building the future

Work Programme

2017 - 2018

ETSI's Vision of a Connected World

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 standardisation has seen our reach extend from European roots to the entire world.

ETSI is officially recognised by the European Union as a European Standardisation Organisation (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 EU to be more competitive.

ETSI is a not-for-profit organisation created in 1988. We have over 800 member organisations worldwide, drawn from 68 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 organisations and societal interest groups.

ETSI is a world-renowned organisation 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 Organisations, 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 organisations, addressing the technical issues that will drive the economy of the future and improve life for the next generation.

Our 'clusters' (above) provide a simplified, yet comprehensive, way of identifying our different areas of expertise based on business relevance or application domain rather than our committee structure.

Each cluster represents a major component of the global Information and Communications Technologies (ICT) architecture and brings together the work of those Technical Committees and other groups which share a common technological scope and vision. It is this joint scope and vision that gives each cluster its own identity; collectively the clusters represent the totality of ETSI's work, and demonstrate the way that technologies are converging into a connected world.

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 2017-2018

Dirk Weiler
Chairman of the Board

Mobile communications has always been one of our strengths. Today we play a leading role in the development of 5G communications, both as a partner in the Third Generation Partnership Project (3GPP™) and in our own activities. In Release 15, 3GPP is now working at full speed on 5G Phase 1, as it looks for early commercial deployments. Work in 2017 will include specifications to extend mission-critical services from simple voice to data and video.

Meanwhile, our Industry Specification Groups (ISGs) in areas such as Network Functions Virtualisation (NFV), Multi-access Edge Computing (MEC) and millimetre Wave Transmission (mWT) are developing what are expected to become the building blocks for a 5G system and key components of the next generation of Information and Communications Technologies (ICT) platforms. A lack of spectrum threatens to hinder both the growth of the Internet and the development of mobile communications, so we are also looking at different ways of spectrum-sharing, such as the use of reconfigurable radio systems.

5G, along with the Internet of Things (IoT), are key areas targeted in our Long-Term Strategy for 2016-21. Standardisation has a crucial part to play in achieving universally accepted specifications for interoperability between equipment and applications in the IoT, and activities to support the IoT will therefore also feature prominently in our work programme over the next 12 months.

For example, as a partner in the oneM2M initiative, we are helping to develop global specifications for IoT technologies. We expect significant progress in 2017 with the third release of oneM2M specifications, which will focus on the industrial IoT, as well as improving market adoption, testing and interworking. In addition, within our own committees, we will enhance SAREF, our smart appliances reference ontology which enables connected devices to exchange information with any energy management system, and we are working on smart cities, eHealth and wireless industrial automation. We will continue to accelerate the introduction of Intelligent Transport Systems, and to maximise their benefits as we lead the drive for international standards.

We have set up a new ISG on cross-cutting Context Information Management (ISG CIM) to support the use of context information for smart cities and other applications, and we will continue to address energy efficiency in the IoT.

Other ISGs are looking into future requirements for Internet Protocols to support developments in local access networks, and our new ISG on Experiential Networked Intelligence (ENI) is harnessing Artificial Intelligence to define a Cognitive Network Management architecture.

Of course, as well as activities related to new technologies, we continue to address well-established topics such as satellite communications, networks, energy efficiency for ICT, rail, air and maritime transportation, public safety, accessibility and media quality. Our broadcasting standardisation is ongoing, and we are working on mobile and broadcast convergence and protection and rights mechanisms. We are beginning to consider the future of Digital Enhanced Cordless Telecommunications (DECT™).

In support of the European Commission's Radio Equipment Directive (RED), we are creating or revising several hundred Harmonised Standards, including, for the first time, Harmonised Standards for broadcast receivers, equipment operating below 9 kHz and radio determination equipment (including Global Navigation Satellite Systems). Changing requirements over the last year or so has caused delays, and this work will therefore continue to dominate activities in some of our committees for at least another year.

Security remains a primary consideration in all areas of our work, but we are also developing specific standards to protect cyber security and critical infrastructures, as well as the privacy of individuals and organisations. Other ongoing security work includes secure elements, electronic signatures, lawful interception, quantum-safe computing and 5G network security.

Looking to the future, we are trying to identify the technologies which will require our attention in coming years, so in 2017 we will participate in Horizon 2020 projects and we will strengthen our links with the R&D community. 'Softwarisation' is changing the way that telecommunications systems are designed and operated; we are furthering this technological revolution in our ISG on NFV. We will continue to explore the synergies between Open Source and standardisation, and to capitalise on the benefits, particularly in our Open Source MANO group and our work on testing and interoperability.

This Work Programme describes the varied activities we have planned for 2017-2018. Full details of all upcoming standards and specifications can be found at: http://webapp.etsi.org/workprogram.

New Beginnings

Innovation, agility and flexibility are important characteristics of our work, particularly in emerging technical areas. To support the development of new technologies in the most appropriate way, we have therefore adopted a range of approaches from light co-ordination to fully fledged standards development.

From Research to Standards

Standardisation 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 commercialisation of research results. At the same time, R&D can trigger new standardisation activities, enabling us to ensure that standards are in place when they are needed.

In 2017 we will seek to further encourage collaboration with researchers and innovators, to promote the smooth uptake of the output of research and innovation into standardisation. 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, and we will participate in European Commission (EC) funded projects. We will explore the European Union (EU) Joint Initiative on Standardisation, which sets out a shared vision for European standardisation to speed up and better prioritise standards-making. We will continue to collaborate with National Standards Organisations 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 standardisation and support stakeholders in standards-related activities.

Horizon 2020

We will monitor activity related to Horizon 2020 (H2020), the EU research funding programme, and to take part in relevant projects, as our resources allow. We are currently engaged as a partner in two EC-funded projects: UNIFY-IoT, aimed at developing a healthy Internet of Things (IoT) eco-system, and the ESPRESSO (systEmic Standardisation apPRoach to Empower Smart citieS and cOmmunities) project, where we support standardised integrated communication and data processing for a sector-independent Information and Communications Technologies (ICT) platform in a smart city.

White Papers

From time to time, we publish ETSI White Papers, which provide informal overviews of important technical topics related to our activity. These papers summarise the work that we and other organisations have been doing in a specific area, and highlight broader issues related to the successful deployment of the technologies and services discussed. In 2017 we expect to produce White Papers on reconfigurable radio systems, experiential networked intelligence, Fog computing and cross-hauling.

Workshops

Every year we organise a varied programme of workshops which bring communities together, provide opportunities for us to share news of our work and its progress, and stimulate new standardisation activities. Our workshops also provide a platform for researchers to share their results and to identify next steps for standardisation; they facilitate early consensus-building and fertilise our ongoing technical work.

In 2017-2018 we will run globally recognised annual events including the ETSI Security Week and our IoT Week. Other events include, in September, the fifth Quantum-Safe Cryptography workshop, co-organised with the Institute for Quantum Computing in Toronto, Canada, and, in October, the ETSI International User Conference on Advanced Automated Testing (UCAAT). We will begin planning for the next ETSI Workshop on Intelligent Transport Systems, to take place in March 2018, and a workshop on Smart Body Area Networks, to be held early in 2018.

Supporting the Development of New Technologies

Industry Specification Groups

Our Industry Specification Groups (ISGs) will continue to shape our industry in 2017. ISGs provide a flexible platform to bring together stakeholders, including non-members of ETSI, and have proved highly successful.

We have recently established two new ISGs. Our ISG on cross-cutting Context Information Management (ISG CIM) will develop technical reports and specifications for applications to update, manage and access context information. Our ISG on Experiential Networked Intelligence (ENI) will define a Cognitive Network Management architecture, using Artificial Intelligence techniques and context-aware policies to adjust offered services based on changes in user needs, environmental conditions and business goals.

Developing the Building Blocks for 5G

We will continue to work to support the development of 5G, both as a partner in the Third Generation Partnership Project (3GPP™) as well as in our own committees.

A number of our activities, such as Network Functions Virtualisation (NFV), Multi-access Edge Computing (MEC) and millimetre Wave Transmission, are expected to form the building blocks for a 5G system and are considered key components of the next generation of ICT platforms.

Spectrum – particularly the lack of it – is a major issue for 5G. We are helping to ensure compatibility between the different uses which may occupy adjacent spectrum and looking for ways to improve spectral efficiency by using the latest methodology and advanced techniques for sharing spectrum.

We are developing standards for monitoring and controlling power consumption in 5G networks, which 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 the specifications to 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 also looking at the needs of smart cities, wireless industrial automation, CIM and eHealth, and we support the IoT with specifications for Digital Enhanced Cordless Telecommunications (DECT™) Ultra Low Energy and Low Throughput Networks.

Open Source

In 2017 we will continue to look into how we can benefit from the use of Open Source approaches, methodologies and frameworks in ETSI. We are exploring how we might accelerate the development of new and innovative digital technologies by working across traditional borders, for example with Open Source communities and foundations.

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

Some of our ISGs are also exploring the use of Open Source. For example, Open Source has a crucial role to play in facilitating interoperability in software-intensive technologies such as NFV, and, in parallel with standards development, ISG MEC is looking at making implementations of our Application Programming Interfaces and functionality available as software. Our Open Source MANO group (ETSI OSM) is developing a software reference implementation 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.

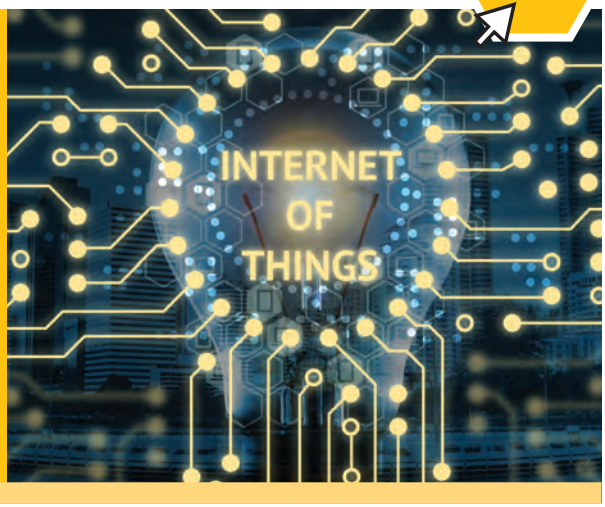
Education on Standardisation

We are working on an EC-funded project on the design and development of teaching materials for education on ICT standardisation. The materials will include a comprehensive set of slides, a text book and lecture notes. By the end of the project in 2018, the plan is to be able to offer several teaching modules to be integrated flexibly as part of curricula for engineers, MBA students and law students.

Online Work Programme

Integrating Objects to Create New Networked Services

An ever increasing number of everyday machines and objects are now embedded with sensors or actuators and have the ability to communicate over the Internet. Collectively they make up the Internet of Things (IoT). The IoT 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.



Industry analysts estimate that, by 2020, over 6 billion IoT devices will be in use worldwide. The IoT is changing the way we live and work with its new and innovative services, offering unprecedented opportunities for creating and commercialising new devices and applications. As IoT devices continue to saturate society, standardisation has a crucial role to play in achieving universally accepted specifications and protocols for true interoperability between equipment and applications.

oneM2M

ETSI and oneM2M

ETSI is one of the founding partners in oneM2M, the global standards initiative for M2M and the IoT. oneM2M brings together 13 partners including eight of the world's leading Information and Communications Technologies (ICT) Standards Developing Organisations (SDOs), as well as representatives of different industry sectors. Membership numbers over 200 companies.

Further information at: www.oneM2M.org

oneM2M draws together the many diverse IoT-related business domains including telematics and intelligent transportation, healthcare, utilities, industrial automation and smart homes. 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 the application developer and lower costs for service providers.

Each oneM2M partner standards body publishes oneM2M specifications as its own local specifications, thereby ensuring there is one global set of specifications, recognised in each region.

By the end of 2017, 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 and improved support for mobile IoT technologies standardised by the Third Generation Partnership Project (3GPP™) such as Narrowband IoT (NBIoT). Smart cities will also be addressed. In addition, Release 3 will include support documentation and tools to assist developers.

Promotion of oneM2M's achievements will remain an important aspect of its work. Activities planned for 2017-2018 include executive briefings, case studies, interviews with key figures in the industry and the continuation of the highly successful programme of webinars on the business and technical aspects of oneM2M. In 2017 oneM2M is initiating a programme of Industry Days, collocated with oneM2M Technical Plenary meetings, where invited participants will give briefings on the take-up and deployment of oneM2M. oneM2M tracks deployment announcements and has noticed an uptick in 2016, with the expectation of further deployments over the coming year, driven in part by NBIoT.

To support its continued roll-out, oneM2M has introduced an interoperability programme, with various events planned for 2017-2018. In addition, a oneM2M certification programme has been launched by one of the partner SDOs. To support this, oneM2M is developing a set of standardised test specifications.

The ETSI IoT Week

In 2017, the ETSI IoT Week will be held in October at our headquarters in Sophia Antipolis, France. The focus this year will be 'Standards and Technologies for the Smart World'.

The week will include a one-day tutorial on oneM2M for developers, followed by a three-day workshop with presentations on IoT service implementations in smart cities, industrial applications, aging well, smart agriculture, smart energy, wearables, smart appliances and co-operative and connected mobility. Standards updates will also be included.

In parallel, various showcases will demonstrate oneM2M in action, with commercially available products and services which have already been deployed from across a wide range of IoT application domains.

Smart Appliances

Our Smart M2M Communications committee (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 standardised solution with open interfaces, along with related test suites, will be the essential enabler of the IoT.

In 2017, we will focus primarily 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 begin work on a series of investigations into different domains, with a view to specifying semantic models to extend SAREF. This work will address smart cities, the industry and manufacturing domains, smart agriculture and the food chain, automation, eHealth/aging well and wearables. We plan to publish a Technical Report (TR) for each domain early in 2018.

In parallel, we will begin work on six new parts for the Technical Specification (TS) which extends SAREF, adding semantic models for each of the six domains covered in the TRs. This work is expected to be completed by the end of 2018.

Building Smart Cities

We are heavily committed to the development of standards which form the technology building blocks for smart cities, both as a partner in oneM2M, as well as in our own committees.

For example, our Human Factors committee (TC HF) is studying the human factors aspects of the services in smart, accessible, sustainable cities and communities. We are also developing specifications for energy efficiency in smart cities. We have created a working group under our Access, Terminals, Transmission and Multiplexing committee (TC ATTM) for sustainable digital multi-service cities, developing standards to support the deployment and roll-out of smart city infrastructures.

We have joined the international group, IES-City, which was established to develop a consensus framework for smart city architectures. The group is enabled by the National Institute of Standards and Technology (NIST), the American National Standards Institute (ANSI) and the Green Building Council in the U.S., the Republic of Korea's Ministry of Science, ICT and Future Planning, the Italian Energy and Innovation Agency and the FIWARE Foundation. It is expected that the group's work will build upon existing standards and specifications, including the work of oneM2M and TC SmartM2M.

Context Information Management

With the rapid development of technologies such as Big Data, semantic web, complex workflow and autonomous decision-making, the need for interoperable context information is growing. Software programmes or agents searching for useful information may only find it if the context is available, i.e. that it is published along with the data. We have set up a new ISG on cross-cutting Context Information Management (ISG CIM) to develop Group Specifications (GSs) for applications to update, manage and access context information for smart cities and other applications.

In 2017 we plan to complete five GSs. These will include the collection and analysis of use cases, the identification of a reference architecture and a standardisation gap analysis, and an initial definition of a standard Application Programming Interface to enable almost real-time access to information coming from many different sources (in addition to the IoT). We will also address Data Publication Platforms and create a CIM information model. In addition, we are developing an annotated bibliography of relevant sources of information.

Wireless Industrial Automation

By mid-2017 we expect to finalise a new Harmonised Standard for radio equipment to be used in the 5,8 GHz band (5 725 - 5 875 MHz) for Wireless Industrial Automation.

eHealth

To support the development of eHealth, our eHealth Project (EP eHEALTH) is preparing a glossary of terms. This will help counter confusion in the vocabulary used to describe eHealth issues.

Our main work in 2017, however, will focus on eHealth in the new environment created by the IoT. We are developing a TR describing typical use cases and identifying gaps in standardisation.

We are also preparing a new White Paper on eHealth.

Body Area Networks

Body Area Networks (BAN) technology uses small, low power devices for applications such as health and wellness monitoring, sports training, personalised medicine (e.g. heart monitors) and personal safety (e.g. fall detection). Our Smart BAN committee (TC SmartBAN) is addressing the pressing need for harmonisation and standardisation to enable BAN technology.

In 2017 we plan to publish a new TR which will provide a system description for smart BANs, including a system overview and use cases.

We have begun new work comparing the performance of smart BAN and other short-range standards such as Bluetooth LE and IEEE802.15.6. We expect to publish our findings in a TR in 2018.

We plan to complete a TR on data representation and transfer, service and application which will provide a high

level description of the infrastructure and mechanisms providing solutions for heterogeneity management in smart BANs.

By the end of 2017 we expect to have updated our TS on smart BAN unified data representation formats, a semantic open data model and a corresponding ontology, by adding extensions for semantic interoperability. This specification and our smart BAN modular ontology have been recognised by key organisations involved in the development of the IoT.

We are revising our TS on low complexity MAC and routing for smart BANs, addressing relay and hub-hub communications.

We will organise an ETSI smart BAN workshop to be held in early 2018.

Medical Devices

We will continue to develop standards for wireless medical devices such as low power active implants and medical BAN systems and we expect to publish a new European Standard on wideband Ultra Low Power wireless medical capsule endoscopy by mid-2018.

Enabling the IoT

An ultra narrowband radio technology for very low data rates for ultra long autonomy devices, Low Throughput Networks (LTN) are ideal for connecting objects in M2M and the IoT which need only low throughput connectivity. In 2017 we will complete a TR on LTN use cases and system requirements and a TS for the LTN architecture. A second TS, on the protocols for LTN interfaces, is due for publication by mid-2018.

We will also continue to enhance the Digital Enhanced Cordless Telecommunications (DECT™) Ultra Low Energy specification, which was designed specifically for M2M communications. In 2017 we will also begin to look at the future development of the technology.

Online Work Programme

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

We provide a wide range of Harmonised Standards by which manufacturers are able to demonstrate that their products comply with a European Commission (EC) Directive, allowing them to be placed on the market or put into service. In this way, we play an important part in helping to create a large, unified European market.

The new Radio Equipment Directive (RED), which replaces the Radio and Telecommunications Terminal Equipment (R&TTE) Directive, was applied throughout the European Union (EU) from June 2016 and compliance is mandatory with effect from June 2017. Our wireless work throughout 2017 will continue to be dominated by the development of standards to support the RED.

The RED covers all products that deliberately use radio waves for communication or for determining their position, regardless of primary function. This means, 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 that they do not use more of the spectrum than is necessary. For the first time, broadcast receivers, equipment operating at frequencies below 9 kHz and radio determination equipment (including GNSS equipment) are included.

We provided the EC with an initial work programme listing the new standards and revisions required. It includes revising existing standards and developing new ones for aeronautical, maritime and meteorological radar. (Our work also takes account of the evolving use of the radio spectrum, with increasingly dense use of the SRD bands at 863 - 870 MHz, 2,45 GHz and 5,8 GHz, and work to liberate spectrum for mobile broadband and 5G developments.) The work programme is updated on an ongoing basis and the EC has introduced additional requirements to ensure our Harmonised Standards integrate smoothly with the 2012 Standardisation Regulation, in particular with the 'Vademecum', published in October 2015. Reworking our Harmonised Standards to include these new procedures and technical requirements has introduced delays, and created concerns for manufacturers. We are working closely with the relevant EC services to minimise delays and come to agreement as soon as possible where new technical requirements are requested. In particular, we have prioritised Harmonised Standards for the use of radio spectrum and access to emergency services, as these standards need to be cited in the Official Journal of the EU before manufacturers can declare compliance without recourse to a third party 'Notified Body'.

Electromagnetic Compatibility (EMC) and Radio Spectrum Matters

Although work in support of the RED is spread across a wide range of our committees, for many years our EMC and Radio Spectrum Matters committee (TC ERM) provided more than 75% of the Harmonised Standards required under the R&TTE Directive, and the committee is working on about 160 Harmonised Standards related to the RED.

We are revising all parts (currently more than 50) of our existing EMC multipart Harmonised Standards and developing new EMC Harmonised Standards for equipment not covered under the R&TTE Directive, but which is now under the scope of the RED. This includes, for example, Digital Enhanced Cordless Telecommunications (DECT™), certain marine equipment, Private Mobile Radio (PMR)/

Terrestrial Trunked Radio (TETRA), fixed link equipment, medical applications, SRDs and Ultra Wide Band equipment. In addition, we are developing two Harmonised Standards for the EMC of combined and/or integrated equipment for industrial and residential locations.

We are co-operating closely with the European Committee for Electrotechnical Standardisation (CENELEC), in particular in the area of 'smart' or 'connected' devices where the 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

Our standards also enable administrations to ensure that users can use spectrum as widely as possible. We help the EC and the European Conference of Postal and Telecommunications Administrations (CEPT) to harmonise 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 standardisation and the developing policy framework.

Reconfigurable Radio Systems

The telecommunications industry today is facing a major challenge – a lack of spectrum to meet growing demand, particularly from the Internet and mobile communications. However, a significant amount of spectrum is allocated exclusively to organisations 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 our modern 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.

Reconfigurable Radio Systems (RRS) – intelligent radio devices which can characterise and act upon their environment – offer an opportunity for the sharing of unused spectrum among multiple services and radio networks. As well as better use of the radio spectrum, potential benefits include reconfigurable, flexible and cost effective architectures for wireless devices and the exploitation of synergies between different domains.

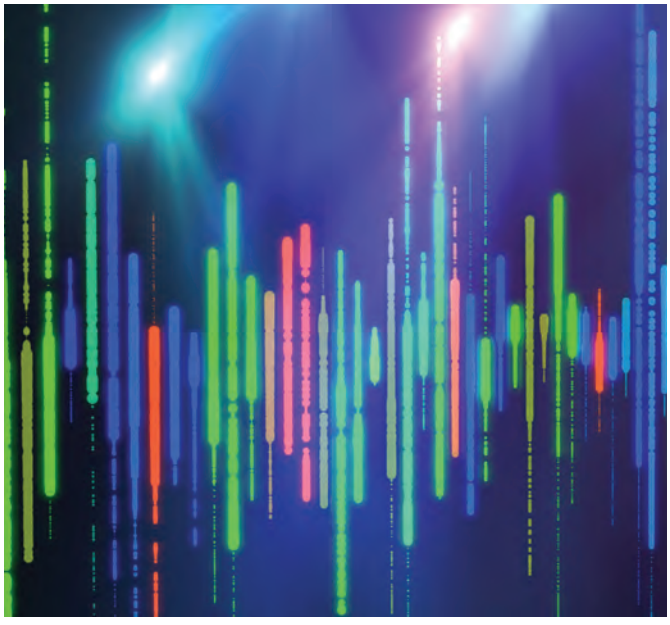
In 2017 our RRS committee (TC RRS) will continue to focus on solutions for mobile device reconfiguration and related certification. The RED includes new features such as the use of RRS that affect device certification which were not addressed by the R&TTE Directive. In 2017, we expect to publish a Technical Specification (TS) which will define the requirements for the introduction of technical solutions enabling dynamic recertification for reconfigurable radio equipment, to support the reconfiguration of reconfigurable radio equipment after its initial certification and deployment.

In addition, by mid-2017, we will complete a security framework for mobile device reconfiguration, complementing our recently finalised European Standard (EN) on mobile device information models and protocols. Together these standards will allow for installed radio applications to be updated, or for new applications to be installed on a device, thus enabling RRS-compatible devices to support future radio access technologies.

We will continue to address the security challenges of RRS, protecting the integrity of radio applications and preventing their use as attack vectors against either individual devices or the network itself. We will complete a new security analysis of reconfigurable radio, taking into account recently identified use cases. We will then publish revised versions of our existing Technical Report (TR) on security-related use cases and inherent security threats in RRS and our TS on security requirements. We also plan to publish a new TR, mapping existing radio access technologies to the RRS model in order to identify missing security requirements.

In parallel, we are revising our two ENs on the radio reconfiguration architecture and requirements for mobile devices by adding new security elements.

With many aspects of our original RRS work now completed, in 2017 we will refocus on information management in the heterogeneous environment. This involves looking into the possible extension of software reconfiguration technology to other network entities such as from mobile to Mobile-Edge Computing nodes or small cells. We are undertaking a feasibility study into a radio interface engine which 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. We plan to define an appropriate eco-system within the equipment and will consider target applications, usage opportunities and use cases, and we will identify the radio interface engine reconfigurability, challenges and potential system requirements. Our findings will be presented in a TR which is scheduled for publication by the end of 2017.



In addition, we will consider extending our work 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) to vertical applications such as Programme-Making and Special Events, eHealth, factory and process automation and public safety. We expect to complete a feasibility study into temporary spectrum access for local high-quality wireless networks, publishing a TR by the end of the year. Our objectives are to identify whether current sharing frameworks, such as LSA and Spectrum Access System, are appropriate for localised, high-quality systems, and to identify possible enhancements and/or alternative technical solutions.

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.

In 2017 we expect to publish a new Harmonised Standard for direct air-to-ground communications systems using beamforming antennas. We will publish a revised version of our EN on Wireless Access Systems (WAS)/RLAN equipment operating in the 60 GHz band, which will include a Listen Before Talk mechanism to ensure co-existence with other WAS/RLAN equipment operating in the same band. We will publish an updated version of our Harmonised Standard for RLANs operating in the 5 GHz frequency band which will include new technologies and address the need for a common sharing mechanism to achieve equal and fair access between various RLAN technologies. Further work to this standard will add the receiver blocking requirement.

We plan to publish a new version of our Harmonised Standard on the use of White Space devices for WAS operating in the 470 - 790 MHz TV broadcast band early in 2018, which will be aligned with the RED and will include improved test methods and updated emission classes.

We expect to complete two new TRs to support the possible extension of the current 5 GHz frequency allocation for RLANs. One involves sharing between RLANs and road tolling and Intelligent Transport Systems; the other will present the findings of a study into the central co-ordination of RLANs operating in the 5 GHz frequency band.

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 2017 the primary focus of our Satellite Earth Stations and Systems committee (TC SES) will be developing Harmonised Standards for high speed Internet access to fixed terminals or terminals on the move, whether in an aircraft, on board a ship or in a vehicle. We will continue to revise our existing Harmonised Standards for compliance with the RED, and standards for GNSS receivers will also be a priority – we expect to publish a TS for GNSS-based location systems.

We plan to publish a revised version of our EN on radio frequency and modulation for the Telemetry, Command and Ranging (TCR) of geostationary communications satellites which will, among other things, extend operation to the Ka band and include non-geostationary communications satellites. Work is ongoing on a new TR which will provide a technical analysis of the radio frequency, modulation and coding for the TCR of communications satellites.

We expect to publish three TRs in 2017. One will define a multi-link routing scheme in hybrid access networks with heterogeneous links, with the aim of delivering a high speed broadband service. A second TR will assess the feasibility of using the LTE™ radio interface defined by the Third Generation Partnership Project (3GPP™) in satellite communication systems. The third TR will compare the performance and complexity of the radio interface in satellite communication systems based on Orthogonal Frequency Division Multiplexing (OFDM) versus Time-Division Multiplexing (TDM).

We are also preparing a TR on the need, requirements, content and structure of a protocol to convey the resource demands of the service provider to the satellite operator and the allocated resources from the satellite operator to the service provider.

Work will continue on the integration of satellite communications and High Altitude Platform Stations in 5G.

Publication of a new Harmonised Standard for fixed and in-motion Earth stations communicating with non-geostationary orbiting systems in the Ku band is scheduled for the end of 2017. We will revise our Harmonised Standard dealing with Mobile Satellite Service receivers in the L band to take account of the projected use of the lower adjacent band by IMT systems. Other work planned for 2017 includes a revision of our Harmonised Standard for satellite broadcast reception equipment in the Ku band.

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 standardisation organisations 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 and LTE-Advanced/LTE-Advanced Pro technologies.

3GPP is supported by ETSI's Mobile Competence Centre (MCC).

Further information at: www.3gpp.org

In 2017, 3GPP will focus on Release 15. As well as building on the functionality of previous Releases, Release 15 will benefit from the results of the first concentrated 5G studies. Unlike previous 3GPP technologies, where the radio access specifications have, to some extent, dominated, 5G is likely to be much wider in its scope and will not necessarily be restricted to further developments of 'conventional' cellular telecommunications. It is also likely to be much broader than traditional cellular applications, extending to the IoT – which will itself include a vast array of Vehicle-to-Vehicle (V2V) and Vehicle-to-Anything (V2X) applications. These will require an enormous improvement in latency and bandwidth and, whilst a vehicle may need to provide a relatively small amount of data, it can expect to receive very large amounts from other vehicles (or other objects) and will have to process these in real time, reacting within milliseconds. It is also likely that Release 15 will see the first moves to use 3GPP technology for non-terrestrial communication, in particular inshore waters, and for satellite communication.

The feasibility reports for new 5G radio technology, to be known as 'NR', having largely been completed in the Release 14 timeframe, 3GPP is now laying the foundations for the normative standardisation work.

The higher frequencies associated with NR pose both different propagation problems as well as opportunities, and demand a different approach to architecture and protocols, given the shorter path lengths and higher base station density.

NR normative work in Release 15 will be divided into so called 'non-stand-alone' radio, where the NR terminals piggy-back onto the LTE radio access network and rely on the LTE core network services and, later, 'stand alone' NR, which needs no LTE network as support and communicates directly via the NR access network to the 5G core network.

3GPP is also addressing the fixed network and security aspects of 5G, including issues raised in the ETSI Summit on 5G Network Architecture held in April 2017. These include the potential difficulties of handling very large numbers of terminals in the 5G IoT world, with correspondingly large numbers of base stations, particularly in urban areas.

All in all, Release 15 already comprises around 100 top-level items, currently split fairly evenly between studies and normative features.

3GPP will also take account of the continuing evolution of LTE technology, particularly in the radio access networks area, with yet more frequency bands and combinations thereof being added for ever more versatile radio data rates.

3GPP will complete the normative work for the extension of mission-critical services from simple voice to data and video in Release 15, making LTE technology attractive to an ever widening user community.

The timescale for the delivery of 5G is very ambitious. Finalisation of the first phase of 5G specifications in Release 15 is expected by September 2018, to accommodate early commercial deployment. The second phase in Release 16 is due to be completed by March 2020, for submission to the International Telecommunication Union as a candidate IMT-2020 technology.

However, 3GPP is expected to approve specifications for 'non-stand-alone' NR in March 2018. 5G standardisation will continue well beyond these dates, with constant evolution of the system, as for 4G and 3G before it.

The international railway community has long used enhanced GSM technology to meet its operational needs. Now that many of those enhancements are being provided to the mission-critical user community, the railway authorities are considering LTE for their next generation of communications.

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 2017, we will continue to focus on the updating of Harmonised Standards from the R&TTE Directive to the RED.

We are also aligning our EN on IMT cellular networks with 3GPP Release 13, by adding new parts to cover features such as Narrowband IoT, machine-type communications and new bands for carrier aggregation. This will enable operators to introduce new features in mobile networks, paving the way for the future development of 5G technologies. We expect to complete our work on the three parts on base stations and the two related to mobile communications in 2017, and we have begun new work to add the Active Antenna System feature. Publication of all these parts is scheduled for 2018.

We expect to complete a new TR which will provide guidelines for assessing the conformity of eCall in-vehicle system devices with regards to essential performance requirements. We are also revising our high level application requirements conformance test specification for eCall.

Millimetre Wave Transmission

Millimetre-wave bands (30 - 300 GHz) offer enormous amounts of under-utilised 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 2017 our Industry Specification Group (ISG) on millimetre Wave Transmission (mWT) expects to complete a Group Specification (GS) on carrier aggregation systems, and two Group Reports (GRs). One report will address the applications and use cases of Software Defined Networking as related to mWT. The other GR will provide a spectrum management overview of the W-band (92 - 114,5 GHz) and the D-band (130 – 174,8 GHz), describing anticipated scenarios and related channel arrangement, with the aim of facilitating the deployment of both future high capacity backhaul systems and innovative solutions for fixed broadband access. We also plan to begin pre-standardisation work for equipment in the W and D bands.

We expect to begin a detailed interference analysis for systems in the V-Band employing Wireless Gigabit Alliance (WiGig) technology. We will use realistic approach-based 3D ray-tracing tools that can take into account the typical geometry of a high, dense urban environment.

Other possible work for 2017 includes the analysis of 5G X-Haul, to evaluate its impact on wireless transport and the long term roadmap for its development.

Multi-access Edge Computing

Multi-access Edge Computing (MEC) technology offers IT service and Cloud computing capabilities at the edge of an access network. This environment is characterised by user proximity and ultra-low latency, and provides exposure to real-time network and context information. MEC enables communication service providers to create application points-of-presence for authorised third party applications within their networks, allowing them to rapidly and easily deploy innovative products for use by mobile subscribers, enterprises and vertical market ecosystems. To enable this

new value chain, a standardised, open environment for efficient and seamless integration of applications across multi-vendor platforms is needed.

MEC has been identified as a key enabler for the IoT, connected cars, industrial automation and other mission-critical, vertical solutions. Additionally, it is helping to advance the transformation of the mobile broadband network into a programmable environment. MEC will help satisfy the demanding requirements of 5G in terms of expected throughput, latency, scalability and automation.

In 2017, our ISG on MEC expects to complete work initiated during Phase 1 and to release its specifications and reports in several packages. The documents to be released in 2017 will include nine GSs related to MEC Application Programming Interfaces (APIs), management interfaces and essential platform functionality, along with GRs on MEC in a Network Functions Virtualisation environment and end-to-end mobility.

As we begin to focus on Phase 2 activities, we will generate the requirements necessary to extend the applicability of our work to non-3GPP access networks (such as Wi-Fi and fixed access) and non-virtual machine-based virtualisation models (e.g. containers), as well as to address gaps in the scope of our Phase 1 activities (such as charging and lawful interception). We plan to complete the requirements by the end of 2017, which is expected to lead to new work to extend existing specifications and/or develop new ones.

Additionally, while we continue to use Proofs of Concept (PoCs) to demonstrate the viability of MEC implementations, we have also initiated an activity designed to make implementations of our APIs and functionality available as software, either via ETSI or through an external Open Source project. Both the PoCs and our software activities are expected to operate in parallel with our standards development efforts.

Online Work Programme

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

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 organisations. Security standardisation, 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.

Building on our previous work, we have begun developing a Technical Specification (TS) which will define metrics for the identification of critical infrastructures, addressing issues such as the impact of a successful attack on a critical infrastructure, categorisation of the critical infrastructure, its dependencies and interdependencies, reporting and registration and access control. Publication is expected before the end of 2017.

We continue to address privacy, in response to European Commission (EC) standardisation request M/530 on Privacy by Design, and in co-operation with the European Committee for Standardisation (CEN) and the European Committee for Electrotechnical Standardisation (CENELEC). By the end of 2017 we expect to have completed a new TS on mechanisms for privacy assurance and the verification of Personally Identifiable Information, a TS on identity management and naming schema protection mechanisms, which will identify means to prevent identity theft and resultant crime, and a TR on a practical introductory guide to privacy.

Our work on Attribute-Based Encryption (ABE) is ongoing. By mid-2018 we plan to publish specifications on the application of ABE for data protection on smart devices, Cloud and mobile services, and on the standard features needed to use ABE as Attribute Based Access Control.

We will finalise a Technical Report (TR) on the implementation of the European Union's Network and Information Security Directive, which will identify existing standards and where new standards are needed in support of the directive, particularly in the area of critical infrastructure protection.

We will also complete a new TS specifying an interface to enable a trusted domain to perform sensitive functions coming from another domain.

Work continues on the updating of our two-part TS on methods and protocols for security, addressing countermeasures and Threat, Vulnerability and Risk Analysis methods and taking account of developing threats and new security techniques.

Our new working group on quantum-safe cryptography, which brings the activities of our former Industry Specification Group (ISG) on Quantum-Safe Cryptography (ISG QSC), into mainstream ETSI standardisation, has begun work on three TRs. Two will compare proposals for quantum-safe key exchange schemes and signature schemes, and a third will review and make recommendations on the impact of integrating quantum-safe algorithms into Virtual Private Network technologies.

We have begun new work on middlebox security protocols, which is expected to lead to the publication of a TS in 2018.

In the spectrum area, we plan to finalise a new System Reference document on critical infrastructure utility operations.

Secure Elements

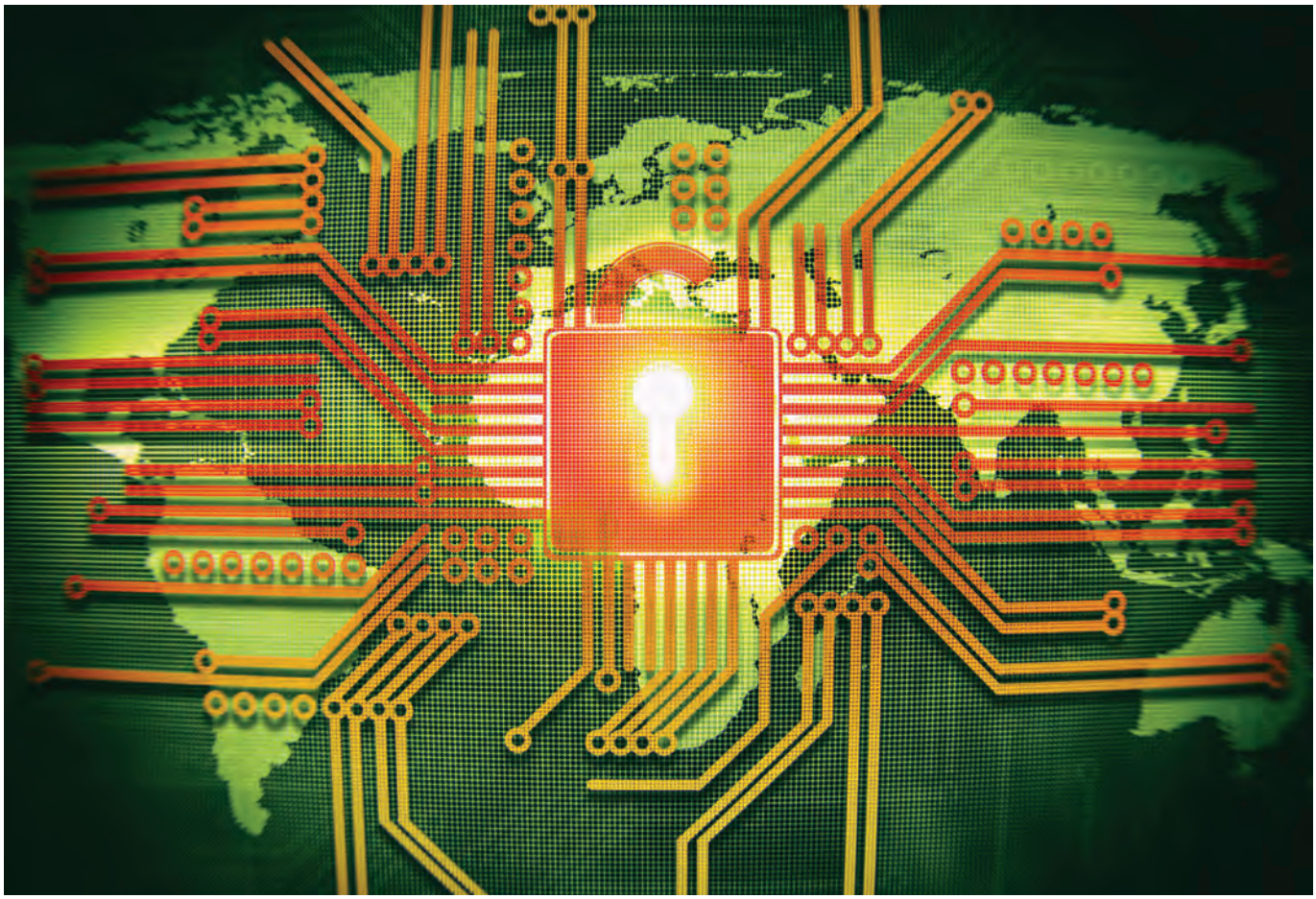
The main task of our Smart Card Platform committee (TC SCP) is to develop and maintain specifications for the Secure Element (SE) and its interface to the outside world for use in telecommunication systems, for general telecommunication purposes as well as for Machine-to-Machine (M2M)/Internet of Things (IoT) communications. As these specifications are generic and application-agnostic, they can also be used as specifications for any application designed to reside in an SE, for its interface to the outside world and the ecosystem in which it is embedded.

In 2017 we will continue to discuss the potential use cases and requirements for a next generation SE. This will include possible improvements to the existing physical/electrical interface, the logical interface and the potential definition of new interfaces for removable and non-removable SEs. For non-removable SEs, interoperability may not be required in terms of physical dimensions, pin locations or the physical/electrical interface. New data structures capable of handling large amounts of data in a secure way will be needed. In addition, configurations will be specified with special emphasis on an optimised configuration for the IoT and 5G. First specifications are planned for publication in early 2018.

Work on the embedded UICC (eUICC) specifications will continue. In general terms, an eUICC is a UICC which is not easily accessible or replaceable, is not intended to be removed or replaced in the terminal, and enables the secure changing of subscriptions. It may be inconvenient, if not impossible, to exchange an eUICC for another one, which imposes specific constraints on the administration of an eUICC, including the electrical personalisation of the UICC. The ability to change subscription-related data in the UICC without its physical removal and replacement in the end-device necessitates new methods for provisioning identity and access credentials both securely and remotely. We are therefore working towards the specification of a technical solution to meet the requirements identified for an eUICC. Building on the first version of our TS on the physical, logical and electrical characteristics of the eUICC which was approved in 2016, work will continue in 2017 to cover open topics such as Public Key Infrastructure and configuration policy.

Our Secure Element specifications are widely used by the industry and certification bodies, and the maintenance and technical improvement of these specifications, as well as the continuous updating of our test specifications to cover new features and functions, therefore form a significant part of our work in this area. In 2017 we will therefore upgrade our existing test specifications, as necessary, to cover new releases of the respective core specifications and we will review our test descriptions to take into account experience gained in the field.

We will continue to maintain the application identity register for Secure Element applications on behalf of various other organisations.



Electronic Signatures

In 2017 our Electronic Signatures and Infrastructures committee (TC ESI) will continue to develop European Standards (ENs) for Electronic Registered Delivery and Registered EMail (REM) services. We are defining policy and security requirements in line with the European Union (EU) scheme for the supervision of eDelivery, and specifying the technical architecture, semantic contents, formats and protocol bindings. We will also complete various quick fixes on existing REM specifications.

Other ongoing work includes three specifications related to signature validation reports and Trusted Service Providers (TSPs) providing AdES digital signature validation services (including policy requirements and protocols). We will start to address TSPs providing remote signature creation, including policy requirements and protocols, and we will complete the enhancement of the XAdES signature format to support the Evidence Record (XMLERS).

We will continue to develop a multipart TS on signature policies. In 2017, we expect to complete Part 4 on a signature validation policy for European qualified electronic signatures/seals using trusted lists and to begin work on Parts 2 and 3 on machine-processable formats (XML and ANS.1) of signature policies.

We will complete the maintenance of ENs on the policy requirements for TSPs and on public key certificate profiles, integrating feedback from implementations and auditors.

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

Building on our study into the standardisation needs for long-term data preservation services, including preservation of/with digital signatures, we plan to begin new standardisation activities which are expected to include the definition of policy and security requirements for TSPs providing long-term data preservation services and development of the standards which will pave the way for interoperability.

Lawful Interception and Data Retention

In 2017 our Lawful Interception committee (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 will include the maintenance of the seven-part TS on the handover interface and service-specific details for Internet Protocol (IP) delivery.

We will continue to develop a new specification on an interface for communication between authorised Law Enforcement Monitoring Facilities (LEMFs) to support (as a minimum) European Investigation Orders related to LI and/or RD. This specification aims to be capable of securely handling real-time and stored data transfer between LEMFs. While triggered by the EU, it will be internationally applicable.

We expect to publish a new specification for an internal network interface X1 for LI covering connections between LI systems and several network elements from different vendors over Handover Interface 1 (HI1). In addition, we will continue to work on the two new related specifications for interfaces X2 and X3 for messages to HI2 and HI3 respectively.

We plan to finalise a TS on the dynamic triggering of interception, which is required as a result of the diversification of service and network architectures.

We are also developing a new specification on security for LI and RD systems, a fundamental requirement which is becoming ever more challenging as networks become increasingly IP service-centric, globally distributed and, frequently, software-based. Our work on Network Functions Virtualisation (NFV), which is a key element in this area, is expected to intensify in 2017, and we will begin to consider the LI needs of Multi-access Edge Computing (MEC).

The specification for an LI interface for Terrestrial Trunked Radio (TETRA) will be revised to address new LI capabilities in TETRA and to bring the document in line with LI activity as a whole.

We will continue to work on two new ETSI Special Reports. One will provide a guide to LI and RD standards and concepts (including an evolutionary overview); the other will offer guidance on LI for LTE™ in the form of Frequently Asked Questions.

Other possible future topics include the media stream handover for encrypted data, for handling intercepted data from communications which have been encrypted by operators.

Security Algorithms

Our Security Algorithms Group of Experts (SAGE) is widely recognised for its work on authentication and encryption mechanisms for different technologies. In 2017, we will continue to develop security algorithms as needed to support our standardisation activities.

Other work may include the development of algorithm variants for 5G. All the radio interface algorithms in 3G and 4G use 128-bit keys, but 5G algorithms are likely to use (or at least support) 256-bit keys. If necessary, therefore, we will adapt our existing algorithms, as well as the MILENAGE Authentication and Key Agreement algorithm, to support 256-bit keys.

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 ISG on QKD is developing standards for the quantum communications industry that will promote and shape the market.

Ongoing work includes the characterisation of the optical output of QKD transmitter modules, QKD deployment parameters, and a specification on the design, construction, characterisation and operation of QKD systems to protect against Trojan horse attacks.

We expect to complete a revision of our specification on the properties of the components and internal interfaces of QKD systems in 2017.

Information Security Indicators

In 2017, our ISG on Information Security Indicators (ISG ISI) expects to complete three new specifications: an ISI-compliant measurement and event management architecture for cyber security and safety, to enable communication between diversified detection tools; 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 all stakeholders within companies, from IT and IT security to business management and executive committees. We also plan to revise our existing Key Performance Security Indicators which were developed to evaluate the maturity of security event detection, to take into account users' feedback.

The ETSI Security Week

We will organise our annual Security Week which will address issues raised by the latest technological advances.

Online Work Programme

Technologies for a Better Life

While technological progress has improved the way we communicate for both social and business purposes and opened up exciting new opportunities, we are careful to minimise 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

A significant part of our work on energy efficiency supports European Commission (EC) policies, regulation or legislation. For example, in 2017 our Environmental Engineering committee (TC EE) will begin new work on an ETSI Standard (ES) on the metrics, methods and parameters for the assessment of the material and resource efficiency aspects of ICT network infrastructure equipment, in the context of the circular economy. This work, in response to EC standardisation request M/543 on material efficiency, will be carried out in co-operation with the European Committee for Standardisation (CEN) and the European Committee for Electrotechnical Standardisation (CENELEC).

We are also developing standards in support of EC Mandate M/462 on efficient energy use in fixed and mobile information and communication networks. TC EE is working on three new European Standards (ENs) for energy efficiency Key Performance Indicators (KPIs) for servers, for Radio Access Network (RAN) equipment and for the application of Network Functions Virtualisation (NFV) in ICT networks, which are due for publication in 2018. Our Access, Terminals, Transmission and Multiplexing committee (TC ATTM) focuses on the energy efficiency of broadband transmission, increasing energy efficiency in operational networks, devices and sites, and improving the management of ICT waste. TC ATTM is also developing KPIs (ESs and Technical Specifications (TSs)) for M/462 to support the deployment of eco-efficient networks and sites and to monitor the energy management of deployed broadband. In 2017 we will complete a new TS in the series, defining the main KPIs for green smart cities. We have also begun upgrading our ESs and TSs, with the aim of publishing them as ENs by 2018, in time to support potential new European legislation related to the development of efficient ICT products and components.

We are revising our two-part ES on the measuring of the energy efficiency of wireless access network equipment, specifically the part on dynamic traffic loads. We expect to complete three new Technical Reports (TRs) in 2017. One will describe best practice in assessing the energy performance of future RAN deployment, the second will present the results of studies into methods and metrics for evaluating energy efficiency for future 5G systems, and the third will outline energy estimation methods for mobile networks using a statistical approach.

We are addressing possible methods for the assessment of the environmental impact of mobile ICT devices.

We plan to publish an ES on measurement methods for the energy efficiency of NFV and we will extend our ES on the 'Green Abstraction Layer' to cover NFV applications.

We expect to publish a new ES defining standardisation terms and trends in energy efficiency, and a revised version of our ES on measurement methods for the energy efficiency of router and switching equipment, to simplify testing.

We will continue in discussion with the Alliance for Telecommunications Industry Solutions (ATIS) with the goal of aligning our respective methodologies for the measurement of energy efficiency in ICT products and networks.

We are revising our ENs on environmental classification and tests for telecommunication equipment, including our multipart EN for test methods for storage, transportation and equipment installed in weather-protected and non-weather-protected locations.

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

We will continue to develop standards on the alternating current interface for ICT equipment connected to a 400V DC source. We expect to publish a revised version of our EN on the requirements for ICT equipment powered by a 400V AC source and to finalise new versions of the two parts of our ES on transient voltages at the 400V and -48V DC interfaces. In co-operation with International Telecommunication Union (ITU) Study Group 5, we are developing an ES which will specify the architecture for connecting renewable energy sources to 400V power systems. We plan to publish a new ES on the management of the migration of telecommunication site installations from -48V DC power distribution to 400V DC, and to complete a TS on the impact on the ICT equipment architecture of multiple AC or 400V DC power inputs.

We expect to complete a three-part 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.

In 2017 TC ATTM will develop our multipart TS on broadband deployment and energy management, completing new subparts on multi-service networking infrastructure and associated street furniture, metropolitan networks, and city individual terminals. These specifications will ease the deployment of smart new services such as IP networks in digital multi-service cities. Work continues on subparts on offices, multi-tenant premises and single-tenant homes and we will begin new work on mobile access networks.

We will continue to develop a nine-part EN on broadband deployment and lifecycle resource management for the end of life of ICT equipment, starting work on several new parts in 2017.

In support of M/462, our Industry Specification Group on Operational energy Efficiency for Users (ISG OEU) expects to complete a new specification on the measurement of energy consumption in memory units and to publish a Group Report (GR) on the deployment of fire extinguishing and alarm systems in ICT sites.

We are developing Group Specifications (GSs) for the smart city: one will define global KPI modelling for green smart cities, covering both residential and office environments, a second will provide KPIs for smart cities, and the third will describe useful ICT services for the management of sustainable intelligent cities.

We are also developing KPIs for the level of ICT energy intensity for different industrial sectors and a specification for a global KPI (Data processing Communication Energy Management (DCEM)), which will be used for monitoring data centres.

Other ongoing work supports the organisation of ETSI Plugtests™ events on broadband and multi-service deployment and green smart cities implementation.

Access for All

The study of human factors can help ensure that products, systems and processes are designed to take proper account of the interaction between them and the people who use them. Much research and development in human factors today is aimed at finding innovative approaches to extend digital inclusion. Increasing the uptake and use of new technologies can improve the quality of lives and the competitive position of businesses in global markets. Both society and industry can therefore profit from a greater focus on end-user aspects and the user's experience of ICT.

The Joint Working Group on eAccessibility, which brings us together with CEN and CENELEC, has allocated to TC HF the majority of the standardisation work required as a result of the EC's new Directive on the accessibility of the websites and mobile applications of public sector bodies (WAD). The aim of the WAD is that people with disabilities, especially those with vision, hearing or cognitive impairments, should have better access to public websites, their contents and mobile applications. In 2017 we will begin a major revision of our EN on the accessibility requirements for the public procurement of ICT products and services to incorporate additional user requirements and to transpose it into a Harmonised Standard supporting the WAD. At the same time, we will consider integrating into the standard the results of our recent work on the needs of people with limited cognitive abilities using mobile ICT. We will also develop compliance test specifications for the functional requirements in the standard.

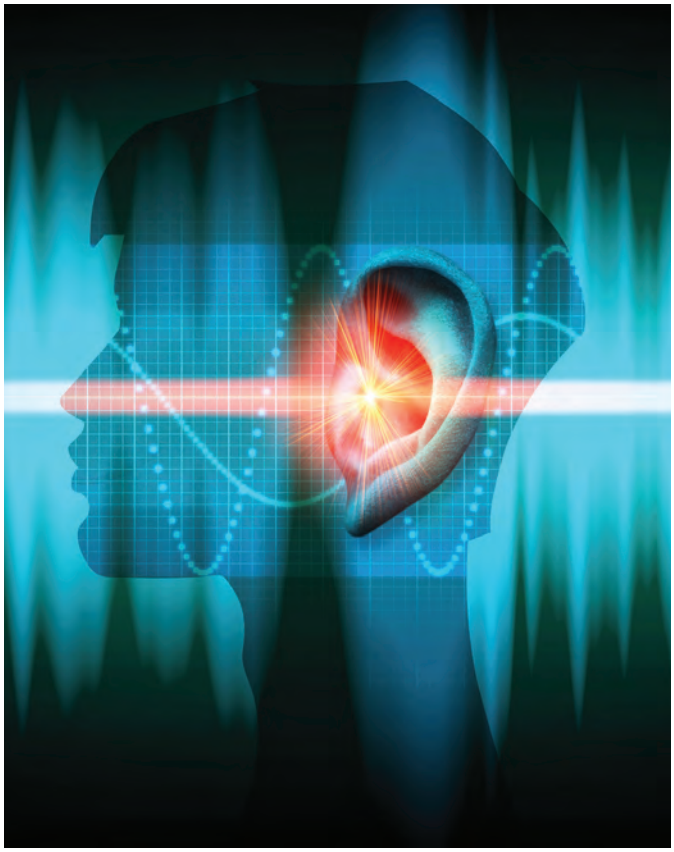
We are developing a new ETSI Guide (EG) on device and service terminology, building on our earlier guides on the subject, adding terms for upcoming device and service features in the five most frequently spoken languages in the European Union (EU) and the European Free Trade Association (EFTA) countries (English, French, German, Italian and Spanish).

We will study the human factors aspects of the services in smart, accessible, sustainable cities and communities, and expect to publish our findings in a TR early in 2018. This report will assess the different consumer needs that should be taken into account in the standardisation of smart cities. We will look at issues such as accessibility, usability, personalisation, interoperability and personal data protection.

We have introduced new work 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. We plan to deliver a new TR outlining our findings before the end of 2017.

Media Quality and the User Experience

In 2017, our Speech and Multimedia Transmission Quality committee (TC STQ) will continue to work on terminals and network configurations using super-wideband and fullband for conversational services for teleconferences and audio-visual applications. With the standardisation of the new Enhanced Voice Services (EVS) codec by the Third Generation Partnership Project (3GPP™), mobile terminals are entering the market which employ new designs and signal processing adapted to new use cases. We will now develop testing and qualification procedures for these terminals and configurations.



We will continue to work closely with 3GPP, and to revise regularly our multipart TS on the Quality of Service (QoS) aspects of popular mobile services to reflect the latest developments in GSM™, 3G and LTE™.

In 2017 we expect to complete revised versions of our four TSs on the transmission requirements for narrowband/wideband wireless terminals (hands-free/handset and headset) from a QoS perspective as perceived by the user, to optimise end-to-end quality. Our work on wireless terminals for super-wideband and fullband is ongoing and new versions are planned for 2017 and 2018.

We will complete new work on mobile communications including a TS on the QoS aspects of mission-critical applications and reports on the QoS aspects of Wi-Fi off-loading and Voice over Wi-Fi (VoWiFi), a framework for multi-service testing, and the QoS aspects of services related to, respectively, the Internet of Things (IoT) ecosystem, the 5G ecosystem and video services.

We plan to complete a new TR on bandwidth calculations and prioritisation in Voice over Internet Protocol (VoIP) systems, a new TS on methodologies, test arrangements and requirements for evaluating the performance of wearable devices for speech communication, and a new TR on the status of technical aspects of net neutrality including broadband access aspects.

We are introducing new work on speech recognition in response to emerging needs in the IoT for the testing, optimisation and qualification of voice-controlled devices employing speech recognition. We will update our existing specifications which allow the simulation of different background noise scenarios in a laboratory type of environment to accommodate the IoT. We will also develop new testing techniques for the verification of different types of devices using speech recognition in various acoustic environments. We are developing methods and procedures for evaluating the performance of voice-controlled devices and functions which will result in the publication of a new TS in 2018.

We are preparing a TS aimed at improving listening quality for people with impaired hearing. 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. This new specification will define requirements and measurement methods to assess the impact of different transmission impairments on intelligibility as well as a model to assess speech intelligibility objectively.

Other new work in 2017 includes the development of methodologies, test arrangements and requirements for the evaluation of multimedia communication performance under parallel physical and/or mental load (dual-task testing).

We are compiling best practices for throughput measurements and expect to publish a new TR in 2018. We will take into account issues raised at the ETSI workshop on ‘Multimedia Quality in Virtual, Augmented or other Realities’ held in May 2017. This new work is expected to lead to the publication of a number of new TSs in 2018.

Our User Group works with our other committees to ensure the needs of users are considered. In 2017 the group will continue its work on a Special Report (SR) on users’ needs in relation to the IoT and a TR on the evaluation of reference values for the quality of ICT services, with the aim of helping users select the most appropriate supplier. Other possible work includes a study into the impact of digital ecosystem evolutions on users

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 RED.

Transportation

Online Work Programme

Bringing the Power of ICT to People on the Move

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

Road Transport

In the very 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. Standardisation 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 maximise their benefits by developing common European standards and technical specifications to enable interoperability. TC ITS is leading the drive to achieve international standards.

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) has therefore created a C-ITS Deployment Platform. Its Phase 2 report is expected by September 2017, together with European Security and Certification Policies for C-ITS. We are following this work closely and will develop the necessary updates to support the anticipated additional requirements for the security and privacy framework.

Security is central to C-ITS. In response to the earlier findings of the C-ITS Deployment Platform, we have already introduced new work on certification and security and we are updating our existing security standards. We expect to publish a new version of our Technical Specification (TS) on trust and privacy management in 2017.

We continue to fine-tune our ITS Release 1 standards in response to standards development and feedback from early deployments.

The major work of 2017, however, will focus on pre-standardisation studies for Release 2 of the C-ITS standards and preparation for automated driving. Release 2 will address new features and functionalities anticipated in future C-ITS to deal with more complex use cases and the interests of a larger group of stakeholders. For example, in 2017 we expect to publish a Technical Report (TR) on Co-operative Adaptive Cruise Control (CACC), with the results of four more studies following in 2018, covering the use of C-ITS to protect vulnerable road users such as cyclists and motor cycle riders, malicious behaviour detection, pseudonym change management and platooning. Other ongoing work will address multi-channel operations. Once published, we plan to produce standards for each of these features. These activities are being co-ordinated with the Institute of Electrical and Electronics Engineers (IEEE) and SAE International to achieve the harmonisation of ITS deployment in different regions.

We will also complete a new TS in 2017, describing the requirements for Intersection Collision Risk Warning using Co-operative Awareness Message and/or Decentralised Environmental Notification Message.

We are developing a new TS on the Collective Perception Service which will enable sensor information to be shared between road users so that, even when his or her own view is obscured, a driver can 'see', for example, pedestrians or older cars without C-ITS, which are visible to another driver.

We plan to complete the facilities layer protocol and facilities layer algorithms for Decentralised Congestion Control in the ITS station management entity and the facilities layer, as well as a two-part TS on the facilities layer function. We will finalise the Multimedia Content Dissemination basic service specification, enabling the vehicle-to-everything (V2X) exchange of multimedia information comprising video, audio, images and data. We will also continue to address ITS-G5 channel models, and mitigation of interference in the 5 GHz range.

We are looking into the possible use of the C-ITS architecture and V2X communication technology to enable new types of transport pollution control and management applications. We plan to publish a TR on the subject by the end of 2017.

We will continue to work to improve the radio characteristics of the Transport and Traffic Telematics Dedicated Short Range Communication link.

Testing is crucial to the commercial deployment of C-ITS. In response to EC Mandate M/453 on C-ITS, we will continue to develop conformance tests and to update our existing specifications. We are developing four new TSs, three for testing the interoperability of V2X use cases, together with a specification on the architecture of the validation framework for ITS interoperability tests.

We will begin work to adopt MirrorLink® specifications for car-smartphone connectivity as ETSI standards under the Publicly Available Specifications (PAS) procedure.

Our Electromagnetic Compatibility and Radio Spectrum Matters committee (TC ERM) is addressing the spectrum needs of ITS and will develop a new System Reference document (SRdoc) on smart tachograph weight and dimension applications in the 5 GHz band.

We also expect to complete the alignment of the Harmonised Standards for ITS and transport and traffic telematics operating in the 5,8 GHz and 60 GHz frequency bands with the Radio Equipment Directive (RED).

Wireless Power Transmission

We expect to publish a new SRdoc and a Harmonised Standard on wireless power transmission.

Aviation

Our main aeronautical work in 2017 will relate to the RED and the need to address the standardisation of communications, navigation and surveillance equipment, such as radar, aspects of which were not covered under the Radio & Telecommunications Terminal Equipment (R&TTE) Directive. This work will include updates to existing standards for meteorological aids, for Ground Based Augmentation System VHF ground-air data broadcast, and for ground-based VHF/UHF radio transmitters, receivers and transceivers for the aeronautical mobile service.

In addition, we will continue to work on five Harmonised Standards required under the scope of the RED, addressing, respectively, primary surveillance radar (PSR) in three operational bands, secondary surveillance radar and multi-static PSR. Other work includes the development of four Harmonised Standards for meteorological radar in three operational bands, and air traffic control surveillance.

We expect to publish the final part of our five-part Harmonised Standard for Ultra Wideband (UWB), addressing UWB on board aircraft.

By September we plan to have completed a new TR on the use of professional unmanned aerial systems in Europe for civil use such as by film crews, for aerial surveys and by the police.

Rail

Our Rail Telecommunications committee (TC RT) will continue 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 commercial 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 2017 we expect to complete the alignment of the requirements for GSM operation on railways with Third Generation Partnership Project (3GPP™) Release 99.

We have begun work on a new TS to define a technical solution and the related minimum requirements for shared use of the 5 855 – 5 925 MHz frequency band by ITS and urban rail applications.

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. We expect to publish our findings in a TR by the end of 2017. At the same time, we will continue to work closely with 3GPP, as well as the International Union of Railways (UIC), on the definition of use cases for the FRMCS. Other ongoing work includes the standardisation of the Extended GSM-R frequency range for use for the FRMCS.

We will also continue to liaise with the UIC and the European Union Agency for Railways on the communications aspects of Technical Specifications for Interoperability (TSIs) to ensure the interoperability of the trans-European rail system.

In the spectrum area, we will develop spectrum-sharing options between the railway community, the automotive community and other similar service providers. Publication of a TS is expected by mid-2018.

We also expect to publish Harmonised Standards for railway systems (Euroloop and Eurobalise) by mid-2017.

Maritime

Publication of our Harmonised Standard on maritime broadband radio links for ships and off-shore installations is scheduled for mid-2017.

We also plan to publish revisions of our Harmonised Standards on the use of Digital Selective Calling in the maritime mobile service, for maritime low power personal survival locating devices, radar equipment used on non-SOLAS vessels, navigation radar used on inland waterways, VHF coastal stations, maritime VHF for Global Maritime Distress and Safety Systems, and UHF on-board communications systems and equipment.

We are developing a Harmonised Standard for maritime mobile transmitters/receivers and radiotelex equipment operating in MF and HF bands.

Satellite Communications

Our Satellite Earth Stations and Systems committee (TC SES) is developing 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.

Online Work Programme

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'.

Our standardisation for home and office focuses on three aspects: home and office wireless, home and office interconnection, and home and office requirements, including Quality of Service (QoS) and security.

Cordless Voice and Broadband Communication

Our Digital Enhanced Cordless Telecommunications (DECT™) specification is the leading standard around the world for digital cordless telecommunications but, at the same time, it has been enhanced to create Ultra Low Energy DECT (DECT ULE), the networking technology for residential and building applications that is primarily driven by a low power requirement for battery-operated devices for Machine-to-Machine communications.

While we will continue to maintain our existing standards and specifications, we have now also begun to consider the future of DECT and to collect requirements. In 2017, our DECT committee (TC DECT) will produce a Technical Report (TR) outlining technology roadmaps for the further evolution of DECT, ULE, Ultra-Reliable and Low Latency Communications (URLLC), New Generation DECT (NG-DECT), DECT evolution and DECT 2020, so that timelines and targets are agreed and commonly known. These roadmaps will define high-level feature sets and implementation targets mapped on a common timeline.

This work will be supported by a number of studies. We have initiated a study into 'DECT 2020: New Radio', and plan to complete a TR on the subject by the end of 2017. This will focus on defining use cases of DECT 2020, the possible use of RF channel measurements in typical deployment scenarios, benchmarking channel models for DECT frequency bands and use cases, and a first definition of DECT 2020, with guidance for the preparation of a technical specification.

We are also investigating URLLC, a usage scenario originating from International Mobile Telecommunications 2020 (IMT-2020) with strict requirements, especially in terms of latency and reliability. We plan to complete a TR by the end of 2017 which will examine URLLC use cases for vertical industries and establish URLLC data service profiles for periodic, aperiodic and streaming data traffic. This TR will form the basis for future technical specifications for DECT, DECT ULE, DECT evolution and DECT 2020.

The security of DECT is an ongoing consideration and we expect to produce a new assessment, with suggested improvements, by the end of 2017.

We will also update the DECT Harmonised Standard related to IMT.

Powerline Communications

We are addressing the co-existence of Digital Subscriber Line (DSL) modems and powerline telecommunications (PLT) at customers' premises to preserve the high throughputs of DSL technologies. In 2017 we will continue work on a test specification for co-existence mechanisms between PLT and Very-high-bit-rate DSL 2 (VDSL2)/the G. Fast Recommendation.

PLT and Premium TV Services

We are also working on the transportation of video over powerlines, in response to the advent of 4K video streaming and video on demand services for Ultra High Definition (UHD) television and new advances in technology which rely on high performance PLT modems. Development of a new Technical Specification (TS) is ongoing, aimed at defining the transcoding of High Definition and UHD video over powerline networks to improve network coverage.

Online Work Programme

Facilitating Content Consumption Whatever the Platform

The Internet, mobile communications and broadcasting are converging. But the standardisation 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 both the industry and the consumer.

Broadcasting

Our standardisation 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 Standardisation (CENELEC) – JTC Broadcast. More than 95% of inputs to JTC Broadcast are standardised by ETSI, with CENELEC responsible for the standardisation 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 2017 JTC Broadcast will focus on virtual reality, multicast for over-the-top (OTT) and new terrestrial network architecture (WiB), and will continue to address Ultra High Definition TV (UHDTV) and digital audio.

In the radio area, 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, and moving towards analogue switch-off in some countries. In 2017 the JTC expects to deal with updates associated with these developments, including enhanced standards for features concerning radio in vehicles, and the publication of minimum requirements and test methods for domestic and in-vehicle digital receivers.

The JTC expects to publish an enhanced version of its Digital Audio Compression (AC-3, Enhanced AC-3) standard and a revised version of its Technical Specification (TS) on DTS coherent acoustics; core and extensions with additional profiles. Other new work introduced in 2017 includes a revision of the specification on backwards-compatible object audio carriage using Enhanced AC-3 and the multipart TS on Digital Audio Compression (AC-4).

To complement the latest version of its popular DVB Audio and Video coding specification, which describes the necessary audio and video coding schemes to be used within DVB broadcast, in 2017 the JTC will prepare a new version of the DVB Subtitle Specification and will update the DVB Service Specification accordingly. In addition, the new Ultra High Definition-1 (UHD-1) Phase 2 features will be added to the DVB Dynamic Adaptive Streaming over HTTP (DASH) specification for OTT delivery of broadcast content.

The JTC will continue to meet the demands of developing UHDTV, by extending its existing TS which standardised a high-performance single layer High Dynamic Range (HDR) system with direct backwards compatibility for use in consumer electronics devices. This TS will be replaced by a new three-part specification, due for publication in 2017, which will include a number of fixes and enhancements including a default mode that works only with static metadata and an improved BT.709 to BT.2020 gamut mapper.

Maintenance of the TV Anytime specifications will continue on an ongoing basis.

Mobile and Broadcast Convergence

Television delivery has traditionally been dependent on broadcasting (one-way, one-to-many delivery networks to fixed TV sets). Today, however, new forms of media consumption dramatically increase the load on mobile networks. Interest is growing in exploring the potential for developing future mobile and broadcasting standards in a more converged way.

Our Industry Specification Group on Mobile and Broadcast Convergence (ISG MBC) is preparing a comprehensive general report exploring the deployment and business models of converged networks. We will propose new solutions and use cases to enable future wireless networks to deliver mass market broadcast services to mobile devices more efficiently, taking into account all industry views. We expect to complete a Group Report (GR) before the end of 2017 and to present this at an ETSI workshop in 2018.

Delivering both linear and non-linear media over converged networks will create attractive services and will benefit ongoing standardisation work in the area of Evolved Multimedia Broadcast Multicast Services (eMBMS) in the Third Generation Partnership Project (3GPP™) as well as future 5G standards.

Protection and Rights Mechanisms

Our ISG on the Embedded Common Interface (ECI) for exchangeable Conditional Access (CA)/Digital Rights Management (DRM) solutions (ISG ECI) is specifying a framework for software-based, easy-to-change protection and rights mechanisms for the delivery and consumption of media content on several types of user equipment. The core of the concept is the ECI software interface to which CA/DRM clients can be attached after being downloaded to the device. This will improve significantly the interoperability between services and devices, allowing consumers to continue using equipment and content they have previously paid for, after a move or a change of network provider, or to access content from multiple service providers from the same device.

Greater flexibility and scalability is also anticipated due to the software-based implementation, leading eventually to cost reductions for both the service provider and the consumer.

We continue to focus on the multipart core Group Specification (GS) and, by the end of 2017, expect to complete three final parts, on trust, test cases and system validation. We will also produce implementation guidelines.

Spectrum Aspects

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

We plan to complete new Harmonised Standards for radio and TV broadcast receivers and amplifiers for broadcast reception on domestic premises, as well as transmitting equipment for DRM broadcasting, Terrestrial-DAB, and the Frequency Modulated (FM) and Amplitude Modulated (AM) sound broadcasting service.

We will finalise a new System Reference document on wideband multichannel audio systems in the 25 MHz - 3 GHz band.

Online Work Programme

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

With Network Functions Virtualisation (NFV), standard IT virtualisation technology is adapted to consolidate many network equipment types onto industry-standard high volume servers, switches and storage. This involves implementing network functions in software which can run on a range of industry-standard server hardware. This software can then be moved to, or introduced in, various locations in the network as required.

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

With a membership now of some 300 organisations, the goal of our Industry Specification Group (ISG) on NFV is to create strong, sustainable specifications that are flexible enough to accommodate and adjust to both current demands and emerging requirements that may as yet be unknown. These specifications will enable network functions to be deployed dynamically and on-demand, making organisations more agile in addressing customer needs and the new challenges facing network technologies.

Work on our third release of NFV specifications has begun in earnest. The main objectives of Release 3 are to provide consistent operational integration with connectivity services, to consolidate security mechanisms and to enable the support of multi-domain scenarios suitable for potential new business models. During the development of Release 3, we will identify and address the additional requirements for NFV technologies as a result of the evolution of telecommunications networks, particularly 5G, and we will explore questions related to multi-domain and multi-tenancy, considering issues such as licensing, accounting and charging.

Our work also includes the development of a consolidated set of protocols and data model specifications to support interoperability. By mid-2017 the first Stage 3 specifications will be published, and a complete set of Stage 3 normative documents based on Release 2 specifications is planned for the end of the year.

Open Source has a key role to play in facilitating interoperability in software-intensive technologies such as NFV. Direct collaboration with relevant Open Source communities in the NFV and Software Defined Networking (SDN) fields is therefore one of our aims in order to maximise the impact of our NFV work, and we have established strong links with various such projects. In addition, we are identifying gaps between our NFV specifications and OpenStack™ Application Programming Interfaces. This work aims to create and maintain a feedback loop between ISG NFV and relevant Open Source projects, in an attempt to avoid a mismatch between approaches, working procedures and languages.

The use of Proof of Concept (PoC) demonstrations to validate key concepts has been crucial to the success of our NFV work to date, by helping to accelerate the adoption of the technology for a broader range of applications. In 2017 we will extend the scope of the existing PoC framework by means of more advanced interoperability assessment practices, refocusing on research results, especially in areas related to 5G.

ETSI Open Source MANO group

Within ETSI we have begun to capitalise on the synergies between the worlds of Open Source and standardisation in our work on NFV. Two of the key components of the ETSI NFV architectural framework are the NFV Orchestrator and the Virtualised Network Function Manager, known collectively as the NFV Management and Orchestration, or MANO. Our Open Source MANO group (ETSI OSM) is developing a software reference implementation (code) 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 method of working means that we can release regular versions of the code approximately every six months. We are now working on our fourth release (Release THREE), with the objective of reaching production-ready maturity by the end of 2017. Meanwhile, we will continue to produce periodic updates of the code and to share updates of relevant activities with the NFV community and the telecommunication industry in general.

Network Access

In the area of fixed radio systems, our Access, Terminals, Transmission and Multiplexing committee (TC ATTM) is revising our Harmonised Standards for point-to-point antennas and multipoint equipment and systems in line with the Radio Equipment Directive.

In 2017 we expect to complete a new Technical Report (TR) on small cells microwave backhauling.

We are updating our specification on Reverse Power Feeding. At the request of the Telecommunications Standardisation sector of the International Telecommunication Union (ITU-T) and the Broadband Forum, we are leading work on standardisation in this area.

Work on Very-high-bit-rate Digital Subscriber Line 2 (VDSL2) continues on an ongoing basis, including an update of our Technical Specification (TS) on European technical requirements.

We expect to complete a new version of the TS on single mode optical fibre systems for home cabling in response to feedback following implementation. We will align the content and the terminology of our existing TS on the optical external network testing interface with recently published European Committee for Electrotechnical Standardisation (CENELEC) standards. Other ongoing work includes a new TS on the European requirements for fibre to the distribution point.

Cable

In 2017, our Integrated Broadband Cable Telecommunication Networks committee (TC CABLE) will continue to address the evolution and extension of broadband cable network capabilities.

With Data Over Cable Service Interface Specification (DOCSIS) 3.1, the standards for one of the core technologies for cable access networks will be updated and evolved into European Standards (ENs).

Work will continue on the creation of ENs defining global Key Performance Indicators (KPIs) for the efficient use of energy in hybrid fibre-coaxial (HFC) access networks and their application in response to the European Commission's mandate M/462 on energy efficiency in information and communication networks.

We are engaged in a thorough review of the results of the Society of Cable Telecommunications Engineers Energy 2020 programme in order to identify potential contributions to our standardisation work. We aim to establish a comprehensive approach to managing the use of energy in the context of delivering broadband and television services using HFC networks.

We plan to publish a new ETSI Standard (ES) for home routers which will define a core set of features to enable multiple subscriber devices to gain access to high-speed data services using DOCSIS. This core set of features allows for both Internet Protocol version 4 (IPv4)- and IPv6-enabled devices to gain connectivity to the Internet.

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

We also plan to publish a new TS on the performance characteristics of coaxial cables used for RF signal transmission in HFC telecommunication networks.

Numbering, Naming, Addressing and Routing

Our Network Technologies committee (TC NTECH) will complete a study on the impact of alphanumeric user identifiers on interconnection scenarios.

The Transition to IPv6

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

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

We are developing a series of Group Reports (GRs) outlining the motivation and best practices for the deployment of IPv6 in different areas. Each report will also include the respective objectives, technology guidelines and an addressing plan, as well as identifying benefits, risks, challenges and milestones. In 2017 we expect to publish a GR on the deployment of IPv6 in relation to the Internet of Things. Work will continue on GRs for the deployment of IPv6 in enterprises, for 5G mobile wireless Internet and in telecommunications, and for Internet Service Providers.

We are also developing key GRs to describe the impact of IPv6 on SDN and NFV, Cloud computing, safety and emergency services, the industrial Internet (6TiSCH), the tactile Internet, security, root servers and the challenges arising from the transition from IPv4 to IPv6 and their co-existence. We will then identify best current practices and develop guidelines for mitigating any issues found.

Future Networks

In the area of autonomic management, TC NTECH plans to publish a TR outlining the business drivers for autonomic networking, a TS describing the Generic Autonomic Network Architecture (GANA) reference model and another TR providing guidelines to instantiating this model onto target implementation-oriented reference architectures. This will complete the transformation of the Group Specifications (GSs) produced by our former ISG on Autonomic network engineering for the self-managing Future Internet (ISG AFI) into ETSI Technical Specifications and Reports.

We will also finalise a report on the application of the GANA reference model to Third Generation Partnership Project (3GPP™) fixed broadband access and aggregation networks, and we will continue to work on the evolution of the GANA reference model to take into account emerging technologies such as SDN and NFV.

We will continue to maintain our Next Generation Network specifications, in particular for business communications and location services.

Next Generation Protocols

The TCP/IP protocol 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 (such as LTE™-A, G.Fast, DOCSIS 3.1 and 5G) will not deliver their full potential unless, in parallel, communications and networking protocols evolve to support these new capabilities.

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 under research, together with an assessment of their maturity and practicality for implementation circa 2020. Our findings will be provided to other Internet and telecommunications Standards Developing Organisations (SDOs) as input to stimulate standardisation work.

In 2017 we plan to publish three GSs which will provide: a reference model for describing protocols and protocol architectures; generic principles for next generation protocol design; and Self-Organising Control and Management Planes. We also expect to complete GRs on next generation architectures toward 5G and beyond, including identity oriented networks and intelligence-defined networks.

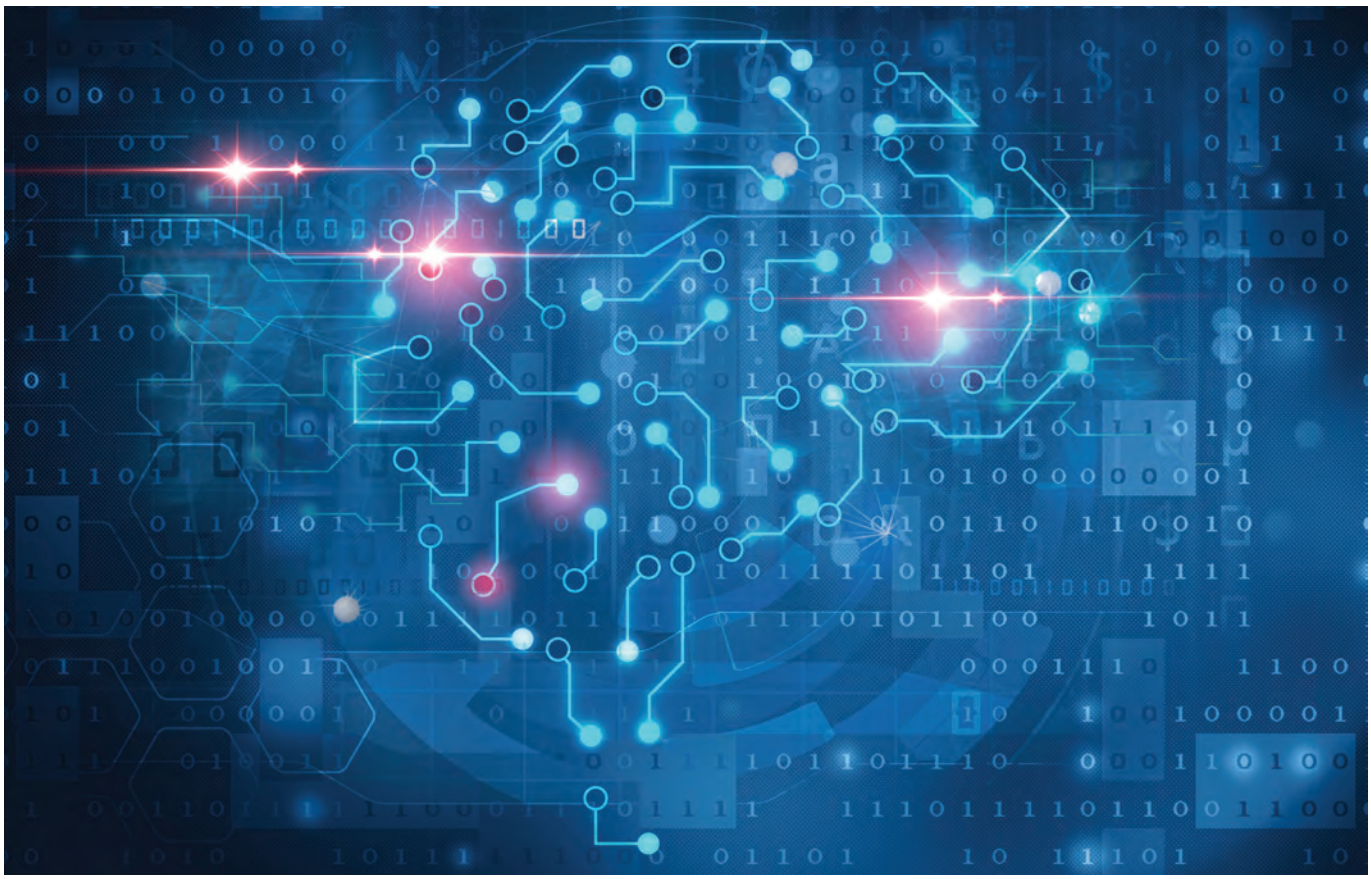
Experiential Networked Intelligence

The use of Artificial Intelligence techniques in the network management system could help solve some of the problems of future network deployment and operation. We have therefore set up a new ISG on Experiential Networked Intelligence (ISG ENI) to develop standards for a Cognitive Network Management system. Our aim is to introduce a metric for the optimisation and adjustment of the operator experience over time by taking advantage of machine learning and reasoning.

We will employ the 'monitor-analyse-plan-execute' control model which enables the system to adjust the offered services based on changes in user needs, environmental conditions and business goals. The policy modelling will encompass open intelligent functionality for network configuration and management. We will provide inputs and objectives to support the industry's progress in intelligent policy-based management.

The introduction of technologies such as 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. ENI will make the deployment of SDN and NFV more intelligent and efficient and will assist the management and orchestration of the network.

We expect to complete the first phase of our work in 2017. It will include a description of use cases and requirements, and a definition of features, capabilities and policies, which we will publish in a series of informative best practice documents (GRs). We will also carry out a gap analysis of work on context-aware and policy-based standards, working with other SDOs to reuse existing standardised solutions for legacy and evolving network functions wherever possible, to avoid the duplication of effort. This informative phase will be followed in 2018 by the development of GSs.



Online Work Programme

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

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. Our Centre for Testing and Interoperability (CTI) supports our committees with hands-on expertise in standards validation.

In 2017 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. The CTI will continue to provide practical daily support to our Open Source initiatives – our Open Source MANO group (ETSI OSM) and the Test Description Language (TDL) Open Source Project (TOP). We will also set up 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 standardisation activities and feedback is increasing. PoCs are being well 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 2017.

Plugtests™ Events

Our Plugtests events provide 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 2017, with varying formats to meet the specific needs of our members and the industries we serve.

This year we will focus on emergency communications. We are organising further Next Generation emergency call (NG 112) events and our first Mission-Critical Push-to-Talk Plugtests event, as well as a final eCall interoperability event, in partnership with ERTICO, before deployment of the system in October.

We will continue to support the development of the Internet of Things (IoT) and, together with our fellow Partners in the oneM2M project, we will continue to organise the series of oneM2M Interop events.

Our activities in Intelligent Transport Systems (ITS) will be extended to include a Plugtests event for Vehicle-to-Everything (V2X) over LTE™.

Test Specifications and Frameworks

In 2017 we will continue to develop conformance test specifications, including for our ITS and SmartM2M committees, oneM2M and the Third Generation Partnership Project (3GPP™). The oneM2M and the 3GPP test specifications will be used in third party certification schemes.

We will maintain and evolve Testing and Test Control Notation version 3 (TTCN-3), and will develop further conformance test suites for TTCN-3 tools and the application of TDL.

Our Core Network and Interoperability Testing committee (TC INT) produces specifications to facilitate the implementation of IP-based networks that can carry both fixed and mobile services simultaneously.

In 2017 we will update our test specifications for 3GPP Releases 12 and 13 and prepare new conformance test specifications for Release 13. We expect to publish a new specification to improve the Quality of Service and Quality of Experience of Voice over LTE (VoLTE) and Video over LTE (ViLTE) interconnection, interworking and roaming. We will develop 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.

Test Description Language

Our Methods for Testing and Specification committee (TC MTS) creates standards for testing and specification languages and provides frameworks and methodologies to enable our other committees to produce documents that are easy to understand and easy to use.

In 2017 the main focus for TC MTS, working closely with the CTI, will be to initiate and run the TDL Open Source Project, or TOP. This project will develop an integrated Open Source toolset for TDL for use by our committees, our Secretariat and external parties. The initial platform is already in place and the project is expected to become fully operational by October 2017.

> The fifth ETSI User Conference on Advanced Automated Testing (UCAAT) will be held in Berlin, Germany, in October 2017. The event will consider how advanced test automation can meet the challenges of fast product development in the age of the IoT and 5G.

Online Work Programme

Mission-critical Communications to Rely on

Communication is a key factor in an emergency situation, whether small incidents such as a man overboard or major natural disasters.

TETRA

Terrestrial Trunked Radio (TETRA) is the leading technology choice for critical communications users, with a projected 5 million terminals in use by 2020. The TETRA standard serves a variety of professional markets – public safety, transport, industry and commercial users – which rely on TETRA's high performance group and individual voice communications services and its wide range of data services, with one radio terminal able to provide many services.

Although use of TETRA for public safety applications, the military and utilities continues to grow, the majority of the work of our TETRA and Critical Communications Evolution committee (TC TCCE) is driven by the requirements of Public Protection and Disaster Relief (PPDR) and other mission-critical services.

The 'Future Vision' for TETRA is an evolution towards a fully integrated and seamless Information and Communications Technologies solution, providing narrowband/wideband/broadband wireless communications for mission-critical and business-critical Professional Mobile Radio (PMR) applications. Broadband will be a crucial factor in this, as it can supply the high data speeds required for various key applications including, for example, streaming video from the scene of an incident.

In the medium term, most users see a hybrid of TETRA and broadband networks as the way forward for critical communications, so we are also looking at methods of integrating TETRA into broadband solutions, and enabling migration from TETRA to (future) broadband. To minimise the work required and to optimise the standardisation process, the plan is to enhance existing standards for technologies, such as LTE™ and 5G, by the development of interfaces and applications, to make them suitable for mission-critical applications. By the end of 2017, we expect to publish a Technical Report (TR) outlining the key issues and solutions for TETRA to broadband interworking which will be followed by a Technical Specification (TS) detailing the required architecture.

We are also developing an architecture encompassing a range of application layer interfaces to LTE, defined in a set of TSs. In response to feedback from the Third Generation Partnership Project (3GPP™), we are revising the TS which covers the mobile-to-network interface architecture of a critical communications application operating over a broadband Internet Protocol (IP) interface. Publication of the new version is scheduled for mid-2018. We have also begun to look at extending our work to interfaces to 5G. In addition, work is ongoing on the detailed specification for the mobile-to-infrastructure interface. We have begun new work specifying the means of encapsulating TETRA speech coding, packet format and rate and end-to-end encryption synchronisation for use in 3GPP Mission-Critical Push-To-Talk (MCPTT) over LTE systems for the purpose of interworking with TETRA.

We continue to work very closely with the Critical Communications Broadband group of the TETRA and Critical Communications Association in relation to a revision of the TR on the user requirements specification on interworking between the Critical Communications Application and TETRA and on migration of services from TETRA to broadband (LTE).

In 2017 we expect to publish numerous standards and specifications which have been revised in response to feedback from manufacturers and users, including 14 documents relating to interworking at the inter-system interface (ISI) between two TETRA systems. This work has involved revising the original ISI European Standard (EN) to take account of the introduction of IP-based networks, dividing the content into several new parts to produce a family of specifications for IP, circuit switched networks and transport layer-independent aspects. We are now beginning to develop corresponding TSs. This work will simplify the future integration of TETRA into LTE.

We will continue to improve the functionality of TETRA Release 1 and the TETRA Enhanced Data Service (TEDS), as required by evolving requirements.

Security is a key issue for critical communications in the future. We expect to finish a study into security mechanisms for mission-critical broadband systems, including security systems appropriate for both an underlying broadband system (such as LTE) and also for applications providing mission-critical services, such as group call and Direct Mode services. We also plan to publish a new TR on the security of interworking between TETRA and broadband critical applications.

Emergency Calling and Alerting

In 2017 our Emergency Telecommunications committee (SC EMTEL) will continue to focus particularly on networks dedicated to emergency services, emergency applications and alerting libraries.

We expect to publish a TS which will provide the requirements, the functional architecture, the protocol and the procedures for implementing the Pan-European Mobile Emergency Application (PEMEA). This will solve the problem of emergency calling applications constrained to boundaries of the Public Safety Answering Point (PSAP) with which they are integrated, making it possible for data to arrive at the most appropriate PSAP, wherever the call is made.

A second TS, due for publication in 2018, is being developed to describe the core elements and corresponding technical interfaces for network-independent access to emergency services.

We will complete a complementary TR describing the test cases and scenarios for interoperability testing of the core elements such as location-based and policy-based emergency call routing, network- or handset-derived caller location (e.g. Advanced Mobile Location) as well as legacy, IP, enterprise/campus, and IMS-based access networks.

We are planning to produce a TS specifying the alerting libraries to be used for public warning, allowing the simple and unique generation of alert messages by selecting different information items from pre-defined lists. Implementation guidelines for the libraries will be developed in parallel as a TR. Both documents are scheduled for publication in 2019.

Other new work for 2017 will include IP caller localisation in private networks and next generation emergency calling, exploring new ways to contact the emergency services via, for example, social media, texting or sending video clips.

Our Network Technologies committee (TC NTECH) will finalise the specification of the protocols required on the interfaces of the functional architecture for emergency caller location determination and transport, in support of European Commission (EC) Mandate M/493. This service is intended to cover a situation where different service providers and network operators need to co-operate to determine the location of an emergency caller.

We will continue to develop conformance testing for eCall, the in-vehicle emergency call service which automatically relays data about an accident from the vehicle involved to the emergency services.

Other Public Safety Activities

In the Third Generation Partnership Project (3GPP™) we are helping to develop the use of LTE for mission-critical communications. In 2017 3GPP will complete standards for the extension of mission-critical services from simple voice to data and video in Release 15, making LTE technology attractive to an ever-widening user community.

By mid-2017, we expect to publish a new Harmonised Standard on avalanche beacon equipment, for locating people buried under snowfalls.

We are also 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
- Air Traffic Management
- Automotive Radar
- Autonomic Systems
- Body Area Networks
- Broadband Wireless Access
- Broadcasting
- Cable Networks
- Cloud Technology
- Cognitive Radio
- Content Delivery
- Context Information Management
- Cyber Security
- DECT™
- Digital Mobile Radio
- Digital Rights Management
- Digital Signatures
- eHealth
- Electromagnetic Compatibility
- Emergency Communications
- Energy Saving
- Environmental Aspects
- Experiential Networked Intelligence
- 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
- Media Content Distribution
- Millimetre Wave Transmission
- Mission-Critical Communications
- Multi-access Edge Computing
- Network Functions Virtualisation
- Network Management
- 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
- Reconfigurable Radio
- Safety
- Satellite Communications
- Security Algorithms
- Short Range Radio
- Smart Appliances
- Smart Cards
- Software Defined Radio
- Telemedicine
- Testing
- Terrestrial Trunked Radio (TETRA)
- Wireless Medical Devices

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