

Winter 2020

EURESCOM message

The magazine for telecom insiders

CELTIC News 2/2020



ICT for Smart Sustainable Cities

The Kennedy perspective
Critical thinking in the age of fake news

Events
European Research and Innovation Days

A bit beyond
Excel accidents





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

CELTIC-NEXT Call for Project Proposals – Deadline: 12th 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 12th 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 Website. Please talk to your national contact early in the process.

Easy proposal process

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- › 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

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Dear readers,

For most of 2020, the world has been struggling with the COVID-19 pandemic. Short-term crisis management has dominated the agenda worldwide and in the EU member states. At the same time the European Union has been pursuing its longer-term vision of becoming the first climate-neutral continent. With the European Green Deal plan, the EU aims to make its economy sustainable by reducing net emissions of greenhouse gases to zero by 2050. The goal is to achieve this by decoupling economic growth from resource use, and by making the transition just and inclusive.

Cities play a key role in the transition to a sustainable economy and society. Most Europeans live in cities, and cities are responsible for the largest share of greenhouse gases. Many initiatives and projects are under way to make cities sustainable. And information and communication technologies are of key importance for enabling cities to become sustainable. The concept for doing this is called “smart sustainable cities”.

In this issue of Eurescom message, we explore what is done in Europe to make cities smart and sustainable. We present selected research and

innovation projects that have contributed to implementing the vision of smart sustainable cities.

In the first article of the cover theme, Eurescom message editors Milon Gupta and Anastasius Gavras give an overview on ICT for smart sustainable cities. The next article presents the European smart cities project STARDUST, which has developed solutions for urban sustainability. In the following contribution, a team of Norwegian researchers from Telenor and NTNU explains the approach of the 5G SOLUTIONS project for co-creation of smart sustainable cities.

In an exclusive interview for Eurescom message, Covenant of Mayors board member Eckart Würzner talks about the sustainable development of European cities and the challenges ahead.

In the final article of the cover theme, the two authors from Orange Romania present a specific solution for 5G powered smart lighting in smart cities, which was developed in the smart city pilot of 5G PPP project SliceNet.

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 Ken-

nedy on the importance of critical thinking in the age of fake news in his column “The Kennedy Perspective”. Under “Events”, we report about two important virtual events – the 5G World Forum and the European Research and Innovation Days. See also our “News in brief” section, which features the 5G PPP White Paper on 5G for verticals as well as the latest sales trends for service robots. Finally, in the latest “A bit beyond” article you can learn about the economic and social risks of spreadsheet errors.

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. Enjoy reading our magazine!

At the end of this remarkable year, we wish you happy winter holidays and all the best for 2021, especially good health.

Milon Gupta
Editor-in-chief





EVENTS CALENDAR

2 December 2020

CELTIC-NEXT Day

Virtual event

<https://www.celticnext.eu/event/celtic-next-day-2-december-2020/>

6 – 10 December 2020

European Conference on Optical Communications – ECO2020

Virtual conference

<https://ecoco2020.org>

7 – 11 December 2020

IEEE Global Communications Conference – Globecom 2020

Taipei, Taiwan / Virtual

<https://globecom2020.ieee-globecom.org>

9 – 12 January 2021

18th IEEE Consumer Communications & Networking Conference – CCNC 2021

Virtual conference

<https://ccnc2021.ieee-ccnc.org>

1 – 4 March 2021

24th Conference on Innovation in Clouds, Internet and Networks – ICIN 2021

Virtual conference

<https://www.icin-conference.org>

8 – 11 June 2021

EuCNC & 6G Summit

Porto, Portugal

<https://www.eucnc.eu>

14 – 18 June 2021

IEEE International Conference on Communications – ICC 2021

Montreal, Canada

<https://icc2021.ieee-icc.org>

28 June – 1 July 2021

MWC Barcelona 2021

Barcelona, Spain

<https://www.mwcbarcelona.com>

SNAPSHOT



Another virtual meeting

The new reality of European research and innovation events in times of corona looks like this: two people – Jean-Eric Paquet, Director-General Research and Innovation, and Mariya Gabriel, Commissioner for Innovation, Research, Culture, Education and Youth – are standing on a stage in Brussels. The four panelists in their session sit in their (home) offices across Europe. And so do all the participants watching the panel session. The snapshot, or in this case rather screenshot, was taken at the European Research and Innovation Days on 22nd September 2020.

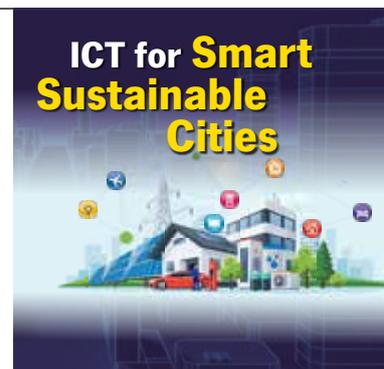


Further information is available on the European Research and Innovation Days website at

<https://research-innovation-days.ec.europa.eu/> and in the event article in this issue of Eurescom message.

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Imprint

Eurescom message, winter issue 2020
ISSN 1618-5196 (print edition)
ISSN 1618-520X (Internet edition)

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Eurescom message is published twice a year. Eurescom message on the Web: <http://www.eurescom.eu/message>

Data Protection Declaration: <https://www.eurescom.eu/data-protection-declaration.html>

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Critical thinking in the age of fake news



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It is concerning me when I see people that I considered sensible sharing unfounded and even false information through social media. The truth has become a flexible commodity today, and seemingly sensible people are proposing “alternative facts” as the truth, mainly because they are too lazy to find the truth.

Intelligent people like Carl Sagan saw this coming. In May 1996 he said: “We’ve arranged a society based on science and technology, in which nobody understands anything about science and technology. And this combustible mixture of ignorance and power, sooner or later, is going to blow up in our faces.”

The scope of the problem

In his 1985 novel “Contact” Sagan posed the thought that: “In the long run, the aggressive civilizations destroy themselves, almost always.” This is raising the question, if our trend for ego-centric, nationalistic and xenophobic politics is setting our civilisation on the way to destruction or not.

When we consider that we, as technologists, have opened Pandora’s Box, which allowed deep data analysis tools to capture our data, identify our susceptibilities and fears, and then let unscrupulous politicians manipulate us through subliminal and false messages, we have to consider how we can regain control.

Today I don’t need to even consider your fact-based arguments, if I simply brand them as fake news. The ability of large groups of people to be happy in the knowledge that the Earth is flat is maintained through an amazing ability to deny all physical proof to the contrary. This is done by designating it as proof that the establishment is behind a conspiracy to keep the truth hidden.

Similarly, when the Brexit team declared that “the people in this country have had enough of experts”, they were indicating a key part of today’s problem – the desire to replace knowledge with opinion based on hearsay, fears and in



some cases paranoia. The same logic asserts that my ignorance is as valid an opinion as your educated position. This has been combined with a hyper-sensitive sense of political correctness – where media is expected to give fair representation to all viewpoints – to actually distort the meaningful debate and collective decisions that democracy depends on. If you ask a scientist to be on a TV programme debating cosmic science with a Flat-Earth believer, you are actually demeaning science by asking it to prove itself against fiction. This approach gives the uneducated views an undeserved status.

How to fix our new world

We really need to go back to basics. The most basic thing is education. We have had global campaigns since World War II to increase the education standards across the globe. We may need to expand our concept of education beyond simply teaching people to read and write, which is only giving them the tools. We rather need to make sure people stay long enough in education to learn how to be critical in their thinking. The link between education and involvement in the civic society has been well identified – why this is linked is not so obvious. Some say the teaching ingrains the benefits of political participation while others propose that schools and colleges teach us to work, play and communicate together for common gain.

Student communities have long been seen as the political vanguard and not willing to accept suppression. Even Lenin complained in his time that students were unwilling to subject themselves to the leadership of the revolutionary – and not so democratic – elites.

But even here we run into a modern interpretation of critical thinking, which basically says: don’t trust anything the government tells you, as they are lying to promote their own agendas. Science asks you to be critical and work through any hypothesis until you have evidence to prove or disprove it. We should renew our global commitment to education to the point where the average person has the capabilities to deal with modern challenges.

When we can stop asking people, if they believe in climate change and instead debate with them, if they understand the implications of climate change, we may be making progress.

What to do now

I would like us all to think about our roles in the chain: are we helping society or are we part of the problem? Your behaviour on social media has a lot to do with this. If you simply share emotive news that you like the sound of and because it re-enforces your biases, then you are the problem. I challenge you to change your behaviour with three steps: 1. Consider the message; 2. Consider the source; and 3. Pause before sharing.

I may be naïve, as we have worked hard to make our social communications powerful and far-reaching – and somehow almost anonymous. But the click-without-consequences world we live in is actually not without consequences. We need to put the values back into our increasing communications, in order to avoid that we sow so much suspicion and mistrust that our civilisation, as we know it, is doomed.

ICT for smart sustainable cities in Europe

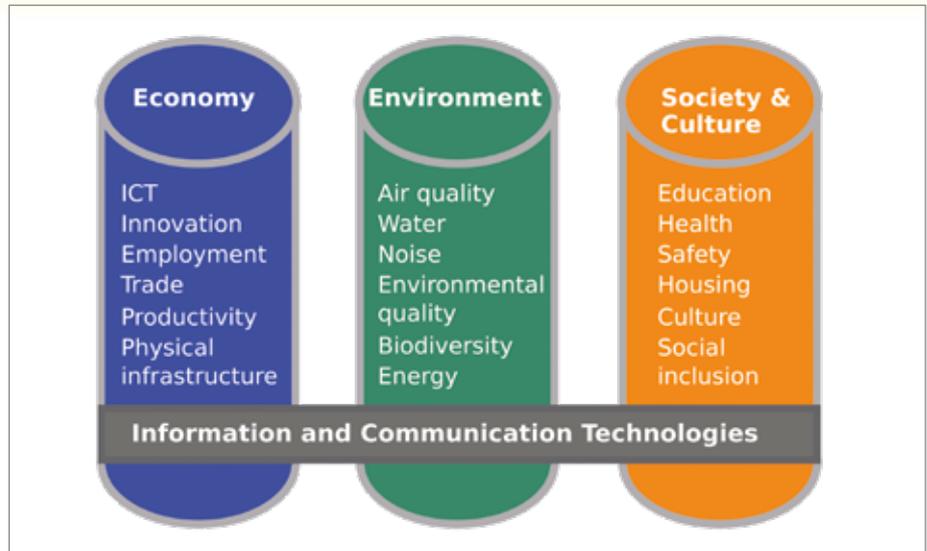
An overview



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UNECE-ITU smart sustainable cities indicators (2015)

Today, 75% of European citizens live in cities. This percentage is expected to grow to 80% by 2050. Cities consume about two thirds of the world's energy and are responsible for more than 70% of global man-made CO₂ emissions. Thus, cities play a crucial role for reaching the European Union's CO₂ reduction goals and the UN sustainability goals. Information and communication technologies are of key importance for enabling cities to become sustainable. The concept for ICT-enabled sustainability on municipal level is called "smart sustainable cities".

Definition and origin

According to the definition by the United Nations Economic Commission for Europe (UNECE), "A smart sustainable city is an innovative city that uses information and communication technologies (ICTs) and other means to improve quality of life, efficiency of urban operation and services, and competitiveness, while ensuring that it meets the needs of present and future generations with respect to economic, social, environmental as well as cultural aspects."

The roots of the smart cities concept go back to the "cybernetically planned cities" of the 1960s and proposals for networked cities in urban development plans from the 1980s onwards. In the late 1990s the "smart growth" movement emerged, which prepared the ground for the concept of smart cities. The smart cities concept became popular within the first decade of this millennium. It was less about developing new technologies, but rather about interconnecting

and synchronising existing technologies, products and services within the networked system called city.

However, this focus on technology and the efficiency gains through ICT limited the smart city concept and its usefulness for achieving environmental and social sustainability goals. Thus, the concept was expanded to smart sustainable cities.

In 2015, the International Telecommunication Union (ITU) established a Study Group, SG20, on "Internet of things (IoT) and smart cities and communities (SC&C)". SG20 defined a set of smart sustainable cities indicators for measuring the progress of cities towards becoming smart and sustainable. These indicators cover the economic, environmental, and social dimensions of sustainability (see figure).

In 2016, the United Nations launched the initiative "United 4 smart sustainable cities" (U4SSC), which is coordinated by ITU, UNECE, and the United Nations Human Settlements Programme (UN-Habitat). U4SSC is supported by 13 UN agencies and programmes. It aims to help achieve UN Sustainable Development Goal 11: "Make cities and human settlements inclusive, safe, resilient and sustainable".

European activities for smart sustainability

The European Union is very active in supporting the movement of cities in the Member States to becoming smart and sustainable. There are, for example, 17 Lighthouse projects with a total of 46 lighthouse cities and 70 fellow cities, which

are funded by the European Commission under Horizon 2020. Numerous other Horizon 2020 projects are in one way or another contributing to research and development on solutions for smart sustainable cities. A major push in this area can be expected from the EC's current Green Deal call under Horizon 2020, which includes the dedicated call topic "Towards Climate-Neutral and Socially Innovative Cities". All funded activities under the Green Deal call aim to lower CO₂ emissions to 55% by 2030, compared to 1990 emission levels, and to zero by 2050. At the same time the Green Deal aims to shape the transition to sustainability in an inclusive way.

Beyond the EC's Horizon 2020, there are smart sustainable city projects funded on EU level by two Knowledge and Innovation Communities (KICs) of the European Institute of Innovation & Technology (EIT), which is an independent EU body. These two KICs are the EIT Climate-KIC and EIT InnoEnergy, the latter with a focus on sustainable energy innovations.

On the financial side, it is important to mention the European Investment Bank (EIB), the financial arm of the European Union. The EIB supports a broad range of urban projects in areas like energy, mobility, buildings, water, and social infrastructure.

In addition to the EU, there are a number of further European organisations and initiatives active in the area of smart sustainable cities. Some of the most prominent include: ICLEI Europe, the European branch of Local Governments for Sustainability; Eurocities, a Europe-wide network for the development of cities; Energy Cities, The Eu-

European association of cities in energy transition; and the Covenant of Mayors for Climate & Energy Europe. They represent the bottom-up initiatives of many European cities acting on their commitments to become climate-neutral through reduction of CO₂ emissions as well as reconcile this with sustainable economic and social development that includes all citizens.

European cities and the European Commission work together in activities like the recent Green City Accord, an initiative to make cities greener, cleaner and healthier, which was launched during the European Week of Regions and Cities in October 2020. The Green City Accord is a movement of European mayors which aims to improve the quality of life of all Europeans, and accelerate the implementation of relevant EU environmental laws. By signing the Accord, cities commit to addressing five areas of environmental management: air, water, nature and biodiversity, circular economy and waste, and noise.

West-East divide in Europe

All these initiatives and the funding gone into them have led to substantial achievements on the path to smart sustainability. However, the current situation in Europe is still divided: while there are a number of cities in Western Europe which have progressed already quite well, the situation especially in Eastern Europe is not as rosy yet.

According to the Lisbon ranking of 28 European capital cities, which was published in 2019, there is a striking geographic divide: 12 of the top 14 cities in the ranking are Western European; 11 of the bottom 14 cities are Eastern European. The ranking is based on 32 indicators, which are related to environmental, social, and economic aspects. Other rankings based on different criteria come to different results for individual cities but confirm the overall impression of a divide between European cities – those that have already progressed well on the path to smart sustainability and those that still have a long way to go.

Major smart city technologies

The technologies that induce “smartness” into cities can be broadly categorised into Internet of Things (IoT), Big Data and ICTs that provide the technical frameworks to implement smart sus-

tainable cities. The “things” of the IoT – devices, sensors, applications – collect the data that facilitate the technology solutions. Although still at a fraction of the possibilities, the current installation base of sensors and devices is already huge, which leads to an enormous amount of data that has to be collected, analysed and processed in order to extract relevant knowledge that is used by dedicated applications for doing their job. The applications are numerous and include tasks like optimisation of city utilities, such as energy, water and waste, optimisation of traffic for passengers and goods, and efficient public protection measures.

Such smart city applications are inherently data-driven, which is why Big Data analytics play an important role in overall city management. Over the last years several solutions, called platforms, have been deployed for managing the process, which are not always easily interoperable. Standards bodies have worked for a number of years on creating the necessary standards to leverage the economies of scale. The International Standards Organisation (ISO) has recently published a short overview of which standards are necessary in the different areas relevant for a smart sustainable city. The complexity of the problem is highlighted by the use of words like “overarching frameworks”, “foundations and platforms”, which are used in the ISO publication.

5G connectivity is currently being introduced as the backbone of smart city technologies. 5G networks provide urban areas with the necessary infrastructure to connect myriads of devices and sensors, enabling the IoT to work efficiently. Advanced information and communication technologies enable unprecedented capabilities for monitoring smart city parameters, for example by using unmanned aerial vehicles. ICTs also enable efficient urban planning by using accurate geo-location data that can be obtained from high-altitude platforms and Earth observation satellites.

Key role of citizens

Beyond ICT, an essential part of any city and any action towards achieving sustainable cities is the citizen. The actions that will be put in place must be accepted and supported by the citizens. A substantial shift has to be induced in the behaviour of citizens, in order to achieve sustainability goals in cities. Recent research in social sciences

indicates that the involvement of citizens in a co-creation process for the implementation of the actions is a promising way for achieving sustainability goals. Nonetheless, it is still not well researched how to measure the citizens’ behavioural change and how to correlate this change to the technically measurable parameters of utilities management, environmental conditions, energy consumption or mobility patterns.

Outlook

Despite the plethora of organisations, initiatives and projects working on making cities smart and sustainable through the use of advanced ICTs like IoT, Big Data, and more, the challenge is still enormous. In order to get the majority of cities in Europe onto the path to smart sustainability and achieve zero CO₂ emissions by 2050, current efforts need to be increased and better synchronised. Plans to do this are under way. Future will tell to what extent these plans can be implemented across European cities with wide differences in development.

Further information

- ITU SG20: Internet of things (IoT) and smart cities and communities (SC&C) – <https://www.itu.int/en/ITU-T/study-groups/2017-2020/20/Pages/default.aspx>
- United 4 smart sustainable cities initiative – <https://www.itu.int/en/ITU-T/ssc/united/Pages/U4SSC-info.aspx>
- smart cities and Communities Lighthouse projects – <https://smartcities-infosystem.eu/ssc-lighthouse-projects>
- EIT Climate-KIC – <https://www.climate-kic.org>
- EIT InnoEnergy – <https://www.innoenergy.com>
- Energy Cities – <https://energy-cities.eu/>
- ICLEI – <https://iclei-europe.org/>
- Eurocities – <https://eurocities.eu/>
- Covenant of Mayors for Climate & Energy Europe – <https://www.covenantofmayors.eu/>
- ISO and sustainable cities (brochure, April 2020) – <https://www.iso.org/files/live/sites/isoorg/files/store/en/PUB100423.pdf>

Lighthouse solutions for urban sustainability

Horizon 2020 project STARDUST helps European cities become smart and sustainable



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Today's urban sprawl can easily be summed up by one figure – 75% – which corresponds to the EU's urban population. It is easy to imagine the resulting high level of resources used and the devastating effects on the environment. The solution? Transforming our cities into smart and sustainable innovation hubs by using the latest findings in the fields of energy, transport and information and communication technology (ICT). This is what STARDUST is all about.

STARDUST is an EU-funded project run by an interdisciplinary consortium of 30 organisations from research, academia and industry, led by the Spanish Renewable Energy Centre CENER. They are making its three "Lighthouse" cities of Pamplona (Spain), Tampere (Finland) and Trento (Italy) more sustainable and citizen-friendly with more than one hundred technological urban solutions.

To ensure wider impact of the project, the approach demonstrated needs to be replicated. Four "Follower" cities – Cluj-Napoca (Romania), Derry (UK), Kozani (Greece), and Litomerice (Czech Republic) – are sharing and refining a replication methodology in their own contexts. This will trigger a cascade effect across other cities and communities through the "JOIN STARDUST" programme, delivering a holistic replication model throughout the continent and beyond.

The STARDUST team also works to ensure the measures are well accepted and adopted. To do so, they raise public awareness about the project and they develop pioneering business models and financial schemes. All these actions will thus turn the seven STARDUST cities into urban incubators of technological, social, regulatory and market solutions for other interested cities around the world.



Figure 1: Installation of a prototype Plug&Play solar roof on the Municipal Police building in Pamplona (Spain). The panels will provide energy for self-consumption and are connected to recycled batteries for energy storage

Holistic solutions

In the STARDUST approach, technical solutions will be provided in the energy, mobility and ICT sectors while business models and citizen engagement activities will directly address policy makers, industry, academia and the general public. Together, these technical and non-technical measures form a new and holistic way to help towns and cities in their green efforts.

Energy: To reduce energy consumption, the project will introduce better technology, methods and materials. This can include retrofitting existing buildings and installing innovative heating and cooling systems to improve residents' comfort. Dedicated protocols and user-designed interfaces for smart grids and storage systems will allow residents and energy providers to monitor and manage energy usage. Data will also be shared between users and other stakeholders. Finally, renewable energy sources and smarter energy storage systems and lighting materials are being introduced to provide energy to the cities (see, for example, figure 1).

Mobility: The main objective for mobility is to reduce carbon dioxide emissions. More efficient means of transport and alternative fuels are urgently needed in Europe to safeguard the environment and break its large dependence on oil. STARDUST is working on the deployment of electric vehicles, such as e-buses (see figure 2) and sharable e-bikes, and on the installation of the related charging stations and vehicle-to-grid infrastructures. Different types of incentives will be introduced by the Lighthouse cities to encourage the use of electric vehicles, together with the implementation of dedicated last-mile delivery strategies.

ICT: Innovative information and communication technologies offer opportunities for the digital (r)evolution in cities. In the STARDUST Lighthouse cities, ICT links urban infrastructures, city managers and end users through real-time information. The three cities will install an extensive set of ICT solutions, such as: smart city apps (for access to different city services); "smart points" equipped with sensors to obtain a range of data (on weather, air quality, traffic congestion, behav-

joural patterns, etc.); a green light optimization system with bilateral communication with cars; smart control and management of public lighting; and street monitoring by citizens via adapted smartphones. Moreover, STARDUST will deploy open city information platforms, which are ICT infrastructures combining all project aspects (building, energy and transport). These platforms will enable the project to achieve its social innovation strategy, business ecosystem and behavioural change goals. More specifically, the platforms will: i) make city data and services available to local industries, entrepreneurs, SMEs, and other third parties, which will encourage innovative businesses and offers; ii) promote the interoperability and interchangeability of existing and newly deployed software components, data sources and services; iii) bridge the digital divide by getting people and businesses to participate throughout the project; iv) increase the number of cities, people and sectors involved or reached; v) help Lighthouse and Follower cities share knowledge and solutions, thus getting them to work and innovate together.

Citizen engagement: New technologies, services and ICT devices don't, in themselves, make a city smart. Cities are their inhabitants, and to transform the cities we need to change their habits. People need to be involved so they can ensure the project's measures are user-friendly and likely to be accepted. STARDUST is therefore keen to focus on both raising awareness and engaging actively with residents (see figure 3).

Expected impacts

In each Lighthouse city, the interventions will reduce greenhouse gas emissions up to approximately 60% and increase both renewable energy share and energy savings by the same amount. This will improve residents' quality of life and ensure an economically viable and prosperous business environment. In terms of return on investment, the bankability of the solutions is expected to rise from a typical value of 4% up to 40%, with payback times dropping from 16-30 years to 2-7 years. In the Lighthouse cities, STARDUST interventions will also lead to new local jobs in the sectors of the solutions implemented. User-driven solutions, such as the active participation of prosumers and easy, efficient transport, will lower energy bills and lead to other savings and better environmental quality.

Outlook

Over the next two years, STARDUST will complete the roll-out of its solutions. For greater impact, the project will remain active in the network of Smart City projects. In fact, STARDUST is not alone in the mission to revolutionise the Europe-



Figure 2: In Tampere, measuring devices have been installed in four electric buses and one hybrid bus to help monitor electricity consumption. The data will be used, for example, for route planning and the electrification of public transport. The charging station is located near the city center in Pynnikipintori square. Due to winter conditions, there is heating under the asphalt of the charging station. Credits: Anna Vilhula e Angelique Lusuan.



Figure 3: Presentation of STARDUST during the 3rd edition of the Trento Smart City Week (16 - 22 September 2019), an event that aimed to bring smart solutions close to citizens.

an urban landscapes. Since 2014, 16 similar EU-funded projects have been performed, covering some 100 cities. Today, this network spans the continent, shaping the urban future of Europe and the world.

Further information

The STARDUST project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement number 774094. You can find more information on STARDUST at <http://stardustproject.eu/>.

Cities should be part of EU climate policy decisions

Interview with Covenant of Mayors board member Eckart Würzner on the sustainable development of European cities

One of the major initiatives promoting the development of smart sustainable cities in Europe is the Covenant of Mayors for Climate & Energy. It was launched in 2008 with the ambition to gather local governments voluntarily committed to achieving and exceeding the EU climate and energy targets. Currently the Covenant of Mayors comprises more than 10,200 municipalities worldwide with a total population of 322 million inhabitants. Eurescom message editor-in-chief Milon Gupta interviewed Heidelberg's mayor Prof. Dr. Eckart Würzner about the progress towards sustainable development in his own city and the cities of Europe. Prof. Dr. Würzner has contributed to this progress not only as mayor, but also as political board member of the Covenant of Mayors for Climate & Energy and president of the climate protection network Energy Cities.

What is your city's most important sustainable development goal for the next 10 years?

E. Würzner: Heidelberg has been committed to sustainable development since the 1990s as a direct result of the Aalborg Charter [*Charter of European Sustainable Cities and Towns Towards Sustainability, 1994 – the editor*]. Since then, the urban sustainable development plan has been continuously updated. The newest update is currently running, which is for the first time based on the SDGs [*17 Sustainable Development Goals of the United Nations – the editor*]. One of the most important goals is SDG 13 – Climate Action. Our climate protection concept passed the city council 25 years ago and has been constantly renewed. In 2019 Heidelberg declared the climate emergency. This created new measures and accelerated the implementation of local climate protection measures for achieving Heidelberg's goal of climate neutrality by 2050.

Which activities have you planned and launched to achieve your city's sustainable development goals?

E. Würzner: Climate protection in Heidelberg extends into numerous administrative areas and also into further important SDGs, including SDG 7 [*Affordable and Clean Energy*], SDG 9 [*Industry, Innovation and Infrastructure*], and SDG 11 [*Sustainable Cities and Communities*]. In addition to the energy transition, there is also a need for a



Prof. Dr. Eckart Würzner
(photo: © 2019 Julian Beekmann)

traffic transition towards environmentally compatible transport and energy-efficient technologies.

In Heidelberg the greatest savings in CO₂ emissions can be achieved in the area of building renovations, renewable energies, energy efficient buildings and the transport sector. That is why our focus is on sustainable renovation and sustainable mobility. Therefore the municipality cooperates in various fields of action with local stakeholders like the university, the municipal utility, and the enterprises.

What is the role of ICT for achieving your city's sustainable development goals?

E. Würzner: Heidelberg is very active in the field of digitisation. The city continues to make steady progress towards becoming a smart city. From broadband expansion and public WiFi to online public participation and open data, digitised infrastructure is set to become as much a part of essential local authority services like electricity, gas and water. The objective is to use new technologies to sustainably improve the lives of all our citizens.

We implement intelligent solutions for different areas of urban development with the help of innovative technologies. In the area of climate protection, for example, these are intelligent house controls to increase resource efficiency. In the case of municipal buildings, energy consumption has been reduced by 50%.

How are Energy Cities and the Covenant of Mayors for Climate & Energy contributing to achieving the vision of smart sustainable cities in Europe?

E. Würzner: The political goals of the networks are to empower the cities in their actions and to strengthen collaboration between them. It is important to give the cities a louder voice at the international level. Therefore, we must link the political commitment of the cities to advocacy on European level. The networks should act like a lobby for financial resources, programmes and European laws for climate protection at city level. The cities put policies and institutional settings, frameworks of climate and energy goals into concrete practice. It is not enough for mayors to be experts at negotiations or conferences. It is most important to give them the right to be a part of the decision-making process. Energy Cities and the Covenant of Mayors can provide the framework for this work. Climate issues must become the guiding principle of EU politics, not only in position papers. The European Green Deal is a first and important step. In cooperation with other networks, Energy Cities should ensure that the Green Deal becomes a reality.

Which major societal, economic and technological challenges need to be tackled in the coming years on the way to smart sustainable cities in Europe?

E. Würzner: The question is if smart cities will be low-energy cities with energy-saving and climate-protection objectives. We have to offer solutions for the contradiction between promoting energy-saving objectives and increasing the number of electronic devices exponentially. More importantly, digital technology may one day be able to optimise the urban system. We need a complete change of paradigm.

Inventing short-distance cities, reclaiming urban space monopolised by cars and returning it to pedestrians and cyclists as well as relocating a significant share of the production – including food production – to the city are just a few examples of urban policies that are more important for smart cities than just achieving the energy transition.

Ultimately, smart sustainable cities are first and foremost cities designed for enabling their inhabitants to lead a free, low-energy life, without being trapped in a technical system.

Co-creation of smart sustainable cities

The 5G SOLUTIONS project



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In 2050, two thirds of the world's population will live in cities, according to the United Nations [1]. In order for cities to handle this growth in a sustainable way, they have to become energy efficient and climate resilient, improve mobility and healthcare, as well as become inclusive and attractive for all citizens. ICT solutions and especially 5G, the next generation communication technology, can become an important enabler for solving these challenges.

5G SOLUTION is one of eight projects under Phase 3 of the 5G-PPP, a private-public partnership initiated and funded through The European Commission Horizon 2020 programme, with the aim of supporting research and innovation within the smart city vertical along with other adjacent verticals [2]. This is a consortium of 26 European partners from academia, research centers, telecom operators, large industries and SMEs in 5G SOLUTIONS [3]. Telenor is a 5G experimental facility provider in the project leveraging the 5G-VINNI platform [4]. While the Norwegian University of Science and Technology (NTNU), Department of Mechanical and Industrial Engineering is a partner in the project addressing “Factories of the Future”, the NTNU smart sustainable cities is a cross-department and cross-disciplinary knowledge cluster and an external partner collaborating with Telenor to address “Co-creation for smart sustainable cities”.

Smart city use cases

In 5G SOLUTIONS an array of smart city use case scenarios are outlined and specified for upcoming trials and validations both technological and business wise.

The smart city use cases outlined in 5G SOLUTIONS include:

- **Smart street lighting:** Electricity consumption is estimated to increase up to 80% in cities until 2030 compared to 2005 [5]. Reducing the electricity for lighting up streets and public areas is one area to become more energy efficient. Dimming or even switching on and off street lamps in low-traffic areas can be activated through sensor- or camera-monitoring persons or vehicles passing by. This will help the municipalities saving money and becoming more eco-friendly, while avoiding negative effects such as car accidents.
- **Smart parking:** Thirty percent of traffic in cities are looking for a parking space [6]. Smart parking solutions using 4K video cameras for real-time detection of occupancy and frequency/turnover of use of metropolitan area parking spaces will contribute to reduction of congestion and emissions, improve traffic safety, and simultaneously allow higher quality of life for the residents. This solution can also be combined with optimizing charging and electric network usage of electric cars and other electric vehicles such as buses or bikes.
- **Smart buildings and campus:** Internet of Things sensors can be deployed in private office buildings and public facilities to measure air quality, room occupancy, etc., reduce the energy consumption, allow for predictive maintenance, and utilize proximity lighting turning off heating or air conditioning when no one is present. 4K video cameras monitoring and automated detection of dangerous situations can help improve the physical security of the cam-

pus as well as the safety of its occupants. Understanding how buildings are used through sensors can also help with better planning of spaces and energy reduction for buildings.

- **Smart harbour and ports:** The Yara Birke-land fertilizer plant at port Herøya in Norway aims to have the world's first fully electric autonomous container ship with zero emissions, replacing 40.000 diesel powered truck haulage journeys a year. 5G infrastructure will be deployed on the port premises supporting self-driving vehicles in addition to digitalizing working processes, e.g. remote VR/AR enhanced maintenance and operation, also providing a safer working environment.

Social innovation

In addition to these four vertical use cases, a new cross-cutting case for smart cities co-creation will be designed around social innovation. This will entail, amongst others, virtual and distributed co-creation between citizens and professional stakeholders and decision makers, supported by reliable live visual distribution and interactive communication with multiple remote areas, the use of digital twins, the exploration of sensor deployment, support for citizen science, and mixed reality media.

All the use case scenarios can be realized through support from 5G technology with higher data rate and lower latency, as well as massive machine-type communication such as connecting high numbers of sensors and IoT devices. A precondition is that the smart city ecosystems of partners and stakeholders are present, starting with municipalities and local governments enabling collaboration with potential industry and academic partners across several sectors [7].

Business model enablement and outlook

Information from these scenarios on energy consumption and behavioural patterns, whether it is data generated by citizens, IoT sensor networks or city level data that has broad communal use and is privacy-protected, could be made available across vertical silos proposing new collaborative frameworks and business models rewarding openness, transaction and data sharing. This can enable start-ups, SMEs, NGOs and local communities to take advantage of this data and build new apps and services relevant to the wider community. Applying machine learning or arti-

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

CELTIC-NEXT Call for Project Proposals – Deadline: 12th 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 12th 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.

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How Eureka Clusters keep reinventing themselves



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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



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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

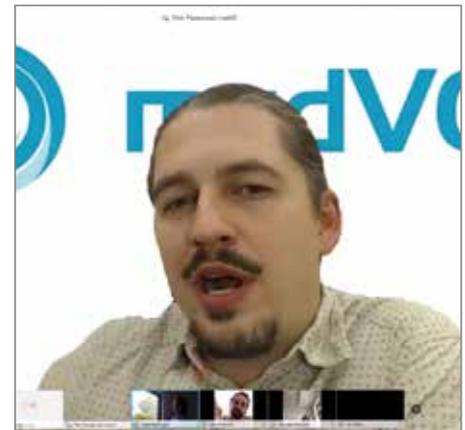


Keynote speaker Dr. Heiko Lehmann from Deutsche Telekom's T-Labs

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

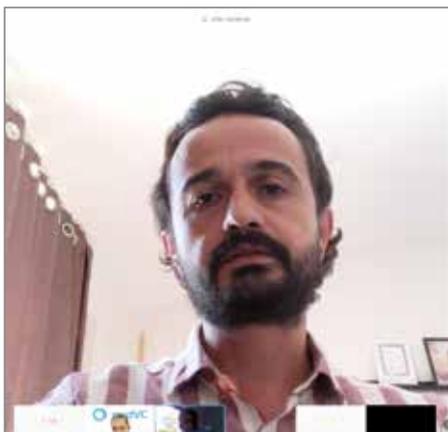


Piotr Pawalowski, Vice-President and CTO of medVC

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.

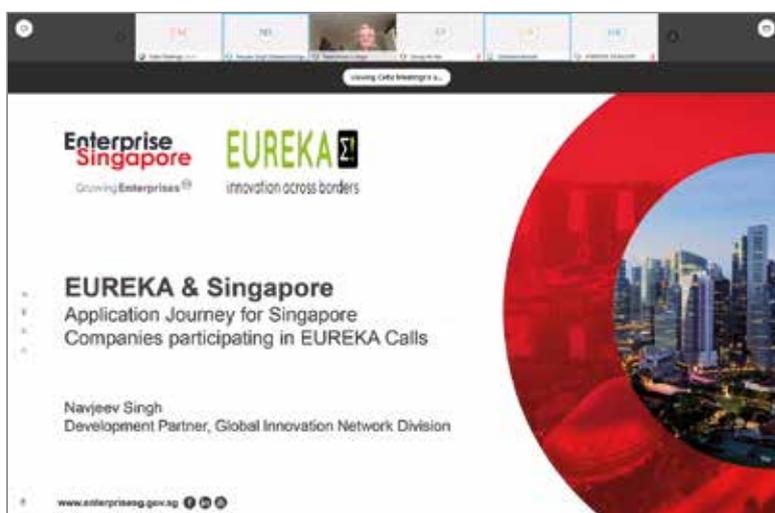
Singapore and South Africa were for the first time represented at a Proposers Day, which shows the growing international reach of CELTIC-NEXT and EUROGIA2020.

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)



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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.

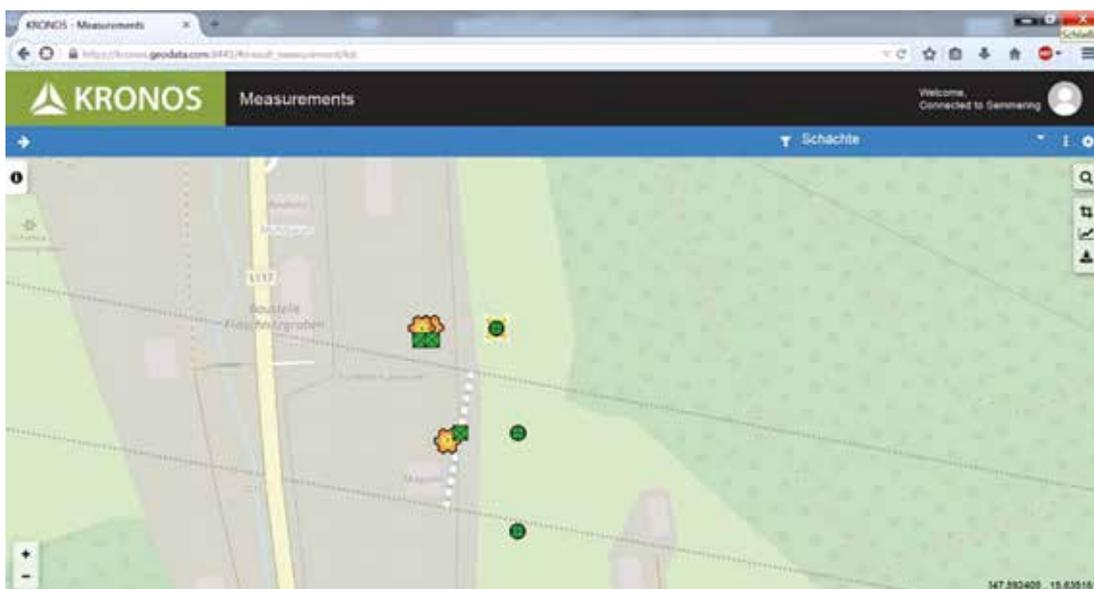


Figure 1: Two UrbMics box field prototypes prepared for construction site installation, left: with, right: without built-in UrbMics WSN components).

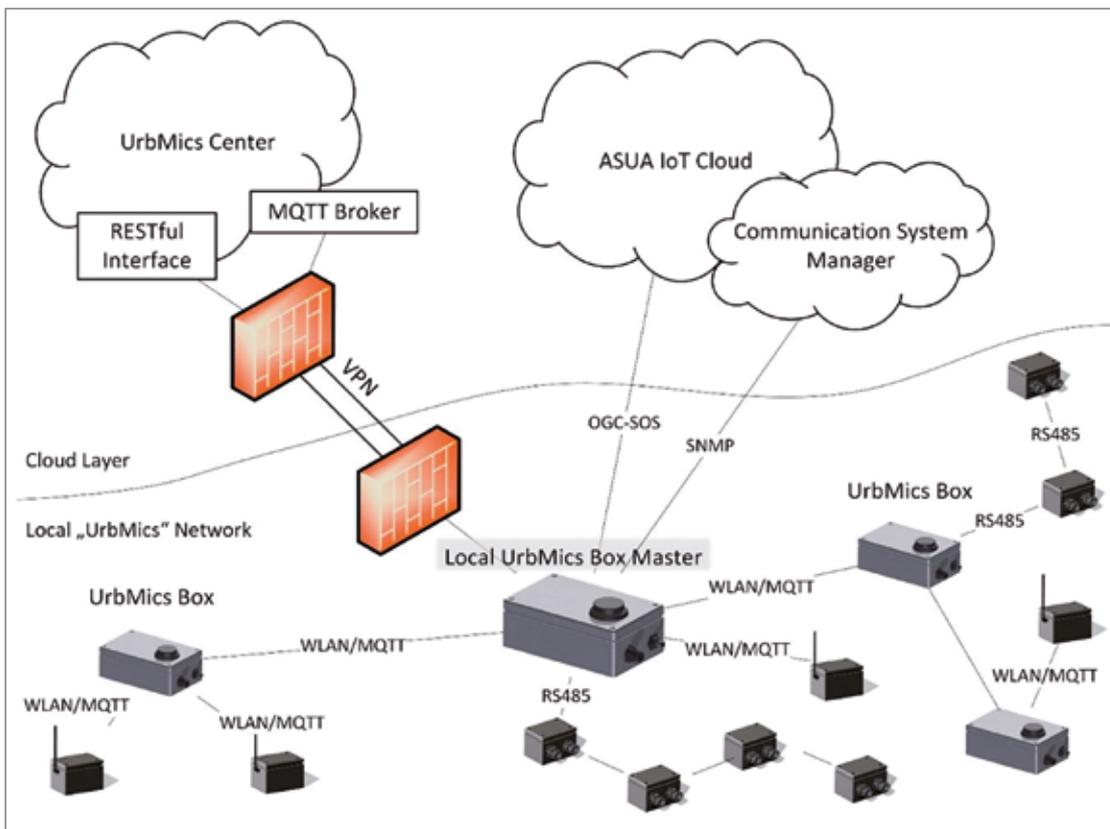


Figure 2: Integration of the UrbMics overall system into the UARP (Urban Automation Reference Platform).

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/>

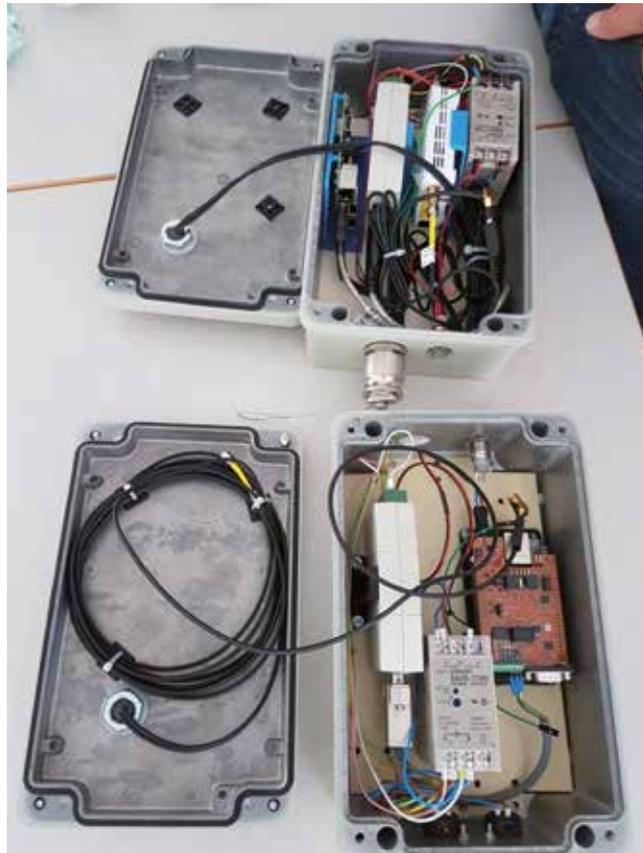


Figure 3: Web interface of the UrbMics center, map showing 3 UrbMics boxes and 6 sensor positions).

More synergies and global cooperation in Eureka

Interview with Eureka Chairman Ulrich Schuh

On 1st 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



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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

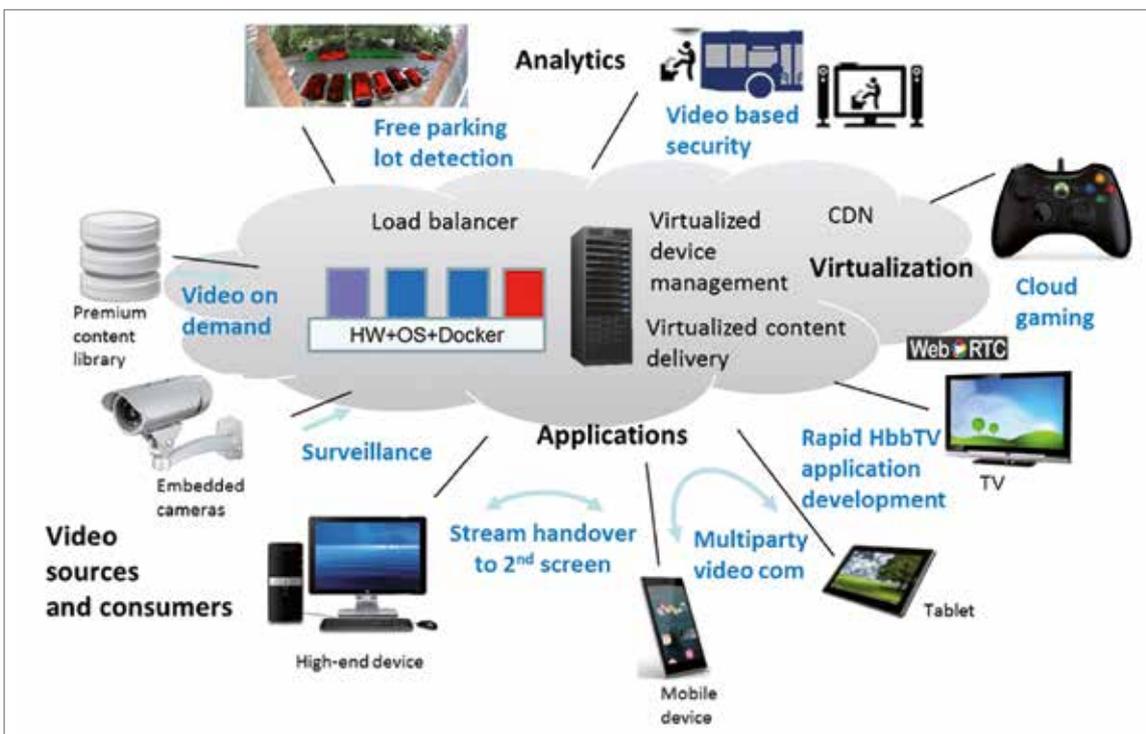


Figure 1 shows the applications targeted by VIRTUOSE and a common framework for their realization.

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



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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/>



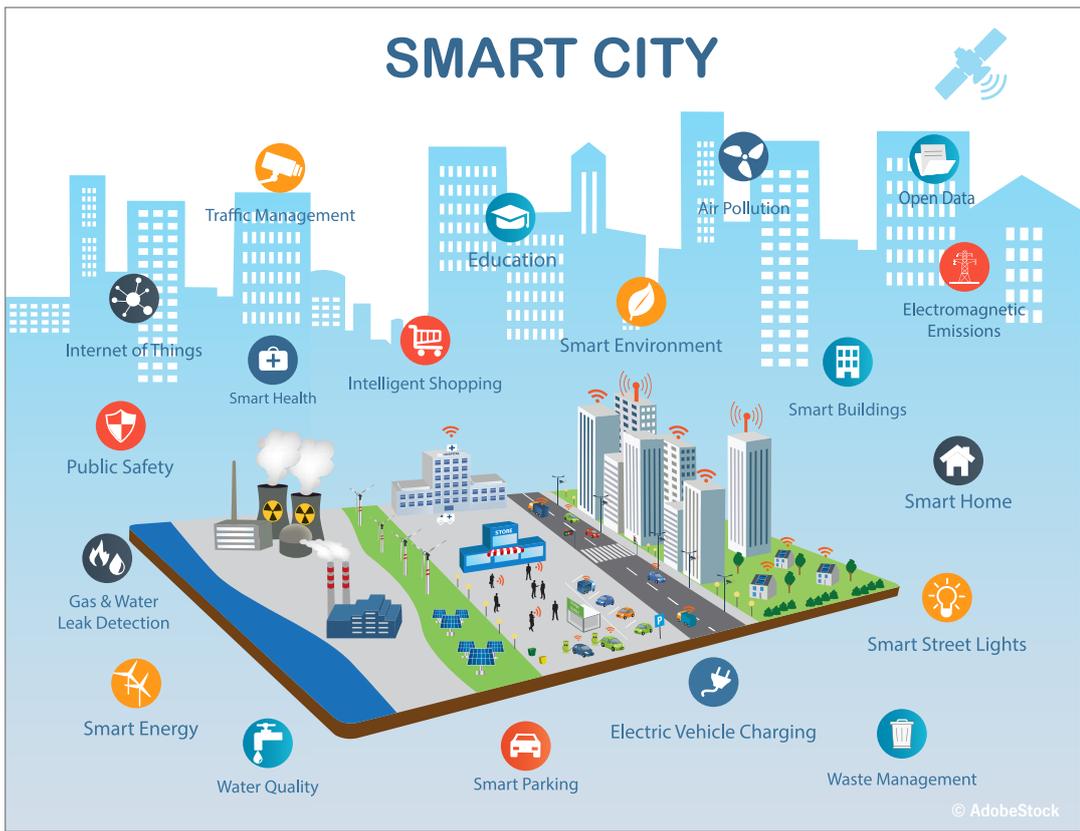
About CELTIC-NEXT

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





Examples of smart sustainable city use case scenarios enabled through 5G technology (Source: AdobeStock)

cial intelligence techniques and algorithms on these data sets can also be an important enabler for detecting cost-efficient and environmentally friendly solutions beneficial for the ecosystem players and in the end for the citizens' well-being.

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5G powered smart lighting in smart cities

SliceNet's smart city pilot



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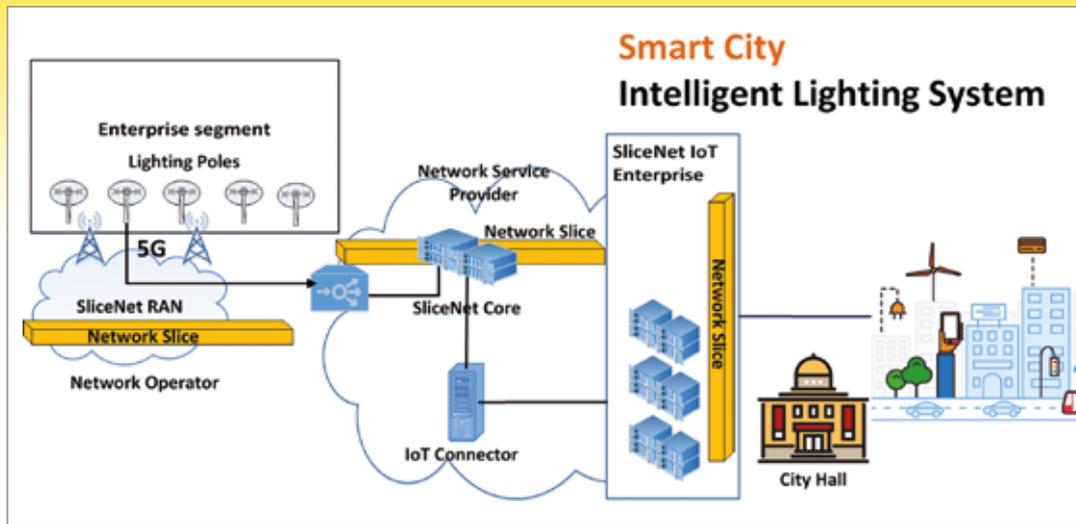
The new 5G network system promises numerous advantages for a large number of vertical sector applications. Horizon 2020 project SliceNet has designed, implemented and executed a smart city pilot to showcase the advantages of network slicing, a new concept that has been introduced in the 5G system. Network slicing enables the operation of independent logical networks over the same physical network infrastructure.

Smart city applications include, among others, metering solutions for gas energy and water consumption, remote monitoring of city infrastructure like pollution, temperature, humidity and

noise, real-time traffic information and control, city or building lights management and public safety alerts for improved emergency response times. The smart city pilot in SliceNet has defined a 5G network slicing architecture for the vertical's smart lighting application as a solution for one of the many smart city applications.

Architecture of the pilot

The smart lighting pilot is based on an end-to-end sliced 5G architecture, vertical-oriented, technically supported through innovative network resources management, control and orchestration, enabled to support the service require-



SliceNet's intelligent lighting system

Collaboration in the 5G PPP

The pilot provided a unique 5G PPP collaboration opportunity between the projects SliceNet and MATILDA. Together the two projects provided a holistic, innovative framework for the design, development, life-cycle-management and orchestration of 5G-ready applications and the related network services. The whole system is based on a programmable infrastructure, virtual network functions and network services, the 5G-ready applications and application components all available through a 5G marketplace. The

collaboration showcased how this innovative smart lighting application is deployed from the 5G marketplace into the infrastructure.

ments by providing Quality of Service (QoS) and Quality of Experience (QoE) service assurance through cognitive machine learning algorithms.

The pilot provides the transition from existing concepts of Internet of Things (IoT) implementations, such as those based on the low-power wide-area network protocol LoRa (Long Range) to standards based LTE-M/Nb-IoT and further to the new 5G network system for smart city use cases.

The pilot system is based on different ICT components and capabilities such as IoT applications and services, virtualised network infrastructure, virtualised network functions implementation, dynamic resources, slices and services orchestration, concurrent slices resources allocation, cognitive modules for QoS/QoE assurance and interfaces facilitating the interaction with the vertical application.

Using existing 4G network components, the pilot provides the possibility to instantiate end-to-end slices stretching from the users' equipment, i.e. lighting poles, up to the IoT application running in a data centre, including all necessary network components that support the use case.

The key achievements, performance and business indicators (KPIs) are demonstrated in a real environment, integrating the technologies and demonstrating the capabilities and key innovative aspects of the project implementation, with a focus towards commercialization. The key aspects addressed by the smart lighting pilot are:

- Adopted model of 5G stakeholder roles and responsibilities, with the vertical stakeholder in the loop
- Time-to-market for business solution delivery
- Customer friendly usage
- Innovative programmable infrastructure deployment, resource, slice and services monitoring and exposure of collected data to the vertical application
- Service QoS/QoE KPIs assurance, metrics (bandwidth, delay, jitter, packet loss)

- Service provision in a massive Machine Type Communication (mMTC) slice
- New operational model for deployment, operation and system service assurance

Deployment and measurements

The smart lighting pilot has been deployed and demonstrated in a real live scenario in Bucharest, Romania. A series of measurements have been conducted to obtain results about the potential capabilities of the system. The measured end-to-end latency is in the range of 27ms on average and well below the target key performance indicator for this application. The measured packet loss observed was 0%. Longer-term measurements under a larger variety of configurations have to be conducted, in order to add more realism to the estimation of service reliability.

Impacts

The pilot has important societal and business impacts. The system integration and use case piloting in a real environment provided a basis for wide communication of the potential through Orange's Romania ties into industry, academic institutes, media and last but not least the city hall. The Orange Fab programme provides the co-innovation environment to channel the results to start-ups and other partners.

Commercialisation opportunities emerge for the whole service, i.e. the smart lighting application or parts thereof such as the programmable infrastructure the service is based upon, the vertical application orchestrator, or the vertical API.

A video summarises the smart lighting application (<https://youtu.be/zmxJbxpSTYQ>).

Standardisation

It has been clear from the start that the solution must be standards based. Where standards do not exist or are not mature enough yet, the project actively engaged with the relevant bodies and contributed in shaping standards as follows:

- ETSI Work Item for "PoC proposal for Predictive Fault management of E2E Multi-domain Network Slices" (using a smart grid use case as an example);
- ITU-T Work Item for "Vertical-assisted Network Slicing Based on a Cognitive Framework" (using an eHealth use case as an example);
- ITU-T Work Item for "Anomaly prediction and integration for eHealth use case based on vertical feedback" (using an eHealth use case as an example);
- ITU-T Work Item for "Noisy neighbour detection and integration in a virtualized infrastructure" (using a smart city use case as an example);
- ITU-T Work Item for "Machine learning based end-to-end network orchestration and network slice management" (across use cases).

Outlook

Smart cities will make significant use of 5G capabilities to improve their services for citizens. SliceNet piloted and validated business opportunities relying on 5G features like network slicing, flexible network management and provision of mMTC and enhanced Mobile Broadband (eMBB) services at scale. It implemented a closed-loop cognition-based autonomous network slice control, management and orchestration framework.

Further information

SliceNet project website - <https://slicenet.eu>

5G and Beyond

5G World Forum explored future networks



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The 2020 edition of the IEEE 5G World Forum was originally scheduled to take place in Bangalore, India in September. Due to the COVID-19 pandemic, the organisers had to turn the event into an online conference. The focus of the third 5G World Forum was on '5G and Beyond: A Comprehensive Look at Future Networks'. It particularly aimed to explore how to nurture and cultivate 5G technologies and applications for the benefit of society.

A plethora of sessions and presentations

The pre-recorded sessions and presentations of the three-day programme were accessible to participants from 10th September to 2nd November. The programme offered participants a rich choice: There were 16 plenary keynotes by speakers from major companies, institutions and universities like the US Federal Communications Commission, China Mobile, Qualcomm, Airbus, ETSI and more. The keynote speakers covered a wide range of topics, from 5G deployment and application to concepts for 6G.

In addition to the keynotes, there were technical paper tracks, workshops, forums and panels, 5G topical/vertical tracks, tutorials, demonstrations, and patron exhibits. Unlike an in-person event, this online conference offered participants the opportunity to attend all the sessions they were interested in.

It is almost impossible to provide a representative account of the numerous sessions and presentations. Thus, the selection of two exemplary sessions below is highly subjective – it is based on Eurescom's involvement in two projects that contributed to the selected sessions, 5G-DRIVE and 5G EVE.

Worldwide 5G industry fora session

5G-DRIVE is a Horizon 2020 project dedicated to EU-China collaboration in the area of 5G testing and validation. The project coordinator from Eurescom was invited to participate in a high-



Panel moderator Jean-Pierre Bienaimé and some of the panelists



5G-DRIVE coordinator Uwe Herzog from Eurescom talking about the 5G-DRIVE project in the Industry Fora Panel

level panel on worldwide 5G industry fora. The topic of the panel session was "5G Trends and Collaborations: Regional Visions, Verticals and Inter-Regional Cooperation Activities". The first panel session focused on Asia and Europe. It was moderated by IREST chairman Jean-Pierre Bienaimé and brought together eight panelists from Europe and Asia representing industry, research, and standardisation.

Among the panelists was 5G-DRIVE coordinator Uwe Herzog from Eurescom. In his statement, he provided some background information on the European-Chinese 5G research collaboration between 5G-DRIVE and its Chinese twin project. In answering the moderator's question on the effectiveness of the European-Chinese collaboration, he emphasized that despite the organizational challenges of coordinating 5G trial activities between two projects on different continents and in different commercial contexts, the joint trial activities have progressed well and yielded a fruitful exchange and interesting results.

In a separate presentation, Uwe Herzog provided a more detailed overview on the joint EU-China trial activities of 5G-DRIVE and the Chinese twin project in the areas of enhanced Mobile Broadband (eMBB) and Vehicular to everything (V2X).



Winnie Nakimuli from UC3M presenting the 5G EVE paper

Overall, the first industry fora panel presented an excellent overview on the manifold activities towards 5G development, testing and deployment in Europe and Asia.

Validation trials workshop

5G EVE contributed a paper to the workshop on "5G Validation Trials across Multiple Vertical Industries" (WS2). The online workshop aimed at providing a forum for industry and academia to disseminate new results on 5G trials in vertical industries as well as share knowledge on related new 5G business developments. It brought together six researchers from industry and academia, who presented their papers.

Among them was Winnie Nakimuli from the University Carlos III of Madrid (UC3M), who presented the 5G EVE paper on "Automatic deployment, execution and analysis of 5G experiments using the 5G EVE platform" (Paper No. 1570654444).

The rationale underlying the workshop was the essential role of validation trials for commercial 5G rollout, to test 5G features of novel services and applications in complex deployed environments. Such validation trials, like the ones performed via the 5G EVE platform, allow identifying and addressing issues related to coverage, interoperability, compatibility, and service provisioning. This is crucial for ensuring that 5G meets the requirements of various vertical sectors.

Further information

- Programme of IEEE 5G World Forum – <https://ieee-wf-5g.org/program/>
- Worldwide 5G Industry Fora Session 2020 – <https://ieee-wf-5g.org/worldwide-industry-fora-session-2020/>
- 5G Validation Trials Workshop – <https://ieee-wf-5g.org/workshop-on-5g-validation-trials-across-multiple-vertical-industries/>

Just transition to a sustainable Europe

European Research and Innovation Days



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The European Research and Innovation Days are the European Commission's annual flagship event for research and innovation. This year, due to the COVID-19 pandemic, it was held as an interactive online event from 22nd to 24th September 2020. The dominating topic was the European Green Deal.

The three-day Commission event combined high-level speeches and panels with topic-specific information aimed at potential project proposers. The large choice of sessions included in addition to the high-level plenary 10 information and interaction tracks called 'Hubs' on the following central areas in EU research and innovation: Policy, Green Deal, Digital, Horizon Europe, Missions, Smart Implementation & Synergies, International Cooperation, European Innovation Council, European Institute of Innovation & Technology, and European Research Council.

Green Deal plenary

In the day-one plenary on "European Green Deal & Just Transition", Frans Timmermans, Executive Vice President of the European Commission, presented the EU vision of a sustainable Europe, which decarbonises its economy and reaches zero greenhouse gas emissions by 2050. Mr Timmermans stressed that this transition has to happen in a socially inclusive way, where no one is left behind.



John Bell, Director Healthy Planet at the EC's DG Research & Innovation



Executive Vice President Frans Timmermans presenting the EC vision of a sustainable Europe and a just transition



Panel session with Commissioner Mariya Gabriel (right)

New European Research Area

In the next plenary, a high-level panel of speakers, including Commissioner Mariya Gabriel, discussed the steps towards a new European Research Area (ERA). The panellists talked about the main novelties of the ERA communication including its contribution to build an excellent European R&I system for the benefit of all, and its new approach towards a wide outreach engaging all levels, including Member States, regions and citizens in this endeavour.

Green Deal Call Info Day

On the second day of the event, several information days on open Horizon 2020 calls took place, among them the information day for the Green Deal call. John Bell, Director Healthy Planet at the EC's DG Research & Innovation, explained the goals and expected outcomes of the Green Deal call. It has a volume of around a billion euro spread across 8 Green Deal work streams. The EC expects from Green Deal projects a short-term and medium-term impact towards the achievement of the EC's CO₂ emission reduction goals.

Mr Bell pointed out that all solutions developed in Green Deal projects need to be scalable and socially acceptable. In view of the coming Horizon Europe programme, he said that 35% of Horizon Europe is envisaged to be for Green Deal related projects.

Conclusion

The event featured many more facets of the EU's vibrant research and innovation ecosystem, including the contribution of women in technology as well as the way research and innovation will help in shaping the post-COVID-19 world.

Beyond sharing information, the event also enabled the interaction with and between participants via proposal pitches at online brokerage events and meetings in virtual chat rooms. Although the virtual format could not replace in-person meetings, it managed to facilitate interaction. Even in a post-COVID-19 world, when large-scale meetings are possible again, it might be the more sustainable option to keep the virtual format for the European Research and Innovation Days.

Further information

European Research and Innovation Days website – <https://research-innovation-days.ec.europa.eu/>

News in brief

5G PPP White Paper on 5G for verticals



The 5G PPP Technology Board and the 5G IA Verticals Task Force have published a White Paper on “Empowering Vertical Industries through 5G Networks – Current Status and Future Trends” (20 August 2020). This white paper summarises

the progress and results produced by the projects of the 5G PPP programme in regard to the development of innovative 5G network services for vertical industries. It analyses 5G requirements and the business case for the use of 5G by verti-

icals. Furthermore, the report presents exemplary use cases from eleven vertical sectors and identifies key 5G features that have been used to meet the specified requirements.

The White Paper is relevant for defining future research and innovation activities beyond 5G. The outcomes of the 5G PPP will serve as the basis for the Smart Networks and Services (SNS) programme, which aims to organise the European research and innovation activities for the evolution of communication networks in the timeframe until 2028. One of the main objectives of the SNS programme is the full digitisation of vertical industries.

✦ Further information

White Paper on 5G for verticals –

<https://zenodo.org/record/3698113>

Sales record for service robots

Between 2018 and 2019, the global sales value of professional service robots increased by 32% to 11.2 billion US dollars. These figures have been presented by the International Federation of Robotics (IFR) in its “World Robotics – Service Robots 2020” report.

Medical robots accounted for 47% of the total professional service robot turnover in 2019. This was mainly driven by robotic surgery systems, which are the most expensive type of medical robotics. By 2022, medical robot sales have the potential to more than double by reaching 11.3 billion US dollars. About 90% of medical robots are from American and European suppliers. The market value of logistics robots sold or leased rose by 110% to 1.9 billion US dollars. Almost all of the logistics turnover was generated with robots for indoor use. Autonomous mobile robots have initially been used in warehouses. Due to the digitisation of production, they are now also part of smart factories. Thus, the IFR considers a continued strong annual turnover growth of 40% or more for logistics robots possible.

The trending **Robotics-as-a-Service (RaaS)** business models lower the hurdle for customers to automate with robots, according to the report. The benefit of using RaaS instead of buying robots is that companies have no fixed capital, no fixed costs, and no need for robot operators. The use of logistics systems in non-manufacturing industries has been strongly driven by warehouse

solutions for major e-commerce companies. A strong potential can also be found in hospitals running their logistics with the help of professional service robots. In the segment of professional service robotics, about 90% of the sampled logistics robots were produced in Europe and North America, and about 10% in Asia.

The segment of **field robotics** consists of robots for agriculture, dairy, livestock farming and other field applications. Sales value increased by 3% to 1.3 billion US dollars. According to the IFR experts, the COVID-19 pandemic might increase demand for field robots. Travel restrictions for workers from Eastern Europe, for instance, who usually travel to Western Europe in harvest season, caused a shortage of labour supply. Farmers might compensate this with the use of field robots. Sales value growth rates of more than 30% for agricultural robots seem possible.

Service robots for personal and domestic use are mainly produced for a mass market in the area of household robots. This includes vacuuming and floor cleaning robots, lawn-mowing robots or entertainment robots. The total number of service robots for personal and domestic use increased by 34% to more than 23.2 million units sold in 2019. The value grew by 20% to 5.7 billion US dollars. Unit prices for the two major segments, robot vacuums and toy robots, have



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been declining in recent years. Today, basic robot vacuums are already available for less than 100 US dollars. 75% of the sampled domestic service robots – vacuum and floor cleaners, lawn mowers and other domestic robots – were produced by American companies in 2019. Asian companies had a share of 19%, European companies of 6%.

A growing market is the use of **assistance robots for elderly or handicapped persons**. The estimated sales value increased by 17% to 91 million US dollars.

In addition, the IFR experts expect that the COVID-19 pandemic will further boost the market for service robots. They envisage high demand in areas like robotics disinfection solutions, robotic logistics solutions in factories and warehouses as well as robots for home delivery.

✦ Further information

IFR press release – <https://ifr.org/ifr-press-releases/news/service-robots-record-sales-world-wide-up-32>

Excel accidents

The economic and social risks of spreadsheet errors



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Whenever executives think of business risks, they usually consider well-known factors like competitors, compliance, and cybercrime, at the moment also COVID-19. However, there is a less obvious, yet potent risk at their fingertips – their trusted spreadsheet programme, which in most cases is Microsoft Excel. It is not just the quirks of the software itself, but rather the way business people use it that leads to trouble.

When Microsoft released the first version of Excel for the Macintosh in 1985 and two years later for Windows, nobody could have guessed how ubiquitous the use of this spreadsheet software would become. Already by the early 1990s, Excel had gained a dominating market position against its toughest competitor at the time, Lotus 1-2-3. It did not take long until the calculations and formulas in cells, rows, and columns led several users astray, causing a never-ending series of spreadsheet errors with sometimes spectacularly disastrous consequences.

History of errors

IT professor Raymond R. Panko from the University of Hawai'i has investigated spreadsheet errors for the last three decades and has come to devastating conclusions: almost 90 percent of all spreadsheets have errors. And even the most carefully edited spreadsheets have errors in one percent of all formula cells. This means that in larger spreadsheets with thousands of formulas there are dozens of errors.

While this in itself may not yet sound shocking, the implications of spreadsheet errors definitely are scary. Nearly one out of five large companies has suffered financial losses due to spreadsheet errors. Typically these errors are caused by a combination of human mistakes and the complexity of large spreadsheets, which provide plenty of opportunity to go wrong. Most of these mistakes do not have an economic impact, but some do. And sometimes, the damage is huge, as the following examples show.



US photographic product company Eastman Kodak had to restate financial results for two quarters by combined 15 million dollars because of an erroneous spreadsheet. It had miscalculated the severance and pension-related termination benefits accrued by one employee.

JPMorgan Chase, the largest bank in the United States, made a wrong credit portfolio assessment based on several faulty equations in a spreadsheet, which cost them approximately 6.5 billion dollars in losses and fines. US mortgage-loan company Fannie Mae had to restate its 2003 third-quarter financials due to a 1.1 billion dollar spreadsheet error, which was due to the flawed implementation of a new accounting standard.

Lost COVID-19 test results in England

While the economic damage by erroneous spreadsheets of businesses large and small is already huge, there is also a high social price to be paid for spreadsheet errors in the public sector. One of the most recent cases involved the loss of COVID-19 test results in England. As BBC News reported in early October 2020, the stunning number of 16,000 coronavirus cases went unreported in England, due to a flawed Excel template by Public Health England (PHE), an executive agency of the UK Department of Health and Social Care. The problem was caused by the way PHE assembled logs produced by commercial firms paid to analyse swab tests of the public, to discover who has the virus.

The firms recorded their results correctly in CSV files, text-based lists that can be processed by Excel. PHE had set up an automatic process to pull these data together into Excel templates for upload to a central system. The problem was

that the developers at PHE had chosen an old file format for the templates, the XLS format, instead of the current XLSX format. As a consequence, each XLS-based template could handle only about 65,000 rows of data instead of the one million-plus rows that the XLSX format is capable of. And as each test result created several rows of data,

this meant that each template was limited to about 1,400 cases. When that total was reached, further cases were cut off.

How to contain spreadsheet errors

Efforts to understand and fight the problem of spreadsheet errors go back more than two decades. Already in 1999, a group of British spreadsheet researchers from the University of Greenwich, the University of Wales Institute Cardiff and Her Majesty's Customs and Excise joined forces to create the European Spreadsheet Risks Interest Group (EuSpRIG), which is dedicated to the art of spreadsheet risk management. EuSpRIG claims to be the largest source of information on implementable methods for processes and methods to inventory, test, fix, document, backup, archive, compare and control the legions of spreadsheets that support critical corporate infrastructures. EuSpRIG runs an annual conference which provides a forum for researchers, practitioners, trainers, vendors, consultants, regulators and auditors to discuss the latest developments in spreadsheet risk management.

Despite the efforts of EuSpRIG and others to reduce the occurrence and damage of spreadsheet errors, the problem seems to persist. In some cases, like the handling of COVID-19 test results in England, the solution may not be to improve the spreadsheet or to better educate users in the proper use of Excel. Instead, it might be better in such cases to rather get rid of spreadsheets altogether and handle large amounts of data in databases that ensure the consistency and integrity of the processed data.



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