short distances with a central base station. PMR is also widely used by emergency services and other closed user groups. Networks consist of one or more base stations plus a number of mobile terminals.

Following revisions to several TSs, we are updating our Technical Report (TR) on Digital Mobile Radio, covering general system design, air interface protocol, data protocol, trunking protocol, and voice and generic services and facilities.

We continue to update our Harmonised Standard for access and sharing of channels for PMR service equipment, as well as updating our Harmonised Standard for Citizens' Band (CB) and a variety of land mobile radio equipment.

In addition, we are developing a Harmonised Standard covering broadband radio equipment used for Public Protection and Disaster Relief, operating below 1 GHz.

Emergency Calling and Alerting

Our Emergency Telecommunications Special Committee (SC EMTEL) maintains its close focus on emergency applications for smartphones, networks for emergency services and their conformance, and Internet of Things devices in the provision of emergency situations.

The concept of 'Next Generation 112' (NG112) has been identified as a potential solution to the increasing requirements and demands of content-rich emergency calling. Following two successful events held in co-operation with the European Emergency Number Association (EENA) and the European Commission, we are hosting the third NG112 Emergency Communications Plugtests™ event in January 2019. This will feature a testing campaign based on the use cases developed by ETSI and EENA. It will also offer vendors of emergency communication equipment the opportunity to test their product against different implementations and scenarios. Supporting this event, we are developing conformance test specifications for NG112.

Meanwhile we continue our work on a TS and associated TR related to network independent access to emergency services. Due for publication in 2018, the TS describes the architecture, core elements and corresponding technical interfaces. This work is complemented by a TR describing test cases and scenarios for related interoperability testing.

Internet of Things (IoT) technologies are now commonplace. However, requirements for emergency communications involving IoT devices have not yet been specified. SC EMTEL continues its work on a TR to prepare requirements for communications involving IoT devices in all types of emergency situations (e.g. communications of individuals with authorities/organizations, between authorities/organizations, from authorities/organizations to the individuals, amongst individuals). Taking into account work already conducted in other projects such as oneM2M and 3GPP, this report is scheduled for publication during 2019.

Other Public Safety Activities

We are creating standards for maritime safety equipment and various mechanisms for road safety through the use of Intelligent Transport Systems.

- 2G, 3G, 4G, 5G Mobile Communications
- Aeronautical Communications
- Artificial Intelligence
- Augmented Reality
- Automotive Radar
- Autonomic Systems
- Body Area Networks
- Broadband Wireless Access
- Broadcasting
- Cable Networks
- Cognitive Network Management
- Cognitive Radio
- Content Delivery
- Context Information Management
- Core Networks
- Cyber Security
- DECT™
- Digital Mobile Radio
- Digital Rights Management
- eHealth
- Electromagnetic Compatibility
- Electronic Signatures
- Emergency Communications
- Energy Saving
- Environmental Aspects
- Fixed-line Access
- Fixed Radio Links
- Human Factors
- Intelligent Transport
- Internet of Things
- Interoperability
- Lawful Interception
- Low Power Radio
- Low Throughput Networks
- Machine-to-Machine Communications
- Maritime Communications
- Millimetre Wave Transmission
- Mission-Critical Communications
- Multi-Access Edge Computing
- Network Functions Virtualisation
- Network Management & Automation
- Next Generation Networks
- Open Source Software
- Powerline Communications
- Protocols
- Public Safety Systems
- Quality of Service
- Quantum Key Distribution
- Quantum-Safe Cryptography
- Radio Regulations
- Radio Systems
- Rail Communications
- Safety
- Satellite Communications
- Security Algorithms
- Short Range Radio
- Smart Appliances
- Smart Cards
- Smart Cities
- Software Defined Radio
- Testing
- Terrestrial Trunked Radio (TETRA)
- Wireless Medical Devices

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