EURESCOM message

The magazine for telecom insiders

Celtic-Plus
Newsletter 1/2018

Smart Transport and Logistics

The Kennedy perspective
It's my data, I'll buy if I want to …

Events
IEEE 5G Summit Brasilia
EuCNC 2018 in Ljubljana

A bit beyond
Flying cars

Proposers Day in Madrid

26 September 2018

Discuss your project ideas with potential partners and find out about funding opportunities in your countries at our next Celtic-Plus Proposers Day in Madrid on 26 September 2018.

Celtic-Plus Proposers Days are discussion fora for organisations related to telecommunications that are interested to participate in a Celtic-Plus project and want to benefit from performing collaborative research through the EUREKA Cluster Celtic-Plus.

The follow up cluster CELTIC-NEXT received the EUREKA Label on the 20th of June 2018. It will start its operations in January 2019. The project ideas that will be presented in Madrid will therefore be the first CELTIC projects starting under CELTIC-NEXT.

You can also have a look at ideas from previous proposers days and get in touch with the proposers.

Further information and registration are available on the Celtic-Plus website at **www.celticplus.eu/event/proposers-day-in-madrid-26-september-2018/**

If you have any questions or need help, do not hesitate to contact the Celtic-Plus Office – we would be pleased to help you.

Contact
Celtic-Plus Office – office@celticplus.eu
Peter Herrmann – herrmann@celticplus.eu

This event is kindly hosted by CDTI.

Join the Industry-Driven Research Programme for a Smart Connected World

Celtic-Plus Call for Project Proposals – Deadline: 15th October 2018

Do not miss the opportunity to participate in Celtic-Plus, the industry-driven European ICT and telecommunications research programme under the umbrella of EUREKA. Submission deadline for the next call for project proposals is 15th October 2018.

Celtic-Plus projects are collaborative private-public partnership R&D projects. All EUREKA member countries and associated countries can financially support them. More information on public funding and national contacts per country can be found on the Celtic-Plus Public Authorities Website. Please talk to your national contact early in the process.

Easy proposal process

Preparing and submitting a Celtic-Plus project proposal is easy. Just register on the Celtic-Plus online proposal tool, fill in the Web forms, and upload your proposal in pdf. Access to the proposal tool and to a proposal template is available via our Call Information page (https://www.celticplus.eu/call-information).

Benefits of participating in Celtic-Plus

- You are free to define your project proposal according to your own research interests and priorities.
- Your proposals are not bound by any call texts, as long as it is within the ICT/telecommunications area.
- Celtic-Plus projects are close to the market and have a track record of exploiting their results soon after the end of the project.
- High-quality proposals have an excellent chance of receiving funding, with an average success rate of 60 %.
- The results of the evaluation will already be known in November 2018.

If you have any questions or need help, do not hesitate to contact us; we are pleased to help you.

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Dear readers,

Recent advances of information and communication technologies offer the promise of making all business sectors more effective in using resources for providing products and services. Transport and logistics is one of those sectors where these advances are most visible. Through smart solutions, the transport and logistics sector will also make an important contribution to reducing greenhouse gas emissions.

In this issue of Eurescom message, we will present some examples of solutions developed in European projects, which contribute to smart transport and logistics.

In the first article of the cover theme, Anastasius Gavras and Halid Hrasnica from Eurescom present an overview on smart transport and logistics in a networked world. The next article presents results from the EU-funded 5G-PICTURE project on 5G solutions for future railway systems. The second EU-funded project featured in the cover theme is DORA, which has developed a door-to-door journey planner which significantly shortens travel time for air passengers.

This edition of Eurescom message also includes a variety of further articles on different, ICT-related topics. See, for example, the new opinion article by Eurescom director David Kennedy on how our personal data are used by profilers and advertisers in his column "The Kennedy Perspective". See also our events section, which contains reports on the IEEE 5G Summit Brasilia, the SELFNET Industry Workshop in Heidelberg, and the EuCNC event in Ljubljana. Finally, in the latest "A bit beyond" article you can learn about how the old vision of flying cars is finally becoming a reality.

My editorial colleagues and I hope you will find value in this edition of Eurescom message, and we would appreciate your comments on the current issue as well as suggestions for future issues.

Milon Gupta
Editor-in-chief

Cover image: © fotolia.de

EVENTS CALENDAR

9 – 11 July 2018
IEEE 1st 5G World Forum
Santa Clara, California, USA
https://ieee-wf-5g.org/

15 November 2018
NetWorld2020 General Assembly 2018
Brussels, Belgium
https://www.networld2020.eu

15 – 16 November 2018
9th FOKUS FUSECO Forum
Berlin, Germany
https://www.fokus.fraunhofer.de/ngni/events/fuseco_forum_2018

21 – 23 November 2018
6th Global 5G Event
Rio de Janeiro
Information will be available via https://5g-ppp.eu

25 – 28 November 2018
6th Global Wireless Summit
Chiang Rai, Thailand
http://web2.mfu.ac.th/conferences/gws2018/

4 – 6 December 2018
ICT 2018: Imagine Digital – Connect Europe
Vienna, Austria
https://ec.europa.eu/digital-single-market/en/events/
ict-2018-imagine-digital-connect-europe

25 – 28 February 2019
Mobile World Congress 2019
Barcelona, Spain
https://www.mobileworldcongress.com/
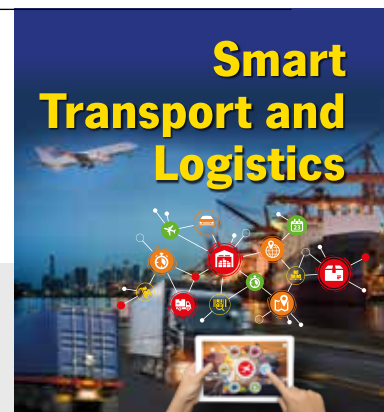
SNAPSHOT

Guess who's smarter

Kuri is a home assistant robot endowed with artificial intelligence (AI). The robot can play music, take photos and videos on the fly, answer questions and engage in conversation. Mapping sensors enable Kuri to find its way around dining room tables and living room chairs. Kuri also comes with face and voice recognition, which enable the robot to determine who it is talking to and adapt its responses accordingly. In addition, Kuri also responds to touch: "a gentle tap to the head will make Kuri look up and chirp affirmatively", as the product website says.

For further information see the Kuri website at https://www.heykuri.com

Contents

It's my data, I'll buy if I want to …

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The recent scandal about how Cambridge Analytica, a British profiling company, has been skimming off data from Facebook for creating precise user profiles, has caused us all to feel a little more vulnerable that we are being watched. What is shocking is that it is not our governments that are watching us so much as large industrial players – or even rich individuals who are financing the data collection to be used for their nefarious purposes.

The discovery from the latest US presidential election that an unnamed billionaire – and I don't mean "The Donald" – has been sponsoring the collection of personal profile data from fifty million Facebook users is frightening. He has been using this data to target the swing voters with fear-instilling messages based on their indi-

Image: © fotolia.de

vidual sensitivities, as identified in their profile, and thereby has directly influenced the outcome of the election. Democracy is being undermined and you probably haven't identified yet who the billionaire was that influenced the presidential elections.

We all know how we are being targeted by advertisers, at least we think we do. But then you discover that each time you open a web page there is an auction of the advertising space on that web page across a huge number of organisations who get sent information on you, from the Cookies in your Browser, to help them decide how much they will pay to hopefully catch your eye.

Not only are they targeting you based on your profile as they have captured it, but they are also trying to bypass your ad blocker software by sending a simple picture/text ad when it is not possible to get a JavaScript ad onto the page you are loading. And you still wonder why your requested web page takes a few seconds to load.

No free lunch

At a recent conference hosted by ETSI in the south of France, experts from all over the world discussed the collective responsibilities of industry, which has to be careful how individuals' data is gathered, stored, processed and monetised. This last point is important: companies are not collecting data for the fun of it, they are doing it because they can make business out of it. Perhaps they can identify ways to get you to spend money that you have not even considered. One of the most memorable phrases I heard at the conference was the clear statement that: "If you are not asked to pay for a service on the internet, then they are making money from your data". Let that phrase sink in a little.

How many times do we spend an evening reading, learning, entertaining ourselves, or communicating with friends via the internet without making any specific purchases? From my experience, lots of times. So how are we paying for this? We are paying by contributing to the big data experiment, where our info goes into the pot with billions of other and allows lots of data miners to find patterns of behaviours that they can use to predict business activities such as identifying what people of your profile will typically purchase and then trying to sell it to you.

What to do in the data world

The first thing to do in the words of Douglas Adams is "Don't Panic". The next thing to do is to educate yourself on the ways of the world today and to learn when you are being manipulated.

I challenged an American friend before their latest presidential election, when he shared a news item that was so obviously false and inflammatory that it was likely to stir up anger and resentment against certain groups. I was shocked when his answer was that he liked the guy who first published it and therefore was happy to trust the source and share it. Even if he was more than clever enough to see it had to be false.

We have to use our judgement more, but this can be manipulated too. The UK conservative Michael Gove came out with the brilliant propaganda statement during the Brexit referendum that the "people in this country have had enough of experts". He elaborated that the people should trust themselves rather than experts. This was a clear example of how the people were being manipulated to think that they knew better than the experts so that they can ignore the advice of anyone who is actually learned in the matter at hand and vote without any real knowledge of consequences.

The other big human weakness being exploited by populist politicians and marketing activists alike is our common tendency to prefer to listen to ideas that re-inforce our thinking rather than challenge us. Emotive language and buzz words also play a part in this. Who can now look at a picture of Hilary Clinton without thinking of "crooked Hilary", even though it is more likely that the inventor of that phrase is much more "crooked".

The need for regulation

Once the number of cars on the road exceeded a relatively small number, it was necessary to have rules of the road to ensure that as we each went our merry way we did not put ourselves or others at risk. This new interconnected world we live in now requires regulation in many different ways to protect us from harm. The new GDRP regulations in Europe are a first step where we should be asked to consent to each and every use of our data, but this is not enough. There are people using out data without our permission or, worse still, without our knowledge. This is being used to manipulate modern society in ways that Machiavelli understood surprisingly well, even if he did not have the internet back in the 1500's, when he said: "Men judge generally more by the eye than by the hand, for everyone can see and few can feel. Everyone sees what you appear to be, few really know what you are."

If we are going to live in this new data world, we better learn how to restore truth and honesty into a soundbite world where such virtues are being eroded dramatically from day to day.

Smart transport and logistics in a networked world

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Globalisation has led to a tremendous expansion of transport of goods and people across the planet. In particular the manufacturing industry with its planning, sourcing and marketing activities has resulted in complex trading patterns dependent on sophisticated networks.

Such networks clearly include transport networks for manufactured goods, materials and people but also telecommunications networks that transport information. The development of trade networks creates needs for logistics management and advanced supply chains. ICT has given the sector the means to span its network globally and improve its efficiency along several dimensions. The support of further efficiency gains in the sector is a clear requirement of the new 5G network infrastructure.

Current and future trends

The more recent development of smart cities is responsible for a large portion of the smart transportation market growth, which is expected to exceed 110 billion euro by 2024 according to a research study by Global Market Insights. Smart transportation is a central element and a platform for connected vehicles. However the increase of transportation has inherently a side effect by increasing CO_2 and greenhouse gas emissions in general. Governments globally are setting targets for the reduction of greenhouse gas emissions, which is impeding growth – unless other sectors foster their efforts to provide solutions that support growth in these sectors

and at the same time help in reducing environmental impact. Together with e-mobility and smart logistics solutions, transportation may still meet the expectations for growth.

Manufacturing has restructured its logistics system by way of relying on inventory centralisation and just-in-time delivery of the necessary production materials to the factories. The same trend is observed in transport of passengers and in both cases is achieved through fewer large hubs like the major airports, ports or railway stations connected via high bandwidth transport corridors.

Companies are re-inventing their supply chain and outsource all activities that do not represent a core competency relying on access to information about the activities and status of sub-contracted, non-core, ancillary activities.

Product flows are being re-designed and time-compressed with many factories being able to respond very fast to customer requirements for new or modified products, relying on integrated logistics that includes customers, suppliers and manufacturers alike.

Supply chain design may in the future have a large impact on transport and logistics by taking into account location of production sites, energy and emission costs related to logistics processes. This may lead to many supply networks to be established in the regional level and may reduce demand for this sector.

Similarities of the networks

The trends exhibit aspects of similarities of the transport and the telecommunications networks. Both networks rely on large "hubs" and high bandwidth connections, like multi-gigabit routers and backbone connection in the telecommunications network. Outsourcing of the non-core activities is a long-lasting trend in the telco world as well, and integrated logistics compares to the flexibility that the future 5G network is promising, for fast and flexible service delivery as well as easy integration of the vertical industries' applications.

Therefore it is not surprising that one of the early large-scale 5G infrastructure trials in this sector is taking place in the Port of Hamburg as part of the 5G PPP project MoNArch. Based on a similar rationale, the DORA project is providing door-to-door information for airports and airlines so that air passengers benefit from real-time information on how to be time-efficiently routed

along their itinerary, considering also the landside part of the travel to, from, and within airports.

Advancements of transport and logistics in the information society

Just-in-time and integrated logistics were introduced in the corporate culture of the transport and logistics sector some time ago. They became possible using innovative ICT at all levels, including product design, exchange of design and ideas, electronic contracts, and localisation of needed components and materials.

In the transport segment the introduction of advanced ICT led to the emergence of Intelligent Transport Systems (ITS), which improve the global transportation network in aspects like safety, efficiency and environmental footprint.

Further ICT-based applications have become inherent part of the transport and logistics sector, like the Global Positioning System (GPS), in-door localization services ensuring an easy movement of people through complex buildings (such as airports, train stations, and storehouses), Electronic Data Interchange (EDI), and Electronic Commerce.

The transformation of society with its rapid urbanization and improved lifestyle has also transformed the transportation infrastructure. The smart systems in vehicles are helping users to deal with impaired traffic condition due to overload or weather conditions and enhance user experience. Such systems are using the developments in the Internet of Things and are assisting the users taking decisions. For the future 5G network connecting smart transportation, the requirements are best described by the service classes of massive Machine Type Communication (mMTC) and Ultra Reliable Low Latency Communications (URLLC).

The role of 5G

Further improvements of the competitiveness of the sector can be supported by the future 5G network in view of the potential support of intermodal transport. New developments in transport and handling technologies will allow the optimisation of the transport patterns through identification and tracking of cargo.

One of the large expectations for the future is that most things will be connected through the Internet of Things with an enormous impact on

transport and logistics like on most industry sectors. We are currently witnessing that many large and small companies outside of the telecoms and information technology industry are becoming driving forces in the development of 5G, which is a healthy development, helping the 5G system to better meet the requirements of its users.

In the context of a single and innovative European transport system, connected driving and cooperative ITS (C-ITS), automation of transport and automated optimisation of traffic flows are facing severe questions about the right technological choices because of investment decisions that need to be taken now and that will have an impact for decades.

In order to mitigate investment risks, stakeholders in the sector have realised that there is a need to promote the strategic use of 5G. One of the best ways to do this is through consideration and involvement in the development of the 5G network infrastructure through requirements and system validation.

Long-term impacts

Like in other ICT dependent sectors in smart transportation and logistics several side effects may occur. The effects can be ordered in first, second and third order effects. The first order effects are directly related to the mere physical existence of the transportation vehicles and include production, use and end-of-life treatment. The second order effects are related to the application of transport and logistics and include effects leading to optimisation of processes in other sectors (e.g. manufacturing), substitution effects (e.g. low storage space due to just in time) and induction effects (when transportation creates more demand in other sectors). The third order effects are related to the societal changes that advanced transportation and logistics bring along. This includes the deep structural change towards urbanisation, the rebound effects, and the increased dependency on a critical infrastructure. The rebound is the stimulation of increased demand due to time-saving optimisation (e.g. increased leisure time traffic) which may compensate the optimisation gains towards reduced greenhouse gas emissions.

Conclusion

Advanced logistics systems can be realised through the strategic use of 5G, which may induce institutional re-engineering or a new organ-isational culture as well as investments in new information infrastructure.

Although 5G, as all ICT, is characterised by a high pace of technological change, flexibility in the sector will allow fast adaptation to new technologies and a fast reaction to induced changes based on the needs of the customers in each sector.

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[3] Towards a Single and Innovative European Transport System – SINTRAS, European Commission, April 2017, doi: 10.2832/297297
PWC, Transportation & Logistics 2030

Image: © fotolia.de

5G for railway innovation
The 5G-PICTURE approach for future railway systems

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Figure 1: Converged heterogeneous network and computing infrastructures supporting railway services

Railway communication infrastructure has historically evolved using a mixture of different network technologies. They brought inefficiencies in terms of investment, deployment, versatility, interoperability, capacity, and other performance parameters. A new integrated communications architecture that overcomes many of these issues is being developed in the framework of the 5G PPP 5G-PICTURE project. This novel architecture will be adopted to build a 5G railway demonstration in the operational rail network of Ferrocarrils de la Generalitat de Catalunya (FGC) in Barcelona, Spain, where the functionality, performance and quality of a set of communication-based services as well as their seamless provisioning will be tested, optimized and demonstrated.

To support sustainable development of railway communication infrastructures, novel data-driven Information and Communication (ICT) solutions are required. These solutions will enable monitoring, analysis and exploitation of energy and asset information for the entire railway system, e.g. power grid, stations, rolling stock and infrastructure. Additionally, they are expected to offer a variety of services with different requirements in terms of e.g. delay, reliability, and mobility, ranging from high-mobility cases – with ex-
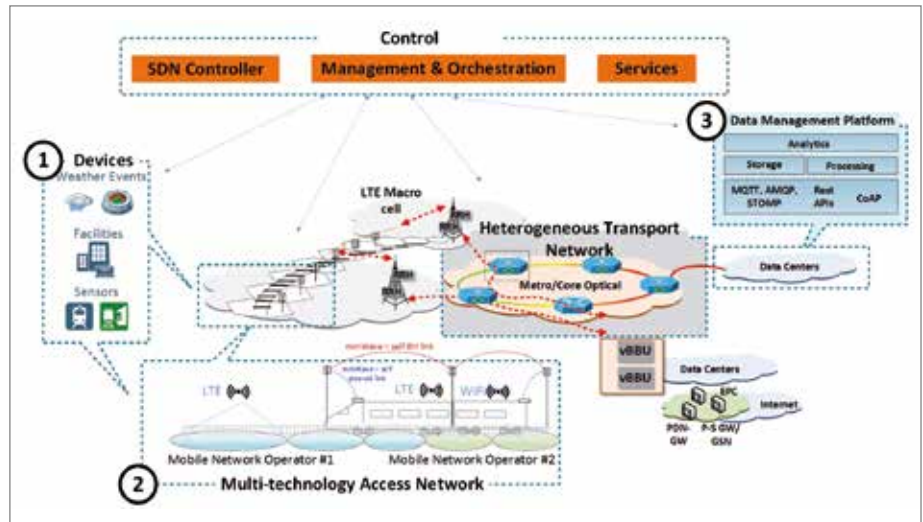
pected speeds higher than 500 km/h in transportation systems beyond 2020 – to low mobility cases such as connection of devices to (sub)-stations.

Addressing these challenges, 5G-PICTURE proposes an advanced communication platform enabling connectivity between a variety of end devices including monitoring devices and computational resources through a heterogeneous adaptable network infrastructure. Fixed infrastructure elements and mobile on-board systems will be interconnected with the operations and control center (OCC), where data centers are hosted, using an integrated transport network based on wired and wireless network technologies.

Some of the benefits this architecture will enable are the ability to build a new common infrastructure to support the whole set of communication-based services. A single common infrastructure can serve a large variety of individual requirements, eliminating the need of multiple independent networks in place today. This will result in significant Total Cost of Ownership (TCO) reduction. These network-based services can enable interoperability between different railway signalling systems (track and train systems), making them neutral from the various stakeholders viewpoints. This approach is in accordance with the European Commission directives, aiming to open the rail transport service market for competition.

The infrastructure will be managed by a flexible control plane, allowing the creation of infrastructure slices over the heterogeneous network. Railway system operators will therefore be able to

instantiate and operate several virtual infrastructures enabling multi-tenancy, jointly supporting a variety of operational and telecom services.

Scenario description and key technology components

A set of advanced optical and wireless network technologies will be leveraged to interconnect a variety of end-user devices and compute resources, and to transport the generated data to the OCC for processing.

The wireless domain of this infrastructure may comprise WiFi and cellular LTE technologies deployed for the on-board and on-board to trackside communications. Cellular solutions will be facilitated through the deployment of millimeter wave (mmWave) small cells used for both backhaul and access (Figure 1). Baseband signal processing in LTE systems is performed by base band units (BBUs), which are either co-located with the antenna radio heads (RHs) or located remotely exploiting the concept of Cloud-RAN (C-RAN).

RHs are connected to the BBUs through high bandwidth links known as fronthaul (FH). To enhance spectral efficiency, macro-cells can be complemented with small cells as they allow higher rates of frequency reuse over carefully defined geographical areas combined with fast and easy access to the network backbone. In addition to small cells, given that WiFi networks are readily available in almost every public or private area and are easy to install and manage, significant benefits are expected by the joint consideration of WiFi and LTE systems in license assisted access (LAA) schemes.
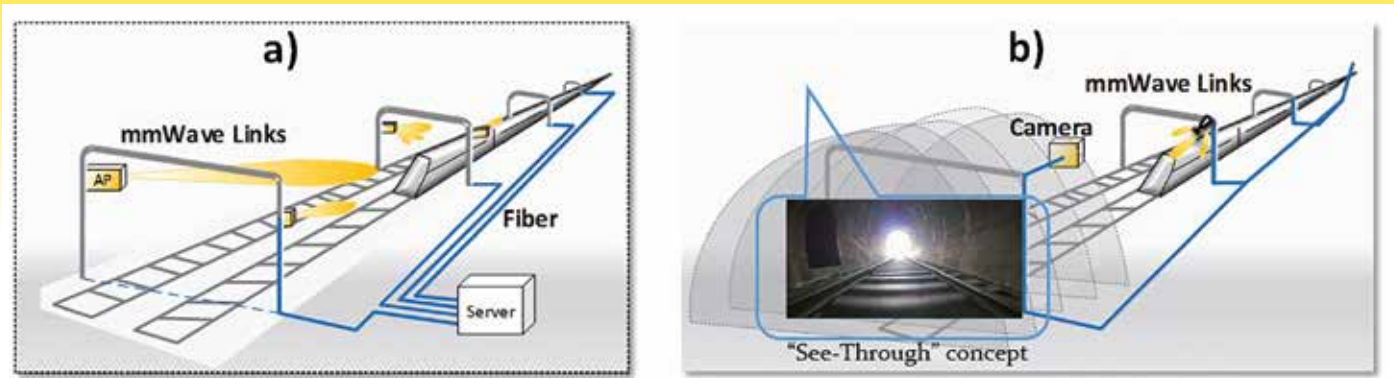
Figure 2: 5G-PICTURE Railway scenario considering mmWave links.

The optical domain comprises an optical transport solution offering high capacity and advanced features for FH and backhaul services, including dynamic bandwidth allocation both, in the time and frequency domain.

Given the technological heterogeneity of the proposed infrastructure, a critical function is interfacing between technology domains including isolation of flows, flexible scheduling schemes, Quality of Service (QoS) differentiation mechanisms and mapping of different QoS classes across different domains. This can be achieved by adopting flexible hardware functions which allow hardware repurposing through concepts such as hardware programmability. Hardware programmability can potentially enable dynamic and on demand sharing of resources, guaranteeing also the required levels of isolation and security.

Control and management

5G-PICTURE proposes the integration of both Software Defined Networking (SDN) and Network Function Virtualization (NFV) approaches. In SDN, the control plane is decoupled from the data plane and is managed by a logically centralized controller that has a holistic view of the network. Through joint SDN and NFV consideration, significant benefits can be achieved, associated with flexible, dynamic and efficient use of the infrastructure resources, simplifying the infrastructure and its management. This in turn, leads to improved scalability and sustainability and facilitates the provisioning of orchestrated end-to-end services.

Handling mobility

To handle mobility, redundant physical resources should be reserved to support uninterrupted service provisioning. The amount of redundant resources increases with the speed of user movement, i.e. with end-user mobility, the size of the wireless cells (mobile users associated with small cells will exhibit very frequent handovers) and the traffic model adopted.

5G-railway demonstration activities

5G-PICTURE will exploit a 5G-railway testbed deployed across lines of the Ferrocarrils de la Generalitat de Catalunya (FGC) network. The partners COMSA and FGC contribute to the implementation of the rail vertical demonstration and service operation. We address two different approaches:

Firstly, the capabilities of the new network will be facilitated through tight integration of millimeter wave (mmWave) links with FGC's optical fibre (as shown in Figure 2a). Self-backhauling mmWave links of 300 meters are expected to establish connections along the railway track. Moreover, mmWave access links will follow the train and the beams will be intelligently steered to the antennas at the train, providing the best connection. This demonstration will focus on infrastructure performance, e.g. throughput, delay, and functionality as e.g. behaviour on handovers, slicing (telecom operators / railway stakeholders), and network clock synchronization.

Secondly, 5G-PICTURE will enable new railway telecommunication-based services or enhancements to the existing ones. In Figure 2b we show, as an example, the see-through concept and the smart track, i.e. using sensors along the track. A variety of such services will be examined under diverse conditions over extended periods of time.

Conclusion

The 5G-PICTURE project offers a new communication architecture to drastically simplify the current network deployment, leading to significant cost reduction and facilitating new business models. The first 5G railway experimental testbed will be built in the context of 5G-PICTURE. Its architecture will support seamless service provisioning and mobility management in real railway environments. This testbed is supported by FGC railway undertaking who encompasses both the rail infrastructure administrator role and the rail operator role.

Further information on 5G-PICTURE at http://www.5g-picture-project.eu.

Shorter travel time for air passengers

Door-to-door journey planner by EU project DORA

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The main motivation for launching the DORA project has been to reduce overall travel time of air passengers. To this purpose DORA has designed and implemented a journey planner and a real-time routing service for travellers. As the possibilities to reduce the flight time of airplanes are limited and economically not feasible, the DORA project focused on optimising the land-side part of the travel and the flow of passengers through the airport buildings.

DORA is a three-year Research and Innovation Action funded by the European Commission under the Horizon 2020 programme. The project started in summer 2015 and has two main goals: (i) establish a seamless and integrated information system about the situation in the land transport and airport terminals and (ii) provide a single user-friendly point of visualisation of the overall trip information for the passengers in real-time. In addition, the DORA concept allows the integration of further services from other providers as well as integration of DORA services within other relevant service frameworks. Currently, the DORA designed concept, services, and applications are evaluated by real users, the air passengers, in the scope of the project pilot.

Roughly estimated, the required average flight time for typical air travels in central Europe is two hours. In addition, air passengers are usually required to be at the airport one hour before the flight. Thus, travellers usually aim to come to the airport 1.5 hours before their flight departures, to have some spare time in case of potential disruptions on the way to the airport or within the airport building. Typical travels to the airports from the origin of travel as well as from the destination airports to the final destination of a travel consume on average one hour each. Altogether, the current European travel time of air passengers is on average longer than five hours. DORA's project target is to reduce it to four hours.

DORA's mission

As mentioned above, the DORA project focused on optimising the land-side section of the travel, as a part of the entire travel time of air passengers going to or from airports, and passengers' flow within the airport buildings (Figure 1). Thus, the DORA mission is to reduce total travel time of air passengers by taking into account: (i) the exact origins and destinations of the travels, (ii) the land traffic situation and disruptions of travels to and from airports, and (iii) congestions at airports.

In order to achieve its mission, the DORA project has been working towards its two main goals:

- Establish a seamless and integrated information system – integrating real-time information on disruptions in the land transport and incidents in the airport terminals

- Provide a single and user-friendly point of visualization of the overall trip information for the passengers – providing time-optimised route recommendations for travels to and from airports and within the airports in real time.

Challenges

To achieve the DORA goals, it is necessary to consider all terminal proceedings (luggage drop-off/belt, security and departure gates, flights status, etc.) and information about all urban transport modes (private car, public transport, bike, walk, car rental & sharing, taxi, etc.). This represented the main challenge for the presented approach, together with the investigation and implementation of technologies for waiting-time detection and indoor localization and navigation in airports. All of this was required to enable real-time service for travel optimization targeting the air passengers.

The integration challenge is complex. The DORA partners had to deal with a variety of mobility information systems and applications. In order to provide an API (application programmable interface) for easy access to various services and information systems in a single system, DORA had to integrate all needed transport modes, mobility services and airport infrastructure data (Figure 2). The integrated information needs to be consolidated in an end-user application, to finally optimise convenience and travel time of air passengers.

In order to provide routing support for passengers within the airport buildings, it has been necessary to establish an in-door localisation and routing service within the buildings, which is still an open research item investigated worldwide. The DORA in-door localisation concept is based on sensing the beacon signals from WiFi access points available in the buildings, which allows to estimate passengers' positions in airports and enables in-door routing. In case coverage by available access points is not sufficient to achieve the required positioning accuracy, the concept includes provisioning of so-called beacon devices, which can be easily installed and powered in the airport buildings to improve coverage.

The same approach, based on access points and beacons, is used to provide a waiting time detection service. It provides estimates and predictions on waiting times at particular points of
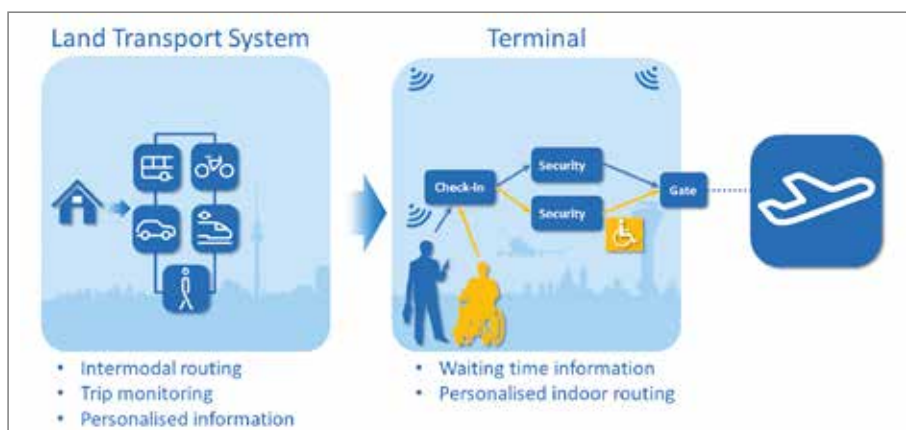

Figure 1: Scope of the DORA concept

Figure 2: The information integration challenge

interests in the airports like, e.g., check-in counters and security gates. The estimated waiting times are then processed by algorithms, which calculate the time passengers need for the airport processes.

The API designed by the project is used for integrating the different DORA services in a single system. It also enables an easy integration of DORA services with other frameworks, i.e. third-party services and applications. The DORA API is independent from type of platform, systems used, programming languages, and more, as it is offered under a public license. The same API is used for easy integration of third-party mobility services into the DORA framework.

The DORA smart phone application

As the final goal is to provide a real-time routing service for reducing travel time of air passengers, all the integrated information has to be presented to the travellers within appropriate end-user applications. Thus, the DORA project created a web-based graphical user interface with a typical website user view, mainly for journey planning purposes. For usage on the move, including real-time guidance and navigation out-door and indoor, DORA has developed a mobile smart phone application (Figure 3), which can be also used for journey planning. In combination with the smart

phone application, a corresponding smart watch application has been developed, to make using the app more convenient – travellers usually carry luggage and other material in both hands.

The DORA app allows passengers to choose between various mobility options, including the expression of particular needs. For example, people who have difficulties to walk can opt for paths with less steps and usage of elevators. During the journey planning phase, the app provides both flight and land-side travel options, which can be selected by the travellers as appropriate. Once the passenger has started his travel from his home or hotel, the app is gathering all necessary information about the travel to the airport and moving within the airport, including information about flight status and actual departure gate. Thus, in case any part of the travel is disrupted and the travel route needs to be changed, the passenger is prompted by the app with a recommendation for a new route.

Outlook

The entire DORA framework of integrated information systems and end-user applications has been designed, developed, and integrated in Berlin and Palma de Mallorca, including the airports in these cities. The DORA system is in operation in Palma and Berlin and is serving the project pilot involving real air passengers on this route, which will run until end of September 2018. From the DORA pilot, we expect to get valuable feedback on the usability and quality of the DORA approach and applications as well as on the impact of DORA in terms of time saving and other related issues.

✈ **For further information** visit the DORA website at www.dora-project.eu
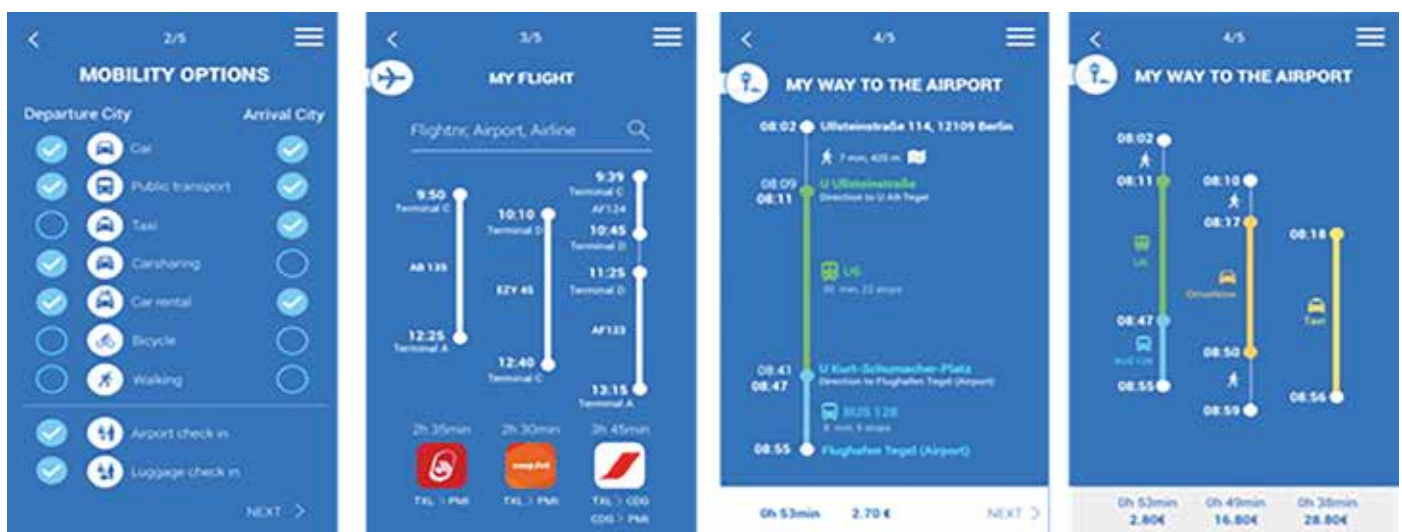

Figure 3: The DORA app

Celtic-Plus
Newsletter 1/2018

Editorial

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Dear reader,

The second edition of our newsletter section Chairman's Corner is dedicated to a very important question: What will come after Celtic-Plus, when it has finished in December 2018? Our Vice Chair, Valerie Blavette from Orange, gives the answer: CELTIC-NEXT! The new cluster's goal is to keep the momentum that Celtic-Plus has created. The CELTIC Core Group has prepared the CELTIC-NEXT application, which has been accepted by EUREKA in June 2018. CELTIC-NEXT will succeed Celtic-Plus for another 8 years.

Start-ups are the ultimate "raison d'être" for research activities, because they are closest to the generation of business. In this issue we give again the word to two of them: aXenic, a British startup, and medVC, a Polish startup. aXenic was generated from the Celtic-Plus flag-ship project SASER. The start-up provides devices for intra- and inter-satellite communications. The initial target of the SASER project for this type of technological development were devices for terrestrial applications. So it comes as an unexpected side effect that SASER spinoff aXenic commercialises devices for space applications. medVC is a Polish spin-off from the award-winning Celtic-Plus project HIPERMED. medVC commercialises a video assistance system for doctors and for hospitals. The medVC technology can be used, for example, during a surgery to give doctors a remote colleague's opinion in case of a difficult medical decision.

The Celtic-Plus project GOLD has won this year's Celtic-Plus Excellence Award for Network Technologies. In this issue you can read about the trilogy of Celtic-Plus projects, 4GBB, HFCC/G.fast, and GOLD. All three created the G.fast broadband family of standards. The G.fast standard was realised in less than five years, and today this Gigabit technology is being rolled out to the customers.

This year's Celtic-Plus Event took place in Helsinki. Like in the two past years, our event was collocated with the EUREKA Innovation Week, which was organized this time under the Finnish EUREKA Chairmanship. The event allowed us to show in the exhibition the results of 13 commercially relevant Celtic-Plus projects. Other highlights were the two keynote presentations in the fields of Artificial Intelligence and IoT/ Industry 4.0. In a round table, we witnessed business impacts of Celtic-Plus projects: representatives of the Celtic-Plus projects GOLD, NOTTS, ReICO-vAir, SENDATE and SIGMONA presented and discussed their achievements.

You will also find in this issue a Project Highlight from another excellent Celtic-Plus project: NOTTS – it has won the EUREKA Innovation Award in the category "Competitiveness and Growth".

In the Celtic-Plus Spring Call that closed on 23rd April, we received five Celtic-Plus project proposals – they all received the Celtic-Plus Label in a meeting with Public Authorities and the Celtic-Plus Core Group that took place in Helsinki on 23rd May. Technical evaluations of the Group of Experts as well as evaluations of the Celtic-Plus Core Group and the Public Authorities have been realized in just one month showing how efficient the Celtic evaluation process is. It is expected that most of these projects will start in the course of 2018 and early 2019.

As you can see in this issue of our newsletter, Celtic-Plus is an exciting programme with a highly innovative community, which is constantly pushing the borders of ICT technology. If you are not yet part of the Celtic-Plus community and would like to join, there are opportunities like the Proposers Days in Madrid (26th September) and Stockholm (end of November), where you can present your project ideas. The ongoing call for proposals opened on 2nd July and will end on 15th October 2018. Feel free to talk to me or any other colleagues at the Celtic-Plus Office – I am looking forward to hearing from you.

Peter Herrmann
Editor-in-chief

CELTIC-NEXT
The next big thing after Celtic-Plus

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The Celtic-Plus cluster has achieved a lot in the past 8 years, as regular readers of the Celtic-Plus Newsletter will know. Recently, we have been working on the extension of this success story for 8 more years under the name CELTIC-NEXT. The new cluster is built on the core principles which have guided the Celtic community for the last 15 years. These principles include a bottom-up industry-driven approach and the concept of large flagship projects aimed at solving issues of strategic importance. However, there will also be important changes in CELTIC-NEXT, which reflect the changes of technology, industry, and society.

Changes in CELTIC-NEXT

In order to symbolise the change, we have chosen a new logo for CELTIC-NEXT (see figure) as well as a new motto for the cluster: Next Generation Telecommunications for the Digital Society. This is meant to indicate a deeper transformation. Public Authorities and Core-Group members jointly worked on improving the Celtic processes, in order to make it even easier than before for CELTIC-NEXT project proposals to get started and produce successful outcomes.

In addition, the Core-Group members defined the scope and research areas of the cluster for the next 8 years. This was a real challenge, as technologies are evolving so fast. Experts from telecom operators, telecom and IT manufacturers, and security providers have put their heads together to design the framework for future ICT R&D projects at European level. As a result, they have created a vision of future communications where the ongoing digitalization will result in the smart automation of many aspects of our lives.

Technological vision

CELTIC-NEXT is based on a technological vision for the next 10+ years. We will move from an era defined by the connection of people and simple things via Mbps of capacity and about 100 ms latency to one defined by Gbps of capacity and about 1 ms of latency. This shift is driven by the current enabling technology trends, like cloud-based services with dynamic and adaptive scaling, extensive virtualization, novel software-defined automated solutions, and wireless connectivity with the 5G mobile networks.

Users will benefit from 360-degree video, virtual and augmented reality as well as autonomous system control with associated cognitive systems that augment human capabilities. All this will demand a fundamentally different, distributed network architecture comprised of cloud processing resources, interconnected by optimized IP and optical edge networks, using a converged ultra-high capacity broadband access layer. The edge cloud network will need to support data rates of 10 Gbps, latency as low as 1 ms, and a trillion connected devices with 10+ years of battery life. Network slicing is a key capability underlying the new business model opportunities by which dedicated virtual networks to various customer groups will be provided much more economically than in the traditional model where these customers would build their own dedicated private networks. All these new capabilities will enable the communications networks to become a tool for the digitalization of various industry areas.

Expanding the CELTIC community towards verticals

What makes CELTIC-NEXT the perfect framework for providing customised and smart solutions for the different economic sectors and the whole society is its end-to-end approach. It includes connectivity, security, and cross-sector technologies such as Artificial Intelligence and Big Data.

A special focus of CELTIC-NEXT will be on applications and services serving vertical sectors, such as healthcare, smart cities, energy, mobility, automotive, smart home, agriculture, manufacturing, education, e-commerce, and fintech. Those verticals are equally important to advance, along with optimising and improving efficiency and reliability with the best end-to-end connectivity and security.

The evolution of ICT services over the next period will be achieved via a partnership model where the vertical sectors collaborate with ICT companies in determining their ICT solutions. This will be a key focus of the CELTIC-NEXT end-to-end perspective. Representatives from vertical sectors will be progressively invited to participate in the CELTIC-NEXT Industry Core Group to ensure the continuous cross-fertilisation of ideas. Therefore we expect that many of the CELTIC-NEXT projects will define and develop self-adaptable solutions, able to fit the needs of many different sectors and societal challenges.

EUREKA label application

In mid-April 2018, the CELTIC-NEXT EUREKA label application form was sent to the EUREKA Secretariat. I would like to thank everyone who contributed for their support and the work they put into preparing the application.

The application form includes the signed support from 16 Core-group companies as well as from the following countries, in alphabetical order: Belgium, Finland, France, Germany, Israel, Luxembourg, Korea, Spain, Sweden, and Turkey. In addition, some other countries have formally declared that they are interested. Other countries are welcome to support CELTIC-NEXT at a later stage.

At the EUREKA HLG/NPC meeting in Helsinki on 19–20 June, the formal decision was made, and the EUREKA label was granted to CELTIC-NEXT by the EUREKA High Level Group.

Conclusion

One of the strengths of CELTIC-NEXT is the coordinated approach of Public Authorities and industry. As we proved in the past years, we can achieve great things together: innovative products and services, business impact, job creation, European leadership, and even world records in technological performance.

Celtic-Plus Event in Helsinki

This year's Celtic-Plus Event took place under the Finnish EUREKA chairmanship in Helsinki, Finland, on 24 May 2018. It was held in conjunction with the EUREKA Innovation Week, which attracted more than 900 participants from 32 countries. More than half of the participants were from industry, and more than 75% came from abroad.

Opening session

The Celtic-Plus Event was opened by the Chair of the Finnish EUREKA Chairmanship, Heikki Uusi Honko from Business Finland, and by the Celtic-Plus Vice-Chair Valerie Blavette who welcomed the participants. The event presented achievements of Celtic-Plus projects and provided insight to the most recent developments in communications and ICT technologies.

CELTIC-NEXT

Peter Herrmann, director of Celtic-Plus introduced CELTIC-NEXT the cluster that is proposed to follow the Celtic-Plus cluster that will terminate at the end of this year. CELTIC-NEXT will focus on "The next generation of telecommunication for the Digital Society" enriched with advanced communication capabilities in vertical sectors such as Automotive Telecom, Industry 4.0, IoT and others. CELTIC-NEXT will contribute to the digital society and will be the key to the development of the next generations of enabling telecommunications technologies and services. It will reflect the evolving needs of businesses in all sectors and citizens in Europe and beyond and generate a broad range of new applications and solutions.

Keynote 1: Artificial Intelligence, a disruption to digitalization of industries

In the first keynote Leo M. Kärkkäinen from Nokia presented his view on "Artificial Intelligence, a disruption to digitalization of industries". He asked the question on what are trends that will change the rules: Moore's law; price of DNA sequencing; Mobile Network with increased amount of base stations and Optical Networks with more wavelengths inside a fibre. He also compared the timescale for decisions of humans with the one of machine algorithms and he argued if and how we will lose the sovereignty on our decisions to machines.

Heikki Uusi Honko, Chair of the Finnish EUREKA Chairmanchip, opening the Celtic-Plus Event

Valerie Blavette, Celtic-Plus Vice Chair from Orange opening the Celtic-Plus Event

Panel on business impacts of Celtic-Plus projects

Mrs Juana Sanchez, Public Authority from CDTI in Spain, highlighted the business impact of Celtic-Plus projects in the business panel. She asked the five panellist about the main outcomes of their projects.

Mr. Les Humphrey from the UK operator BT presented break thoughs in Broadband Connectivity realized by the GOLD project. After the 4GBB and the HFCC-G.fast it is the third project developing this new G.fast technology. Les emphasised the short time to standardisation of this technology in only 5 years (compared to 12 years of the preceding ADSL technology). Today BT rolls out this technology to 10 million of their customers.

Mr. Antonio Cuadra Sanchez from the Spanish technology provider INDRA presented the Celtic project NOTTS that implemented Quality of Experience control in OTT networks. NOTTS is this year's EUREKA Award winner for Competitiveness (see next article).

Mr. Dieter Kreuer from Qosmotec, a German provider of test automation systems for wireless networks, presented the project on Reliable Industrial Communication Over the Air, ReICOvAir. This project works on secure wireless solutions allowing the use of wireless technologies in the manufacturing environment. Secure wireless solutions will open the way to fast set up of production cycles in the fully atomised factory. He

Peter Herrmann Celtic-Plus Office Director presenting the follow up Cluster CELTIC-NEXT

underlines that international Celtic-Plus projects allow to be more ambitious and achieve a higher impact in standardisation.

Mr. Tauno Vähä-Heikkilä, Vice President at VTT responsible for the Connectivity Business Area, presented the 73 million euro flagship project SENDATE. SENDATE is still a running project that is very active in generating intellectual property rights and transforms the generated knowledge into standards. Participating countries are Finland, France, Germany and Sweden.

The last project was presented by Mr. Jari Lehmusvuori from the network provider Nokia who presented the 5G breakthroughs of the SIGMONA. He said it was good that the project partners had the opportunity to introduce SDN technologies at an early stage in 4G and 5G networks.

Panel on business impact (from left): Jari Lehmuvuori (Nokia), Tauno Vähä-Heikkilä (VTT), Les Humphrey (BT), Dieter Kreuer (Qosmotec) and Juana Sanchez (Moderator from CDTI)

SIGMONA developed early Software-defined networking (SDN) concepts that are today widely used in LTE and 5G networks. This has allowed much more efficient network management and speeds up the deployment of new networks.

Keynote 2: IoT and Industry 4.0

In the second keynote, Mesut Sen, Product Operations Director at Turkish ICT solution vendor Netaş, talked about "IoT and Industry 4.0". He presented his views on disruption in the fourth digital revolution and how digital disruption waves are coming over us, one after the other. One of his suggestions is: "Be disruptive against yourself, before someone else does".

The second keynote was followed by the the 2018 Celtic-Plus Awards session, moderated by the Celtic-Plus Vice-Chairs Valerie Blavette from Orange and Riza Durucasugil from Netas.

- Further information on the Celtic-Plus Event 2018, including the presentation slides, is available at https://www.celticplus.eu/event/celtic-plus-event-in-Helsinki/

EUREKA Innovation Award Winner 2018
Celtic-Plus Project NOTTS – Smart content delivery for the digital age

The Celtic-Plus project NOTTS has won the this year's EUREKA Innovation Award in the category of "Competitiveness and Growth".

A scalable and robust video streaming solution has been developed to deliver adapted media content to smart devices, with the level of quality that customers increasingly expect and demand. The NOTTS solution makes it easier for content providers to deliver Over the Top (OTT) services directly to consumers. A total of 27 new improved products were created through the project and are now on the market, enabling media service providers to guarantee quality of service and thus attract more customers. NOTTS has also contributed significantly to trendsetting standards in this field.

- Further information on the EUREKA Innovation Award 2018 is available at http://www.eurekanetwork.org/content/eureka-innovation-award-winner-2018-smart-content-delivery-digital-age

Antonio Cuarda Sanchez receives the EUREKA Innovation Award for the Celtic-Plus project NOTTS

Gigabit broadband to the home
G.fast standards developed by 3 Celtic-Plus projects
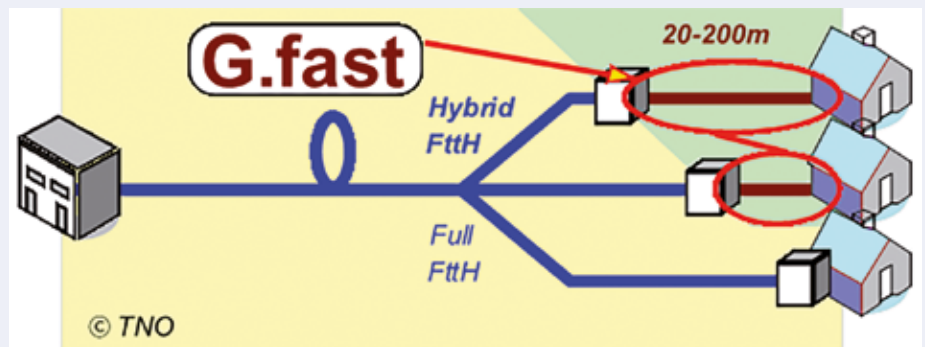
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Internet access and other broadband services have become a vitally important part of European life and business. The value creation and life-style options brought by having Internet access accelerates Europe forward and is fuelled by increasing bitrates and increased availability. This article tells the story of how the trilogy of Celtic-Plus projects, 4GBB, HFCC/G.fast, and GOLD, created the G.fast broadband family of standards.

About ten years before GOLD was completed, around 2008, there was a political push for bringing 100 megabits/second solutions to European homes. The envisaged solution was to bring optical fibre to every European home. However, there were no public funding schemes supporting this ambition, nor were there many customers willing to pay several thousand euros for a connection they would then have to pay again to subscribe to. Operators had not amassed sufficient funds to undertake such an epic investment and grand fibre-to-the-home projects were dropped globally as cost killed them.

However, a closer look at the costs revealed that a large portion was associated with the last meters of deployment and with entering the homes to install the terminals. These costs were partly related to obvious causes like that the last meters of digging were to individual homes and the cost could thus not be shared by many customer, or just that installing equipment and testing the installation is cumbersome and takes time.

But there were also a lot of unexpected costs and delays, like customers having strong opinions about where to dig the last meters, say to avoid rose bushes and the like, or where the connector should be placed and how the fibre should be drawn inside the home. It was even common that customers who had ordered fibre to the home rejected the installation when it dawned on them that drilling holes in their homes was needed to pull the fibre through.

Another frequent event was that the customer simply was not at home when the installation crew knocked on the door, or that no male field staff could enter a home for religious reasons, if no adult male living there was at home.

G.fast – combining fibre and copper

Given the pressure to deliver higher bit-rates and the insight that most of the cost of bringing fibre into the homes was associated with the last few meters, it was not far-fetched to look for a solution where new fibre was combined with reusing the last meters of the existing copper cables. The disadvantage this would bring was that active equipment would not only be in the central node and the home, but also in a place near the home. However, this is then compensated by the ease of installation where the customer is not bothered. The G.fast modem can be left in a bag hanging on the door handle and can be connected by the customer.

New knowledge

At the start of the project series, little was known about the high-frequency characteristics of telephony copper cables and there was a widespread belief that they could not be used for signalling at hundreds of MHz due to their poor quality. There was also concern that the noise at these frequency ranges would be prohibitively high. The first project in the series, 4GBB, removed these concerns and concluded that the telephony cabling was surprisingly noise-free and generally would be able to deliver fibre-like bitrates often exceeding a gigabit per second.

The following projects, HFCC/G.fast and GOLD, also had new concepts to deal with. It was quickly realized that generally no power would be available at the points near the homes where G.fast was to be installed and that it would be expensive to arrange power there. Thus, it was decided that G.fast should have the capability of reverse power feeding, i.e. that the customer modem sends power from the users' homes to the network-side modem, the distribution-point unit. A whole new ETSI standard was needed for this.

This also meant that G.fast could lose power by natural causes, i.e. if all customers of a node switched off their modems, also the network-side modem would lose power. Normally when a node loses power, alarms go off in the operator's management system and technicians are promptly dispatched to fix the problem. To avoid this, the concept of the persistent management agent was invented. The agent runs on a cloud server and speaks for the modems as if they were always on. The agent then talks to the modems when they are available, conveying the wishes of the management system. A number of similar new inventions were needed, as G.fast is architecturally quite different from earlier technology. G.fast is more of an extension of the home network to reach the fibre feed, than a traditional DSL system.

Outlook

The trilogy of projects ending with the GOLD project jointly produced and presented more than 600 standardization contributions and completed the first version of the G.fast standard about five years quicker than previous DSL-type standards, in spite of the large number of new concepts needed. Work is continuing in two directions: towards higher bandwidths and higher bitrates in the G.mgfast standardization and towards merging the access and in-home networks, including the WiFi-drops, into a single managed network solution. This work is supported by a new Celtic-Plus project named FU5ION.

HIPERMED-based start-up medVC
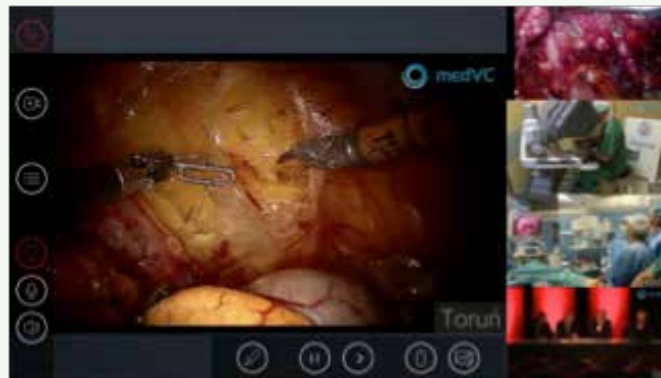## A remote collaboration tool for medical professionals

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It is not an easy task to turn R&D project results into market ready products, but we have succeeded. medVC.eu sp. z o.o. is an SME from Poznań, Poland that offers on the European markets a telemedical platform based on research conducted within the Celtic project HIPERMED.

"HIPERMED – High Performance Telemedicine Platform" was a very successful Celtic project that ended in December 2013. It was awarded the "Celtic Excellence Award" and the "EUREKA Innovation Award" in 2014 as well as the "Celtic-Plus Innovation Award" in 2016 due to its very promising outcomes. In 2014, I spent 3 months at Stanford University in the US, attending a course on Science Management and Commercialization, and there I was bitten by the entrepreneurial bug. Since then I have known that I want to bring the results of HIPERMED to the market.

Incubating

At this time, I had already been working for over 10 years as a researcher at the Poznań Supercomputing and Networking Center (PSNC). Together with the Directors of PSNC, we worked out a plan of creating a market-ready product based on the prototypes from HIPERMED. NETICTECH, an incubator working within the business support environment of PSNC, was chosen to help us bootstrap our start-up. What we needed was money for a year of product development. NETICTECH managed to acquire 250,000 euro from the FICHe project, which was part of the FIWARE Acceleration Programme. With this funding and the business development support from NETICTECH and FICHe, in one year's time we were able to develop the medVC telemedical platform and to create our own company.

What is medVC?

medVC is a remote collaboration tool for medical professionals allowing real-time audio-video communication and the usage of specialised medical services. It is based on hardware devices designed to be installed in operating rooms, conference rooms and doctors' offices and makes it possible to send multiple high-definition video streams coming from medical cameras, microscopes, endoscopes and other medical equipment. medVC terminals are controlled using a touch-screen that allows doctors to pause videos, draw on the picture, take snapshots, collaboratively work on DICOM images, record a session or even broadcast it live over the Internet. Furthermore, medVC can transmit stereoscopic (3D) video from surgical robots or 3D endoscopes. All these features make medVC a superb remote collaboration and education tool for medicine. The pictures above show medVC in action.

Conclusion

We have now been present on the market for two years already, and we are gaining more and more traction. medVC is already being used by hospitals in France, Italy, Germany, Luxembourg, Poland, Spain, and the Netherlands. We are regularly co-organising large telemedical events, like the European Laryngological Live Surgery Broadcast, with almost 10 000 viewers worldwide. We are improving medVC all the time, bringing new functionality and starting close cooperation with large partners from the medical industry. As the company grows, I can say with confidence that the results of the HIPERMED project are and will be enabling better healthcare services and enhancing medical education.

■ For more information please visit our website: https://medvc.eu/

Better optical data transmission in space
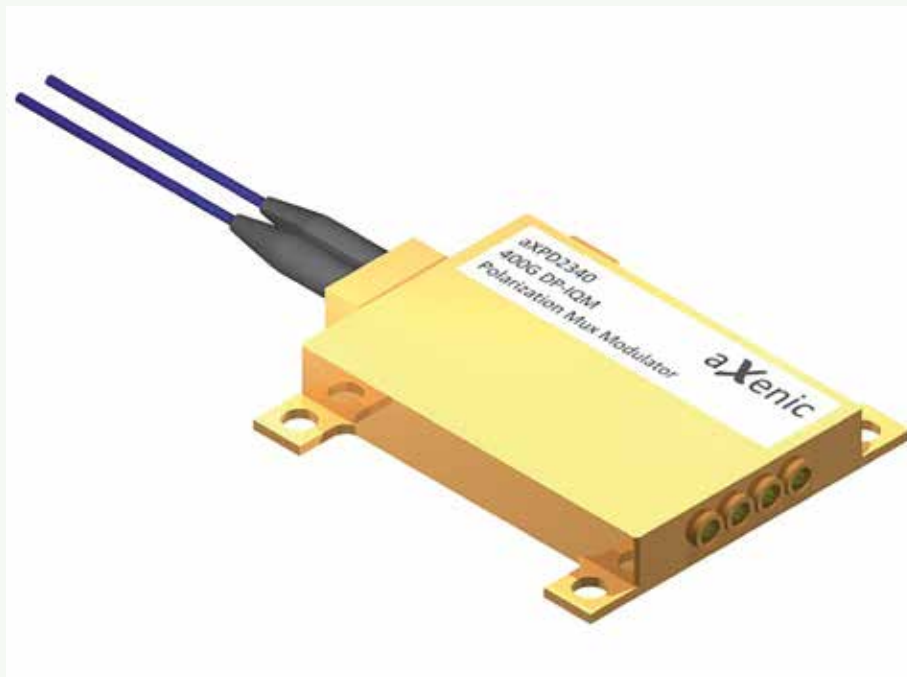## New 50 GHz modulators by SASER project spinoff aXenic

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aXenic, a start-up company spun off from Celtic-Plus flagship project SASER, has developed a novel solution for better optical data transmission in space. The aXenic solution based on SASER results consists of a folded package format and small gallium-arsenide semiconductor technology, which have been used to halve the size of optical modulators and increase the bandwidth to 50GHz and beyond.

Packaged Optical Modulator using Folded Optical paths developed in SASER

The devices developed in SASER were at first compatible with the format of competitor technology based on lithium niobate. The Celtic-Plus project went on to produce a folded format, which halved the size of the package and also halved the fibre handling space with weight and size advantages for many applications. The figure shows the package format for a four-channel RF input onto a folded optical path with fibre entry and output on the opposite side.

The work at aXenic since SASER has taken advantage of the reduced size to also improve the bandwidth of the devices to reach 50 GHz and beyond, which is a leading capability for high-performance modulators. At aXenic, a management buyout which followed the completion of SASER, this capability has been exploited in aerospace applications, including for inter-satellite and intra-satellite communications.

The capabilities developed under SASER, together with advances in performance since then, have attracted significant interest from the space community, who see data transmission as a major bottleneck in the development of services on and between satellite constellations. The format is readily extended to arrays of devices within a single package providing further cost, size and weight reductions that are a key demand for future commercial satellite systems.

Conclusion

Development of folded-format optical devices under Celtic-Plus project SASER has allowed a halving in size and weight, which is ideal for use in space applications. Together with advances which provide very high-frequency capability using this format, the optical modulators produced by aXenic are positioned to enable the use of photonics in place of electronics. This will revolutionise the management of data in space within and between satellites.

5G in Brazil and the world
IEEE 5G Summit Brasilia

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The IEEE 5G Summit Brasilia [1] took place on 22 May 2018 in Brazil's capital. It was part of Painel Telebrasil 2018 [2], a large regional conference, which focused on policy aspects of ICT. The 5G Summit was organised as one of 8 parallel sessions of the three-day Painel Telebrasil and attracted around 100 participants. The purpose was to report on and discuss the progress of 5G developments in Brazil and globally.

Anastasius Gavras from Eurescom presenting the SELFNET project

The host

The event was hosted by the Brazilian telecoms association Telebrasil. Recently Telebrasil joined the global efforts towards 5G development with its 'Projeto 5G Brasil' in an effort to jointly and globally address the enormous technological and societal challenges for defining and deploying the 5G network.

Telebrasil is a private association with 65 institutional members whose main objective is to represent the interests of the telecommunications sector in Brazil and to promote its development. The main goal of 'Projeto 5G Brasil' is to promote the development of a 5G ecosystem in Brazil through:

- enabling and establishing the communication between the ICT sector and all spheres of government and regulatory agency in Brazil
- looking for financial support for the promotion and use of 5G technology
- promoting national and international cooperation agreements for 5G technology development and adoption
- establishing and maintaining open interaction with vertical sectors
- sharing information regarding 5G technology among Telebrasil's full members and associate members in line with compliance and legal limits
- representing the common interest of the members, when requested, in national and international forums related to 5G.

The event was organised in 4 thematic sessions that were organised with presentations and subsequent panel discussions moderated by the general co-chair of the IEEE 5G Summit Brasilia, Prof. Flávio de Oliveira Silva from Universidade Federal de Uberlândia.

Brazil and the world

In this session the speakers provided an overview of the current 5G initiatives in the world and in Brazil. Rui Aguiar from Instituto de Telecomunicações Aveiro presented the European perspective and status of the 5G PPP. He reported among others on the roadmap for trials and experimentation in Europe and the relationships with global efforts. Other speakers from the R&D institute CPqD, TIM Brazil, and Ericsson Brazil gave an overview from the research and innovation perspective, the network operator perspective towards deployment as well as a vendor perspective on the future products and systems. This session provided an excellent overview of the different approaches to achieve the 5G vision with a view on specific challenges of Brazil.

Standardization and concrete experiences

In this session the speakers addressed the challenges in standardisation and spectrum allocation for 5G. Speakers in this session included representatives of Anatel, the Brazil regulator, Oi, the largest telecommunications company in Brazil and South America, as well as Huawei Brazil.

The session discussed the requirements for spectrum allocations in Brazil and how they relate to the global efforts for 5G-specific spectrum assignments as well as the progress being made in the international standards bodies and forums for the definition of 5G. The session summarised the actions necessary from the Brazilian side and how these could complement the global efforts in these areas.

The impact of 5G on society

In this session the speakers discussed the societal challenges in relation to 5G. The highlights of the session were reports and presentations from the European 5G-PPP perspective. The SELFNET project was presented by Anastasius Gavras from Eurescom and 5G-XHAUL was presented by Belkacem Mouhouche from Samsung UK.

At the panel discussion, many successful EU-Brazil collaboration projects were discussed. The conclusion was that the wide variety of requirements, which have been formulated in the scope of 5G, should yield solutions that can satisfy seemingly different requirements of societies in Europe and Brazil, as noted by Carlos Oliveira from the delegation of the European Union to Brazil. Some of the successful collaborations between the EU and Brazil include projects like FUTEBOL, 5G-RANGE, 5GINFIRE and others. José Gontijo, director at the Ministry of Science, Technology and Innovation of Brazil (MCTIC) elaborated on the unique societal, environmental

and geological topics to be addressed by the Brazilian government. Finally a representative of Nokia Brazil provided an overview on the activities of Nokia in this region.

Initial perspectives and use cases in Brazil

In this final session the speakers presented ongoing 5G activities in Brazil. Initial scenarios were sketched on how 5G could be deployed in Brazil and how the telecommunication service providers could incorporate and exploit 5G infrastructures. Rodrigo Cavalcanti Porto from Universidade Federal do Ceará presented the joint EU-Brazil project 5G-RANGE, which works towards enabling the 5G network to provide an economically effective solution for Internet access for remote areas. Prof. João Henrique de S. Pereira from Algar Telecom, a smaller operator in Brazil, presented exciting new challenges with respect to culture and innovation. Finally a representative of Inatel, a research organisation in Brazil, provided insights into technological developments that address specific Brazilian requirements.

Conclusion

The IEEE 5G Summit Brasilia is one of many 5G Summit events organised regularly worldwide. The objective of the Brasilia event was to facilitate the exchange of experiences, discuss approaches to technological challenges and standardisation as well as address the impact on society. From a European perspective the event was useful for establishing European leadership for 5G solutions and fertilise potential future collaborations between the EU and Brazil.

References:
[1] http://www.5gsummit.org/brasilia/
[2] http://paineltelebrasil.org.br/

5G-XHAUL presentation by Belkacem Mouhouche from Samsung UK

Panelists discussing the impact of 5G (from left): Diana Coll (Nokia), José Gontijo (MCTIC), Prof. Flávio de Oliveira Silva (moderator, Univ. Federal de Uberlândia), Belkacem Mouhouche (Samsung UK), Anastasius Gavras (Eurescom)

The way ahead to autonomous network management
SELFNET Industry Workshop in Heidelberg

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The Industry Workshop organised by 5G-PPP project SELFNET on 24 May 2018 attracted an audience of more than 30 experts from all over Europe to Heidelberg, Germany. The audience included representatives from telecoms network operators, vendors and solution providers. On the 11th floor of Print Media Academy, they discussed effective network management in 5G and particularly the way ahead to autonomous network management.

The SELFNET network management framework

The focus of the first workshop session was on the SELFNET network management framework, which has the potential to help network operators manage their 5G networks more effectively while reducing operational expenditure. Pedro Miguel Neves, Solutions Architect at Altice Labs in Portugal, explained in his presentation the functionality and benefits of the SELFNET framework and how SELFNET results contribute to autonomous networking in 5G.

As became clear from his presentation, the SELFNET framework provides major benefits for 5G networks. It helps operators build a resilient network infrastructure for 5G, which makes the most effective use of the network technologies they already have. More specifically, it enables service providers to significantly reduce the time for service creation, depending on the conditions down to about 10 minutes. In this way, the SELF-NET framework can help network operators significantly reduce the total cost of ownership for their network infrastructures.

The second speaker was Giacomo Bernini, R&D Technical Coordinator at Italian communications solutions provider Nextworks. He presented the commercial exploitation approaches of SELF-NET. He started by explaining the transformation

Pedro Miguel Neves from Altice Labs explaining the SELFNET network management framework

of telecoms networks driven by 5G, and the new business roles and relationships emerging from this transformation in the telecoms industry. Based on this he highlighted the commercial opportunities for exploiting the SELFNET results, which are driven by the SELFNET use cases on self-healing, self-optimisation and self-protection of networks. Concrete exploitation routes are already being explored for the optimisation and protection cases.

As an example of concrete use-case driven exploitation he mentioned the Immersive UWS project, which was launched by SELFNET consortium member University of the West of Scotland (UWS) in April 2017. The project combines virtual/augmented reality and 5G technologies to transform how students are taught and how staff conduct their research. Immersive UWS is leveraging SELFNET's 5G and video technologies as well as know-how primarily developed from the self-optimisation use case.

Demonstration of results

As the last speaker before the lunch break, Mathias Strufe from DFKI GmbH gave an overview on selected SELFNET results, which were presented at six demo tables in the exhibition room.
During the extended networking lunch and demo time, participants had ample opportunity to get first-hand insights on the following SELFNET use case results explained at the demo tables:

- AI in 5G – Zero Touch Network in the Self-Healing Context
- Trust Node – Hardware accelerated Self Optimization Use Case
- SELFNET GUI – Your Network status at a glance
- Self-Healing Use Case: Autonomous VNF fault mitigation
- SDN/ NFV Application Management
- Cybersecurity Techniques in the Self Protection Use Case

Strong interest in SELFNET use case results at the demo tables

Panel participants at the SELFNET Industry Workshop (from left): moderator David Kennedy (Eurescom), Maria Barros (Eurescom), Giacomo Bernini (Next-works), Raymond Forbes (Huawei), Sławomir Kukliński (Orange Poland), Eunice Ribeiro (Ubiwhere), and Kieran Sullivan (Waterford Institute of Technology)

Panel discussion

In the afternoon, a panel of experts moderated by David Kennedy, director of Eurescom, talked about the next steps towards autonomous network management in 5G. Sławomir Kukliński, Senior Researcher at Orange Poland, played the devil's advocate and challenged his fellow panellists and the audience by stating that despite all the great results from numerous R&D projects including SELFNET, no telco had yet implemented fully autonomous solutions in their networks yet. This triggered a lively discussion with his fellow panellists – Maria Barros, SELFNET co-coordinator from Eurescom, Giacomo Bernini from Nextworks, Raymond Forbes from Huawei, Eunice Ribeiro from Ubiwhere, and Kieran Sullivan, co-chair of the 5G PPP Network Management &

QoS Working Group from Waterford Institute of Technology.

The audience joined in and Gert Grammel from Juniper, one of the SELFNET advisory board members, argued that there is still a considerable risk involved with using artificial intelligence in networks and going towards fully autonomous network management. At the end of an insightful discussion, moderator David Kennedy concluded that many of the questions raised would require further and deeper exploration before autonomous network management could become a reality in 5G.

In the same spirit, Anastasius Gavras, SELFNET project co-coordinator from Eurescom, provided an outlook on future research topics in the area of autonomous network management before wishing participants a good autonomous flight back home.

⤤ **Further information** about the workshop, including presentation slides, is available on the SELFNET website at https://selfnet-5g.eu/industry-workshop/

5G and Beyond
EuCNC 2018 in Ljubljana

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The European Conference on Networks and Communications (EuCNC) is one of the most established public research events on ICT in Europe. This year's 27th edition of EuCNC took place in Ljubljana, the capital of Slovenia. The theme of EuCNC 2018 was "5G and Beyond". The four-day event on 18-21 June 2018 attracted around 500 participants from Europe and beyond, who witnessed a well-organised conference and exhibition.

The event started with a pre-conference day hosting eight workshops and three tutorials. From Tuesday onward, attendees saw four thought-provoking keynotes, three panel sessions addressing the current hot topics in 5G, and a broad choice of regular and special sessions organised in six parallel technical tracks. The conference part was complemented with an impressive exhibition, which included a number of compelling 5G demonstrations.

Keynotes

The first keynote speaker in the opening session was Michele Zarri, Technical Director at the GSM Association, who explained the role and objectives of GSMA in the 5G era. In the ensuing keynote, professor Thomas Kürner from the Technical University of Braunschweig, Germany gave a fascinating outlook on THz communications, which could become a feasible option for wireless communications beyond 5G.

The second day started with a keynote by Walter Weigel, Vice President at Huawei European Research Institute, Belgium. He shared some insights on vertical use case scenarios in the areas of automotive, healthcare, and industry 4.0, in-

The new 5G infrastructure projects attracted a lot of interest

Uwe Herzog from Eurescom presenting results of the SPEED-5G project at the conference

cluding real 5G tests and the design of the radio interface for these use cases.

In the final keynote, Biswanath Mukherjee, Distinguished Professor of Computer Science at the University of California presented his thesis that the network user is becoming more powerful, as he is armed with increasingly capable smart devices.

Insights from the parallel sessions

From the plethora of high-quality sessions and presentations, we would just like to share a few subjective insights.

Dirk Trossen, Senior Principal Scientist at InterDigital Europe, has challenged in a special session whether slicing of radio spectrum and/or the radio access network (RAN) is the most effective way of using spectrum resources. While slicing is currently held in great regard in Europe, it nevertheless is worthwhile discussing alternative views, in order to progress.

In the same session, Antje Williams, Executive Program Director at Deutsche Telekom has presented the first results of 5G trials done at the port of Hamburg in collaboration with the Hamburg Port Authority as part of the 5G-Monarch project.

In the final special session, professor Serge Fdida from Pierre and Marie Curie University outlined the vision of an "Invisible Network" in which the user no longer would have to actively deal with the details of the network. The same concept was independently presented by Anastasius Gavras in the Network Management and QoS Workshop. This vision is rooted in Mark Weiser's ubiquitous computing concept.

One of the most popular sessions in terms of participation was the session on the three new 5G infrastructure projects from 5G PPP phase three – 5G EVE, 5G-VINNI, and 5Genesis – who presented their plans.

Our own company, Eurescom, was strongly represented in the exhibition via different projects, namely To-Euro-5G (organising the 5G PPP stand), SLICENET, SELFNET and IORL, which are all coordinated by Eurescom, and with presentations in conference sessions.

Conclusion

EuCNC 2018 provided an excellent snapshot of where Europe is standing and where it is heading in regard to 5G. In addition, many exciting concepts beyond 5G, like terahertz communication and the Invisible Network, were discussed, which could soon become a major field for European ICT research.

Further information
EuCNC website – https://www.eucnc.eu

Productive discussions in the exhibition of EuCNC 2018

News in brief

New EU data protection rules

On 25 May, the General Data Protection Regulation (GDPR) became effective across the EU. Two years ago, on 6 April 2016, the EU had passed a major reform of its data protection framework by replacing the twenty years old Directive with the GDPR.

With the new rules Europe asserts its digital sovereignty and gets ready for the digital age, according to the European Commission. Andrus Ansip, Vice-President for the Digital Single Market, explained that two thirds of Europeans are concerned about the way their data was being handled. The new rules would ensure that citizens can trust in how their data is used. V ra Jourová, Commissioner for Justice, Consumers and Gender Equality, added that companies will also benefit from the new rules, because they will be the same everywhere and the companies will only have one authority to deal with. This would make it easier to expand a business activity to another Member State.

Comments by industry on the GDPR mentioned the additional effort for companies to implement the new rules. ETNO, the European Telecommunications Network Operators' Association, stated that GDPR is lots of work, but also a global standard. While ETNO regards GDPR positively, the association considers the proposed ePrivacy Regulation in its current shape as insufficiently aligned with GDPR and an obstacle for providing a fair playing field among different actors providing communications services.

The Commission will monitor how Member States apply the new rules and may take action, if necessary. In 2019, one year after GDPR has become effective, the Commission will organise an event to take stock of different stakeholders' experiences in implementing the regulation. This will also feed into a report the Commission is required to produce by May 2020 on the evaluation and review of the regulation.

Further information at:
EC press release: http://europa.eu/rapid/press-release_STATEMENT-18-3889_en.htm
ETNO press release: https://etno.eu/news/etno/2018/970

Nordic countries commit to closer 5G cooperation

Photo: Victor Svedberg, Swedish Government Offices, Creative Commons license CC BY-NC-SA 4.0

Nordic prime ministers with 5G declaration (from left): Erna Solberg (Norway), Juha Sipilä (Finland), Lars Løkke Rasmussen (Denmark), , Katrín Jakobsdóttir (Iceland), and Stefan Löfven (Sweden)

The prime ministers of Sweden, Norway, Denmark, Finland and Iceland have signed a declaration of intent, which commits the five countries to creating the public sector conditions needed for 5G and digitalization to flourish in the region.

The declaration was signed at the annual meeting of the Nordic leaders in Örnsköldsvik, Sweden, on 23 May. It states that the Nordic region will be the first interconnected 5G region in the world and identifies areas in which Nordic cooperation needs to be intensified. The declaration was welcomed by regional industry CEOs.

Further information at:
https://www.government.se/press-releases/2018/05/new-nordic-cooperation-on-5g/

Commission proposes 9.2 billion euro investment in digital programme

Focus areas under the Digital Europe programme (source: European Commission)

On 6 June, the European Commission proposed to create a programme for investing 9.2 billion euro in key digital challenges over the next long-term EU budget period 2021-2027.

The goal of the Digital Europe programme is to increase the EU's competitiveness by investing into digital capacities in the areas of high-performance computing, artificial intelligence, cybersecurity and advanced digital skills.

The five proposed areas include:

Supercomputers: 2.7 billion euro are planned for funding projects to build up and strengthen supercomputing and data processing in Europe, which is considered crucial for the development of many areas, from healthcare and renewable energy to car safety and cybersecurity. The funding aims to ensure a more effective and wider use of supercomputing in both the public and private sectors, including small and medium-sized enterprises. Digital Europe will aim to deploy a world-class supercomputer and data infrastructure with exascale capabilities (a billion billion or 1018 calculations per second) by 2022/2023, and post exascale facilities by 2026/2027, endowing the EU with its own independent and competitive technology supply, achieving excellence in applications and widening supercomputing availability and use. The planned initiatives will build on the European strategy on supercomputers that will help the EU advance in many areas from health care and renewable energy to car safety and cybersecurity.

Artificial intelligence (AI): 2.5 billion euro is planned to help spread AI across the European economy and society. This budget builds on the European approach on AI presented on 25 April 2018: the aim is to boost investments to make the most out AI, while taking into account the

socio-economic changes brought about by AI and to ensure an appropriate ethical and legal framework. The Digital Europe programme will give public authorities and businesses, especially small businesses, better access to AI testing and experimentation facilities in Member States, while increased investments in research and innovation under Horizon Europe will ensure that the EU stays at the forefront of scientific and technological developments in AI. The Commission proposes to develop common 'European libraries' of algorithms that would be accessible to all, to help the public and private sectors to identify and acquire whichever solution would work best for their needs. Open platforms and access to industrial data spaces for artificial intelligence will be made available across the EU in Digital Innovation Hubs, providing testing facilities and knowledge to small businesses and local innovators.

Cybersecurity and trust: 2 billion euro will be invested into safeguarding the EU's digital economy, society and democracies through boosting cyber defence and the EU's cybersecurity industry, financing state-of-the-art cybersecurity equipment and infrastructure as well as supporting the development of the necessary skills and knowledge. The proposal builds on the wide range of cybersecurity measures presented in September 2017, and on the first EU-wide legislation on cybersecurity that came into force in May 2018.

Digital skills: 700 million euro are planned to ensure that the current and future workforce will have the opportunity to easily acquire advanced digital skills through long- and short-term training courses and on-the-job traineeships, regardless of their Member State of residence. In the Digital Europe programme, the Digital Innovation Hubs

will carry out targeted programmes to help small and medium-sized enterprises and public administrations to equip their personnel with the needed advanced skills to be able access the new opportunities offered by supercomputing, artificial intelligence and cybersecurity.

Ensuring a wide use of digital technologies across the economy and society: 1.3 billion euro will be invested in the digital transformation of public administration and public services and their EU-wide interoperability. It is planned to facilitate access to technology and know-how for all businesses, notably SMEs. Digital Innovation Hubs will be 'one-stop shops' for small and medium-sized enterprises and public administrations, providing access to technological expertise and experimentation facilities, as well as advice to better assess the business case of digital transformation projects. A network of Digital Innovation Hubs will be supported, ensuring the widest geographical coverage across Europe. Digital Innovation Hubs are today one of the key elements of the Digitising European Industry strategy.

The Commission aims for an agreement on the next long-term budget in 2019 and a seamless transition between the current long-term budget (2014-2020) and the new one. To what extent the Commission plans will become reality will depend on negotiations with the Member States and the European Parliament in the coming months.

⟡ **Further information** at:
http://europa.eu/rapid/press-release_IP-18-4043_en.htm

Flying cars
The revival of an old vision

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"Where's my flying car?" This question has been the running gag for the last few decades, whenever the supposed failure of modern technology to match yesterday's futuristic visions comes up. Maybe technology critics should start thinking about new jokes, as flying cars may finally hit the market – more than a century after the first prototype.

The third Waterman Arrowbile in 1937

Henry Ford's vision

None other than Henry Ford, the pioneer of mass-produced cars, predicted in 1940: "Mark my word: a combination airplane and motorcar is coming. You may smile, but it will come." Already in 1926, Ford had launched an experimental single-seat aeroplane called "sky flivver". However, the early prototypes of flying cars, also called roadable aircraft, were built by others. In 1917 Glenn Curtiss tried to build the first roadable aircraft. His Curtiss Autoplane was capable of lifting off the ground, but never achieved full flight. Curtiss's former associate Waldo Waterman was more successful 20 years later – his Arrowbile took to the air on 21 March 1937 as the first roadable fixed-wing aircraft to actually fly.

Flying cars in popular culture

There was no shortage of further attempts to build a roadable aircraft. But until recently none of them made it beyond the prototype stage. Despite, or because of the failure to turn the vision of flying cars into reality, they featured prominently in popular culture ever since 1965, when movie villain Fantômas escaped the police in his Citroën DS with retractable wings which converted the limousine into an airplane.

In the movie Blade Runner (1982), the protagonists are driving and flying through a futuristic world set in the Los Angeles of 2019. Their means of transport is a fictional flying car called 'Spinners', which cruises much like a vertical take-off and landing (VTOL) aircraft. In The Fifth Element, a movie produced in 1997, which is set in 2263 New York City, flying cars are used as the main means of transportation. In the 2000s the attitude towards flying cars in fiction seemed to have changed from futuristic admiration to parodist ridicule, like the Onion News Network's episode titled "Mean Automakers Dash Nation's Hope for Flying Cars" (2008). It featured The Onion's anchor Brandon Armstrong humorously arguing about the feasibility and existence of flying cars with fictional representatives from General Motors, Toyota and Ford.

Flying cars to buy

A few years ago, when the general public had lost interest and hope for flying cars to ever become available, a new wave of pioneers ventured a fresh attempt to bring flying cars to the market.

Slovak company AeroMobil s.r.o. has created a prototype roadable aircraft, which was first flown in 2013. AeroMobil presented a production version of the vehicle, AeroMobil 4.0, in 2017. Delivery is announced to begin in 2020.

Before you pre-order the car via their website [3], you should know that it is a tad more expensive than your average car. AeroMobil says it will cost between €1.2 million and €1.5 million. As co-founder and CEO Juraj Vaculík explained, the vehicle is intended for "wealthy supercar buyers and flight enthusiasts".

If you prefer your flying car a bit cheaper, you could have a look at the PAL-V Liberty Sport Edition or the PAL-V Liberty Pioneer Edition, which were announced in 2017. Dutch company PAL-V International B.V. offer its roadable aircraft for a base price of €0.3 million, €0.5 million for the Sport Edition, and €0.5 million for the Pioneer Edition. The production model was first publicly shown at the Geneva Motor Show in March 2018, and CEO Robert Dingemanse stated that he expected all certification requirements to be completed in 2019.

The future of flying cars

Before you dream about escaping traffic jams by just taking off, you should know that this is not exactly what the currently offered models are about. What you can do with these vehicles, provided you have a pilot license besides your driver license, is to drive to the airport, enter the runway, take off, and after landing continue your journey on the road. Although PAL-V claims that all required regulation for this scenario is in place, it appears there are still a few practical hurdles to be overcome before you can do this.

In the industry, the term 'flying car' is not used at all. Most experts use the acronym eVTOL, which stand for 'electric vertical take-off and landing'. More importantly, transport providers like Uber and Zee.Aero, a company funded by Google co-founder Larry Page, do not seem to be much interested in eVTOLs but rather in VTOL (Vertical Take-Off Landing) aircrafts, which allow the aircraft to take off vertically without needing a runway, but are not meant to be driven. The current trend seems to be rather going towards autonomous VTOL aircrafts like the car-size Lilium Jet [5] than eVTOLs.

Once autonomous VTOL aircrafts and autonomous cars will have entered the market, it is only a small step to autonomous flying cars. When it will happen is hard to predict and could become a new theme for bickering technology critics. Thus, the classic question should be amended: "Where's my autonomous flying car?"

AeroMobil 4.0 at the IAA in Frankfurt 2017 (photo: Alexander Migl, license: CC BY-SA 4.0 [2])

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[2] https://creativecommons.org/licenses/by-sa/4.0/
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