

# CELTIC News 2/2020

The newsletter of EUREKA Cluster CELTIC-NEXT

CELTIC Chair's Corner  
How Eureka Clusters keep reinventing  
themselves

Public Authority Profile  
Austrian Research Promotion Agency – FFG

Eureka  
Interview with Eureka Chairman Ulrich Schuh

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IMPRINT

CELTIC Office  
 Dr. Peter Herrmann  
 CELTIC Office Director  
 c/o Eurescom GmbH  
 Wieblinger Weg 19/4  
 69123 Heidelberg, Germany  
 Phone: +49 6221 989 381  
 Email: office@celticnext.eu



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

CELTIC-NEXT Call for Project Proposals – Deadline: 12<sup>th</sup> April 2021

**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 12<sup>th</sup> April 2021.**

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 proposal is 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 2021.

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

### Contact:

CELTIC-NEXT Office  
 office@celticnext.eu  
 Peter Herrmann  
 herrmann@celticnext.eu  
 Website: [www.celticnext.eu](http://www.celticnext.eu)



# How Eureka Clusters keep reinventing themselves



Valérie Blavette  
Orange  
blavette@celticnext.eu

In order to effectively foster innovation, the Eureka Clusters, including CELTIC-NEXT, are constantly innovating themselves. This is why we are currently setting up a new Eureka Clusters Programme that increases synergies between Clusters. This new programme was designed during the former Dutch Eureka Chairmanship and is being implemented during the current Austrian Chairmanship, whose motto is "Towards a New Eureka". It is impressive to see how an Intergovernmental organisation that was created in 1985 is so dynamic, flexible and future-looking to enhance collaboration at a global scale.

It was decided to set up a new governance structure for the Eureka Clusters Programme, which is based on new bodies for representing both the Public Authorities and the Cluster communities, as well as to facilitate dialogue between the industry and the national funding bodies.

## New governance for better public-private dialogue

For enhancing the public-private dialogue, the Public Authorities Committee (PAC) has been set up at director's level with representatives of over 20 countries at the time of writing. In addition, the Clusters Committee (CC) has been formed, with three industry representatives of each Cluster.

The kick-off meeting of the ECP programme took place on 15th October. In the meeting, the PAC and CC members discussed the importance of the Eureka Clusters for their respective company, industry and community as well as some strategic and topical priorities.

CELTIC-NEXT is represented by Vincent Marcatte, Orange Vice President, Julie Byrne,

Nokia Head of Partnerships and David Kennedy, Director of Eurescom.

At the time of writing, the new Public Authority Committee (PAC) had already gathered 19 participating countries, chaired by the UK.

## Agreeing on strategic priorities

When industry and the Public Authorities will agree on some strategic topic, it will be reflected in the Multi-Annual Plan (MAP) of the ECP. When the MAP will be finally approved in June 2021 thematic calls among a set of clusters or at individual level will be decided for the next four years, starting with the most urgent ones. Among the topics and challenges high on the agenda of both the Public Authorities and the PAs are AI, Green Deal, Cybersecurity and Beyond 5G/6G.

Denmark and South Korea have proposed a new joint Cluster call on "Technology driven Green Transition" that could take place already in the transition period with projects funded already in 2021, if enough countries can join.

## The Central Coordinating Function and the CC Support Group

The new ECP will be supported by the Central Coordination Function (CCF) that will be half funded by the PAs and half by the clusters. Nadja Rohrbach, who has been working at the Eureka Secretariat in charge of Clusters since more than two years, seconded by the German Ministry for Education and Research (BMBF), has been in charge of the CCF from the PA side since last summer.

The Cluster Committee will be assisted by a Support Group, where CELTIC will be represented by Jari Lehmusvuori from Nokia, Antonio Cuadra Sanchez from Indra Minsait, Peter Herrmann, Celtic Office director, and the CELTIC-NEXT Chair.

## CELTIC-NEXT and the Eureka Clusters AI call

CELTIC-NEXT paved the way for the new governance during its Inter-Cluster Spokespersonship. We started seizing the opportunity of AI being high on the agenda of both industry and a number of Public Authorities by setting-up the first AI call jointly organised by CELTIC-NEXT, Eurogia, ITEA, PENTA and

Euripides. It was both a collective challenge and an educating experience. A new cluster tool and portal had been developed by Eurescom specifically for this first joint call.

The clusters attracted 16 countries who gave their financial support to that call including Singapore, which is new in Eureka. By mid-June, when the call ended, we received 41 valid project proposals.

For this first joint call it was decided to synchronise label and funding decisions wherever possible. The supporting Public Authorities agreed to participate to a pre-consensus and a consensus meeting where the decision to label / fund projects from all clusters was examined, taking into account the evaluations both from the cluster technical experts and from the PAs.

Finally 16 projects were labelled and a quick path for funding of those projects has been explored by the countries.

## Open to the verticals and to challenges

The Eureka Clusters keep innovating, and CELTIC-NEXT is open for more joint initiatives and challenges that advance European and global innovation in the smart connected world domain. For our autumn call we organised once again a joint call with Eurogia, the Cluster on low carbon energy. In mid-September we had an exciting joint proposers day with over 200 registered participants, and a new brokerage tool. This is just one example for a converged industry effort including the verticals, which shows how CELTIC-NEXT contributes to the new Eureka Clusters Programme.

## Conclusion

After two years of dense activity as CELTIC-NEXT Chair, I am now required for a new position inside Orange.

Through my roles as CELTIC Chair and Inter-Cluster Spokesperson, I have been happy to contribute to increasing the interest of the Public Authorities towards CELTIC-NEXT and Eureka Clusters in general.

As for me, I will still participate as CELTIC-NEXT Core-Group member from Orange.

Last but not least, I wish all the best to my successor and to CELTIC-NEXT!

# Next generation communications meets clean energy

## Virtual Proposers Day of CELTIC-NEXT and EUROGIA2020



Milon Gupta  
CELTIC Office  
office@celticnext.eu

The second Proposers Day held by CELTIC-NEXT and EUROGIA2020 on 15–16 September 2020 was quite different from the first edition, which took place on 29th January in Madrid at the Nokia premises. This time, the COVID-19 restrictions made an in-person event impossible. Thus, the Proposers Day was held as a virtual event. The positive aspect was that the number of registered participants doubled to over 200. Also the number of proposal ideas for the joint CELTIC Eurogia Call in autumn increased, from 12 to 15. And no less than 11 Public Authorities presented funding opportunities in their countries.

Due to the successful first joint proposers day, CELTIC-NEXT and EUROGIA2020 had decided to bring together both Eureka Cluster communities again for the autumn call that was open until 19th October. Responding to the growing need for cross-cutting approaches and synergies between Eureka Clusters, the goal of the joint call was to expand knowledge, boost visibility and promote cooperative efforts for innovative results. The second joint Proposers Day offered a discussion forum for organisations interested to participate in a collaborative research project via CELTIC-NEXT in the area of next generation communications or via EUROGIA2020 in the area of low-carbon energy technologies.

### Welcome and keynote

The first day of the event started with welcome speeches by Valérie Blavette, Inter-Cluster Spokesperson and CELTIC Chairperson from Orange, and Sinem Altuncu, EUROGIA2020 General Manager from Paycore. This

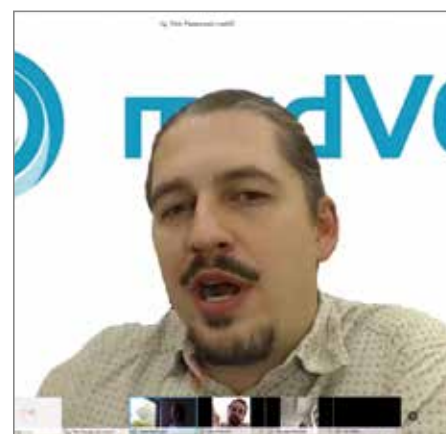


Keynote speaker Dr. Heiko Lehmann from Deutsche Telekom's T-Labs

was followed by a keynote on cybersecurity challenges, given by Dr. Heiko Lehmann from Deutsche Telekom's T-Labs. According to Dr. Lehmann, the rapid evolution of cybersecurity threats creates growing market opportunities.

### Session on proposal submission

After the inspiring beginning, it was time to get to the nuts and bolts of proposal submission. Pierre Besse, Vice-President of EUROGIA and Dr. Peter Herrmann, CELTIC Office Director presented how easy it is to submit a project to the Joint Call. Both presented the

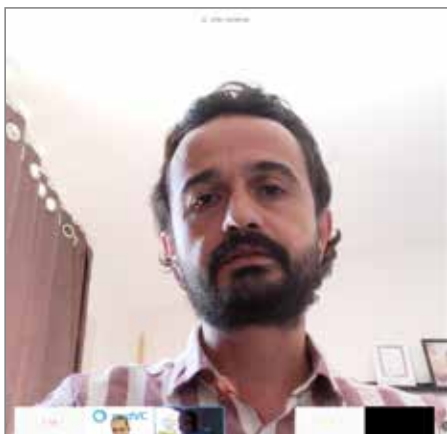


Piotr Pawalowski, Vice-President and CTO of medVC

eligible subjects of their respective Cluster and explained the requirements for a successful project proposal and how the online submission tool can be accessed. In addition, they explained the timeline and the evaluation process for proposals by technical experts and Public Authorities.

### Business Impact from CELTIC and EUROGIA projects

If some participants were wondering about the benefits of getting involved in Eureka Cluster projects, they got convincing answers in the session on business impacts from CELTIC



Utku Korkmaz, CEO of Solarcati

and EUROGIA projects, which was moderated by Pierre Besse from EUROGIA2020. In the first presentation, Dr. Antonio Cuadra-Sanchez presented the business benefits which his company Minsait (part of Indra Sistemas S.A., Spain) gained from its multiple participations in CELTIC projects, in particular the award-winning NOTTS project on next generation over-the-top multimedia services.

The business example for EUROGIA was equally convincing. Sahin Calglayan from Turkish Energy IoT Platform provider Reengen presented the benefits and impacts of EUROGIA project SolarPact.

### Funding and focus in different countries

On the second day, representatives from 11 Public Authorities presented in a session moderated by CELTIC Programme Coordinator Christiane Reinsch the funding situation and research focus areas in their respective country. The countries and representatives included: Austria – Michael Walch, FFG; South Africa – Toto Matshediso and Vinny Pillay, DST; Canada – Narayanan Kasturi, NRC-CNRC; Israel – Neta Gruber, IIA; Turkey – Umut Ege, TUBITAK; Finland – Hannu Nurmi, Business Finland; Germany – Sabine Hemmerling, DLR; Spain – Juana Sanchez, CDTI; Switzerland – Colette John-Grant, InnoSuisse; South Korea – Hye-wook Joung, KIAT; and Singapore – Navjeev Singh, Enterprise Singapore.

Singapore and South Africa were for the first time represented at a Proposers Day, which shows the growing international reach of CELTIC-NEXT and EUROGIA2020.

### Successful SMEs

The session on successful SMEs, moderated by CELTIC Office Director Dr. Peter Herrmann, featured two success stories of SMEs which had benefitted significantly from their involvement in the respective Cluster project.



Joint CELTIC-NEXT and EUROGIA2020 call timeline



Presentation by Navjeev Singh from Enterprise Singapore

Piotr Pawalowski, Vice-President and CTO of medVC, a Polish medical collaboration tool provider, explained how medVC developed major elements of its services through participation in CELTIC projects. The SME from Poznań had participated in the award-winning CELTIC project “HIPERMED – High Performance Telemedicine Platform” and the also award-winning successor project “E3 – E-health services Everywhere and for Everybody”. Today, medVC has a growing business, meeting the increasing telemedicine service demands by hospitals and patients.

Utku Korkmaz, CEO of Solarcati, presented how his company, a Turkish solar panel service provider in Turkey, is benefitting from its participation in EUROGIA2020.

### Project idea pitches

Another core element of the Proposers Day was the pitching of project ideas. 15 proposers presented their ideas on a wide range of ICT and energy topics. The presentations led to productive discussions, which were moderated by Christiane Reinsch from the CELTIC Office. CELTIC Consortium Building Sessions had been organized and announced to support the participants to find partners and build a successful proposal.

### > Further information

> Proposers Day page on the CELTIC-NEXT website – <https://www.celticnext.eu/celtic-eurogia-online-proposers-day-15-16-september-2020/>

# How Austria supports CELTIC-NEXT projects

## The Austrian Research Promotion Agency (FFG)



Michael Walch  
Eureka National Project Coordinator  
Austrian Research Promotion Agency (FFG)  
michael.walch@ffg.at

The Austrian Research Promotion Agency (FFG) is the one-stop shop national funding agency for industrial research and development in Austria. All FFG activities aim to strengthen Austria as a research and innovation centre on the global market. Thus, the FFG helps to assure jobs and wealth sustainably as well as to make a lasting contribution to the strength of the Austrian economy.

The FFG is wholly owned by the Republic of Austria and subsidized by the Federal Ministry for Climate Action, Environment, Energy, Mobility, Innovation and Technology (BMK) and the Federal Ministry for Digital and Economic Affairs (BMDW). As a provider of innovation

enabling services, the FFG is also active on behalf of other national and international institutions.

### Involvement in Eureka and CELTIC-NEXT

As part of its activities, FFG supports Eureka as an initiative to encourage collaboration between organisations across Europe and beyond in the near-market development of new and innovative advanced technology products, processes and services. With this strong market orientation, Eureka complements the EU's strategic research programmes. The flexible Eureka programmes offer multiple opportunities for SMEs, large companies, universities and research organisations.

Eureka Clusters like CELTIC-NEXT are industry-led initiatives that focus on technology areas of strategic interest. Projects are driven by communities of large companies, SMEs, universities, research institutions and end users. The aim is to promote development of new products and applications through networking and to strengthen the European economy on the world market.

FFG actively supports CELTIC-NEXT and provides the required funding to Austrian companies, in line with the distributed public-private partnership model that Eureka clusters employ. Likewise, FFG funding schemes play an important role in gener-

ating new knowledge, developing new products and services, and enhancing competitiveness in the global marketplace. They make it easier, or possible, to finance innovative projects, and help to absorb the risks involved in research.

Information about the process for submitting a successful project proposal and funding conditions in Austria can be found on the FFG's CELTIC-NEXT page at: <https://www.ffg.at/europa/eureka/cluster/celtic-plus>

### Case study – CELTIC project ASUA

A good example of a successful CELTIC project with Austrian participation is ASUA, a collaboration between 8 consortium partners from 5 countries dedicated to Advanced Sensing for Urban Automation. The research work of the two Austrian consortium partners Geodata Ziviltechnikergesellschaft and Montanuniversität Leoben included the development of a system for the introduction of Smart City technologies in urban tunnel construction. The system called UrbMics is composed of (i) a multifunction box (UrbMics box) for local storage, intelligent processing and wireless transmission of monitoring data of a tunnel construction site, (ii) a wireless sensor network (UrbMics WSN) as well as (iii) an associated web-based information and control

center (UrbMics center) to control the multifunction boxes and manage their data. In the project, the components have been specified, planned, developed, implemented and tested and validated on an ongoing, urban tunnel construction site. For this, Smart City application scenarios defined within the framework of the CELTIC project have been designed and implemented. The UrbMics platform is integrated into an ASUA reference platform and has also been used by other CELTIC project partners to validate their technologies.

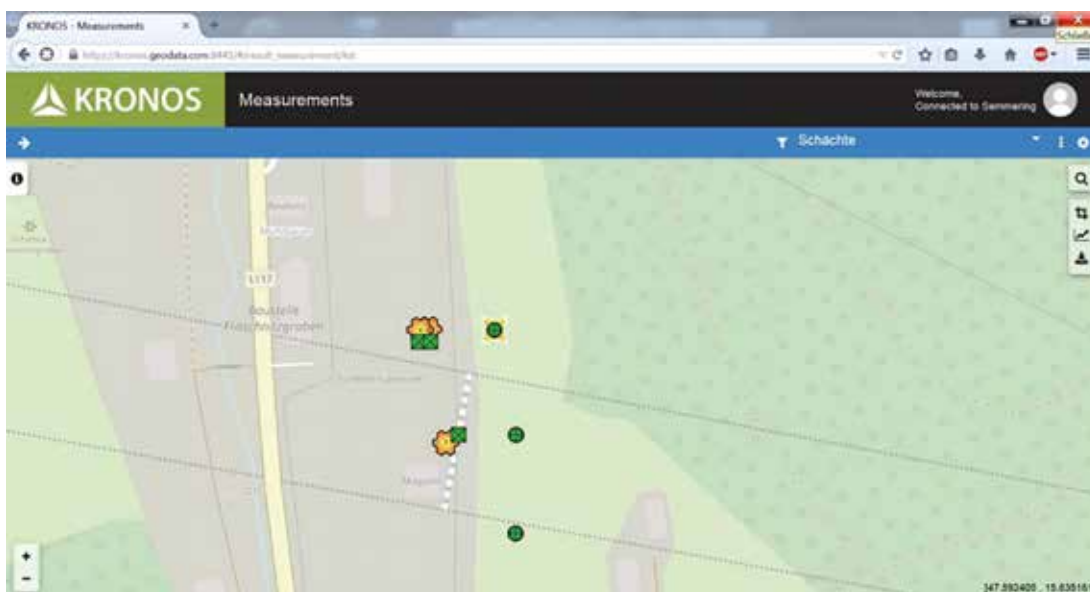


Figure 1: Two UrbMics box field prototypes prepared for construction site installation, left: with, right: without built-in UrbMics WSN components).

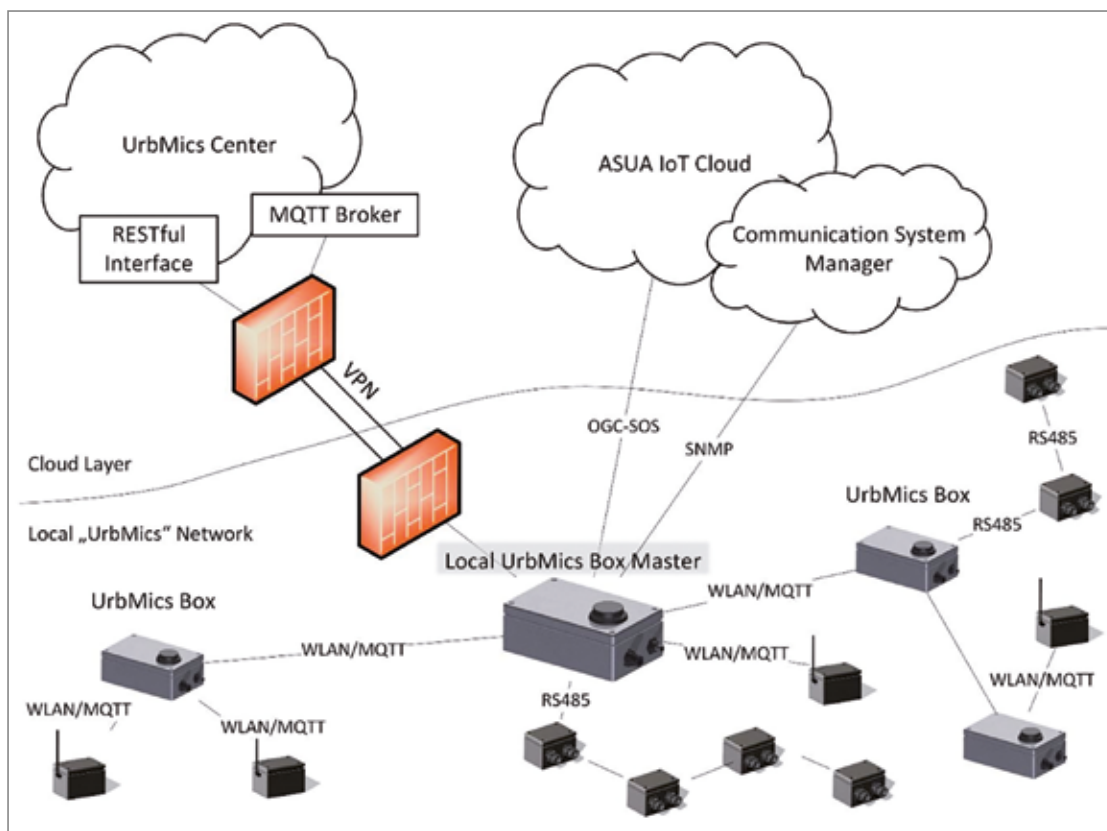


Figure 2: Integration of the UrbMics overall system into the UARP (Urban Automation Reference Platform).

The Austrian end result are operational prototypes of the systems UrbMics box, UrbMics WSN and UrbMics center and field tests of the prototypes.

### Outlook

Austria, as one of the founding members of Eureka, takes over the chairmanship of the network in 2020/2021 and will pave the road "Towards a New Eureka". Accordingly, in the upcoming year the network will prioritise the further development of Eureka's programmes, global outreach and internal cooperation. All core activities of the Austrian Chairmanship are built around the celebration of 35 years of Eureka. Thereby, one of the important topics is the revitalization of the Eureka Clusters. The goal is to renew the successful Eureka Clusters model to provide the best opportunities for global RDI in the time to come. Likewise, at FFG we look ahead to a bright future with CELTIC-NEXT and the projects generated in this programme.

### > Further information

- > FFG website – <https://www.ffg.at/en>
- > CELTIC project ASUA – <https://www.celtic-next.eu/project-asua/>



Figure 3: Web interface of the UrbMics center, map showing 3 UrbMics boxes and 6 sensor positions).

# More synergies and global cooperation in Eureka

## Interview with Eureka Chairman Ulrich Schuh

On 1<sup>st</sup> July, Austria took over the Eureka Chairmanship for one year – already for the second time in the 35-year history of Eureka. The ambitious motto of the Austrian Chairmanship is “Towards a New Eureka”. CELTIC News editor Milon Gupta asked Eureka Chairman Ulrich Schuh from the Austrian Research Promotion Agency (FFG), which hosts the Chairmanship on behalf of the Ministry for Digital and Economic Affairs, about the ambitions and plans behind this motto.

### Which challenges and opportunities do you see for Eureka today and tomorrow?

U. Schuh: Since the foundation of Eureka, the world has changed fundamentally and also the conditions for international cooperation in the field of innovation. Eureka faces the challenge that member countries currently have a wide set of opportunities at hand that allow the support of innovative companies at European and global level. So Eureka has to prove its added value. At the same time, the model of Eureka that is based on the principle of variable geometry and a decentralised organisation is more modern than ever. This has allowed Eureka to become a truly global organisation with 47 countries in its network.

### What are the main priorities of the Austrian Eureka Chairmanship?

U. Schuh: The Austrian Chairmanship is guided by the slogan ‘New Eureka’, which is also the headline of the new Strategic Roadmap approved during the last Dutch Chairmanship. We have three priorities. First, new instruments will be launched during this year: the new Eurostars Partnership with the European Commission and especially the New Clusters Programme. Second, Austria will intensify and enlarge global cooperation within Eureka. We are proud to welcome Singapore to our network during our Chairmanship.



Third, we will improve our services for our stakeholders and want to encourage all Eureka countries to be even more engaged in the activities of our network.

### Which enhanced roles do you anticipate for the current Eureka Clusters in the new Eureka Clusters Programme?

U. Schuh: The Clusters are a success story of Eureka, but we have also understood that the potential of the Clusters programme has not yet been fully exploited. In order to boost the impact of the Clusters, we want to increase their visibility to potential stakeholders and to use synergies to improve efficiency and effectiveness. Visibility will be enhanced by synchronised thematic calls developed in cooperation with the existing Cluster communities. Synergies will be realised by the close cooperation of Cluster Communities through a multi-annual strategy and an annual work programme. The synchronised Call on Artificial Intelligence is a first successful pilot in this respect.

### How is the involvement of non-European countries like Canada and Korea enhancing the Eureka network?

U. Schuh: At its foundation, Eureka allowed Member States of the European Union to benefit from cooperation with EFTA countries in order to establish a Western European alternative in research, development and innovation to global competitors. Meanwhile, Eureka is a truly global organisation with 47 countries. The non-European Eureka countries have proven to be an essential asset of Eureka. Korea became a partner country in 2017; Canada is also very active and has for example initiated the COVID-19 ECHO call in April this year. Also, our other associated countries – South Africa, Chile and Argentina – are reliable partners in the Eureka family.

### How should the Eureka programmes add value in the evolving European and global innovation landscape?

U. Schuh: After 35 years the Eureka model of cooperation is more relevant than ever. The most pressing current challenges of countries in Europe and all over the world are the COVID-19 pandemic and climate change. It is understood that these challenges cannot be solved at local, regional, national or even at European level. Here, global cooperation is inevitable, and this is true especially in the field of technology, where solutions have to be developed. Whenever two companies from two different countries are developing an R&D project, Eureka is the most suitable platform to support this initiative. We have the infrastructure in place, the available funding, efficient procedures, and via the Globalstars programme we reach out all around the world far beyond our current 47 countries.



# VIRTUOSE

## Virtualized video services



Mehmet Dagli  
Netas  
mdagli@netas.com.tr



Tiia Ojanperä  
VTT Technical Research Centre of Finland Ltd.  
tiia.ojanpera@vtt.fi



Serhan Gül  
Fraunhofer HHI  
serhan.guel@hhi.fraunhofer.de

The motivation for CELTIC project VIRTUOSE was to develop video services that are scalable, secure and easily deployable on different computing platforms. This was achieved by using cloud computing and virtualization techniques for deployment of video services in order to realize different core use cases.

The three-year project (2016-2019) contributed to several R&D areas in the context of the core use cases. VIRTUOSE was a joint undertaking of 19 industrial and research partners from five European countries: Finland, Germany, Romania, Spain and Turkey. Nokia was the project coordinator and VTT the technical coordinator in VIRTUOSE.

### Approach

The four core use cases studied during the project were: cloud gaming, multiparty video communications, video transcoding & distribution, and video analytics. These video services benefitted from virtualized components and a common system architecture, allowing easy and dynamic video service deployment and scaling. Within the work areas, several sub-use cases were analysed and their implementations showcased in the form of demonstrators.

Novel cloud computing techniques, consisting of virtualization solutions, such as KVM, and Linux containers, such as Docker and LXC, were used to containerize the video services. Rancher was deployed to manage containerized service instances. In this manner, the VIRTUOSE architecture is able to offer solutions to the trade-off between distribution of the computation and localization of the data, as well as making the source code portable to different virtualized platforms.

### Achieved results

The main results of the VIRTUOSE project include a common architecture for the different



Figure 1 shows the applications targeted by VIRTUOSE and a common framework for their realization.

core use cases and virtualized components for video coding, analysis and streaming that can be easily deployed, maintained and scaled using lightweight containers. The project advanced the state-of-the-art through several algorithmic and system-level contributions in different domains.

For the cloud gaming use case, a low-latency video encoder was developed using a low-complexity approach called logarithmic hopping encoding (LHE). The implementation was published as open source and integrated in the popular multimedia framework FFmpeg. For the video transcoding & distribution use case, Docker was used to containerize different video services and showcase a scenario where a video service provider sets up a new video distribution service for end users. In the developed demonstrator, video is transcoded in real-time, streamed over a content delivery network (CDN), and accessed with a HbbTV compatible set-top box. Virtualizing different components of the processing and transmission chain significantly advanced the flexibility, time to market and scalability of video-on-demand (VoD) services.

For the multiparty video communications, a new motion adaptive layer selection algorithm was developed, which provides continuous video delivery and highly increased quality of experience (QoE), especially on high motion activity video streams. Furthermore, an adaptive approach was adopted, in which containers for video conferencing services are scaled based on the number of participants. Efforts in the video analysis were focused on the development of low-complexity algorithms and approaches based on neural networks that provide high accuracy. Specifically, an object tracking algorithm was developed that operates directly on compressed video data, and a new approach for object detection was developed that allows weakly-supervised training using transfer learning and synthetically generated training data. Several analysis algorithms were integrated into a virtualized platform for camera-based vehicle management in challenging parking lot environments.

Live demonstrators were showcased in both project-specific and public events. The VIRTUOSE consortium also actively disseminated the results in scientific, industrial and

standardization forums.

### Conclusion

VIRTUOSE contributed to several R&D areas, ranging from computing, telecommunication and image processing to artificial intelligence and neural networks, thanks to the wide coverage of the considered use cases. Development of a new low-latency video encoder for cloud gaming, VoD service streaming through CDN by using virtualized components for video encoding and distribution, introduction of a new motion adaptive layer selection algorithm for video conferencing and low complexity algorithms based on neural networks for video analysis were the main achievements. The project also conducted successful demonstration, dissemination and exploitation activities, including scientific and technical papers, patents applications, master and PhD studies and participation to a number of events and exhibitions.

### > Further information

> VIRTUOSE project page – <http://www.tut.fi/virtuose/>

## 4KREPROSYS

### 4K ultra-HD TV wireless remote production systems



Anthony Convers  
HEIG-VD/REDS  
anthony.convers@heig-vd.ch



Marco Mattavelli  
SCI-STI-MM/EPFL  
marco.mattavelli@epfl.ch



Romuald Mosqueron  
HEIG-VD/REDS  
romuald.mosqueron@heig-vd.ch

The CELTIC project 4KREPROSYS developed a new integrated cost-effective approach for the production of 4K TV content. The solution is capable of covering the needs from indoor studio production up to difficult mobile outdoor production at large events. High-performance video compression for low-bandwidth usage, remote production capabilities and “all-IP” connectivity are the principle of the solution.

The production system was built by developing an integrated IP-based wireless system that can be used in the event production venues to capture audio-visual content in HD and Ultra-High Definition (UHD), including High Dynamic Range (HDR) formats ideal for covering large-scale sporting events, which require high outdoor mobility, with state-of-the-art image quality.

### Main goals

The evolution of multimedia content and associated services towards improved user experience must rely on higher resolutions and more immersive and interactive formats. However, this is only possible if the production of such contents is economically viable and fully compatible and scalable with the production of traditional content formats. Previous production technologies and systems were the results of an “ad-hoc patchwork” of different components based on often non-compatible or non-appropriate



*New HEVC low-delay wireless system used during FIFA world cup*

legacy technologies that need to be integrated with difficulties and deployed in the field with very heavy and costly logistic means. New emerging and powerful technologies such as MPEG HEVC video compression, Internet/IP based wired and wireless connectivity with high bandwidth and low latencies, provided the motivation to re-think and re-design the essential components of TV content production infrastructures in a unified integrated approach.

The project focused its investigations and developments on the integration of MPEG HEVC and IP-based communications carrying content and service signals for both wireless and wired production components. The goals were to study, develop and experiment in the field production systems that support high performance (i.e. very high bitrates) for high-quality UHD and advanced multi-view formats, including high robustness for reaching high levels of reliability for indoor and highly mobile outdoor settings. Major challenges were to implement very powerful processing systems in compact and battery-operated assemblies. Moreover, the systems were required to answer to the new location approach of the TV studio infrastructure, traditionally deployed in the field, which is becoming a “virtual” component that can be locally or remotely deployed according to the best logistic (i.e. economical) solution for the specific production operation.

### Approach

The technologies developed to design the new 4K production systems are:

- › Ultra-low latency MPEG HEVC encoding and decoding (the only compression standard that provides the necessary performance to compress 4K TV signals to reasonable bitrates with full studio quality).
- › Low-latency IP-based wired and wireless communication links for local and remote production for both audio-video UHD and service signals.
- › Low latency switching and synchronization of compressed streams without packet loss for the mixing and multiplexing of wired and wireless content and service streams.
- › Low-latency content protection for on-line encryption of compressed streams.

### Main results

The new audio-video codecs and wireless transmitters developed by the project made possible to master a complete RF recording & transmission infrastructure supporting 4UHD resolution. Another innovation on the production side was the approach based on integration and transmission of IP signals for both content and services. Multiplexing of audio, video and service data managed at the very beginning of the chain enabled the reduction of the number of frequencies needed for production events. By realizing robust and reliable bi-directional full-IP connectivity, the

project has made it possible to deploy production configurations with full remote studio control.

Applied to a post-production distribution chain, the technologies developed in 4KReProSys can also be used for increasing QoE in broadcast services and support new contribution concepts.

### Conclusion and outlook

The major result of the project is a fully integrated production system, controlled by a remote studio via a low-band width communication infrastructure, for the production of UHD TV resolutions capable of covering highly mobile outdoor sport events. In July 2018, AMP-VISUAL-TV was able to set up and manage with full success the transmission of all wireless 4K cameras used for one month to cover 12 stadiums during the FIFA World Cup event in Russia.

The most visible European business perspective will be the possibility of all television and production companies to profit from the new 4K wireless and all-IP production capabilities associated to the new low-bandwidth remote production possibilities.

For the results achieved, the 4KReProSys consortium won a prestigious European distinction, the CELTIC Excellence Award for Multimedia.

### › Further information

- › 4KReProSys project page - <https://www.celticnext.eu/project-4kreprosys/>



#### About CELTIC-NEXT

CELTIC-NEXT is the EUREKA Cluster for next-generation communications enabling the inclusive digital society. CELTIC-NEXT stimulates and orchestrates international collaborative projects in the Information and Communications Technology (ICT) domain. The CELTIC-NEXT programme includes a wide scope of ICT topics based on new high-performance communications networks supporting data-rich applications and advanced services, both in the ICT sector and across all vertical sectors.

CELTIC-NEXT is an industry-driven initiative, involving all the major ICT industry players as well as many SMEs, service providers, and research institutions. The CELTIC-NEXT activities are open to all organisations that share the CELTIC-NEXT vision of an inclusive digital society and are willing to collaborate to their own benefit, aligned with their national priorities, to advance the development and uptake of advanced ICT solutions.

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

