

## **FITCE Congress 2017 (Madrid) – Technical Sessions**

This year's FITCE conference was attended by about 230 delegates and featured 50 speakers in six technical sessions and seven round tables. Thirteen of the preselected papers will be made available via IEEE Explore. There were over a thousand Twitter posts about the conference. All sessions were recorded and it will be possible to download the presentations. An overview of the content of the technical sessions is given below:

### **Current and future challenges of the European Space program: an opportunity for electrical and communication engineers** – Javier Ventura-Traveset (ESAC Director's Office and Head of ESA's Galileo Science Office)

This session looked at the challenges of the Space Programme, run by the European Space Agency (ESA) which had a budget of €5.75 bn in 2017. There are 22 member states and there are currently 80 ESA satellites in orbit and there have been over 230 launches of the Ariane launch system and 50% of missions have been for communications satellites. The goals of the programme include space research, scientific co-operation and the development of space applications. It is estimated that 8% of telecommunications activity is associated with satellite activity, but this is 40% of the overall telecommunications budget. One out of three telecommunications satellites is made in Europe and the European role in this area of technology has grown.

Satellite is seen as a complement to 5G and not a competitor, further satellite navigation through the Galileo system, which supports 6 billion devices, is of growing importance. Satellite work is 6% of European GDP.

Javier took us through some of the recent ESA missions, starting with the Planck satellite, which examines the Cosmic Microwave Background, the echo of the early days of the universe from a Lagrange point 1.5 million km from the earth. Another experiment the Lisa pathfinder will be able to detect gravitational waves from space. The ExoMars project is a mission launched in 2016, which will help develop understanding of the mystery behind the presence of methane on Mars. ESA also have a mission of Enceladus, one of Saturn's moons, to look for signs of life. There are also projects to examine the atmospheres of the exoplanets. A key high light is the crashing of the Cassini probe into the surface of Saturn (see <https://saturn.jpl.nasa.gov/news/3121/nasas-cassini-spacecraft-ends-its-historic-exploration-of-saturn/>). Interestingly the timely intervention of a telecommunications engineer, who detected an initial problem, prevented this mission being aborted at an early stage.

### **Internet of things and the value of engineers in the digitalization of the companies and society** – Enrique Blanco, Global CTO (Director of Systems and Network) at Telefónica

Enrique emphasised the importance of latency in Internet of Things applications. There are now 20 to 30 IOT devices per person on earth. These capabilities require a mix of disciplines to implement and there is a lot of competition in the market and digital natives and new players in the market place are creating a changing world and engineers must respond to the challenge. The concept of the Internet of Things, 7 to 10 years ago was connected with cellular technology. The density of devices is growing exponentially and there is a need to simplify devices and sensors, to the stage where they can be powered by sources weaker than a triple A battery. The need is to evolve and simplify. Complexity reduction is important if we are to have manageable IOT networks. Latency becomes more important and less than 1 millisecond latency is required for a self-driving car and in health care. Defining a clear topology and architecture is important.

Industry 4.0 is seen as the fourth industrial revolution. The Internet of Things will help us go faster and 5G is important and IOT will speed up attainment of Industry 4.0. IoT will provide a vehicle for some of the data mining required for real-time analytics. Where and how information from billions of devices is managed is important.

We need to evolve and 5G is growing and this is modifying the role and demands on the core network. Latency is a prime concern. This generates a massive need for Capex expenditure and the availability of high frequency radio spectrum needed to duplicate the capabilities of fibre.

### **5G, a tool to change the way we live and work** – Elizabeth Cassin, VP Group Spectrum Office at ORANGE

The average person spends 3.2 hours in front of a screen today, but regulation restricts revenue and reduces the opportunity for innovation investment. Regulation of spectrum is particularly important. There has been a 10 year gap between each successive generation of cellular infrastructure implementation. There are still uncertainties in the 5G business case and roll out is not expected until 2020.

Automotive appears to be a significant use case, but operators are struggling to identify how to monetise the 5G case. More flexibility is required in the deployment of base stations and the benefits of massive MIMO deployment are being constrained by emf regulatory issues. More fibre and speed are needed for the investment and more spectrum needs to be made available for 5G use. Whilst spectrum sharing is an option, it is complex to manage.

The availability of high frequency spectrum is very important, but it's recognised that different regions have different requirements; in the USA for example the priority is fixed wireless access. There is a need for closer collaboration between policy makers, regulators and mobile operators. Europe is falling behind the USA and Asia in this technology and we need to be quicker in standardisation and regulation.

#### **Proposals for the industry 4.0**

##### **Control Systems and the Internet of Things – Shrinking the Factory – Edward Smith, BT, UK:**

This session highlighted the role of feedback mechanisms and illustrated this with reference to implemented computer enabled factory control systems. As the technology has developed, the cost of computing has reduced drastically, programming interfaces have improved, sensors are simpler and more cost effective and high performance communications across a wide area are readily available. This was illustrated by considering a prototype application, based on the Raspberry Pi and a domestic Internet solution over a Wireless LAN, to monitor the activity of vulnerable adults. A comparison of the prototype with the factor system showed how technology had advanced and costs had fallen; however practical systems spanning thousands of sites will be more complex to deliver and will have more stringent data processing and management demands and security requirements. These should be seen as key requirements of an industrial scale system and not as barriers to deployment.

##### **Enabling Automatic Event Detection for the Pipe Workshop of the Shipyard 4.0 – Luis Castedo, UDC, SP**

This was a research project carried out with a shipping company Novantia, who are creating a new generation of warships. This is a long term project expected to come to fruition in 2020-25 and will require the introduction of new processes. The focus was on the location of pipes in the pipe networks of these vessels, which distribute essential services in these vessels. More efficient management of the installation of these pipes is required; this needed the introduction of additional traceability by using RFID tags to label the pipes and the development of a measurement system.

Readers were deployed at strategic locations and could cross reference pipe location to a strategic database. This is used to generate a map showing the location of pipes and provide a GUI interface to provide control over location.

##### **Commercial considerations – Oscar Pallarols, CELLNEX**

The prime concern of this paper was the evaluation of the commercial realities and a more complete understanding of value chains. The author argued that the value of data is high and processing includes: data collection, filtering, business logic and analytics for prediction of trends. Actions arising from processing may depend on the setting of particular thresholds. There is also the consideration over whether standard or bespoke sensors are required. In the development of sensors it is vital to consider the role of 5G. We are at an early learning stage. Bespoke sensors may be required for microbial detection. One specific application is the deployment of sensors in manhole covers, to detect the opening and closing of manholes. Early implementations reported a large number of false positives; that is situations where manholes were erroneously detected as being open.

## **New networks of communication for digital transformation**

### **Analysis of the Technologies enabling the broadcast convergence - Fernando Hernández, UC3M, SP**

In broadcast systems a number of factors need to be taken into account, such as: the need for continuous reconfiguration and integration, activity at the transport and application layers, analysis of the technical change and how that drives the sector and changes in the regulatory framework. In the market place the mantra is “keep up or be displaced” and the less successful organisations demonstrate a resistance to change. Broadcasters need to be aware of the wide range of access mechanisms and the changes in patterns of consumption. The competition comes from traditional suppliers, Over the Top providers and the Internet.

Standards are developing that allow traditional technologies to adapt to changes. Providers are moving to new capabilities such as 4K in the case of Google and VP9 in the case of YouTube. This gives the Telcos new horizons to fight for. Netflix are competitors to broadcasters and Telcos, with IPTV and OTT representing a turning point. The big need is to take a customer centric approach; the catch being that customer behaviour is unpredictable – keeping an eye on the technology is insufficient, a “soul watch” is also required.

### **Testbed Laboratory for the Physical Analysis of Gigabit Passive Optical Access Networks (GPONs) – Noemi Merayo, UVa, SP.**

The quality of such systems can be assessed in a number of ways such as: Quality of Service measurement and analysis of the physical layer. In a GPON system the physical layer is a tree starting with the OLT at the exchange and ONUs on customer premises. Traffic upstream is managed by TDMA. The test rig used needed to be able to emulate an access network that included a single route of 20km. The testbed is used for both teaching and research processes and features OTDR to analyse the transmission characteristics of the fibre. Digital oscilloscopes compare electrical and optical signals and the network control function is built from a network control function based on Openflow, with additional modules written in Python.

### **Single- and Multiple-RF Load Controlled Parasitic Antenna Arrays Operating at Cm-Wave Frequencies: Design and Applications for 5G Wireless Access / Backhaul– Constantinos Papadias, AIT, GR**

This session looked at low complexity antenna arrays and focussed on mobile small cells. It considered an antenna design that would maximise capacity and improve gain with a mix of active and passive antenna elements. The system developed improved the gain of the received signals.

### **How increased availability of GIS data and PC calculation power allows to save millions of Euro’s in an FTTx network rollout – Raf Meersman, COMSOF, BE**

Raf noted the growing prominence of Fibre to the Home and noted this could be very expensive to deploy with labour costs of up to €500 per line. He described a PC based system based around GIS that led to optimal design, particularly in the deployment of fibre and multiplexors.

## **ROUND TABLE: The profession of engineer ICT in Europe**

This session was chaired by Ed Smith from the UK and featured Andy Valdar (president of FITCE), Maurizio Mayer from Italy, Raf Meersman, from Belgium, Andrzej Dulka from Poland and María Nuño Valdes from Spain. After Ed had introduced the session, Andrzej who works for Bell Labs commented on the situation in Eastern Europe and in particular talked about the rapid changes in technology and how this impacted careers.

Maria then took us through a recent study conducted by the AEIT looking at the demographics of employment for ICT engineers in Spain and the opportunities available. The key findings were that 82% of the

telecommunications engineering workforce is male and 18% is female. 36% of the workforce is aged between 35 and 44, with 26% between 45 and 54 and 23% between 25 and 34. Madrid was the site of the largest number of respondents by a very large margin. There was a strong commitment both to academic and professional training across the sector. The level of unemployment in the sector is below the Spanish average. Women's salaries are significantly lower than their male equivalents on average. Most people appear to be content with their job and work life balance and the tendency to work long hours has reduced. 75% of telecommunications students are men.

Maurizio gave a general overview of the situation in Italy and drilled down into the ICT situation, examining the topics of Market certifications and engineering partnership across the Mediterranean region. Andy Valdar then examined the topics of recognition by society of the role of the engineer and the need for engineers to have a rounded education. His message was that in today's ICT environment it is the commercial, regulatory and service features and usability aspects that dominate, not the technical, giving rise to the need for a rounded education at degree level. Raf gave a view of how the rate of change in technology and commercial pressures affect job opportunities and recruitment, including what drives young engineers of today and working in the new digital era.

### **Technologies and systems for the digital transformation of the society**

#### **Building Information and Communication Technology (ICT) Value-Propositions for the Post-Information Age - Edward Smith, BT**

This session covered the proposal from economists that we are entering the Post Information Age, which is expected to succeed the current Information Age as the principal engine of economic activity. The presentation examined how this impacts Information and Communications Technology (ICT)'s approach to meeting the needs of the digital transformation in business and society. It considered the means of constructing a business case for new communications solutions, noting that the Post-Information Age will create new opportunities for Network Service Providers and examined key differences in the way offerings are constructed for the whole market sector, from consumer to major corporate / central Government solutions..

#### **Empowering the Digital Workplace– Berit Schubert, Unify, GE**

This session looked at new requirements for the workplace and considered that Digital Transformation is a megatrend. Not only is technology changing in the area of IT services, but new business models such as those used by Airbnb and Uber are emerging. This places the emphasis on new ways of working particularly the role of collaboration and flexible working. These changes are disruptive and reflect changing needs and the pressure for full customisation. This presents a paradigm shift in the way people work, which is accelerated by Digital Transformation. Millennials are demanding ubiquitous access to services, with mobility being a major feature. This enables virtual teams to succeed, humanising digital access while engaging in the on-demand economy. Key enablers are: the growth of collaboration platforms, UCaaS (Unified Communications as a Service), IP Platforms, SME participation, customer service developments, CPaaS (Communications Platform as a Service) and on premise solutions.

#### **An Agile Container-based Approach to TaaS – Joaquín Salvachúa, UPM, SP**

TaaS in this context is testing as a service. In moving forward with sophisticated propositions infrastructure and privacy are major concerns. A set of tools is needed that could be used to build an Internet of Things. This testing solution features a high degree of automation and is based on Open Source code to overcome distrust of black box solutions and reducing development costs. The solution includes the exploitation of RESTful APIs to provide the interface to the automation. The Generic Enablers for this solution have been funded by the EU. A range of solutions has been developed.

### **Service oriented cloud CPE as a means of a future terminal** – George Agapiou, OTE, GR

This looked at providing CPE functionality within a service orientated cloud, in a complex carrier network. This is enabled by the migration of functionality into software. Currently a great deal of complexity has to be accommodated in the home modem which can be reduced, by migrating, some functionality, such as parental control and deep packet inspection, into the core network. This supports centralised configuration. This allows a modem with multiple accesses such as terrestrial and mobile and satellite. Key benefits are improved code flow and a stabilised solution, together with reduced CPE prices as network functionality into the cloud increases.

### **Can learning methodologies contribute to develop digital competences in telecommunication engineer education?** – José Luis Martín, UPM, SP

A high percentage of professionals have not developed the competences need to face new emerging roles. The higher education curriculum has been reviewed. There has been resistance to learning new skills from some sectors, but a new framework has been developed in the form of the Digital Competence Framework for Citizens. There are some reservations about schools and higher education's ability to get the message across and there is a lack of training for professionals. It is important to promote digital learning, through perhaps promoting skills on line or a new M.Sc. in Telecommunications Engineering at Madrid University giving a strategic vision of technologies and systems integration. The design of the latter included: gamification and online quizzes, with gamification gaining the better satisfaction scores from students. Millennials seem to have a different mind-set from the rest of the population and getting them engaged needs a fresh approach.

## **SMART Technologies**

### **Theoretical approach for a multi-operator synergistic utility planning and its real-life implications** - Jonathan Spruytte, University of Ghent, BE

This presentation considered the situation with utility planning and the approach to virtual technologies. Currently there are 376 external works planned in the city, 80% of which could be expected to show some synergies with each other; however only 28% are currently executed in synergy. Such works can lead to damaging infrastructure and traffic jams. A strategy for enforcing synergy could be setting each utility a maximum budget; however the disparity in the size of the companies involved could limit the effectiveness of this. The work to evaluate the situation is based on examination of street plans and looking for street segment overlap between planned works. This is hard to quantify universally, but a points based system may help with evaluation. A model has been developed that evaluates synergy savings against yearly plans, the initial results show that overlap could be increased to 32%, with further improvements to 46% being feasible.

### **Smart Cities / Smart Regions** – Felix Herrera, COIT, SP

The key factors in defining a smart city are the economy, people, governance, mobility, life style and the environment. In Spain there is a national smart cities plan, however most cities are not smart. The likely changes are more technological than urban, because technological solutions tend to give a faster result. The progress of the national plan is assessed using three categories of city.

### **Network Virtualization: Transformation of the Data Center, Carrier Network and Branch Office Communications** – Ignacio Loizaga, Chief Marketing & Technology (TELDAT)

This section explored the roles of virtualisation and its impact. It described how the development of the VMWare environment created an environment where reconfiguration of the IT infrastructure was more rapid than that of the associated network. This led to the development of the virtual switch. This leads to the development of infrastructures that can compete with those offered by OTT providers such as Amazon and Google. AT&T

claims to have virtualised 35% of its network, with facilities such as ONAP and SDWAN. A key application would be the dynamic charging of bandwidth.

**The 5G Business Potential** – Ivan Rejón, Head of Strategy, Gov't & Industry Relations, Marketing & Communications (Ericsson)

When considering applications for 5G it is necessary to talk about more modern applications such as artificial intelligence and block chain. The market for ICT as a whole is growing at 13.3%, whilst communications are only growing at 1.3%. He includes 5G in the ICT basket. The USA and Asia are placing more emphasis on 5G than Europe is. Low latency is a compelling feature of 5G, thus gaining significant attention from the Automotive Alliance for driverless car applications and GSK for remote healthcare applications. The EU will create an action plan, known as 5G for Europe, by the end of 2017. This study has identified over 20 use cases.

**The role of IEEE as a professional organization** – Antonio Luque, President IEEE Spain Section

The IEEE is the largest technology based professional organisation in the world with 430,000 members. Its goals are to advance technology for the sake of humanity and to improve technical innovation. It comprises of 38 technical committees, covers 160 countries; publishes 170+ journals and sponsors 1500 conferences per year. In Europe there are 80,000 members, in the US 200,000 and in Asia-Pacific 80,000. The organisation was established in 1963 and was descended from the American Institute of Electrical Engineers (established 1884) and the institute of Radio Engineers established in 1912.

The 170's US economic situation forced the IEEE to look at priorities within the profession and took the view that it was there to benefit both its members and the public. The organisation in Europe has been set up using a collaboration approach. The IEEE European Public Policy Initiative (EPPI) is involved in influencing EU policy and has published a wide range of public and policy positioning statements.

### **Cybersecurity Round Table**

The messages around security are changing in line with the changes in people's public and private lives and this has both commercial and social implications. Each major security incident costs in the region of €1,6bn and in 2017 5m new threats were observed. Protecting critical infrastructures was a major concern. It is vital to secure national infrastructure and protect the administration, any failure to do so will rebound on the public. There are several different approaches, but it was vital to understand the environment, monitoring infrastructures and rapidly reacting to incidents in a timely manner. Whilst there has been an increase in the number of incidents, detection rates are improving and the number of false positives reported has grown smaller. Lessons have been learned from the ransomware attacks in May and new measures applied. Information sharing across organisations is a critical factor in combating cybercrime.

Not only does the industry have to become more agile, it needs to increase the numbers of researchers employed not only on platforms but also on common taxonomies. The consensus appears to be that there are too many threats and too few professionals. As a result security professionals are very expensive to employ. Information needs to be made as quickly as possible when an incident occurs. There is a new EU directive aimed at encouraging organisations to share information. Well-equipped Security Operations Centres are important but it needs to be appreciated that the citizen is the weakest link. Work is in hand to link skills with accreditations, but one problem is that increased emphasis on cybersecurity takes away credits from other areas or the curriculum.

### **Round Table: Engineers in the companies of the 21st century**

This session extolled the role of the engineer and delivered promises of providing contacts. It considered the development of engineers through the education system in Spain, suggesting that the role of the engineer should be explained to students very early in their educational careers. At the pre-university stage there were a number of disincentives for students to take up engineering, due to perceptions that the area of study was hard. This led to a diminished impact of effort culture. There are many opportunities in the field, but work life balance needs

some attention. By 2025 it is hoped to have a 50:50 gender split in the profession. There is a social challenge to get girls in the age group 12-18 interested in the profession.

### **Round Table: The present and future role of engineers' professional associations**

The digitisation agenda pushed by professional organisations in Spain needs to cover codes of conduct, lifelong learning and being professional in one's actions. The session explored the roles professional schools and professional organisations in Spain and concluded that they were different models for the same thing. Key issues like low introductory salaries, too many engineers leaving the profession and the challenges of specialisation were explored. There is a need for a single engineering voice to shape the profession.

### **Round Table: The training and qualifications of the ICT engineer in Spain**

The Bologna accord has made life more difficult (this was an agreement signed across the EU in 1999 to ensure comparability in the standards and quality of higher-education qualifications). This raises a number of questions covering academic standards, talent acquisition, new degrees and technical professions. In masters' programmes, the number of students entering is decreasing and the level of attainment of those applying is reducing. Many students are electing to study in other areas. There are a number of areas being looked at to improve the situation including better continuity with first degrees, but there is a problem at entry level. There are some tactical measures being put into place to improve things. ICT solutions have taken over and this is seen as a more attractive career than telecommunications engineering. The current generation sees technology as a commodity; leaving the question how do we make the profession more attractive?

So the priority is to capture talent and this goes beyond just good grades and knowledge, motivation and attitude are big factors also. Many employers are moved to import talent from overseas; however the educational system has got to prompt them to look at talent from the indigenous student body. There are a number of new degrees that have been introduced and there are now 112 different types of degree. The work environment is very different and new capabilities such as Smart Cities tend to favour IT degrees. We need to ask ourselves what is telecommunications engineering, the overlaps are hurting and there is significant leakage at the masters' level to other disciplines. Further the demographics of the profession are showing an aging profile, due to the fact that younger people are moving to other disciplines. Perhaps professional certification can play a role in attracting people to the profession.

### **Conclusions from the Congress**

The key conclusions of the congress were:

1. Satellite communications remain an important media and will supplement 5G
2. The low latency features of 5G will be needed to support advanced applications such as driverless cars. Europe's roll out of 5G is behind that of Asia and the USA. Network operators need support from regulators and mobile operators.
3. The Internet of Things is with us now and can build on the experience gained from other robotics and factory automation systems.
4. Sensor networks that form the basis of many IoT implementations are becoming better understood.
5. The demands of broadcasters, driven by changing consumer expectation, will have a significant impact on network providers.
6. ICT applications will have a major role in automating testing, supporting design decisions and scheduling implementation activity.
7. Security remains an important aspect of the industry, both as an independent service and as a key design consideration for infrastructures and products.
8. Antenna design continues to evolve and will be a key component in the roll out of 5G.
9. Virtualisation of infrastructures, both IT and communications remains important.
10. New business models are needed within the industry, as new OTT models appear to replicate and mutate.

11. Whilst the outlook for ICT engineers in Spain is good, there is a great deal of debate on the best way of training them and developing them as their career develops.
12. Professional organisations remain highly relevant and beneficial to the community in general and engineers in particular.