

Winter 2019

# EURESCOM message

The magazine for telecom insiders

**CELTIC News 2/2019**

The background image shows a multi-lane highway with several vehicles, including a white van, a white truck, and a dark SUV. Blue and green wireless signal waves emanate from the vehicles, illustrating 5G connectivity. The text '5G for Connected and Automated Mobility' is overlaid on the image.

# 5G for Connected and Automated Mobility

The Kennedy perspective

**Digital anxiety – The new  
malady of the digital age**

Events

**IEEE 5G World Forum  
in Dresden**

A bit beyond

**Face protection – How to  
escape facial recognition**



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

CELTIC-NEXT Call for Project Proposals – Deadline: 30<sup>th</sup> March 2020

**Do not miss the opportunity to participate in CELTIC-NEXT, the industry-driven European ICT and telecommunications research programme under the umbrella of EUREKA. Submission deadline for the next call for project proposals is 30<sup>th</sup> March 2020.**

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- Your proposals are not bound by any call texts, as long as it is within the ICT/telecommunications area – see CELTIC-NEXT Scope and Research Areas.
- CELTIC-NEXT 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 higher than 50 %.
- The results of the evaluation will already be known in May 2020.

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,

Mobility is at the centre of many public discussions and technological developments. The rapid growth of transport and traffic, especially in urban areas, has come at the price of pollution, congestion, and accidents. Connected and Automated Mobility (CAM) offers now the opportunity to tackle many of these problems, especially as many enabling technologies have now reached a high level of maturity. Think of robotics, the Internet of Things, artificial intelligence, high-performance computers and, of course, 5G.

The European Union is committed to using the opportunities that CAM offers, as stated on the EC's Digital Single Market website: "The development and large-scale deployment of Connected and Automated Mobility (CAM) provides a unique opportunity to make our mobility system safer, cleaner, more efficient and more user-friendly." (<https://ec.europa.eu/digital-single-market/en/connected-and-automated-mobility-europe>)

In order to make the vision of better mobility a reality, the European Commission and industry have committed to large investments in R&D for CAM solutions.

In this issue of Eurescom message, we provide an overview on the current status of 5G-based CAM development in Europe and present selected CAM-related R&D activities under the EU's Horizon 2020 programme.

In the first article of the cover theme, Eurescom message editor Uwe Herzog presents an overview on 5G for Connected and Automated Mobility.

The next article presents cross-border 5G trials for cooperative, connected and automated mobility by 5G PPP project 5GCroCo. The following article by the 5G-MOBIX project also covers cross-border mobility solutions and in addition urban connected and automated mobility.

In an exclusive interview for Eurescom message, Dr. Maxime Flament, CTO of the 5G Automotive Association (5GAA), explains the current status and future plans for connected and automated mobility using 5G in Europe and worldwide. The next article by 5G PPP project 5G-CARMEN presents the project's CAM approach for Mobility Corridors. Finally, the authors from the

5GinFIRE project explain their city-scale 5G automotive testbed for open experimentation.

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 digital anxiety in his column "The Kennedy Perspective". See also our "Events" section, which this time is focused on the IEEE 5G World Forum in Dresden and the 2nd workshop on 5G-Trials, which was part of the IEEE 5G World Forum. Finally, in the latest "A bit beyond" article you can learn about escaping the growing surveillance based on facial recognition.

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



## EVENTS CALENDAR

**9 – 13 December 2019**

**IEEE GLOBECOM**

Waikoloa, USA

<http://globecom2019.ieee-globecom.org>

**17 December 2019**

**5G-DRIVE workshop on V2X**

Tampere, Finland

<https://5g-drive.eu/events/5g-drive-v2x-workshop/>

**10 – 13 January 2020**

**CCNC 2020 – IEEE Consumer Communications & Networking Conference**

Las Vegas, USA

<https://ccnc2020.ieee-ccnc.org>

**24 – 27 February 2020**

**MWC Barcelona 2020**

Barcelona, Spain

<https://www.mwcbarcelona.com>

**24 – 26 March 2020**

**6G Wireless Summit 2020**

Levi, Finland

<https://www.6gsummit.com>

**18 – 20 May 2020**

**NEM Summit 2020**

Dublin, Ireland

<https://nem-initiative.org>

**7 – 11 June 2020**

**IEEE International Conference on Communications (ICC)**

Dublin, Ireland

<https://icc2020.ieee-icc.org>

**15 – 18 June 2020**

**EuCNC 2020**

Dubrovnik, Croatia

<https://www.eucnc.eu>

## SN@PSHOT

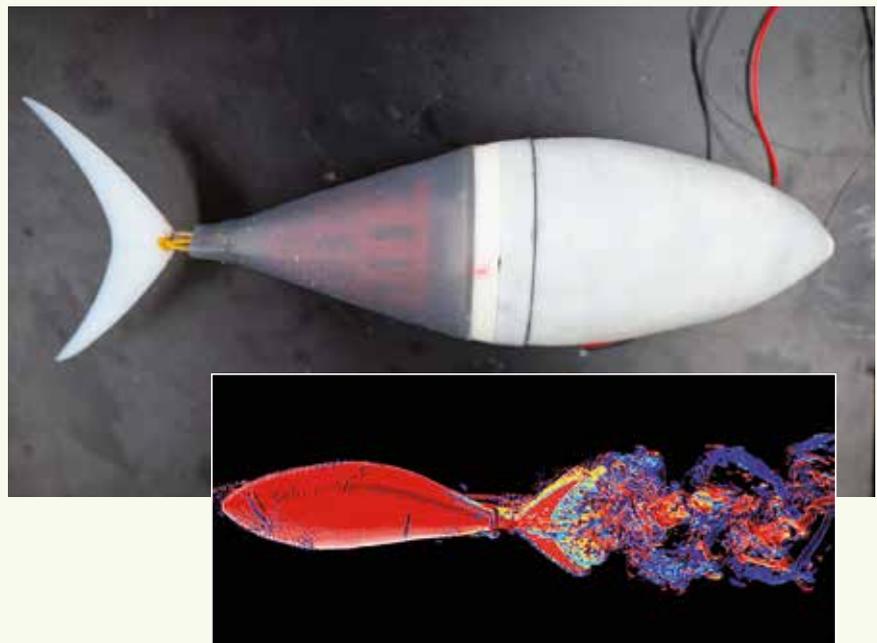


### Tunabot

Mechanical engineers at the University of Virginia's School of Engineering have developed a robotic fish, which mimics the speed and movements of a real yellowfin tuna.

The aim of the robotic tuna project was to better understand the physics of fish propulsion. The research could eventually inform development of the next generation of underwater vehicles, driven by fish-like systems instead of propellers.

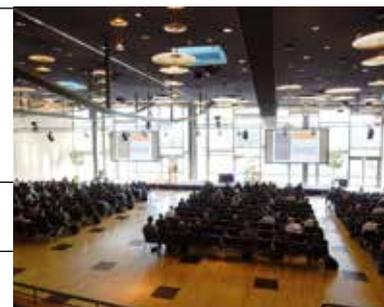
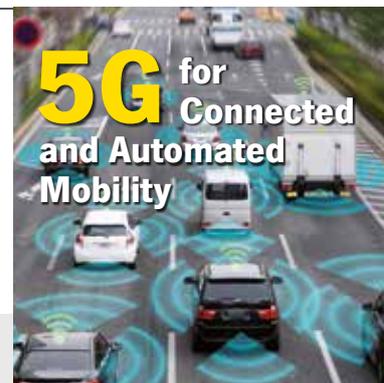
For further information see the University of Virginia website at <https://news.virginia.edu/content/uva-engineering-led-team-unveils-robotic-fish-tunabot>



© Photo by UVA Engineering, Image by UVA Engineering

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# Digital anxiety

## The new malady of the digital age



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**While we know it is unproductive to spend long periods on-line, we can now observe the new stress, digital anxiety, which can appear when we're disconnected. Digital anxiety is usually arising out of our own inability to manage our connected lives. Actually digital anxiety can have many forms, and the different forms can also combine in many ways to have quite a negative impact on our lives. I do not want to give the impression that everything about the digital era is negative but, as with most things in life, overdoing it can be harmful to us.**

### What is digital anxiety?

There are some obvious digital crisis situations that most people can identify with: who has not felt the moment of panic, when you cannot locate your phone while you are travelling? Suddenly your plane ticket, your hotel booking and even your ability to contact anyone are at risk. This stress can also happen on a smaller scale, when your phone tells you that you have only 5% battery left, and you have no means to charge it.

Probably the biggest impact the connected world has on us is the way we have become interrupt-driven. We react to messages, emails and calls, as if they are the most important thing in our lives at that moment. If we are honest, 99% of them do not need an immediate answer, but we feel compelled to react immediately – even in the evening when we should be sleeping.

This is part of what is called the “fear of missing out” – we stay connected, because we don't want to be the one who does not know what is happening in our social group. The good aspects of connectivity, like being able to contact the family anytime, should not be overlooked, but we have achieved a good balance.

A particular evil in the digital era is the ability of social media to prey on our insecurities by making us always aware of social comparisons. We post pictures of our holidays, and even our breakfasts, not really knowing if we are doing it to



share our experience with our friends, or just to make them jealous. And we are definitely at risk of spending too much time recording our experiences, at the expense of enjoying them in the moment.

The ultimate level of this is where some deem themselves to be “social influencers” on the basis that so many people are looking at their posts that other people should pay them to promote goods or services just because they are popular. We should avoid adopting these populists as role models as they add no value – better form your own opinions. It depresses me that the current generation of populist politicians have learned to trigger such emotional responses via social media without providing any substance or value. This is something we must learn to overcome.

The other aspect of the connected digital era that needs management is the work-life balance. It is easy today to keep answering emails in the evening and not give yourself the few hours to relax from the stresses of work. Some people maintain that it is easier to answer the mails in the evening without interruption, but that brings us back to the starting point that we are allowing ourselves to be interrupt-driven.

### Anxiety in other aspects of life

Anxiety in itself is a natural response where the body, when faced with a threat, releases a rush of adrenaline into your system, which uses these anxious reactions to launch the “fight-or-flight” response. This is hard-wired in us from prehis-

toric times, when we needed to react to the risk of attack by wild animals. It was not just a healthy response, it was necessary to stay alive.

Today these responses can become a problem when we feel under continuous range anxiety to complete work tasks for a specific deadline, solve family or money problems, or any issue that causes tension and demands your attention to the point where the adrenalin kicks in but you don't actually need to fight or flee.

### Managing our digital lives

As we strive for greater connectivity capacity and “always-on” services, we need to ensure that the good aspects are enhanced and the less helpful ones are controlled. We need to set our devices so that, for example, social media posts and messages do not give us a notification for every message. Then we can choose the time and energy to invest in seeing our messages when it suits us. Time management is critical in all things, just as you set time to exercise, have dinner, etc., you can set a time for reading emails and switch them off for a few hours when you have something important to do.

Having said that, my technical support people have just told me that they need to disconnect me from the mail server for about 6 hours to update the mail server – I am already beginning to feel insecure about such a long disconnection, and it has not even happened yet. Maybe I need to investigate my own relationship with the digital connected world.

# Overview on 5G for Connected and Automated Mobility



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**Connected and Automated Mobility services are one of the potential application areas of 5G that are currently being widely discussed. These services have a huge potential to make automotive mobility safer, more relaxing, and more economic.**

## Motivation

Among the multitude of potential vertical sectors in which 5G applications are currently considered, mobility-related applications are ranking close to the top. This is indicated by the number of trials which are currently ongoing in the various vertical sectors. According to the 5G Observatory Quarterly Report of September 2019, the vertical sector with the second-most number of trials in the EU is transport (28 trials), followed by automotive (20 trials) – only the media and entertainment sector has more trials. Thus, it is not surprising that Connected and Automated Mobility (CAM) is considered to be a flagship use case for 5G deployment along European transport paths within the European 5G vertical strategy.

## Applications

A major application rapidly advancing in automotive is autonomous driving. This has been enabled so far at its various automation levels through vehicle-internal technology. Complementing it with 5G technology could accelerate the path towards fully autonomous driving. However, CAM is much more than autonomous driving. The 5G Automotive Vision White Paper, prepared by representatives from the automotive and the telecoms industry in the 5G PPP, lists further services, such as road safety and traffic efficiency services, including intersection collision risk warning, green light optimal speed advisory (GLOSA) and road hazard warnings. In addition, 5G can also foster the digitalization of transport and logistics and more intelligent navigation services. All such services and more are covered by the above-mentioned European 5G

vertical strategy, which aims at creating complete ecosystems around vehicles, beyond the safety services targeted by the Cooperative-Intelligent Transport System (C-ITS) roadmap of Europe.

## Cross-border corridors

For Connected and Automated Mobility services it is important that they seamlessly work across borders. In order to prepare for the deployment of 5G cross-border corridors for CAM, the EU Member States had signed a Letter of Intent in 2017 to intensify cross-border cooperation for testing and pre-deployment. In 5G PPP, three projects have been launched for testing of 5G CAM technology in cross border corridors – 5GCroCo, 5G CARMEN, and 5G-MOBIX, and another 3 to 4 EU projects will be launched via a Horizon 2020 Call in the 5G PPP, which closed in November 2019.

## Technology

When it comes to the technology required for deploying CAM services, 5G still seems to be lagging a bit behind. The most recent completed 3GPP specification – Rel. 15 – does not yet specify the Vehicle-to-Anything (V2X) communication using 5G new radio (NR); this is only planned for Rel. 16. Therefore current trials rely mainly on LTE-V2X equipment. Of course, a subset of CAM services can also be deployed using the eMBB specifications in 3GPP Rel. 15, and also equipment following the alternative ETSI ITS G5 standard could be used. However, for 5G communication from vehicle to other vehicles or to road-side units, a couple of years' patience will probably be required.

## Deployment

From the deployment perspective, we cannot expect that 5G Vehicle to Infrastructure / Vehicle to Network (V2I/V2N) will be deployed across the whole road network within a short period of time period. As we see current trials with a focus on motorways, it is expected that these and other busy roads – urban but also rural – will be the first roads where CAM services will be deployed. However, car manufacturers cannot wait until a large coverage of V2X along roads is achieved; neither can they easily deal with service interruption during a trip; especially if CAM is used for safety applications. We therefore might see the



emergence of CAM services at hot-spot areas, or those relying on communication with gNodeB 5G Base Stations instead of Roadside Units.

## Business viability

It still seems to be unclear, what a viable V2X ecosystem could look like. Which stakeholders will play a role? What will be their relationships? Who of them will contribute to the required investments into the network infrastructure and to what extent? The latter is an important aspect given that CAM services require a network with high reliability, high bitrate and very low latency.

The question then is what a viable business and revenue sharing model could look like. The 5G-PPP Automotive Working Group has tried to address this in its 5G Automotive White Paper published in February 2019. According to the paper, the deployment of a “5G digitized highway” is a main enabler, and it should be deployed only by private sector investments. In their cost and profit analysis the 5G-PPP Automotive Working Group concluded that, at least during the initial phase of service take-up and assuming a multi-network operator deployment, an active network sharing would be the most preferential option to keep costs at a reasonable level. The study expects a positive business case for roads with a high density of vehicles, which means that public investments are likely to be required, if CAM services shall also be available on less busy roads.

## ✦ Further information

5G PPP Automotive Working Group: Business Feasibility Study for 5G V2X Deployment, February 2019 – [https://bscw.5g-ppp.eu/pub/bscw.cgi/d293672/5G%20PPP%20Automotive%20WG\\_White%20Paper\\_Feb2019.pdf](https://bscw.5g-ppp.eu/pub/bscw.cgi/d293672/5G%20PPP%20Automotive%20WG_White%20Paper_Feb2019.pdf)

# Cross-border 5G trials for cooperative, connected and automated mobility

## 5G PPP project 5GCroCo



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**The vision of cooperative, connected, and automated mobility (CCAM) in Europe can only be realized, when harmonized solutions that support cross-border traffic exist. The possibility of providing CCAM services across different countries for vehicles driving across various national borders has a huge innovative business potential. However, the seamless provisioning of connectivity and the uninterrupted delivery of real-time services across borders also pose technical challenges, which 5G technologies promise to solve. The situation is particularly challenging given that multiple road authorities, telecoms network operators, telecoms vendors, car manufacturers, and network generation scenarios are involved in any cross-border layout.**

Motivated by this, the 5GCroCo project aims at validating 5G technologies in the Metz-Merzig-Luxembourg cross-border corridor, crossing the borders between France, Germany and Luxembourg. The 5GCroCo validation will focus on three use cases: 1. Tele-operated Driving (ToD), 2. High Definition (HD) map generation and distribution for automated vehicles (HD mapping), and 3. An-

tipicated Cooperative Collision Avoidance (ACCA). The results will help reduce the uncertainties associated with enhanced vehicle-to-everything (eV2X) communications across borders in Europe in preparation of commercial 5G deployment.

### 5G technologies in 5GCroCo

5GCroCo has identified a set of key 5G technologies which will become enablers for CCAM (see Figure 1). They have all been thoroughly evaluated in previous and ongoing research and innovation projects. Some of them are even commercially deployed already. The motivation of 5GCroCo is to evolve them to also fulfil their purpose and role in overall Quality of Service (QoS) fulfilment in cross-border, cross-MNO (Mobile Network Operator), cross-telco-vendor, and cross-automotive-OEM (Original Equipment Manufacturer) deployments. Service continuity is a particular goal in this context. The key technologies that have been identified are:

- Mobile Edge Computing/Cloud (MEC)
- Predictive QoS
- End to End (E2E) QoS with Network Slicing
- Precise positioning, and
- Cybersecurity

The V2X services that will be studied in the 5GCroCo trials for the selected use cases have unique characteristics which make the use of these technologies particularly interesting.

The first one is a limited area of interest. Information is often only needed close to the source where it was generated. This is true for many, but not all applications. It particularly applies to the use cases of HD mapping and ACCA. MEC-enabled cellular networks, but also direct communication omitting the cellular network, must therefore be part of the Vehicle-to-everything (V2X) architecture.

The second unique property is the multi-OEM-, multi-MNO- and multi-vendor challenge. For a typical mobile radio network, where main services run for voice and data communication, it does not matter that peering points between MNOs, vehicular clouds, and public data networks are located far from the “edge”. In a MEC-enabled V2X architecture, this problem must be solved, and the solution cannot be to have just one MEC provider. E2E QoS guarantees must be provided where needed, regardless of which MNO is serving the vehicle and also when roaming.

The third unique property is the role of the road authority as another source and sink of information. This comes along with often closed, sometimes even proprietary, information technology (IT) systems needing integration in an MEC-enabled V2X network architecture. A particular challenge arising from this is that crossing national, in some cases also regional borders results in a new road authority with its own IT infrastructure taking over responsibility.

With these technologies, 5GCroCo will address the gap of existing cellular V2X technologies, like, e.g., LTE Release 14, by enhancing a number of key performance indicators (KPIs) in the 5G network, such as latency, reliability, packet error rate, etc., even under the conditions of cross-border, cross-MNO, cross-telco-vendor, and cross-automotive-OEM operations.

### Trial and test sites

5GCroCo will conduct large-scale trials in the European 5G Corridor passing by different cities of France, Germany, and Luxembourg. It is the so-called Metz-Merzig-Luxembourg Corridor and is part of the pan-European network of 5G corridors facilitated through several regional agreements. These agreements allow Europe to use hundreds of kilometers of motorways where tests can be conducted up to the stage where a car can drive autonomously with a driver present and always ready to regain control (third level of automation). These corridors are part of the European Commission’s 5G Action Plan, which aims at ensuring commercial deployment of 5G technologies by the end of this decade.

In addition to the large-scale trials in the corridor, 5GCroCo also plans to deploy local test pilots as a testing and integration step before large-scale deployment in the corridor. As shown in the figure, these tests will be deployed in Monthéry-UTAC test-track (South of Paris, France), two in Germany (in the 5G-ConnectedMobility test-site, a section of Motorway A9 south of Nuremberg and a test-site in the Munich city center), one in the city of Barcelona (Spain) where a cross-border city setting will be emulated, and also in the AstaZero test-track (East of Gothenburg, Sweden). These tests will allow testing 5G functionalities locally (geographically close to the different involved partners), and possibly in restricted closed areas so that the complexity of doing the trials in the large-scale corridor can be managed.

5GCroCo solutions, trials and use cases

These tests will allow selecting and fine-tuning the 5G capabilities that will then be integrated in the large-scale trials, thus reducing the uncertainties associated to their deployment and trial.

**Key performance indicators**

The approach in 5GCroCo will be to continuously monitor and evaluate the performance of the proposed 5G innovations in the trials based on the measurement of KPIs. First, KPIs related to telco operations will be considered. These include throughput, latency, packet error rate, reliability, session continuity or duration of potential interruption in case of cross-border-handover, maximum speed supported by user equipment, etc. In addition, there will also be KPIs associated to the specific use cases, from an application-oriented perspective, such as braking time, anticipation time, service interruption time, etc.

**Business studies and spectrum**

In addition to the 5G trials for CCAM, the study and definition of new business models and cost-benefit analysis is a fundamental part of 5GCroCo to understand the business possibilities that emerge from CCAM services which can operate across borders. The possibility of having advanced 5G functions operating in a cross-border, cross-MNO, cross-telco-vendor, and cross-automotive-OEM fashion generates a new arena for

innovation. 5GCroCo will analyse the cost/benefit relationship of deploying 5G in such a complex scenario and develop tools which can allow for the definition of valid business models. This process will be done in parallel with the deployment of the trials, learning from the experience acquired, understanding the needs of all stakeholders, and reducing the uncertainties of deploying a 5G infrastructure to offer unprecedented 5G-enabled services for CCAM.

Finally, 5GCroCo also aims at evaluating the needs from the perspective of the usage of spectrum. A cross-border setting requires coordination among countries and operators to ensure that proper and efficient use and allocation of spectrum is conducted. 5GCroCo will also explore this area and plans to provide recommendations to relevant organizations.

**About the project**

5GCroCo is a 17-million-euro Innovation Action, partially funded by the European Commission under the Horizon 2020 programme, where key European partners from both telco and automotive industries have joined efforts to test and validate 5G technologies at a large scale in a cross-border setting. The mission is to reduce uncertainties, before CCAM services running on top of 5G communication infrastructures are offered on the market. 5GCroCo also aims at identifying business opportunities and defining new

business models for disruptive CCAM services which can be possible thanks to 5G technology, as well as ensuring the appropriate impact into relevant standardization bodies both from the telco and automotive sectors. 5GCroCo is an important element of the 5G Infrastructure Association (IA) Trial Roadmap Strategy v2.02, being directly aligned with the 5G Action Plan for Europe and planning to contribute to and synchronize with the overall 5G Public Private Partnership (5G-PPP) ecosystem.

**Further information**

- 5GCroCo project website - <http://www.5gcroco.eu>
- 5GCroCo Twitter account - @5GCroCo

# 5G for cross-border and urban connected and automated mobility

## The 5G-MOBIX project



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5G is seen as a very important game changer for all sectors of industry. It is also addressing future societal needs, in particular in the context of mobility. 5G is expected to significantly progress the performance of autonomous vehicles by providing real-time connectivity and flexible mobile network services addressing automated mobility needs everywhere.

### The 5G Action Plan for Europe

With the 5G Action Plan for Europe (5GAP), the European Union aims at achieving 5G deployment along the main transport corridors in the

EU, with appropriate 5G coverage for autonomous vehicles in all Member States by 2025.

One particular challenge with the wide deployment of 5G along the main roads is the x-border areas, seen as regions with “mild” business cases for the telecommunication industry. Beyond the business case issues, technological challenges are expected relating to the roaming and handover situations as well as the needs of continuity of services relating to the Automated Driving needs. The European Union has launched a series of Innovation Actions under Horizon 2020 to address the 5G deployment needs for CCAM (Connected and Cooperative Automated Mobility), with a specific focus on the x-border challenges.

The 5G-MOBIX project is an integral part of the EU 5G Action Plan for Europe (5GAP) that brings together a united commitment and bold initiatives to ensure that the EU can use 5G connectivity as a strategic advantage to lead digital transformation and in particular in the area of Connected and Cooperative Automated Mobility

(CCAM) with a strong focus on identifying and partially solving cross-border continuity of service issues.

### CCAM trials at two 5G corridors

5G-MOBIX will execute CCAM trials along two cross-border corridors, between Portugal and Spain (Porto-Vigo corridor) and between Greece and Turkey, with a specific focus on solving hard-border challenges of automated vehicles, like for instance truck platoons. Additionally, six national trial sites will contribute to the deployment and trials of the two cross border sites with advanced testing grounds and local competences about 5G network integrations and automated driving use cases testing.

The trials will allow 5G-MOBIX to conduct impact assessments, including business impact and cost/benefit analysis, particularly in sparsely populated cross-border areas with mild market failures of mobile network connectivity.

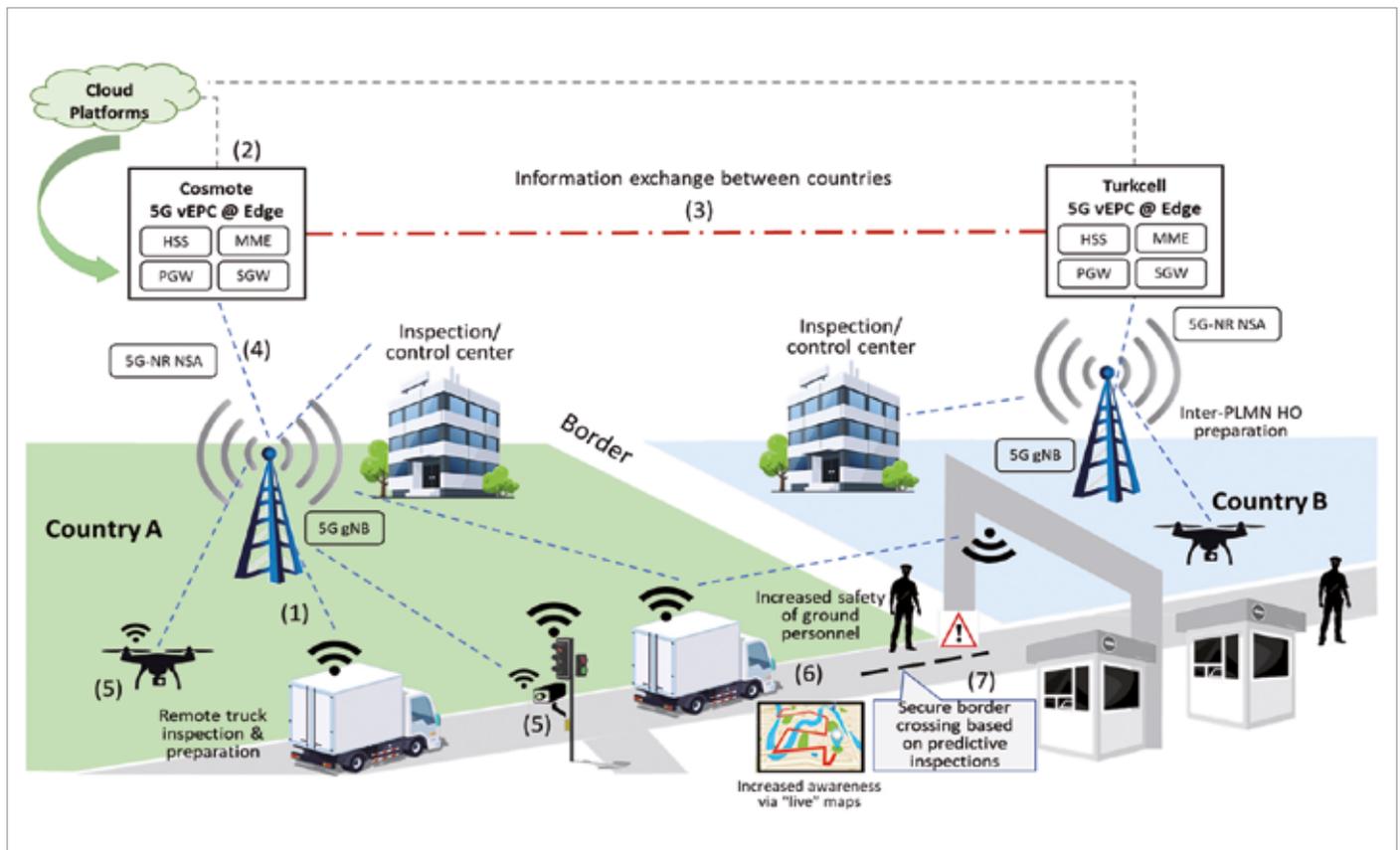


Figure 1: 5G-MOBIX Greece-Turkey cross-border site

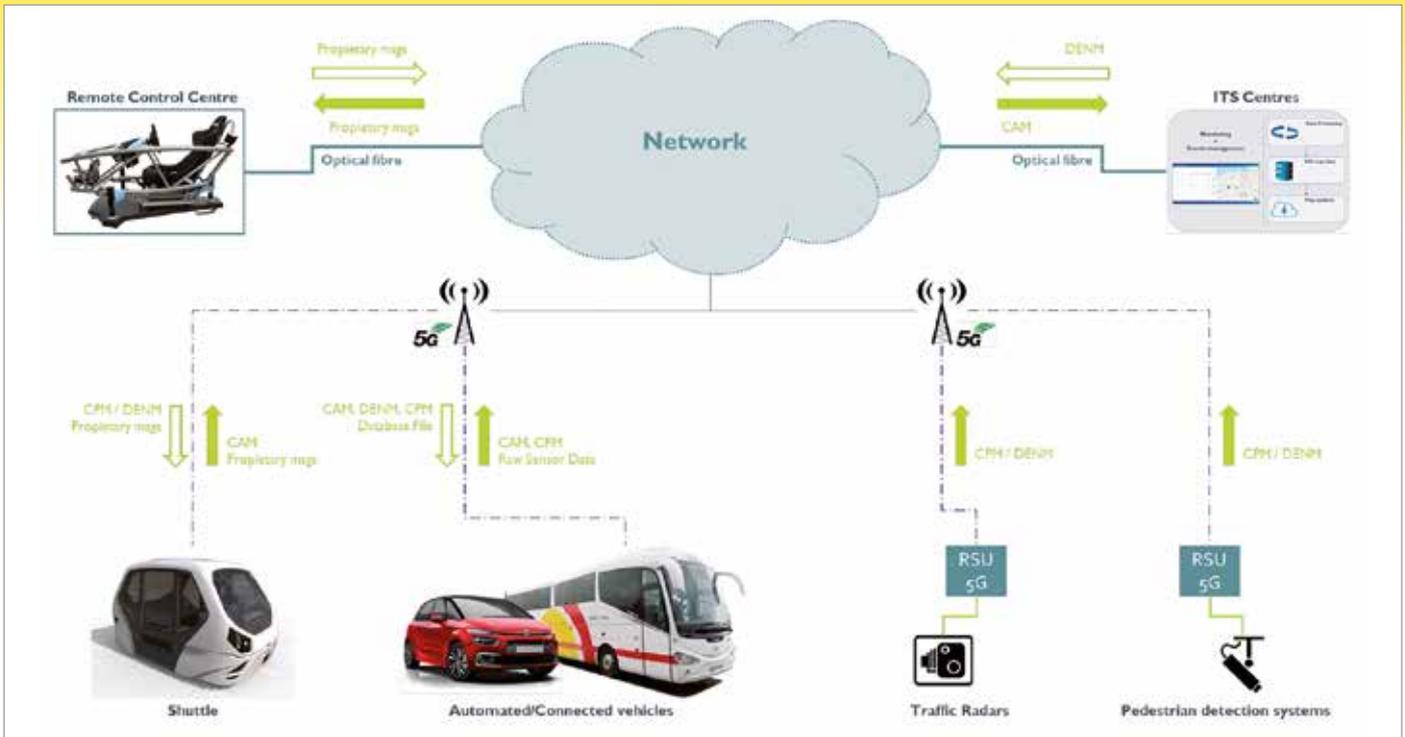


Figure 2: 5G-MOBIX Portugal-Spain cross-border site

As a main impact, 5G-MOBIX will use the results of the trials, the international cooperation with its Chinese and Korean trial sites, and consultations with the public and industry stakeholders, to identify new business models for 5G-enabled CCAM. Furthermore, 5G-MOBIX will propose recommendations and options relating to standardisation, regulation and spectrum allocation to solve cross-border deployment challenges.

Existing key assets such as infrastructure and vehicles will be utilized and upgraded to test the smooth operation of 5G within a heterogeneous environment that includes other concurrent technologies such as ITS-G5 and C-V2X.

### The Greece-Turkey 5G corridor

The Greece-Turkey corridor will offer the unique opportunity to address 5G cross-border deployment issues while driving across a hard border where trucks have to stop and are subject to human control. 5G-MOBIX will identify the opportu-

nity to use 5G to allow crossing hard borders with automated truck platoons provided by FORD Otosan, firstly ensuring truck platooning continuity but also easing the customs controls (see figure 1).

### The Portugal-Spain 5G corridor

The Porto-Vigo 5G cross-border corridor will be the place to trial several selected automated driving scenarios either on a highway or at two cross-border cities. The automated driving use cases will include complex manoeuvres for high-level automated-driving cars, remote control and monitoring of automated driving shuttle and Multimedia continuity of services for buses (see figure 2).

### Urban trial sites

There are four European urban trial sites – in Espoo (Finland), Versailles (France), Berlin (Germany) as well as Helmond Brainport in the Netherlands. They will support the two cross-border

trials while offering the flexibility of experimenting with the deployment and integration of novel 5G technologies on an existing infrastructure. This allows trying out different deployment and configuration strategies, approaching the same automated driving use cases with simulated 5G cross-border environment (simulated handover), and providing also trials for national handover.

Finally, two Asian urban trial sites located in China (Jinan) and South Korea (Yeonggwang) are tightly coupled to 5G-MOBIX. They provide a worldwide perspective for the deployed technologies and the applicability of selected use cases. Harmonising the approach among the urban trial sites ensures maximum impact of 5G-MOBIX results and proposed solutions.

➤ **Further information** is available on the 5G-MOBIX website at [WWW.5G-MOBIX.COM](http://WWW.5G-MOBIX.COM)

# V2X in Europe or not?

## Interview with 5GAA CTO Maxime Flament

The development of connected mobility using 5G is progressing rapidly. How will the automotive sector change? And by when will the connected mobility future be a reality? Eurescom message editor-in-chief Milon Gupta asked someone who should know about the impact of 5G on the automotive sector – Dr. Maxime Flament. He is CTO of the 5G Automotive Association (5GAA), a global cross-industry organization of companies from the automotive, technology and telecommunications industries. The 5GAA members collaborate to develop end-to-end solutions for future mobility and transportation services.

### What is the 5GAA's vision for the automotive mobility of the future?

M. Flament: We see vehicles sharing information to make transportation safer, greener, and more enjoyable already at our doorstep. The technologies associated with this concept are collectively known as Cooperative Intelligent Transportation Systems, or C-ITS. The impact on road safety alone is sufficiently important to make C-ITS a priority.

5GAA is working actively with its members to enable "Connected mobility for people, vehicles and transport infrastructure".

5GAA bridges the automotive and telecommunications industries, in order to address society's connected mobility and road safety needs. We do this with applications such as automated driving, ubiquitous access to services and integration into intelligent transportation and traffic management. 5GAA's contribution focusses on evolving, testing and promoting cellular-based communications, supporting standardisation, and accelerating global deployment and commercial availability.

### What is the importance of 5G for realising the 5GAA's vision?

M. Flament: 3GPP, as a global initiative to make global standards in the mobile network industry, has been building 5G step by step and will include 4G for many years in its non-standalone version. What's important is that we can do plenty with current connectivity while much more is coming. There are 30 million vehicles out there that are already connected to mobile networks. On this basis, the 5GAA wants to start its deployment base. However, at this stage current mobile networks cannot provide the low latency required for safety of life. This is why 3GPP has specified



Maxime Flament

the short range LTE-V2X PC5 interface to deliver basic safety services. Eventually it will be complemented by the new NR-V2X radio interface for advanced driving. 5GAA promotes the combination of the long-range mobile network connection, V2N, with the short range to connect to other vehicles, road-side and other smart devices.

The pure 5G part of C-V2X, called NR-V2X, is about advanced features. Among others, it will bring the possibility to address in unicast and groupcast modes and to guarantee a required level of quality. It basically enables sensor sharing or coordinated manoeuvring for automated driving.

### How will 5G change the ecosystem of vehicles and road infrastructures?

M. Flament: 5G network communication will redefine mobile experience by offering multi-gigabit speeds for immersive user experiences, as well as new infotainment, telematics, and teleoperation use cases.

What 5G brings to the connected vehicle ecosystem is the huge experience of the telecommunication industry, mobile network operators, their suppliers and phone manufacturers. They have decades of know-how to optimally deploy, operate and maintain large communication networks. 5G is based on the global 3GPP standard and will evolve with a long-term perspective while maintaining backward interoperability release after release.

With 5G New Radio, a full set of new spectrum bands have been allocated. This gives operators the possibility to tailor-fit their services to the de-

mand of the automotive industry: reliable, predictable, low-latency QoS for advanced driving features. This comes on top of the operation in the 5.9 GHz band for ITS short-range services.

### Which technical, regulatory and legal challenges need to be overcome on the way to connecting all vehicles?

M. Flament: As a global standard, C-V2X [cellular vehicle-to-everything, a 3GPP standard – the editor] is being prepared for deployment worldwide and will first come to the countries where spectrum regulations and policies have been proactively supporting 5G.

In China, the government is completely supportive of the incorporation of 5G technologies. The MIIT forecasts that up to 30% of all new cars will be equipped with LTE-V2X as of mid-2021. Also, LTE-V2X road-side coverage is planned on expressways and major urban roads infrastructure. Once ready, 5G-V2X will complement the services with advanced features.

In North America, the US FCC is considering the revision of the exclusive use of DSRC radios in the 5.9 GHz band which has remained largely underutilised. A 5GAA Waiver to the US FCC was submitted to allow C-V2X operation in the upper 20 MHz of this band. US policymakers recognise the value of technology-neutral policies and welcome a consensual industry solution to maximise use of the 5.9GHz band for improving road safety and efficiency.

In Europe, the European Council has objected to the adoption of a delegated regulation on C-ITS. 5GAA had advocated for a technologically neutral approach. The objection sends a strong signal to the European Commission to revise its plans. Only a level playing field between existing technologies will allow safer, more efficient mobility on European roads.

### What will be the economic impact of 5G on the automotive sector? How will 5G change business models and market structures in the global automotive sector?

M. Flament: C-V2X has a clear evolution path to 5G. It is a scalable, cost-efficient solution.

For vehicles, C-V2X can be integrated with widely available cellular platforms/modems to drive cost efficiency; many new vehicles are expected to feature cellular connectivity in the next few years. C-V2X can deliver both short-range safety V2X applications and long-range network

# CELTIC News 2/2019

The newsletter of EUREKA Cluster CELTIC-NEXT

CELTIC Chair's Corner  
Ready for change

Events  
CELTIC Event in Valencia

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Universal Critical Infrastructures

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

CELTIC-NEXT Call for Project Proposals – Deadline: 30<sup>th</sup> March 2020

**Do not miss the opportunity to participate in CELTIC-NEXT, the industry-driven European ICT and telecommunications research programme under the umbrella of EUREKA. Submission deadline for the next call for project proposals is 30<sup>th</sup> March 2020.**

CELTIC-NEXT 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-NEXT Public Authorities Website. Please talk to your national contact early in the process.

### Easy proposal process

Preparing and submitting a CELTIC-NEXT project proposal is easy. Just register on the CELTIC-NEXT 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.celticnext.eu/call-information>).

### Benefits of participating in CELTIC-NEXT

- 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 – see CELTIC-NEXT Scope and Research Areas.
- CELTIC-NEXT 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 higher than 50 %.
- The results of the evaluation will already be known in May 2020.

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

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# Ready for change

How CELTIC-NEXT's flexibility enables our industry-driven projects to be successful



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The ICT landscape is changing rapidly. In order to keep pace, R&D programmes need to adapt to meet the changing needs. In the case of CELTIC-NEXT, I can confidently say that we are up to the challenge, as this year's successes confirm. At the CELTIC Event in Valencia on 19<sup>th</sup> June 2019, which was co-located with the EuCNC Event and the Global 5G Event 2019, three projects were awarded for their excellence in the areas of networking technologies (SOOGREEN), applications (E3), and multimedia (4KREPROSYS). The NOTTS project was honoured with the Innovation Award for its outstanding market innovation beyond the project lifespan.

This year has been quite special for our Cluster, as three already awarded CELTIC projects have received in addition EUREKA Awards! In May, SIGMONA was highlighted as EUREKA Global Project of the Year at the EUREKA Global Innovation Summit in Manchester. In September, 4KREPROSYS and E3 each received a EUREKA award at the EUREKA Stakeholder Event in Amsterdam.

These awards for CELTIC projects are the direct consequence of our programme's flexibility. It allows projects to stay aligned with the quickly evolving technological landscape and the company strategies. CELTIC's flexibility in combination with the industry-driven character is at the core of our programme. In view of the ongoing initiative for defining the future of Clusters, which has been launched by the current EUREKA chair from the Netherlands, I am convinced that we need to maintain the flexibility and the industry-driven character of our programme in order to stay successful in the future.



## The future of Clusters at the EUREKA Stakeholder event

The future of Clusters was a major topic at the EUREKA Stakeholder event in Amsterdam on 4th September. In this context, a central goal was to capture feedback by stakeholders on Clusters and other EUREKA instruments. Representatives from industry and academia shared their views about EUREKA Clusters. In addition, a live survey among the audience on areas of improvement for Clusters was conducted, which showed interesting results. The participants voted that the most essential measures for improving the Cluster programmes should be:

- › Increase availability of funding from countries – 41% of participants supported this
- › Simplify the proposal process – 25%
- › Have a shorter time to contract – 21%
- › Higher visibility of EUREKA Cluster programmes – 9%
- › Create cross-technology / cross-Cluster projects – 5%

The major improvement factor identified by the stakeholders – availability of funding from countries – is beyond the scope of any structural change within the Clusters. Concerning the other factors, which are to varying degrees influenceable by Clusters, it should be noted that in the case of CELTIC-NEXT part of the proposal process has already been simplified. We have changed from a two-phase proposal submission to a one-phase submission process, which reduces the required time and effort.

## My highlights from the Proposers Day in Istanbul

In order to foster new project submissions, CELTIC-NEXT held a proposer's day in Istanbul on 25th September. There was a keynote by Hakan Çelik, the R&D Design Chief of ISBAK, about the smart city of Istanbul, which I found particularly interesting.

Mr Çelik explained in his presentation that smart cities are a complex and overarching topic. It includes security, smart mobility, governance, energy, living issues, as well as people and NGOs representing them. According to Mr Çelik, the ultimate goal of smart cities is to improve quality of life and enable better sustainability.

Another highlight was a panel on the business impact of Celtic projects, which was moderated by İşıl Özkan from Turkcell. Representatives of Vestel, Argela, NETAS and ISBAK shared their experiences on the benefits of a number of CELTIC projects in which they were involved, including CONVINCe, TILAS, H2b-2Vs, SIGMONA, VIRTUOSE, and COMOSEF. The panellists emphasized the flexibility of CELTIC as a key success factor.

Finally, in the pitching sessions 12 interesting new project ideas were presented, in order to find additional partners for project proposals to be submitted in October or at our spring call next year.

Across the various CELTIC-NEXT Proposers Days in 2019, a total of 52 project pitches were presented, which indicates how attractive our Cluster is to industry and academia in Europe and beyond.

Plans for call on Artificial Intelligence

One of the hottest topics is currently Artificial Intelligence (AI). A number of countries have expressed their interest in a synchronised AI call between CELTIC-NEXT and most of the other EUREKA Clusters. Among the interested countries are Spain, UK, Turkey, Germany, Sweden, Finland, Canada, Denmark, Netherlands, Austria, South Korea, and Hungary as well as the Belgian regions Flanders, Brussels, and Wallonia. Some other countries may join this AI initiative later.

We aim to organise this synchronised AI call in June 2020 in addition to the usual CELTIC-NEXT bottom-up calls. Keep checking our website and social media channels for updates.

Conclusion

My first year as CELTIC chairperson has been exciting. It has shown me that it is important for our programme to embrace change. And it has shown me at the same time how important it is to adhere to the key principles of



CELTIC – flexibility and the industry-driven character of our programme. Based on this, I am confident that CELTIC will continue to thrive in a changing landscape. And as this year's inter-Cluster spokesperson I may add

that EUREKA Clusters as a whole will keep playing an important role in generating value for industry and citizens in Europe and beyond.

# On the road to future networks

## CELTIC Event in Valencia

This year's CELTIC Event took place in Valencia, Spain on 19<sup>th</sup> to 20<sup>th</sup> June. It was co-located with EuCNC, the European Conference on Networks and Communications, which gave CELTIC-NEXT additional attention among the 5,000+ EuCNC participants. The CELTIC Event consisted of a conference with award ceremony on day 1 and sessions for project proposers on day 2. In parallel, 15 selected CELTIC projects showed their results in the exhibition at the Valencia Conference Centre. One of the highlights of this year's event was the emergency communication demo at the harbour of Valencia, which was performed by CELTIC project UNICRINF.



Eric Hardouin, Ambient Connectivity Research Director at Orange



Valérie Blavette, chairperson of CELTIC-NEXT

Keynotes and SME success story

In the first keynote, *Eric Hardouin*, Ambient Connectivity Research Director at Orange, presented a vision of future networks. He emphasised that beyond performance aspects, research on future networks has to address a number of additional challenges, including trust and resilience in multi-tenant environments, EMF-aware transmissions, the efficiency of energy and natural resource usage as well as digital

inclusion. He pointed out that there is still a lot of research needed to deliver the full 5G potential. According to Mr Hardouin, the exploding complexity of networks due to multiple requirements for optimisation calls for system-level solutions.

In the second keynote, *Diego R. Lopez* from Telefónica I+D shared his insights on the application of Artificial Intelligence (AI) to network transformation for nurturing the Smart

Network. According to Mr Lopez, such a network should be smart in all senses, i.e. fast, simple to use, easy to tune, and above all, intelligent in order to make the network scalable, adaptable, multi-purpose, and suitable for integration.

The third speaker, *Steny Solitude* from French SME Perfect Memory, shared the story of his company's success, which is closely linked to its participation in CELTIC



Diego R. Lopez from Telefónica I+D



Steny Solitude from French SME Perfect Memory

projects. Perfect Memory has created an innovative digital asset management (DAM) solution based on results by CELTIC projects MediaMap and MediaMap+.

### Panel on impact of CELTIC projects

After the opening keynote, the audience witnessed a lively panel session on the impact of CELTIC projects, which was emceed by David Kennedy, director of Eurescom. The five panellists represented six CELTIC projects: 4KREPROSIS - Marco Mattavelli, EPFL, Switzerland; flagship project SENDATE - Emmanuel Dotaro, Thales, France; NOTTS and MONALIS - Antonio Cuadra Sanchez, INDRA, Spain; SIGMONA - José Costa Requena, Cumucore, Finland; and UPSC - Isil Ozkan, Turkcell, Turkey.

Not surprisingly, all five panellists concluded that the industry-driven and close-to-market projects under CELTIC allowed their organisations to reap immediate benefits in terms of accelerating market innovations, sustained competitiveness, and a profound increase of their knowledge base and international business connections. The type and scope of these impacts varied widely, due to the fact that the panellists represented on the one hand large companies like Thales or Turkcell and on the other hand SMEs like Cumucore.



Panellists discussing the impact of CELTIC projects (from left): José Costa Requena, Cumucore; Antonio Cuadra Sanchez, INDRA; Emmanuel Dotaro, Thales; İşıl Özkan, Turkcell; Marco Mattavelli, EPFL



### CELTIC Awards

The first day of the CELTIC Event ended with a highlight - the CELTIC Awards. Four CELTIC projects won the CELTIC Award for their outstanding work. Three of these projects were awarded for their excellence in the areas of networking technologies, applications, and multimedia. The fourth was honoured with the Innovation Award for its outstanding market innovation beyond the project lifespan. The awards were presented to representatives of the winning projects by CELTIC-NEXT chairperson Valérie Blavette and handed over by Juana Sanchez from CDTI, the representative of the Public Authority in Spain.

### Excellence Award for Multimedia: 4KREPROSYS - 4K ultraHD TV wireless REmote PROduction SYStems

The project partners have been very successful in their specialized video production ecosystem. The business relevance of the developed 4KREPROSYS solution has been evaluated as very high. The successful involvement in major events like the FIFA World-Cup 2018 underlines the competitiveness of the solutions brought forward by the project.

Coordinator: Dominique Grillet, AMP Visual TV

Duration: December 2014 - June 2018

Project Video - <https://youtu.be/NNvWkSVlpHo>

Website - <https://www.celticnext.eu/project-4kreprosys>



François Valadou, AMP Visual TV, France and Marco Mattavelli, EPFL, Switzerland, from 4KREPROSYS; Juana Sanchez, CDTI, Spain; and Valérie Blavette, CELTIC-NEXT Chairperson



Valérie Blavette, CELTIC-NEXT Chairperson; Dominique Bodere, SOO-GREEN Project Coordinator from Orange, France and Juana Sanchez from CDTI, Spain (from left)



E3 project coordinator Oscar Chabrera from Vilyn, Spain and Juana Sanchez from CDTI, Spain



NOTTS Project Coordinator Antonio Quadra Sanchez from INDRA Spain, Juana Sanchez from CDTI, and Valérie Blavette, CELTIC-NEXT Chairperson

### Excellence Award for Network Technologies: SOOGREEN – Service-oriented optimization of Green mobile networks

SooGreen's main objectives were to reduce the energy consumption of services and to improve the mobile network architectures and content delivery, taking advantage of the smart grids by using a holistic approach at the level of network components, architecture, management and control. The project has addressed the need to reduce the energy consumption of services in different mobile network architectures, focusing on topics like modelling and measurement of services energy consumption in mobile networks; dynamic optimization in access; energy-efficiency aspects of emerging virtual and cloud RAN architectures; and interaction between service delivery in mobile networks and smart grids.

Coordinator: Dominique Bodere, Orange

Duration: July 2015 - November 2018

Project Video - <https://www.youtube.com/watch?v=rVZfvAaHUIA&t=47s>

Website - <https://www.celticnext.eu/project-soogreen>

### Excellence Award for Applications: E3 – E-health services Everywhere and for Everybody

E3 designed and implemented an end-to-end platform to make e-health services available in both rural and urban areas, to patients and professionals. E3 used and extended the results from the awarded CELTIC project HIPERMED. E3 developed the HIPERMED results further by addressing other communication types and compression techniques. In addition, E3 extended the type of scenarios by testing the developments in 15 healthcare scenarios, which were validated by doctors and professors who tested the platform results.

Project Coordinator: Oscar Chabrera Villarreal, ViLynx Spain S.L.U.

Duration: December 2014 - June 2018

Project Video - [https://www.youtube.com/watch?v=X7\\_fH8wUQDw](https://www.youtube.com/watch?v=X7_fH8wUQDw)

Website - <https://www.celticnext.eu/project-e3>

### Innovation Award: NOTTS – Next generation Over-The-Top multimedia Services

The project had developed a sustainable integrated solution to guarantee the OTT content delivery from the customer's perspective for the whole content distribution chain. The main activities included new media distribution architectures for OTT contents, and novel methods for Quality of Experience (QoE) estimation. NOTTS technology has supplied European content providers, service providers and telecoms network operators with new technologies that allow increasing revenue from new OTT business models.

Project Coordinator: Antonio Quadra Sanchez, INDRA Spain

Duration: May 2013 - 31 March 2016

Project Video - <https://www.youtube.com/watch?v=UmQn2o-7Ak4>

Website - <https://www.celticnext.eu/project-notts>

### Exhibition

In the EuCNC exhibition area, 15 commercially important CELTIC projects presented their results. Visitors had the chance to experience first-hand prototypes of solutions which have been developed in the selected CELTIC projects. The demos allowed visitors to experience the technological progress made by those projects in an interactive and playful way.

### Live emergency demo at the harbour

Shortly before the EuCNC social event on 18th June, CELTIC project UNICRINF showcased a live emergency demo at the Port of Valencia. The demo attracted a large number of visitors who witnessed how the UNCRINF solution enabled the communication between emergency teams on land, in the air, and at sea.

*The video of the live demo is available on the CELTIC YouTube channel at <https://youtu.be/b2wFQ6eB6Zo>. See also the article about UNICRINF in this edition of CELTIC News.*

### Sessions for proposers

The sessions on the second day were dedicated to helping proposers learn about making a good proposal for the upcoming autumn call in October and finding the right partners for their consortium. In the first session, CELTIC Office Director Peter Hermann presented best practices for proposers and explained how to set up a successful CELTIC project. The ensuing round-table with representatives of Public Authorities provided practical information on funding and research topics in different EUREKA countries.

The afternoon was dedicated to project idea pitches and networking. This offered ample opportunities for meeting other experts from the ICT community to discuss emerging R&D needs and proposals for related collaborative projects. Session moderator Christiane Reinsch, Programme Coordinator at the CELTIC Office, introduced 17 new project ideas. This was followed by



*Exhibition – High media interest in CELTIC projects, here the VIRTUOSE project*



*UNICRINF-Demo-YouTube*

proposers, who pitched their innovative project ideas for the upcoming CELTIC call in short elevator pitches. The CELTIC Event ended with open networking and bilateral discussions between proposers and representatives of Public Authorities.

### › Further information

CELTIC Event 2019 page – <https://www.celticnext.eu/event/celtic-event-co-located-with-eucnc-19-20-june-in-valencia-spain/>

# EUREKA Awards for CELTIC Projects 4KREPROSYS and E3

EUREKA Stakeholder Conference in Amsterdam



At the EUREKA Stakeholder Conference in Amsterdam on 5th September 2019, the CELTIC projects 4KREPROSYS and E3 were among the happy winners of the prestigious EUREKA Awards. The EUREKA Awards were presented on the main stage of the DeLaMar Theater by Odilia Knap, Chairwoman of the EUREKA Network.

Three months earlier, in June 2019, both projects had already received CELTIC Excellence Awards at the CELTIC Event in Valencia – 4KREPROSYS for excellence in multimedia and E3 for excellence in the applications domain.

## EUREKA Award Winner 4KREPROSYS

4KREPROSYS (4K ultraHD TV wireless REMote PROduction SYSTEMS) investigated and developed a new integrated cost-effective approach for the production of 4K TV content. The goal was to cover a wide range of 4K TV production needs, from indoor studio pro-

duction to large outdoor events, such as Olympic Games, cycling, and car races. 4KREPROSYS was involved in major events like the FIFA World Cup 2018, which underlines the high relevance of the project's solutions.

The project consortium included: AMP VISUAL TV (coordinator), France; WorldLinX Alliance NV, Belgium; Siru, Finland; Supponor Oy, Finland; TUT-Tampere University of Technology, Finland; INSA de Rennes (IETR), France; Kalray, France; NuLink SA, Switzerland; European Broadcasting Union (EBU), Switzerland; EPFL - Ecole Polytechnique Fédérale Lausanne, Switzerland.

4KREPROSYS website: <https://www.celticnext.eu/project-4kreprosys>

## EUREKA Award Winner E3

E3 (E-health services Everywhere and for Everybody) designed and implemented an end-to-end platform which enables patients and

professionals in both rural and urban areas to cost-effectively access e-health services based on high-quality video conferencing technology. The platform was successfully tested in 15 healthcare scenarios and validated by doctors and professors.

The project consortium included: ViLynx Spain S.L.U., Spain; Calboquer S.L., Spain; IDI EIKON, Spain; SeniorSome Oy, Finland; eHOIVA Palveluverkko Oy, Finland; Institut Mines Télécom, France; Université de Lorraine, France; Vitec Multimedia, France; Poznań Supercomputing and Networking Center, Poland; Galaksiya Bilisim Teknolojileri, Turkey; SoSoft, Turkey; Vestel Electronics, Turkey.

E3 website: <https://www.celticnext.eu/project-e3>

# Proposal pitching in Turkey

## CELTIC-NEXT Proposers Day in Istanbul



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The CELTIC-NEXT Proposers Day in Istanbul on 25th September highlighted the strong interest of the Turkish RDI community in building international partnerships. The audience witnessed inspiring presentations, engaged in interesting discussions, and learned about twelve new interesting proposal ideas.

The event took place at the Istanbul Technology University. It was organized by CELTIC-NEXT and the Turkish Public Authority TÜBİTAK with the support of Sabancı University and Enterprise Europe Network. The programme consisted of interesting keynote speeches, practical information about the CELTIC-NEXT programme and the national funding programmes in Turkey and Spain, a lively panel discussion about the business impact of CELTIC projects, and a session for project proposal pitches.

In the morning, Mr. Tarık Şahin from TÜBİTAK, Ms. Valérie Blavette, CELTIC Chairperson from Orange, and Mr. Rıza Durucasugil, CELTIC Vice-chair from NETAŞ, opened the event and welcomed the participants. After the opening, Ms. Fatma Kesik from Sabancı University presented the opportunities of the Enterprise Europe Network. In the following keynote speech by Mr. Mustafa Eruyar from ISBAK, he shared the future vision of smart cities and presented exemplary scenarios and use cases from the city of Istanbul.

The Public Authority representatives, Mr. Tarık Şahin from Turkey and Ms. Juana Sánchez Pérez from CDTI in Spain, highlighted their support of the CELTIC-NEXT programme and presented the funding opportunities in Turkey and Spain. Guidelines and recommendations on how to submit a CELTIC-NEXT project proposal were presented as well.



*Speakers and organisers of the Proposers Day (from left): Hakan Çelik from ISBAK, Rıza Durucasugil, Vice-chair of CELTIC Core Group from NETAŞ, Juana Sánchez Pérez from CDTI (Spanish Public Authority), Valérie Blavette, CELTIC Chairperson from Orange, Mustafa Eruyar from ISBAK, Maria Barros Weiss, CELTIC Office at Eurecom, and Umut Ege from TÜBİTAK (Turkish Public Authority)*

### Panel discussion

The ensuing panel discussion was moderated by Ms. Işıl Özkan, CELTIC Core Group Member from Turkcell, and focused on the business impact of CELTIC projects. In the discussion, Mr. Burak Görkemli from Argela mentioned the importance of international collaboration and referred to the projects his company has been involved in, namely TILAS, H2b2Vs and SIGMONA.

Mr. Yaşar Burak Savak, from Vestel Electronics, stressed the impact created by awards, based on the example of CELTIC and EUREKA awards received by the E3 project. Mr. Mehmet Dağlı, from NETAŞ presented the impact of the VIRTUOSE project on the different organizations in the consortium, referring to the patent submissions, prototypes and field trials. He also mentioned new and improved products implemented by the project. In addition, he highlighted a start-up on cloud gaming created in Spain, which uses the video encoders implemented in the project. Mr. Mustafa Eruyar from ISBAK stressed the importance not only of the impact on business but also on the quality of living, highlighting results of CELTIC projects like COMOSEF. The social impact created through the services offered by the projects to the public was also recognised during the discussions.

The panellists also discussed challenges of CELTIC projects and international collaborations in general, like for example the size of the consortium or dealing with the requirements of multiple funding agencies. They also pointed out the contradiction between agile processes and short deadlines used by many companies and the long deadlines of project proposals, which are hard to reconcile. Many times the companies' strategies change during the long duration of project set-up and implementation, which could become a risk for projects.

They mentioned leadership roles in CELTIC-NEXT as beneficial for the organizations, and they especially appreciated the bottom-up character of the programme, which they considered to be a big advantage for the alignment of project work with the companies' strategies. The impact of project collaborations for academia was also stressed, as well as the importance of having academic partners in projects, proven for instance by the 110 high-quality papers published by CELTIC projects SIGMONA, H2B2VS, and TILAS combined.

Timely technology and quality of the project implementation, as well as a strong coordination and valid use cases were factors indicated as crucial for the success and business impact of the projects.

## Proposal pitches and networking session

During the proposal presentations session, twelve potential project ideas were presented to the audience, covering topics like 5G, artificial intelligence, big data, IoT, blockchain, automation, and others. The proposed applications of such technologies ranged from a wide spectrum of vertical industries, such as banking, supply chains, self-driving vehicles, assisted living, smart energy, and smart agriculture, just to name a few. The interest of the audience in the project ideas was demonstrated not only by the full room, but also through the lively networking session at the end and the interactions among the event participants and feedback to CELTIC and Public Authority representatives.

## Outlook

The Proposers Day in Istanbul was part of a series of events co-organised by CELTIC-NEXT to support interested proposers in finding collaboration partners and building international project consortia. Besides the several proposers days organized in different EUREKA/CELTIC countries, CELTIC also offers Proposers Sessions via web-conference. The pitch presentations presented during all the proposers days or sessions are available for download on the CELTIC-NEXT website.

### › Further information

- › How to get involved – <https://www.celticnext.eu/how-to-get-involved/>
- › Proposal pitches presented at the Proposers Day in Istanbul – <https://www.celticnext.eu/pitch-presentations-from-proposers-day-in-istanbul/>



Panel on the business impact of CELTIC projects (from left): Mustafa Eruyar, İSBAK, Mehmet Dağlı, NETAŞ, Burak Görkemli, Argela, Yaşar Burak Savak, Vestel Electronics, and moderator Işıl Özkan, CELTIC Core Group Member from Turkcell.



Audience at the CELTIC-NEXT Proposers Day in Istanbul

- › Join new project ideas – <https://www.celticnext.eu/join-new-project-i>

# Universal Critical Infrastructures

## CELTIC Project UNICRINF



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Major catastrophes demand efficient coordination and control of resources in order to ensure people's safety. In the era of 5G and IoT, networks and applications play a fundamental role in monitoring and decision making in all areas involved. CELTIC project UNICRINF plans to use the available communications infrastructures to create a global integrated platform to monitor catastrophes, create ad-hoc communication infrastructures, communicate with emergency teams, and advise citizens.

Areas involved in a major catastrophe include emergency services, affected people, hospital resources, communications networks, infrastructure, and more. The fundamental objective during an emergency situation is the safety of the people. Technology should help and allow information to flow smoothly between all people involved.

**Emergency scenarios and application domains**

Emergencies come in different shapes – it could be an earthquake, a tsunami, a flood, a volcanic eruption, a toxic explosion, or a big fire. What all these disasters have in common is that they can compromise communications, which is vital for emergency services and affected people.

However, communications must also include the monitoring of the affected infrastructures, the contact with the people within the affected area regardless of the operator that serves them, the warning of the nearby population by all means available with action guidelines or the evacuation route of victims and available resources. The UNICRINF project aims to facilitate effective disaster communication solutions covering a variety of scenarios and use cases, including:

- › Helping to up the part of the optical trunk network using a contingency truck that replaces the affected node as well as the priority services.
- › Updating a local 5G or 4G VPN network using small cell or portable nodes
- › Facilitating access to the internet and external servers through an ad-hoc satellite connection
- › Performing a national pseudo roaming in order to have the affected people listed and located in the affected area regardless of the operator that serves them

Currently not even the geolocation is available in 112 calls as well as the broadcast of the same service.

- › Allowing the transmission and reception of images taken by unmanned aerial, land or sea drones, both to the control centre and to people on the ground through augmented-reality glasses
- › Multiscreen display in the control centre of the state of physical, human and image resources
- › Control of victims with digital triage and allocation of vehicular and hospital resources with online monitoring
- › Traffic control by emergency services for greater fluidity in the evacuation of people and victims
- › Monitoring and control of damaged infrastructure and possible toxic spills (air or sea) through IoT sensors
- › Notice to the population of the affected area with action guidelines or evacuation orders

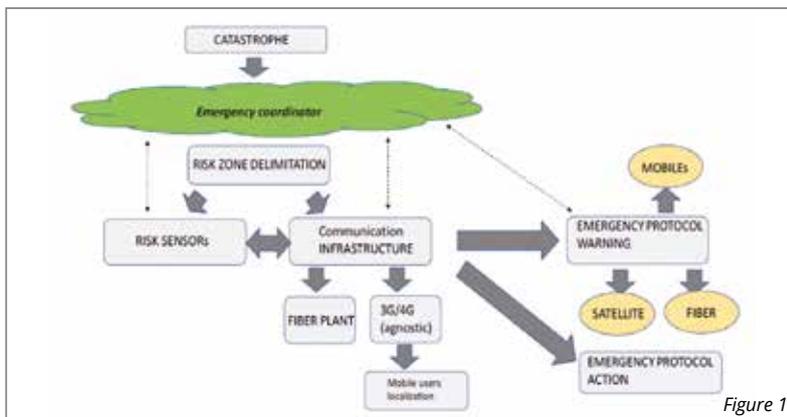


Figure 1

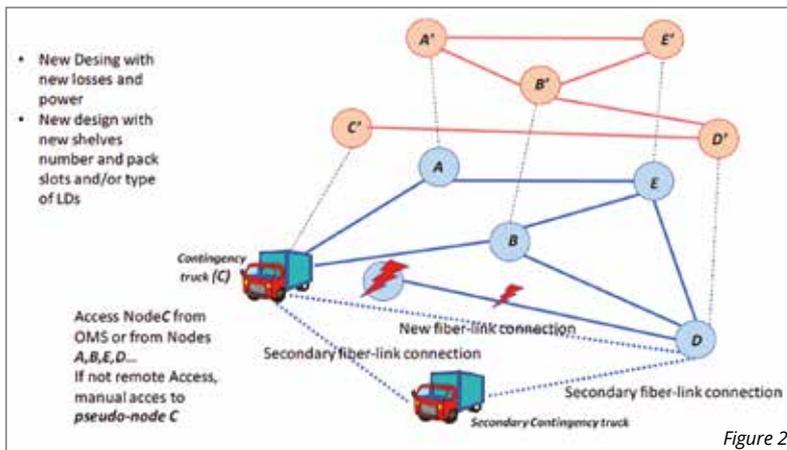


Figure 2

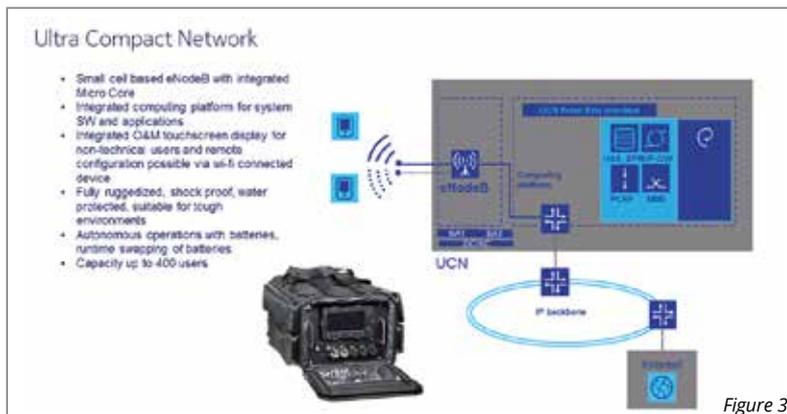


Figure 3

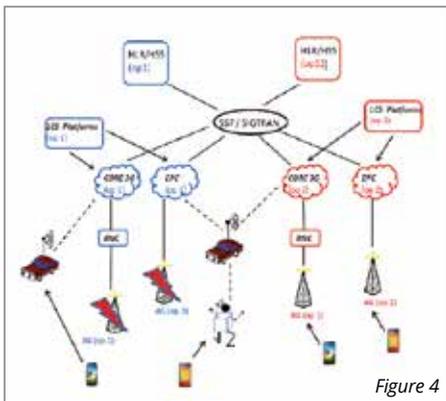


Figure 4



Figure 5

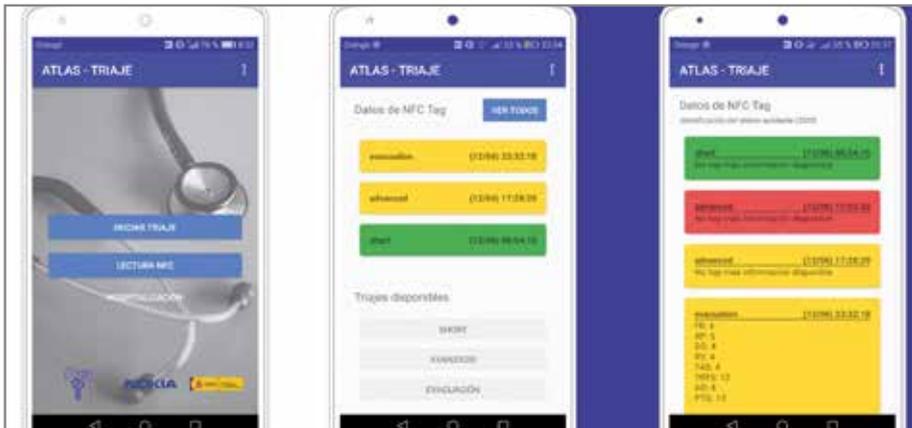


Figure 6

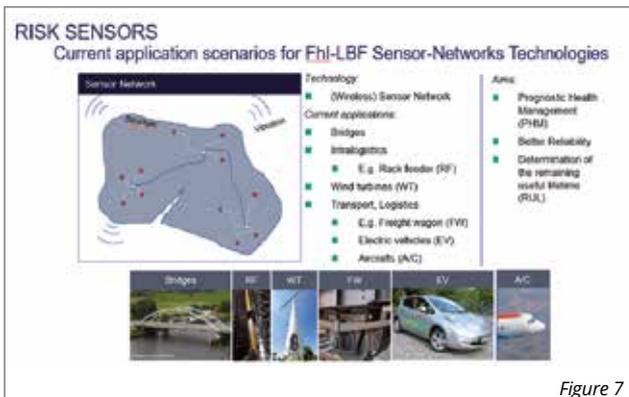


Figure 7

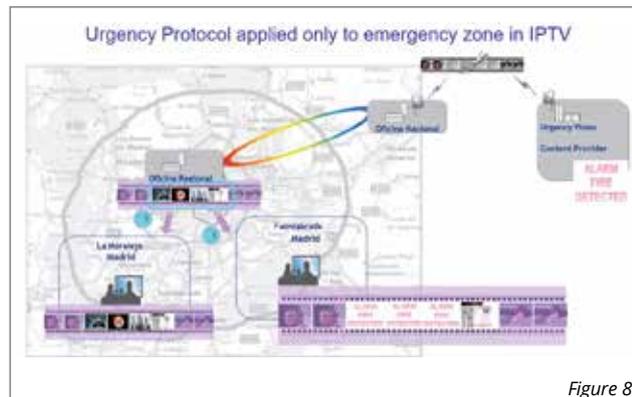


Figure 8

### Information for emergency decisions

For correct decision making in an emergency situation, the state of the communications network, the acquisition of data and its presentation in a user-friendly way are important. Applications that facilitate the coordination and control of resources should be

included and handled in a simple way. The collection and processing of data from sensor networks must be able to be filtered according to programmable criteria. There are many areas where current information to facilitate the resolution of problems from the control centre is required.

#### > Further information

- > UNICRINF project page - <https://www.celticnext.eu/project-unicrinf/>
- > Video of emergency communication demo - <https://youtu.be/b2wFQ6eB6Zo>



#### About CELTIC-NEXT

CELTIC-NEXT is an industry-driven European research initiative to define, perform and finance through public and private funding common research projects in the area of telecommunications, new media, future Internet, and applications & services focusing on next-generation telecommunications for the digital society. CELTIC-NEXT is a EUREKA ICT cluster and belongs to the inter-governmental EUREKA network. CELTIC-NEXT is open to any type of company covering the CELTIC-NEXT research areas, large industry as well as small companies or universities and research organisations. Even companies outside the EUREKA countries may get some possibilities to join a CELTIC-NEXT project under certain conditions.

[www.celticnext.eu](http://www.celticnext.eu)



communications via one single modem, which accelerates time to market and market penetration and contributes to enhanced safety and reduced cost.

C-V2X will also find its way into consumer-electronics smartphones for use by pedestrians, cyclists, and unequipped vehicles, due to its low power consumption and its possible integration with 4G/LTE chipsets.

C-V2X will also benefit from economies of scale, as it can leverage synergies between trans-

portation and other verticals which are moving towards 5G e.g. e-health, smart cities, industry 4.0, smart farming, and more.

**By when do you expect fully networked vehicles and road infrastructures to be achieved in Europe?**

M. Flament: LTE-V2X technology is already commercially available across the globe. First C-V2X deployments on roads and in vehicles will be

starting in China in 2020, to be followed by other regions, when the regulations allow it. As one example, Ford have already announced that they will deploy C-V2X in all new models in the USA as of 2022. In Europe, the connected cars are already a reality for some time now. And, for short range V2V and V2I, the standards are ready, the spectrum regulation is technology-neutral, the Delegated Act was objected. So, as long as different technologies can co-exist in the 5.9GHz band, C-V2X is ready to deploy.

# Connected and automated road mobility in the European Union

## 5G PPP project 5G-CARMEN



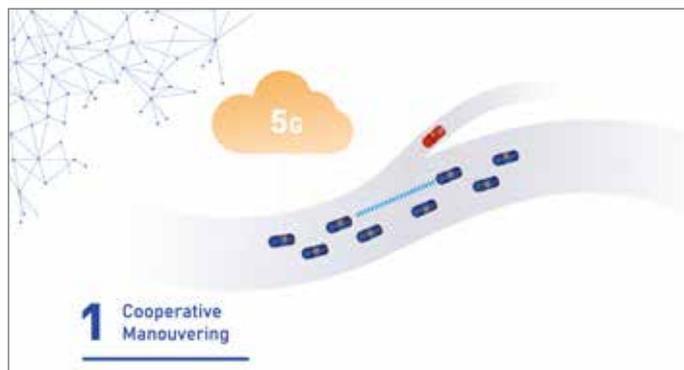
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**European mobility is drastically changing: growing urbanization, environmental aspects, and safety are only a few of the key indicators pointing in this direction. Road infrastructures and vehicles are blending with the digital world, becoming always-connected, automated and intelligent. In this context, the European Union pushes for large-scale collaborative cross-border validation activities on cooperative, connected and automated mobility. 5G-CARMEN, a Horizon 2020 project within the 5G PPP, addresses these challenges by harnessing the concept of Mobility Corridors.**

The 5G-CARMEN consortium conducts extensive trials across an important 600 km road corridor from Bologna to Munich, which is connecting the three European regions Bavaria, Tirol and Trentino. 5G-CARMEN will realise a 5G-enabled corridor to validate a set of innovative Cooperative, Connected, and Automated Mobility (CCAM) use cases from both business and technical perspec-



tives. To achieve this, 5G-CARMEN will leverage the most recent 5G technology enablers, including 5G NR, C-V2X interfaces, Mobile Edge Computing (MEC), end-to-end network slicing, highly accurate positioning and timing, and predictive quality of service.

**Expected impact**

5G-CARMEN is investigating four cross-border application scenarios: cooperative manoeuvring, situation awareness, green driving, and infotainment. For the use cases, the project targets an automation level of up to SAE L4. The Society of Automotive Engineering (SAE) defines six levels of automation, from level 0 up to level 5, with level 0 being no automation and level 5 being full automation, i.e. a vehicle without steering wheel.

The use cases are expected to have a societal impact by improving both traffic safety, enabling coordinated driving by enhancing environment perception, as well as reducing emissions by aggregating heterogeneous information. Moreover, a commercial impact is expected putting automotive OEMs, the telecom operators and the road operators at the global forefront of Safety and Driving Assistance Systems. Beyond this, the 5G-

CARMEN project is expected to have an impact on over-the-top service providers by allowing them to provide advanced infotainment services to passengers in cars and coaches.

**Technical approach**

The key innovations proposed by the 5G-CARMEN project are centred around a hybrid network, combining direct short range V2V and V2I communication, long-range V2N network communication and back-end solutions into a single platform. 5G-CARMEN employs different enabling technologies such as 5G New Radio, C-V2X, as well as secure multi-domain and cross-border service orchestration to provide end-to-end network services.

**Cooperative Manoeuvring use case**

Cooperation between drivers is a key aspect in ensuring safe and efficient navigation through intersections, lane changing, overtaking, entering and exiting highways, etc. Nowadays cooperation is based on visual communication via braking lights, indicator lights, or hand gestures. The information conveyed in such manner is, however,



limited and often cannot be exchanged at an optimal point in time. To this end, 5G can be used to exchange speeds, positions, intended trajectories or manoeuvres, and other helpful data among vehicles. The on-board systems can use this information to derive, in the case of automated operation, an optimized driving strategy or a recommended course of action for a human driver to follow, in order to actively optimize the traffic flow and avoid dangerous situations.

Cooperative lane changing on a highway, for example, can help create the needed gaps for a smooth transition. Cooperative lane merging can be realized either in a localized or centralised manner. The former involves direct exchanges between the vehicles, while the latter builds upon an MEC server and a 5G network, which support the vehicles' systems in determining the optimal behaviour to either execute or pass on to the driver as a recommendation. Both of these approaches are explored in 5G-CARMEN.

**Situation Awareness use case**

Automated vehicles and human drivers are limited in their ability to ensure safe and efficient travel because of their perception of the road traffic situation. The sensors utilized for automated driving, such as cameras, lidars and radars, can only "see" until the next obstruction, and the same applies to the human eye. Hence, sources of danger – such as objects on the road, other vehicles, or vulnerable road users like pedestrians or motorcyclists – are often hidden until the very last moment. Moreover, sudden changes in the weather conditions, like dense fog, fog benches, or ice on the road, dramatically increase the risk of accidents, if the traveling speed is not adapted accordingly.

In order to help reduce the dangers in vehicular transportation, 5G-CARMEN will promote extended situation awareness by enabling vehicles and infrastructure to share their perception of the environment. This allows for potentially dangerous situations to be recognized well in advance so that appropriate actions can be derived to mitigate the risk of property damage or physical harm.

**Green Driving use case**

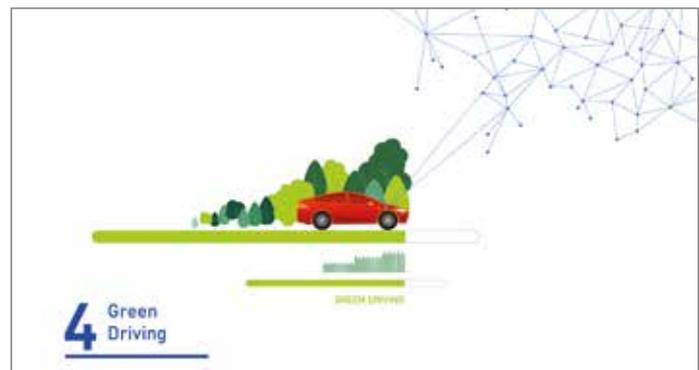
European road operators and authorities have extended their management capabilities beyond safety and traffic efficiency. Air quality and air pollution have become hot topics in our society.

Although the transportation sector strives to limit its impact, it is a significant contributor to pollution with Nitrogen Oxides (NO<sub>x</sub>), Carbon Monoxide (CO), Carbon Dioxide (CO<sub>2</sub>) and Particulate Matter (PM). In fact, around 12% of CO<sub>2</sub> emissions in the EU are produced by vehicles.

5G-CARMEN will provide solutions towards the promotion of greener driving attitudes leading to meaningful improvements in terms of air quality as well as providing elements for entirely new solutions for road operators, road authorities and transport authorities. To this end, the 5G-CARMEN platform will take advantage of sensor-based information, either coming from connected vehicles or from smart sensors measuring the local emissions. In addition, data on the weather condition, on the current traffic situation, legislation databases and more can be leveraged to determine a course of action that limits the negative impact of vehicular transportation on the public health and the environment.

**Infotainment use case**

As wireless networks and phones have become more advanced, we can see that the content consumed by its users has evolved as well. The on-demand streaming of movies, live broadcasts and HD videos is one of the most popular forms of entertainment and dominates the Internet traffic today. It would be a passenger's expectation to be able to enjoy the same service in an autonomous vehicle, i.e., an always-on connection, which delivers the speed and latency needed for high-quality video streaming, no matter where they are.



5G-CARMEN will explore different network architectures and configurations, aiming to satisfy the users' Quality of Experience (QoE). Key in this regard is the prediction of the expected network Quality of Service and the proactive adaptation of streaming applications in order to avoid interruptions in the service whenever possible. High-quality services should always be available, even in cross-country border situations and inter-operator scenarios. Therefore, mobile network synergies between LTE, 5G, C-V2X and other technologies will also be investigated by 5G-CARMEN, in order to guarantee not only the data rate requirements but also the needed coverage at all times.

**Outlook**

5G-CARMEN is currently concluding its first year of activities. During this timeframe the project identified on which borders each use case will be trialled. Moreover, the project has made significant progresses towards the definition of an EU-wide platform for CCAM. During the second year of activities the project will move forward with its planned country-wide pilots as preliminary step towards the final cross-border trials to be performed during the third year of activities.

✦ **Further information**  
 5G-CARMEN website – <https://www.5gcarmen.eu>

# 5G for automotive innovation

## A city-scale 5G automotive testbed for open experimentation



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**Vehicular networks are seen as one of the key enablers for the always-connected paradigm, providing useful communications among vehicles and between vehicles and the infrastructure. As a natural consequence, the design and implementation of Intelligent Transportation Services (ITS) applications has been a hot topic, and a proper evaluation of these applications must consider a realistic environment. This article presents the IT-Av automotive testbed, a city-scale multi-communication vehicular environment with virtualization capabilities, along with some of the services and applications already evaluated through external partners. This platform has been used as the automotive test site of Horizon 2020 project 5GinFIRE.**

When considering vehicular networks, simulation tools are probably the most used environment for the evaluation of new proposals. This is valid not only for the network layer (routing protocols, channel access management, etc.), but also when addressing new applications and services. Acknowledging that network simulators are getting more and more accurate when representing a real

scenario, they are far from acceptable when in driving assistance and safety situations. In these cases, the evaluation environment should be as close as possible to the real scenario.

### The testbed

An automotive testbed, deployed in the campus of the University of Aveiro, Portugal, and managed by Instituto de Telecomunicações – Aveiro, has been widely used for the evaluation of new services and applications for the vehicular vertical. In its current state, the vehicular testbed consists of On-Board Units (OBUs), deployed in vehicles, and Roadside Units (RSUs). The OBUs (and therefore the vehicles) are able to connect to each other via standard IEEE 802.11p/WAVE links, and are able to connect to the RSUs through IEEE 802.11p/WAVE, IEEE 802.11n/WiFi and/or cellular links, in a multihomed communication.

The simultaneous connectivity between the OBU and the RSUs, through the available interfaces, is also possible, enabling the choice of the services to be transmitted through each technology. RSUs are connected through Ethernet to a central entity, responsible for coordinating the vehicles' handovers, and provide Internet connectivity through every RSU connection. The cellular network is granted through a small cell C-RAN using Band 7 (2.6GHz) powered by an OpenAir-Interface (OAI) Evolved Packet Core (EPC). The

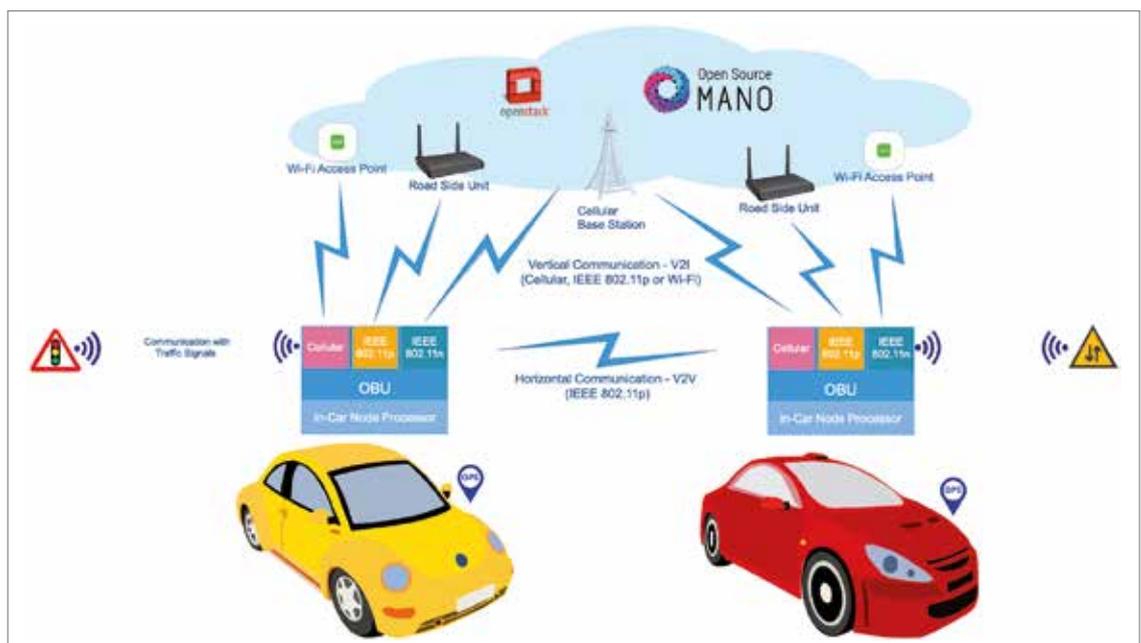
figure illustrates the IT-Av automotive architecture in its current status.

Each OBU is equipped with an additional IEEE 802.11n/WiFi interface, to disseminate a WiFi connection to end-users, usually vehicle occupants, to have connectivity to the Internet. In order to grant transparent handovers to the end-user, a mobility solution based on N-PMIPv6 is applied. Moreover, each vehicle has access to its information such as velocity, GPS and heading, and is also equipped with in-Car Node Processors that can be used to increase the computational power of the OBUs.

The IT-Av automotive testbed has been in constant upgrade. As a result of the participation in the 5GinFIRE project, the testbed is now enabling resource sharing, making use of softwareized networks, replacing hardware network functions through software functions by the means of Network Function Virtualization (NFV) technologies. This way, network functions, as well as many other applications, are available in the Cloud, enabling flexibility, programmability and extensibility to the network.

### Experiments

The IT-Av automotive testbed has been thoroughly explored, not only in the scope of research projects, as is the case of 5GinFIRE, but also for in-house research activities. The scope of the



IT-Av automotive testbed architecture

experiments exploring the IT-Av automotive testbed has been considerably wide, ranging from automotive safety up to multimedia, highlighting its importance and applicability.

Going into detail in some of the previous experiments, SURROGATES (<https://5ginfire.eu/surrogate/>) explored the virtualization of instances of OBUs at the edge of the vehicular network to foster 5G vehicular services, by extending their capabilities and offloading processing tasks from the same unit to its virtualized representative in the cloud. Focused on the safety topic, the VRU-Safe experiment (<https://5ginfire.eu/vru-safe/>) explored prediction mechanisms to avoid vehicular accidents using a hybrid architecture combining Edge and Cloud Computing to identify and predict potential imminent road hazards involving Vulnerable Road Users and vehicles.

Focusing on multimedia, the CAVICO experiment (<https://5ginfire.eu/cavico/>) explores the use of Cloud virtualization to push the boundaries of the QoE-aware adaptive streaming by virtualizing context-aware mechanisms that can use no-reference, context-based QoE metric subsets, to allow a single system to cope with many use case scenarios, e.g. to remotely operate automotive cars. To that end, a video transcoder module, virtualized in the Cloud, is dedicated to optimizing video streaming in the function of quality parameters read from network radio interfaces

and video streams in the vehicular network. Regarding public safety, the 5G-CAGE experiment (<https://5ginfire.eu/5g-cage/>) explored a virtualized city safety solution to monitor and analyse video streams collected from heterogeneous and distributed sources. The analysis is performed in the Cloud, using machine learning techniques on top of video streams gathered from diverse video sources, supplying advanced features for detection of city safety elements, such as license car plates.

### A new version

In an update operation, the Instituto de Telecomunicações along with its technological partners, namely Altice Labs, University of Aveiro and the Municipality of Aveiro, are extending and upgrading the automotive testbed. Funded by an EU project under the Urban Innovative Actions programme, the Aveiro STEAM City (<https://uia-initiative.eu/en/uia-cities/aveiro>) is building a city-scale 5G network in the city of Aveiro. This infrastructure, that will support the expansion of the current automotive testbed, will count with 25 reconfigurable radio units, ready to operate under the 5G standards, connected through optical fibre up to the 5G core, located in IT premises.

To complement the 5G cellular network, the infrastructure will also include a renovated ver-

sion of the vehicular network mentioned before. In detail, each OBU will be equipped with Cellular-Vehicle to Everything (C-V2X) technology. With this technology, OBUs will be able to communicate with each other through the PC5 interface, being capable of achieving higher throughputs when compared to IEEE 802.11p/WAVE technology. This new testbed will also enable the software virtualization in the edge of the vehicular network (i.e. in the OBUs), extending the actual virtualization features solely in the Cloud.

### Conclusion

The IT-Av automotive testbed offers a complete playground for the development and assessment of new ITS applications and network mechanisms. Due to its integrated multi-communication solution and edge virtualization capabilities, the range of services to be explored are countless: road safety (e.g., collision detection, lane change warning, and cooperative merging), smart and green transportation (e.g., traffic signal control, intelligent traffic scheduling, and fleet management), location-dependent services (e.g., point of interest and route optimization), in-vehicle Internet access, and many more.

➤ **Further information** is available on the 5GinFIRE website at <http://5ginfire>.



# 5G-driven efficiency boost for manufacturing

## IEEE 5G World Forum in Dresden



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The second edition of the IEEE 5G World Forum, the flagship event of the IEEE Future Networks Initiative, took place in Dresden, Germany from 29<sup>th</sup> September to 2<sup>nd</sup> October. The event was held in conjunction with the 4<sup>th</sup> IEEE 5G Summit and consisted of a conference, several workshops, and an exhibition. More than 1,000 international participants came to the International Congress Center Dresden to discuss the future of 5G.

### Cautionary messages at the opening

In the opening plenary, Prof. Henning Schulzrinne from Columbia University seemed rather sceptical about the economic success of 5G – at least as far as telcos and equipment manufacturers are concerned. He rather expects that 5G could lead to industry consolidation.



Prof. Henning Schulzrinne



Dr. Thyaga Nandagopal from the US National Science Foundation took a similarly sceptical line. He tried to calm down the hype about 5G that some say might change everyone's life. Dr. Nandagopal warned not to expect too much. That said, he was confident that there would be many interesting new applications enabled by higher bandwidth, lower latency and higher device density.

Dr. Michael Bolle, Chief Digital Officer and Chief Technology Officer at Bosch, was more upbeat about 5G. In the area of mobility, he considers 5G to be an answer to the requirements of V2X, e. g. for platooning or tele-operated driving. In the manufacturing domain, Dr. Bolle sees the high potential of 5G for improving efficiency and cost of production – especially in Bosch's own 180 plants worldwide. This will be needed to respond to the trend of mass customisation, which requires high flexibility and wireless connectivity



Dr. Michael Bolle

as well as flexible device positioning with wireless charging. Especially for safety-critical functions he considers 5G to be better than WiFi.

In terms of 5G deployment, Bosch clearly favours closed and private networks connected to the Bosch factories, either autonomously or provided by telcos and device manufacturers. Dr. Bolle stressed that for Bosch, security and avoiding attacks is crucial.

#### More insights from the conference

In the Worldwide 5G Industry Fora Session, Heinz Bernold from Boston Consulting Group highlighted the operators' increased network costs for 5G; he estimated a 60% increase.

In the plenary session on the second day, Dr. Hannes Ametsreiter from Vodafone Germany

highlighted the importance of 5G's low latency for applications like controlling a drone or remotely controlling building cranes and other equipment.

As an application example for factories he mentioned a recently completed car production plant in Aachen, which is 5G-enabled. This gives high flexibility to the production process, for example by providing almost real-time detailed information on the status of the production process. This information can be stored in a blockchain and monitored any time.

Peter Riedel, President and Chief Operating Officer of Rohde & Schwarz, emphasised that 5G can help in automation and save infrastructure

costs. He said Rohde & Schwarz has seven-digit infrastructure costs every year. Apart from cost-savings, he stressed the importance of security, reliability and low latency as well as high reliability enabled by 5G.

#### Further information

IEEE 5G World Forum website – <https://ieeewf5g.org>

## From 5G experiments to business validation

### 5G-Trials workshop at IEEE 5G World Forum



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Keynote speaker Michael Meyer from Ericsson

**On 1<sup>st</sup> October 2019, the “2<sup>nd</sup> Workshop on 5G-Trials – From 5G Experiments to Business Validation” took place in Dresden. It was part of the IEEE 5G World Forum in Dresden from 30<sup>th</sup> September to 2<sup>nd</sup> October 2019. The workshop was jointly organised by the 5G PPP projects 5G-DRIVE, 5G EVE, 5G-VINNI, 5GENESIS, and SLICENET.**

At the current stage of 5G evolution, the design phase has been successfully completed, the first set of standards has been released, and the commercial rollout has started. In this context, a large number of 5G trials are currently being conducted around the globe. According to IDATE DigiWorld statistics from June 2019, 153 5G trials are currently taking place in the 28 EU Mem-

ber States. The 5G-Trials workshop provided a forum for industry and academics to disseminate new findings on 5G trials and new business development.

The workshop was sponsored by five 5G PPP projects. They included, among others, the three projects that are currently building experimental 5G infrastructures, which will be offered for experimentation to vertical industries for testing innovative 5G applications. From that perspective the organisers are well connected in the 5G community and were successful in distributing the call for papers for this workshop. With 14 paper submissions received, this workshop was ranked number 3 among all workshops. Due to the high quality of papers, 9 out of the 14 papers were accepted. The paper presentations together with

two invited keynote speeches and two panel discussions filled a long and interesting day for the about 40-50 workshop attendees.

#### 5G trials in Europe

In the welcome talk, an overview was given of 5G trialling activities in Europe and showed some statistics e.g. in terms of trials per country, spectrum usage, the participation by vertical sectors in 5G trialling activities and the size of larger trials and first 5G roll-outs around the globe. Media and Entertainment is the sector in which most 5G trials are currently performed, followed by Transport and Automotive.

In the first keynote speech, Michael Meyer from Ericsson gave his view on “Experiencing 5G

in early trials". He said that 5G is being propelled by three areas – massive machine-type communications, critical machine-type communications, and Enhanced Mobile Broadband, where the use cases will be diverse, ranging from Haptic Healthcare to driverless buses and fibre-equivalent residential access. Ericsson's 5G radio and core testbeds have evolved to include an increasing number of 5G features. Trials are being performed in both below 6 GHz but also in mm-wave bands. In the speaker's view, 5G industry trials are important to explore the digital transformation of different industries, and to demonstrate the value of 5G, which he explained by using examples from the mining industry, connected mobility, and connected adaptive production.

In the first paper session, three papers with results related to the 5G PPP trial infrastructure projects were presented. These projects build 5G infrastructures for the large-scale trials carried out by other 5G PPP projects. The first paper, presented by Giada Landi from Nextworks, introduced the experimental architecture developed in 5G EVE, and explained the experimental workflow to be used by other projects. The next paper, presented by Anastasius Gavras from Eurescom, introduced the trial infrastructure of the 5G-VINNI project. 5G-VINNI aims to provide infrastructure as a service to other projects. He explained the conceptual architecture, technical areas covered by the project, and the testing capability of the facility. The third paper was also from 5G-VINNI, but it focused on the business aspect of the project. It explained the strengths, weaknesses, opportunities and threats (SWOT) analysis of the 5G-VINNI facility.

### Use of 5G by verticals

In the second keynote, Panagiotis Demestichas from University of Piraeus presented the 5G Pan-European Trials Roadmap which is being prepared by the 5G Infrastructure Association's 5G Trials Working Group. The presentation provided ample details of ongoing and planned 5G trialling activities in Europe. He also informed the audience about an informative brochure on selected 5G trials and pilots being undertaken by 5G PPP projects. The brochure can be downloaded from the 5G PPP website.

The second paper session was related to the use of 5G technologies for verticals. Two papers were presented. The first paper, presented by Mikko Uusitalo from Nokia, introduced how ultra-reliable and low-latency communication (URLLC) services can be applied to the automation of harbours. The paper investigated, if the latency of 5G networks can satisfy the remote-control needs of crane operation. The second paper, presented by Mark Roddy from Cork Institute of Technology, introduced the network slicing results from the SliceNet project. It showed how the combination of network slicing and edge computing can sup-

port the emergency use case of stroke patients in an ambulance.

The third paper session focused on the evaluation of three 5G use cases. The first paper examined 5G solutions for the media and entertainment industry. Presented by Giuseppe Caruso from Engineering Ingegneria Informatica, the paper introduced three 5G business scenarios in the media industry. It explained also how 5G may affect business relationships of stakeholders in the media industry. The second paper, presented by Eleanor Davies from Lancaster University, presented the performance measurement of a fixed wireless broadband system based on TV white space and millimetre wave in rural areas of UK. It showed that TV white space has potential for stable broadband services in rural areas, while the millimeter wave has limitations due to line-of-sight constraints in irregular terrain. The third paper dealt with the 5G tourism use cases. Konstantinos Katsaros from Digital Catapult presented how 5G technologies can support an augmented reality tour of ancient Roman baths. The 5G key technologies used in the test include multi-access edge computing (MEC) for remote rendering, network slicing, and software defined networking (SDN).

### Panel discussion on 5G trials

Two interesting panel discussions followed the paper sessions. The first one, moderated by Uwe Herzog, focused on results from 5G trials, verticals and business opportunities. The panellists included Dr. Michael Meyer from Ericsson, Dr. Mikko Uusitalo from Nokia, Prof. Panagiotis Demestichas from University of Piraeus, and Mr. Jean-Pierre Bienaime from IREST. The panellists discussed the main conclusions from recent 5G trials, which vertical sectors are the most challenging ones for introducing 5G technologies, and which verticals will be the first to adopt 5G services.

The second panel, moderated by Anastasius Gavras, focused on the challenges for further trialling and beyond 5G research. The panellists included Prof. Riku Jantti from Aalto University, Prof. Slawomir Kuklinski from Orange, Dr. Ville Miemela from University of Oulu, and Dr. Maria



Keynote speaker Panagiotis Demestichas from University of Piraeus



Panellists of the first panel session on Results from 5G Trials, Verticals and Business Opportunities (from left): Panagiotis Demestichas, University of Piraeus; Jean-Pierre Bienaime, IREST; Mikko Uusitalo, Nokia; and Michael Meyer, Ericsson.

Guta from ESA. The panellists shared their opinions on what type of trials are still needed for 5G, what type of experimental infrastructures are needed to support beyond-5G research, and how the 5G infrastructure will be evolved for future services.

### Further information

- Workshop website – <https://ieee-wf-5g.org/workshop-2nd-workshop-on-5g-trials-from-5g-experiments-to-business-validation/>
- 5G PPP brochure "Trials & Pilots" – [https://5g-ppp.eu/wp-content/uploads/2019/09/5GInfraPPP\\_10TPs\\_Brochure\\_FINAL\\_low\\_singlepages.pdf](https://5g-ppp.eu/wp-content/uploads/2019/09/5GInfraPPP_10TPs_Brochure_FINAL_low_singlepages.pdf)

## News in brief

### Libra Association launched

On 15<sup>th</sup> October 2019, the 21 initial members of the Libra Association formally signed the Libra Association charter in Geneva, Switzerland. In addition, they formalized the Libra Association council, elected the Board of Directors, and appointed members of the Libra Association executive team.

Libra is a planned digital currency, which was proposed by US social media company Facebook on 18 June 2019. The mission of Libra is to provide a simple global currency and financial infrastructure for billions of users, including those without access to the financial system. According to a World Bank report, 1.7 billion people, 31% of the global adult population, do not have access to an account at a financial institution or to mobile money. The Libra founders claim to address this problem.

The Libra will be based on blockchain technology, the Libra Blockchain. However, unlike Bitcoin, for example, Libra will not rely on cryptocurrency mining. Only members of the Libra



Association will be able to process transactions via the permissioned blockchain. The evolution of the Libra Blockchain will be overseen by the Libra Association, an independent not-for-profit headquartered in Geneva. The association will be responsible for facilitating the operation of the Libra Blockchain and managing the reserve that backs the currency. The Libra Association will consist of geographically distributed and diverse businesses, nonprofit and multilateral organizations, and academic institutions.

Before the first Libra meeting, seven companies which had participated in the Libra discussions had left: Booking Holdings, eBay, Master

card, Mercado Pago, PayPal, Stripe, and Visa Inc. Since its inception, the project has faced strong criticism. Regulators and politicians criticised that Libra could undermine national sovereignty and the functioning of the global financial system. Privacy advocates have pointed out data protection risks, which could result from Facebook's involvement via its subsidiary Calibra.

#### Further information

Libra website – <https://libra.org>

### Third review of EU-US Privacy Shield

On 23<sup>rd</sup> October 2019, the European Commission published its third annual review report on the functioning of the EU-US Privacy Shield framework, which became operational on 1<sup>st</sup> August 2016.

The Privacy Shield aims to protect the fundamental rights of anyone in the EU whose personal data is transferred for commercial purposes to certified companies in the United States. Today there are about 5,000 companies participating in this EU-US data protection framework.

Since the second annual review, there have been a number of improvements in the functioning of the framework, as well as appointments to key oversight and redress bodies, such as the Privacy Shield Ombudsperson. Among the improvements, the third review notes that the US Department of Commerce is ensuring the necessary oversight in a more systematic manner by, for example, carrying out monthly checks of a sample of companies to verify compliance with Privacy Shield principles. Enforcement action has improved with the Federal Trade Commission taking enforcement action related to the



Privacy Shield in seven cases. An increasing number of EU individuals are making use of their rights under the Privacy Shield, and the relevant redress mechanisms are functioning well, according to the report.

In spite of the improvements, the Commission recommends concrete steps to better ensure the effective functioning of the Privacy Shield in practice. This includes further strengthening the certification process for companies who want to participate by shortening the time of the certification process; expanding compliance checks, including checks concerning false claims of participation in the framework; and developing additional

guidance for companies related to human resources data. The Commission also expects the Federal Trade Commission to further step up its investigations into compliance with substantive requirements of the Privacy Shield and provide the Commission and the EU data protection authorities with information on ongoing investigations.

When the report was published, litigation was pending before the European Court of Justice on EU-US data transfers, which may also have an impact on the Privacy Shield.

#### Further information

- Press release – [https://ec.europa.eu/commission/presscorner/detail/en/ip\\_19\\_6134](https://ec.europa.eu/commission/presscorner/detail/en/ip_19_6134)
- Third Privacy Shield review report – [https://ec.europa.eu/info/sites/info/files/report\\_on\\_the\\_third\\_annual\\_review\\_of\\_the\\_eu\\_us\\_privacy\\_shield\\_2019.pdf](https://ec.europa.eu/info/sites/info/files/report_on_the_third_annual_review_of_the_eu_us_privacy_shield_2019.pdf)

# Face protection

## How to escape facial recognition



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**Facial recognition is becoming ubiquitous. That is great news for marketers, policemen and dictators. Privacy-conscious citizens, however, are not amused. They do not relish the prospect of living in a surveillance society, where authorities and tech giants can monitor every step they make. Are there ways to defy surveillance and escape facial recognition? A few innovators have taken up the challenge.**

### The road to ubiquitous surveillance

Over the past decade, dozens of databases of people's faces have been compiled globally by companies and researchers. Many of these images are shared around the world, thus spreading the use and effectiveness of facial recognition technology. The databases are built on images from social networks, photo websites, dating services, and cameras placed in restaurants and on campuses.

Facial recognition is already commonplace in China: police scan public spaces for suspects, consumers pay their shopping with their faces, and taxes are paid by face as well. Chinese unicorn start-ups like Megvii, SenseTime, CloudWalk, and Yitu are providing solutions, which contribute to the Chinese government's goal of becoming global leader in Artificial Intelligence. The solutions are used by the Chinese government to establish complete surveillance of all its citizens.

Although China may be most advanced in the size and scope of using facial recognition, US tech giants like Google, Facebook and Microsoft are pushing the deployment of this technology as well – and so is the US government. US Immigration and Customs Enforcement officials have employed facial recognition technology to scan motorists' photos to identify undocumented immigrants. And the FBI has used such systems for more than a decade to compare driver's licenses and visa photos with the faces of suspected criminals, according to a Government Accountability Office report.



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Many other countries are quickly adopting facial recognition technology to identify their citizens. In Europe, France is to become the first European country to use facial recognition technology for identifying citizens. The French government is planning to incorporate facial recognition technology into a mandatory digital identity for its citizens.

In November France was to roll out an ID programme called Alicem, an acronym for "certified online authentication on mobile". The Alicem app reads the chip on an electronic passport and checks its biometric photo with the mobile phone user via facial recognition to validate the identity. Once confirmed, the user can access a host of public services without further checks.

France's data regulator, CNIL, has warned that the programme breaches the EU's legal requirement of consent, because it provides no alternatives to facial recognition to access certain services. In addition, there are concerns over data security, as an allegedly secure French government messaging app was hacked earlier in 2019. Sooner or later, it will be hard to find a spot on Earth, where your face is not recognised. More importantly, our faces will be increasingly used as identifiers to withdraw money or pass border controls. This increases the incentives for hackers to steal your digital face and get access to your money and more.

### Blocking facial recognition

Are we completely defenceless against facial recognition? An Israeli start-up says 'No'. The start-

up called D-ID claims to have developed a new solution which blocks facial recognition. Current solutions like eyeglasses that reflect light to jam cameras or camouflaging your face through make-up and fancy headgear are of limited use for not being recognised. Thus, D-ID has gone in a different direction: they replace human faces with computer-generated faces. The modifications are just enough to escape detection by facial recognition algorithms. If you put the original photo and the manipulated image side by side, the changes are noticeable, but on its own the altered picture appears normal. Their solution, called 'Smart Anonymization' can be used for videos and still images.

'Smart Anonymization' removes facial images without processing or profiling the subject. It then replaces the images with AI-generated, photorealistic faces of non-existent people. D-ID claims that these anonymised faces make the technology far superior compared to legacy solutions which rely on blurring or pixelation. The anonymized faces preserve key non-identifying attributes of the original face including age, gender, expression, gaze direction and more. According to D-ID, this allows for analytics to be performed while respecting privacy laws and regulations.

### Alternatives and open questions

As elegant as D-ID's solution appears, it is not a panacea for escaping facial recognition. First of all, many people already have unaltered photos of themselves on the Web, which have already been stored and processed in the databases of



tech giants and authorities. Second, it is not unlikely that AI-powered facial recognition systems will further advance and either link anonymized faces to real faces in the database or at least mark the manipulated photos as such and deny access.

Recently, a woman from the Chinese city of Wenzhou found out that after plastic surgery, her access to all kinds of services that require facial recognition was blocked. Among others, access to payment services and online shops was denied, because the systems could not identify her anymore. Her doctor recommended that she should just register again on the central identification system. I have no information how that worked out, but at least it meant a lot of hassle for the woman.

What alternatives are there? Some designers have been very imaginative in designing anti-surveillance hijabs, fashionable camouflage, photo-realistic, 3D-printed face masks, and seemingly random patterns printed on shirts to dazzle computer algorithms.

Outside of China, you might get away with such fancy trickery. However, the moment you go through security at an airport, your camouflage will only get you in trouble - instead of an AI system, a flesh-and-blood police officer will identify you.

Does this mean there is no escape from facial recognition and a surveillance society like in China? Not necessarily. Even if technical means may be too limited to fool facial recognition sys-

tems, democratic societies offer more potent means to stop tech giants and authorities from spying on us - public debate and legislation. It may take more time than donning a face mask, but it could be more effective in the long run.

**✦ Further information**

Website of Israeli start-up D-ID - <https://www.deidentification.co>



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