EURESCOM message

The magazine for telecom insiders

The Internet of Things

The Kennedy Perspective
Collaboration or sabotage

Events
European Conference on the Future Internet in Munich

A bit beyond
Whacky fundraising

Celtic-Plus Event

Co-located with Software Days

Vienna, 27–28 April 2015

The Celtic-Plus Event 2015 will be organised on 27-28 April 2015 in Vienna. The event is co-located with the Software Days 2015 and will be hosted by the Austrian Research Promotion Agency FFG together with the Austrian Chamber of Commerce and the Vienna Business Agency.

Use the opportunity to network with proposers and experts
The event will include a comprehensive matchmaking possibility and facility, where you can meet other experts from the ICT community to discuss emerging R&D needs and proposals for related collaborative projects. The matchmaking part is an extraordinary opportunity for participants to present their companies and expertise, to offer project ideas for collaboration and to find partners. The meetings will be organized upfront, supervised and the meeting places will be provided. Celtic-Plus invites the participants to submit their proposals at the Celtic-Plus Call in spring 2015.

See and hear about the results of Celtic-Plus projects
Results of about 15 commercially important Celtic-Plus projects will be presented in presentations and at the related exhibition. The prototypes evolving from these projects will allow you to experience in an interactive

and playful way the technological progress made in those projects, The project-teams will be at your disposal to explain and demonstrate their research results.

Meeting government representatives
Experts and representatives from national governments will explain their research agendas and the opportunities for public funding. Come and discuss with them how you can participate in the sizzling European ICT arena.

Witness the Celtic-Plus Award
Every year Celtic-Plus selects the three best rated Celtic-Plus projects for the Celtic Excellence Awards. At the common dinner the winners will be announced and celebrated.

Venue: Austrian Chamber of Commerce, Wiedner Hauptstrasse 63, 1040 Vienna
Further information: **www.celticplus.eu**

NetWorld2020 GA 2014
The future of telecommunication networks

3 December 2014

Bedford Hotel, Rue Du Midi 135, Brussels, 1000, Belgium
www.bedfordhotelcongresscentre.com

The NetWorld2020 Annual Event 2014 will take place in Brussels on 3 December 2014. This year's event theme is "The future of telecommunication networks". Being at the phase where the first large set of projects of the 5G PPP initiative are being prepared, the event will address some of the related aspects but will go beyond, aiming to look at a more comprehensive picture going beyond 5G. Requirements and views on future telecommunication systems will therefore be presented by a set of distinguished keynote speakers from various domains and regions of the world. The event will also present news regarding 5G-PPP, its planned working mode once the first projects have been started in 2015, but also, looking further into the future, presenting the priorities of the 5G PPP Association for the Horizon 2020 work programme 2016–17.

Four parallel sessions will be organised on selected topics, where key experts will present their view. These sessions are intended to stimulate discussion. The results from these discussions are planned to feed back into the work of the NetWorld2020 expert group's work and the 2016–17 work programme.

For further details, agenda and registration please visit the NetWorld2020 website: **http://networld2020.eu/**

Room capacity is limited.
Registrations will only be possible until room capacity has been fully used.

Dear readers,

The vision of interconnecting uniquely identifiable embedded computing devices, also called the Internet of Things (IoT), has been around since the early 1990s. Now, more than two decades later, the vision is becoming a reality in ever more areas of business and social life. Thus, the editorial team considered that the time had come for dedicating our cover theme to IoT. Although it is impossible to cover all facets of the fast-growing IoT field, we believe that the selected articles we present in this issue give you a good idea about the progress of IoT in Europe.

In the introductory article to the cover theme, Adam Kapovits, Eurescom's coordinator of the IoT-related EU research project RERUM, gives an overview on the Internet of Things. This is followed by a RERUM article about on-device intelligence, which the three authors regard as a way to improve security and privacy of IoT.

In an exclusive interview the chairman of the IoT Forum, Mirko Presser, shares his insights on the progress of IoT in Europe. As a concrete ex-

ample of IoT progress in Europe, Michael Tost from the public sanitation provider in Berlin explains the opportunities of smart waste bins for the German capital. The cover theme is concluded with an article by Raffaele Giaffreda from CREATE-NET on the iCore project and how it is enhancing IoT with cognitive technologies.

This issue also includes a variety of further articles on different, ICT-related topics. See, for example, the new opinion article by Eurescom director David Kennedy in his column ''The Kennedy Perspective'' on the collaboration challenges of project proposals. Or the event articles on the 2nd European Conference on the Future Internet in Munich and the IEEE Healthcom in Brazil. Under 'European Issues' Eurescom message editor Uwe Herzog provides the latest information on the 5G Public Private Partnership, complementing our spring 2014 cover theme on 5G technologies and services. Finally, in the latest ''A bit beyond'' article you can learn about the humorous side of crowdfunding.

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

Milon Gupta
Editor-in-chief

Events calendar

2 – 5 March 2015
Mobile World Congress
Barcelona, Spain
http://www.mobileworldcongress.com

10 – 11 March 2015
ITEA & ARTEMIS Co-summit 2015
Berlin, Germany
https://itea3.org/co-summit-2015/index.html

16 – 20 March 2015
CeBIT 2015
Hannover, Germany
http://www.cebit.de

24 March 2015
2nd CI-FIRE Industry Workshop
Brussels, Belgium
http://www.ci-fire.eu

25 – 26 March 2015
Net Futures
Brussels, Belgium
http://netfutures2015.eu

27 – 28 April 2015
Celtic-Plus Event
Co-located with Software Days
Vienna, Austria
http://celticplus.eu

29 June – 2 July 2015
EuCNC – European Conference on Networks and Communications
Paris, France
http://eucnc.eu

Snapshot

Ping-pong robot

In October 2014, a ping-pong robot developed by Japanese electronics company OMRON Corporation received the Grand Prix in the Innovation Awards at the Combined Exhibition of Advanced Technologies, CEATEC JAPAN 2014. The robot is meant to showcase advances in real-time processing, sensing and mechanics.
Further information: http://www.omron.com/media/press/2014/10/c1010.html

Contents

Collaboration or sabotage

David Kennedy
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A recent set of discussions with a number of partners trying to form a project proposal got quite tense as it emerged that several parties had different ambitions and even different agendas for the proposal that we were supposed to collaborate on.

Normally some conflict can be expected in a proposal preparation phase, as personal ambitions get molded into the shape of the proposal and everyone has to make some compromise, but what was happening here is that some parties wanted a totally different proposal and others simply did not believe that their vision actually addressed the call text and therefore was doomed to fail.

This caused such friction that I began to wonder did someone have a malicious agenda. Or was it simply that they had misinterpreted the possible proposals that could succeed under the call? And if you are working with these guys, how do you separate innocent misunderstanding from malicious sabotage?

Existing relationships

Much faith is put into working with people you have worked with successfully before, and here I came to the realization that, in many organizations, it is not the organizational culture you see, but the personality of the individuals concerned. So with the same company your relationships can be harmonious or stressful, depending on the guys you are dealing with. It can be terribly confusing, if you have a good relationship with a company and this falls apart when another individual gets involved. Here you have to work on the basis that the good guys you have known and worked with will come to the fore and do the right work before it is too late.

What to do?

Well, the first thing I had to do was insist on the proposal being done on the basis of what the majority believed as giving the best opportunity for success. Here it is important to promote the innovative ways the proposal addresses the requirements of the call and how the team has the competence to deliver. This must be complemented with an offer of resources that can credibly achieve the results being promised in the time available. This may mean that you have to drop the dissenters, if they insist on hanging on to a structure that is not viable, and this is not easy. But no one will win, if you are forced to make a proposal that is wrong and fails.

Maintaining relationships

If forced into a confrontational discussion, as described above, the issue is how to get through it and retain good working relationships. Johann Wolfgang von Goethe understood this in how he said our actions influence the actions of others: ''I possess tremendous power to make life miserable or joyous. I can be a tool of torture or an instrument of inspiration; I can humiliate or humour, hurt or heal. In all situations, it is my response that decides whether a crisis is escalated or de-escalated, and a person is humanized or de-humanized. If we treat people as they are, we make them worse. If we treat people as they ought to be, we help them become what they are capable of becoming.''

This puts the challenge back to each of us to understand how our words and actions influence others and to try and have a win-win outcome. You may not succeed in every case, but at least you can avoid winning by humiliating your counterpart.

As regards making the best proposal collectively, I can leave it to Jack Welch to sum up our possibility of making a winning proposal in terms of gaining from our shared knowledge and polling our competence: "An organization's ability to learn, and translate that learning into action rapidly, is the ultimate competitive advantage."

The Internet of Things – An overview

Adam Kapovits
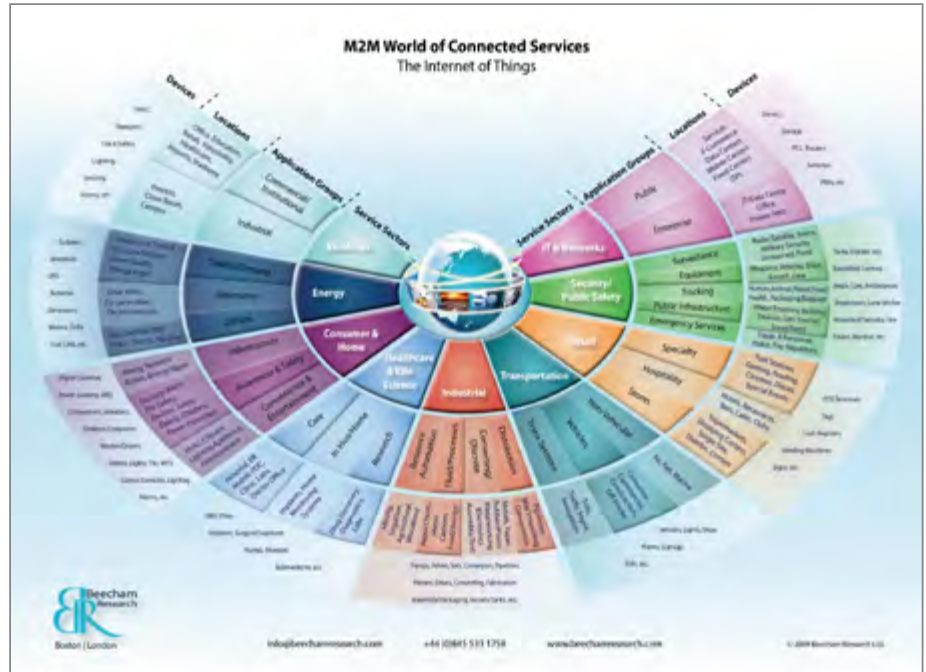Eurescom
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Microprocessors and some limited intelligence are now increasingly built into everyday devices. These devices are ranging from domestic appliances through various tools to cars and buildings. Some of them cannot only sense and monitor their environment, but also take actions. The Internet of Things (IoT) is the interconnection of these uniquely identifiable, embedded computing devices within the existing Internet infrastructure. The recent acquisition of California-based home automation company Nest Labs by Google for an amount of 3.2 billion US dollars highlighted the huge importance and potential of the Internet of Things.

M2M and IoT application domains (Source: Beecham Research)

Typically, IoT is expected to offer advanced connectivity of devices, systems, and services that goes beyond machine-to-machine communications (M2M) and covers a variety of protocols, domains, and applications. The interconnection of embedded devices is expected to usher in automation in nearly all fields, while also enabling advanced applications.

IoT and Big Data

There is an interesting link to Big Data, as the very large number of those embedded devices will generate a huge amount of data, even if individually each of them contributes only a limited amount. In addition, the time factor needs to be considered, because even though these devices in most cases provide a relatively small amount of data at any particular point in time, but often they do it continuously, at regular intervals. So even if the frequency of providing the data is low, but as they are supposed to operate often for many years, if not for decades, over time they provide a very considerable amount of data even individually. Thus, IoT is one of the key contributors to the Big Data phenomenon, and indeed for the success of IoT it is critical to be able to make sense of that large amount of data and to enable advanced applications and services the right big data analytics tools are needed.

To put IoT in a broader context going beyond the technicalities, it is usually heralded that the overall ambition of IoT is to provide improved quality of life to people, preferably to a significant portion of humankind. To deliver on this promise in a satisfying and economically affordable way very much depends on how this emerging ecosystem is constructed.

The ability to have physical objects communicate allows for a multitude of opportunities, from optimisation of existing business processes to the creation of entirely new business cases. The figure by Beecham Research shows the ubiquity and relevance of IoT for an extremely wide range of sectors and industries, basically covering all aspects of life.

Recently some impressive figures regarding the expected growth and size of the IoT market have been published. Gartner predicts 26 billion connected devices by 2020, and with this figure it sits between the 18 billion predicted by Machina Research by 2022, and Cisco's prediction of 50 billion by 2020. Machina Research expects that connections will be dominated by two sectors: consumer electronics (including cameras, music players and TVs) and intelligent buildings (e.g. security and heating, ventilation and air conditioning- so called HVAC – systems). Between them they will account for almost 70% of the total. Furthermore, short range technology will dominate M2M: 73% of M2M devices will be connected by short-range technologies.

In terms of revenue, Machina Research expects an impressive compound annual growth rate (CAGR) of 16%, reaching a total volume of 1.3 trillion US dollar in 2022. Two-thirds of the revenue opportunity is accounted for by devices and installation, and one-third by M2M services.

The stakeholders

Let us have a look at the key players that can benefit from the explosive growth of IoT, and who can make it happen. Ultimately, the main beneficiary is expected to be the general public. As the figure by Beecham shows a multitude of sectors are expected to benefit in various ways. Finally, there are a few sectors that are directly involved in the development and delivery of IoT solutions. Among them the connectivity providers (telcos, mobile operators, internet service providers, satellite connectivity providers) have a special position, as they are holding the key to connect and interconnect trillions of devices. Next to the connectivity providers, application and service providers, data analytics experts and anyone involved in Big Data are also critical to expedite the realisation of the IoT value promise.

Technological challenges

M2M and IoT will feature orders of magnitude more nodes than human-to-human communication, and most of those will create low bandwidth, upload based traffic. The connected objects are in many cases simple objects, often

isolated and running on battery, with sensors that detect certain events or information and transmit that data to an IT system. The information can be anything from energy consumption, temperature, humidity, location, presence information, health data, and many more. These applications tend to have very different network and data transmission requirements with regards to connectivity than traditional network clients, such as mobile phones and computers.

Other main challenges include:

- Low cost and extreme cost effectiveness to permit very high volume deployment.
- Low energy consumption:
  The objects, including their components responsible for the radio communication, should consume as little power as possible to allow for many years of maintenance free operation.
- Size, simplicity and ease of deployment and maintenance:
  Howard Sian, Micron Technology writing about wearable devices argues that the space, power and application requirements of wearables and other mobile connected devices require a fresh approach to system design, emphasizing integration, both on-chip (SoC) and in packaging (MCP/multi-chip package), faster boot times, and lower standby power. System designers can't simply down-scale existing mobile device platforms, but must take a fresh approach and optimize component choices for system requirements. With IoT systems most often automatically offloading collected data to cloud-based repositories, the need for local storage on wearables can be minimal, meaning that just adequate local storage capacity can suffice, and benefits such as execute-in-place convenience for application code and low standby power to extend device battery life can become the decisive factor.
- Security and reliability:
  The devices that are installed most often are expected to be operational for years, even decades. The security systems embedded in those devices might be sufficient today, but not in the future. As Ubuntu founder Mark Shuttleworth has put it: "We need to prevent access to the devices, both physically and logically, blocking access to the configuration parameters [...] We need to create a security layer, upgradeable, between one device and the device or the service it needs to talk to, on both sides". [Panel discussion at the 2014 Mobile World Congress, http://www.eetimes.com/document.asp?doc_id=1321229] EU research project RERUM, which is focusing on security, plans to provide solutions for over-the-air upgrades.

- Frequency independent and deployable worldwide:
  In today's globalised world it is extremely important to be able to connect millions of objects without roaming restrictions or any administrative hurdles, which also points to standardisation and a favourable regulatory framework being critical.

A low throughput object – in terms of data transmission – would be expected to have very low power consumption and a reduced connectivity cost, as the objects only send small messages once in a while. The challenge for traditional connectivity network providers is their ability to truly deliver on these aspects, whilst their networks have not been built for this kind of network usage. In summary, suitably adapted connectivity solutions for low throughput connections is one of the major obstacles in achieving the expected industry growth.

Finally, in the words of Adam Gould, vice president of the Sensinode Business at ARM: "We need standards at the radio level, the security layer, and the data format level... For developers it is necessary that they know that those devices are going to be able to talk to each other and [that they] really focus on the application." (Panel discussion at the 2014 Mobile World Congress, http://www.eetimes.com/document.asp?doc_id=1321229)

Conclusion

Currently there is a clear momentum behind the Internet of Things. It is one of the most dominating developments in the area of future communications. By being low bitrate, potentially high-value, the IoT represents the opposite of another current technology trend: ultra-high bandwidth video communication. These two have very different characteristics and demands towards the emerging future Internet infrastructure, and it is a real challenge to serve both with a common infrastructure. The rapid evolution of communication technologies, particularly in the area of IoT, involves also challenges far beyond the technological dimension, for example in regard to data protection and privacy. Thus, the development of IoT offers Europe both huge opportunities, but also significant technological and societal challenges.

✈ **Further information**

For security aspects see the RERUM project website at http://www.ict-rerum.eu
For a general technological and market view see a SIGFOX White Paper on IoT and M-to-M at http://sigfox.com/static/media/Files/Documentation/SIGFOX_Whitepaper.pdf
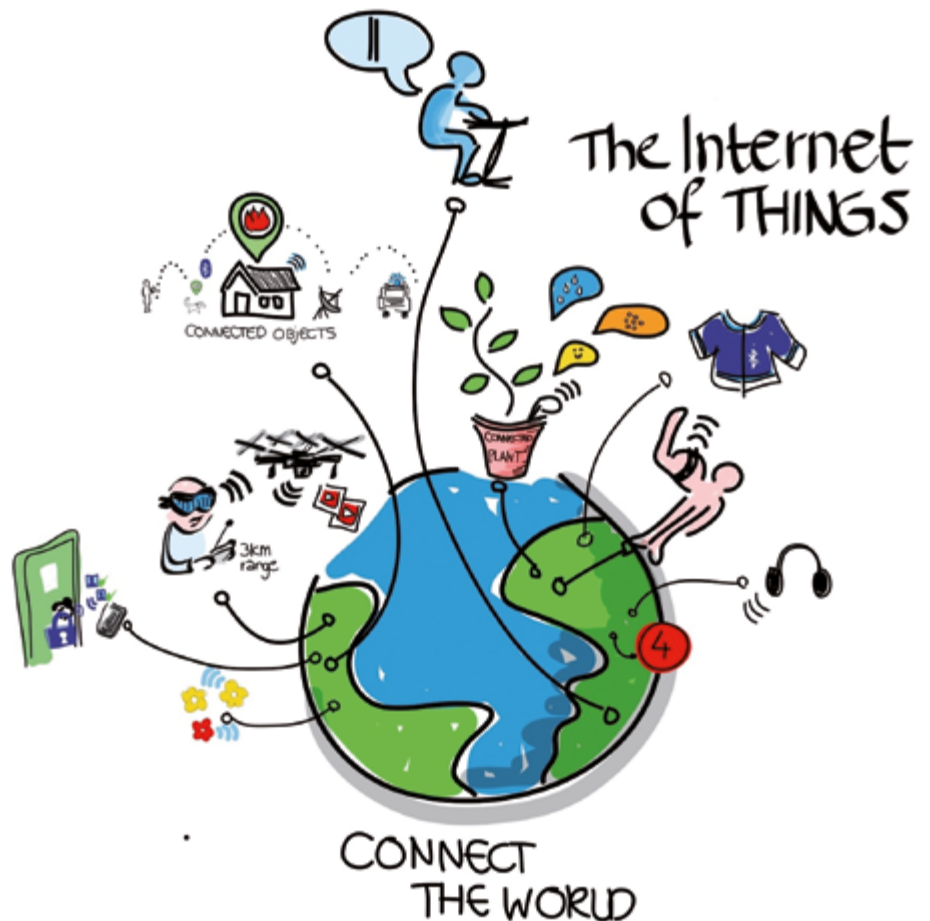
RERUM – On-device intelligence for a better IoT

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RERUM is an EU FP7 project, which is developing, evaluating, and demonstrating an architectural framework for reliable, resilient and secure IoT for Smart City applications. The framework is based on the concept of security and privacy by design, addressing the most critical factors for the success of Smart City applications. RERUM investigates indoor applications for Smart Houses that have moved into the spotlight for improving their security, privacy and reliability. Visionary solutions are already available on the market and drawing attention, but are also exposing the unresolved risks for privacy and security.

Key challenges

A key challenge for the Internet of Things (IoT) towards Smart City applications, such as smart living spaces, is ensuring reliability, which incorporates the notions of security, privacy, and availability. This summer, Time magazine featured a double issue on "smarter homes" (Time, 26 June 2014, http://time.com/topic/the-smart-home/). An array of visions and technical implementations in the market were displayed to a wide audience, with some features that strongly relate to the focus of RERUM. The majority of presented solutions advocates objects becoming intelligent. However, this intelligence is limited due to size and computational constraints of the devices: data are typically sent to servers for mining, to produce the smartness that you feel in your home. Time magazine cites Alex Hawkinson, founder and CEO of SmartThings, as this being a "creepy factor". Hawkinson explicitly ensures security by hiring white-hat hackers to continuously probe and pinpoint vulnerabilities that must be fixed ("This Startup is Trying to Create – and Control – the Internet of Your Home", Time, 26 June 2014, http://time.com/2926400/at-your-service/). RERUM performs vulnerability and threat assessments and considers security as part of the design process of the architectural framework.

The current approach by IoT smart-home solution vendors, mentioned in the Time magazine article, moves the "intelligence layer" away from devices and reduces devices to "primitive capabilities". RERUM argues that for privacy and network efficiency, intelligence should be local and under little observability. Indeed Hawkinson's SmartThings run on rules examined in the Cloud, e.g. "if motion detected in the hallway and time is before lunch, then fetch today's weather forecast and play on my speakers". This kind of programme in the Cloud is waiting to be triggered whenever motion is detected. Hence, SmartThing's Cloud gets all motion events to their servers, even if the motion happens at night and no action is in need of being triggered.

Putting intelligence and most capability in the Cloud leads to privacy-invasive surveillance and also non-efficient network utilisation, as the following example of IP-based video cameras shows: You connect the camera to give it Internet access. Next, you connect to a camera-unique URL on the vendor's server to watch your video. This is not a direct connection. The camera vendor's server is a proxy, allowing the vendor to offer 'intelligence', e.g., services like motion-detection alert e-mail. Even when at home, on the same WiFi, you watch via the vendor, and for motion detection, the camera streams everything 24/7 to that vendor.

Albeit being an obviously poor design in terms of both privacy and network utilisation, other factors like (a) ease of Internet access behind routers, (b) decreased time to market, (c) higher flexibility for the provider to update and deploy new services are currently seen as a business advantage. RERUM's research challenges this and considers privacy a part of the initial design.

Some design decisions are: (a) localise the capability to evaluate local events and take decisions, (b) decouple actions observable by third-parties from the outside from internal, local events as much as possible. RERUM is not opposing Cloud solutions, on the contrary, it aims to complement Cloud solutions providing a low-level option enhancing security and privacy on smart devices for achieving secure and privacy-preserving local smartness: Too dumb devices are technically incapable to adequately protect your privacy, let alone utilize sparse network resources efficiently.

Requirements for IoT security

More complex, but very important in Smart Cities is location privacy: Applications will need to rely on participants' location, without leaving citizens traceable. Privacy is related to security, but it is not the same. Apart from privacy, RERUM's security goal is preventing un-authorized actions from happening in the IoT domain:

- Integrity protection removes the ability to modify messages, e.g. a burglar will not be able to change the message from the door's sensor that screams "open" into a message saying "closed" to hide his intrusion.
- Authentication allows identifying which sensor is sending a message, e.g. also ensuring that you can present yourself as the owner to sensors that belong to you. Hence, that burglar will not be able to abuse the message "closed" sent from the window's sensor, as a message coming from the door.
- Confidentiality allows hiding the contents of a message from third parties, e.g. like your neighbour cannot read the energy consumption reported by your washing machine. Trying to prevent the observing neighbour from learning that it was the washing machine that sent a report is also tackled by RERUM, and falls into the intersection of privacy and confidentiality, and requires solutions like pseudonymous routing protocols.

On-Device First and On-Cloud Second

Observing the current industry trend for implementing the IoT, next to no smartness is running on a device near you. This, as we illustrated already, negatively impacts user privacy and requires an implicit (yet not always justified) trust in the service company and the intermediate

nodes or proxies. At the same time, it also puts vital controls of a Smart Home in the hands of an Internet connection and a provider's server that both must be up, running and secure. A broken Internet access could mean that you cannot open doors, or worse, a fire hazard may go undetected. Current reluctance to put functionality near you can be explained because it is much harder and more costly to maintain. Software updates for your smart devices require reprogramming them over the air, restarting them preferably without needing configuration again.

Hardware must be capable of supporting advanced or even basic security mechanisms without becoming more costly; an insecure or non-private system design is hard to be turned later on into a privacy preserving or secure system.

RERUM is therefore taking an ''On-Device First and On-Cloud Second'' approach. RERUM designs an IoT architecture taking smart devices,

which are capable to run lightweight algorithms that enable the protection of security and privacy. This is shown in detail in the figure, which maps the security and privacy mechanisms of RERUM on the Architecture Reference Model of the Internet of Things – Architecture (IoT-A ARM). As it is depicted, many mechanisms are embedded on the devices.

Thus, RERUM allows:

- using on-device security and privacy preserving mechanisms, whenever an application needs this protection it is already available, without the need to implement it,
- updating on-device software, to cope with software bugs or provide new functionality.

Conclusion

RERUM develops an IoT architecture based on the concepts of security and privacy by design. It is designing security and privacy-enhancing mechanisms onto the device to have them in-place, if an application would need them. RERUM puts more intelligence on the devices because the system and the applications greatly benefit from it. This way, RERUM protects the devices themselves and the data that are gathered, avoids network congestion and avoids disclosure of citizen-private data to unauthorised third parties, because they will not be transmitted as-is to the outside world.

✈ **Further information** on FP7 Smart Cities project RERUM is available at www.ict-rerum.eu
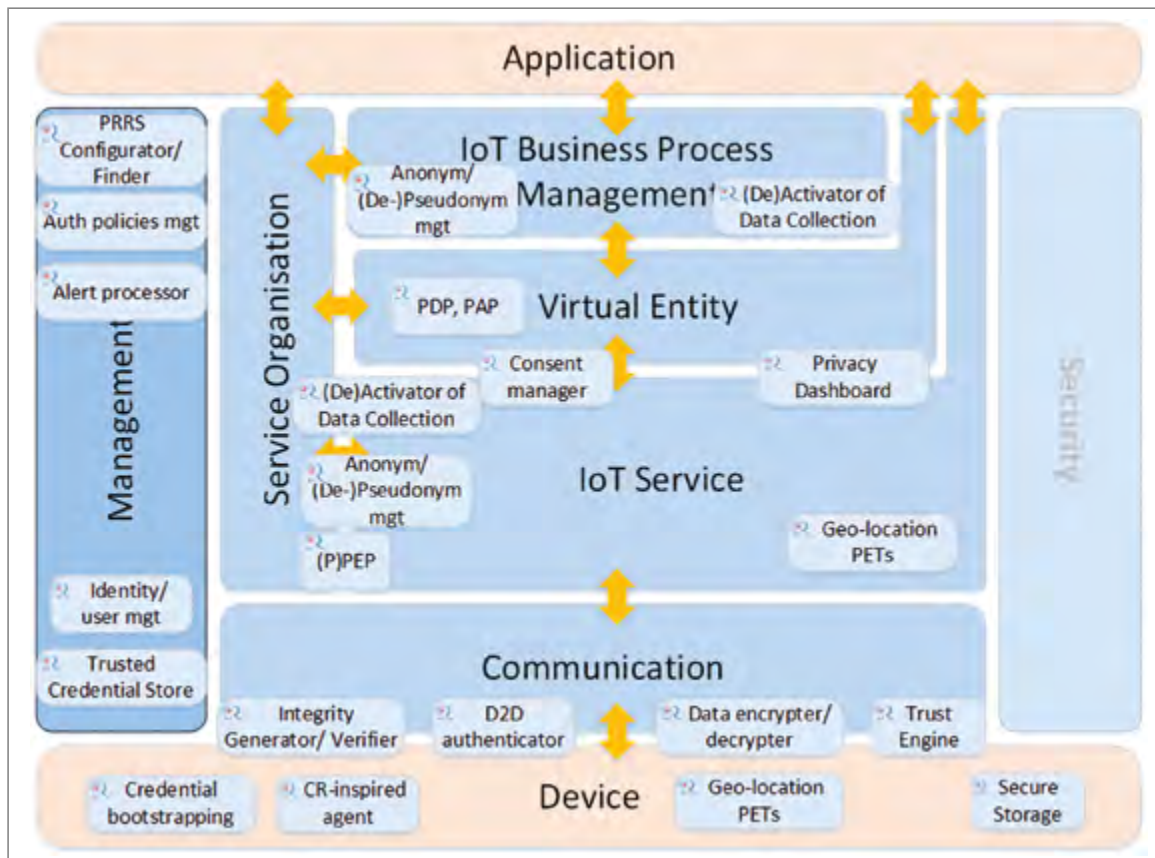
The RERUM security, privacy and trust components overlaid on the IoT-A ARM

A life more quantified

Interview with Mirko Presser on the progress of IoT in Europe

The Internet of Things is coming. What has been just a vision some years ago is now becoming reality in all areas of life. This raises questions on social and economic impacts as well as challenges and opportunities for Europe. In order to better understand the current status of the Internet of Things (IoT) in Europe, Eurescom message editor-in-chief Milon Gupta interviewed one of the leading IoT experts in Europe, Mirko Presser from the Alexandra Institute in Denmark (alexandra.dk), who has been working in several European IoT projects and is chairman of the IoT Forum (iotforum.org), which is organising the annual IoT Week (iot-week.eu).

How will the Internet of Things change European society and economy in the next five years?

Presser: Predicting the future is hard. But if we look at the trends we can see that the IoT has already had impacts across many industries, government and individuals.

For example, from an industry perspective, IoT is changing how we are doing business. The move from out-of-the-box products to services has been going on for some time now, but the IoT is accelerating this. Take the case of Rolls-Royce: they are selling their jet engines by flight hours. This pay-per-use model has now also become feasible for much cheaper products-as-a-service, for example Car2Go and Hilti, and soon this will be seen in products that do not cost thousands of euros but less than 50 or even 10 euro. So, pay-per-use as a business model will grow rapidly and create a sharing economy.

From a government and infrastructure perspective we are already experiencing that services are becoming cheaper by introducing digitisation. The IoT offers this digitisation of more and more services as well as added value services. Existing examples are smart metering, street lighting or contactless payment. In the future, the introduction of technologies such as the driverless car will revolutionise transportation.

On the individual level, we are today experiencing the IoT in terms of gadgets, like the weight-scale, the fitness wristband, the plant sensor, and others – an endless array of products promising us a better life. This trend is on the one hand fuelled by the big names, like Nike, Adidas and Garmin – all of them offer great wristbands. However, there is a new group of entrepreneurs joining the market: the makers, for example The Hug, DrinkMate, Blink, RunScribe, elemoon, and others. They are all active Kickstarter projects, meaning they are based on crowdfunding, who are starting to make an impact.

What progress has been achieved in European research on IoT, and what research challenges lie still ahead?

Presser: In the last two years, the IoT has matured rapidly. I recall the time before the end of 2012. Getting funding for IoT was difficult. Talking about IoT products was based on RFID and at best M2M. Politicians rarely acknowledged IoT as something interesting. Today everyone is talking about the IoT, and funding is much more easily available – and more competitive. So research has matured. It has also given way to market forces and commercialisation.

Research has proven the basic concepts of the IoT – low cost, small size ICT in everything as well as the platforms to manage these devices and the data processing that need to come with it. But this does not mean we are done in terms of research. There are many challenges that need to be addressed.

Personally I am interested in addressing the interoperability of the IoT – this has a lot to do with standards, but we need to put emphasis on novel research in, for example, semantic interoperability and APIs.

Other topics that I find essential are the ethical implications of the Internet of Things – how will a world that quantifies everything change society and government?

And finally, how will the Internet change when the IoT has been absorbed into its patchwork of protocols? – Something that for instance CoRE at the IETF is doing with COAP, the constrained application protocol.

What are the security risks of IoT, and how should they be addressed?

Presser: Each time we deploy a device, we create a weakness in the system. That is sort of the worst-case assumption that we can make. But there is a lot of truth in this. Even if we do not see it as a weakness in terms of cyber-attacks we need to consider that if we digitise a service and rely on it, a power outage or otherwise a failure will cripple this service and we cannot use it anymore.

So the question we need to ask ourselves is simple – what is a good pace of adopting IoT? Do we need to introduce new processes of introducing new technology into critical infrastructures and services? Do we need to ask ethical questions before we deploy a set of sensors in the environment?

Today I think we are falling short and are often blinded by technology being oversold. In the future we should introduce a more rigorous approach to testing possible security risks before wider deployments are in place.

We need to have larger-scale experimental deployments and test solutions closer to the end user – ideally jointly with the end user – and in more realistic conditions.

What are the business opportunities of the Internet of Things for European companies?

Presser: I think there are currently three main drivers for IoT-based business: firstly, pay-per-use service, which means moving from out-of-the-box products to servicification; secondly gadgets, what I would call the glamour and promise of technology; and thirdly cheaper services and processes via digitisation which save time and cost. Europe has been a strong IoT player globally. I think for much of the time Europe has been the leader in IoT research. Evidence are the many successful IoT conferences in Europe as well as Cisco's choice to launch their IoT World Forum in Barcelona last year.

However, there seems to be a disconnect between the research community and business. The many results that so many EU projects have produced are locked away in unread reports and are implicit in the research community. The IoT Forum, through events like the upcoming IoT Week in Copenhagen in June 2015, is countering that by bringing together industry with the research community to facilitate a faster knowledge exchange. Time will tell, if we will be fast enough to close the gap.

How well are European ICT companies positioned to compete in the IoT market?

Presser: Europe has some great industrial leadership, entrepreneurs and makers. And we have the research capacity in the IoT that is at a higher standard, still, compared to any other region. Europe is also still the largest single market globally. So on paper I think we are in a great position.

However we need to solve the fragmentation issue. Industries are traditional and slow to react the larger they are. Companies such as Schneider Electric, Siemens, Bosch and Grundfos are building up competences and starting an organisational change process to react to the IoT – but it is a slow process, and my feeling is that the wheel is being reinvented from time to time. Entrepreneurs and makers need readily available knowledge to create impact. So, the disconnect or fragmentation between the commercial impact and research is evident.

How will IoT have changed your personal life in five years?

Presser: Be ready for a life more quantified. All aspects of life will be measured, directly and indirectly, consciously and sub-consciously, by us and by others. It will help us become more efficient, healthier and safer. And at the same time, it will make us more paranoid and susceptible. Maybe we will change as a society and learn to be more transparent and deal with more and more information, ultimately becoming a utopian knowledge society that is emotionally detached and driven by logic, or we will be deteriorating towards a totalitarian regime of knowledge imbalance, where people are measured based on consumer KPIs. I expect, we will be somewhere in the middle.

Personally, IoT has both ruined my life and helped me excel. After buying a gadget for my bicycle I have ruined my experience of just cycling – I am now perpetually competing against myself, driven by the little voice telling me I am behind my personal best. But I have also found the joy of house plants – something that I used to buy and throw out after all the leaves have fallen off, is now a thriving indoor garden thanks to my little sensor board and a set of sensors.

This is just the tip of the iceberg and I see exciting opportunities ahead for all of us.

Smart waste bins on the streets of Berlin

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More than 21,000 waste bins are spread across the streets of Berlin requiring 4.6 million emptyings in a year. There is a big potential for optimisation with respect to positioning of the waste bins, frequency of emptying, route planning and waste bin maintenance.

There are approximately 4,000 employees on the streets who try to describe the position and type of defective waste bins in their individual way. Thus, plenty of misunderstandings resulting in inefficiencies may occur. In order to support the maintenance process, Fraunhofer FOKUS has developed a web-based application, which runs, e.g., on a tablet PC (see figure 1).

The geo-position of the waste bins can be determined and filed by using GPS coordinates and waste bin IDs; maintenance orders can be placed by the logistic department and can be executed by the employees in real time. In addition to that advertising labels on the waste bins can be managed easily.

Fill-level measurement in waste bins

Fill-level data are required in order to be able to optimise the waste management and removal process. As part of the FP7 research project

Figure 1: Mobile maintenance application

Celtic-Plus
Newsletter 2/2014

HIPERMED
The high-performance low-cost telemedicine platform

SASER
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Celtic-Plus opportunities
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Editorial

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Dear reader,

The Future Internet is emerging at great speed, Smart Cities and Internet of Things with billions of sensors and activators are very high on the agenda, the 5th Generation of mobile and wireless networks is one of the central themes in European research, ensuring security and privacy in telecommunication and IT systems became a very urgent request of European governments. It seems that European collaborative ICT research is peaking as never before.

At the height of these enormous opportunities and challenges our colleague Heinz Brüggemann, who has been Director of the Celtic Office for more than 10 years, returned to his parent organisation Deutsche Telekom in June. A big thank you for the huge amount of work Heinz did to bring Celtic-Plus to the status it has now in the telecommunication R&D community. Since July we have a new Celtic Office organisation with a higher emphasis on strategic developments.

In the first half of 2014 the ICT R&D community was very much focused on the Horizon 2020 Call. The improved funding mechanisms for big industry players led to more than 1,600 project proposals in the Horizon 2020 ICT area, of which probably only about 10% will be accepted for funding. The Celtic-Plus Programme had suffered a bit from the fact that all concentration went to Horizon 2020 during this first half year. The more we are happy that at our Autumn Call in October 2014 we received eight interesting project proposals. The Celtic-Plus programme benefits from its bottom-up research themes, low administrative overhead, high success rate, and the short time that is achievable between the project proposal and the start of the actual project.

We are very proud that the Celtic-Plus project HIPERMED (HIgh PERformance teleMEDicine) has won the prestigious EUREKA Innovation-Award. Celtic-Plus Chairman Jacques Magen congratulated the HIPERMED consortium on behalf of the Celtic Core Group for their outstanding achievement. Let me quote what he wrote: "I was already particularly proud that they were selected as a finalist as the best EUREKA project in the 'added value' category – added value and industrial impact are two essential objectives of Celtic-Plus. I am also very pleased about this award,

due to the fact that the HIPERMED project is led by an SME and includes SMEs as well as larger companies and academic partners along with end users. This combination is an excellent basis for further successful exploitation of the project results on the market by the partners involved. I would also like to thank the public authorities from France, Poland, Spain, Sweden, and Turkey who also believed in this idea and supported the project. I am now looking forward to further exciting projects in the e-health area in the future within Celtic-Plus." If you are now curious what HIPERMED has done, read the Success Story article in this newsletter by HIPERMED project coordinator Oscar Chabrera from Spanish SME Merkum-ViLynx.

In June 2014, we had a very interesting high-level conference in Berlin, where results of the Celtic-Plus flagship project SASER (Safe and Secure European Routing) were presented. Major European communications technology companies signed a memorandum of understanding for the development of secure European network technologies. Many success stories could be reported. A few of them are explained on the next pages.

To keep our community informed about public funding possibilities we started a new category "Views from Public Authorities". In this issue we start with Germany, which is amongst the most active partners in the Celtic-Plus programme.

We included in this issue three articles from Celtic-Plus projects dealing with green terminals for next generation wireless systems (GREEN-T), technology improvements for large scale smart cities deployments (TILAS), and converged Infrastructure for emerging regions (CIER).

We hope you find the articles in this issue interesting and would welcome your comments.

Peter Stollenmayer
Editor

New Celtic Office organisation

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In June, our colleague Heinz Brüggemann, who has been Director of the Celtic Office for more than 10 years, returned to his parent organisation Deutsche Telekom. We used this occasion to renew the Celtic Office organisation and to split the responsibilities into operating the Celtic-Plus programme and developing new strategies.

Within the new organisation we have now two strands within the Celtic Office:

- Supervising and supporting the running Celtic-Plus projects and ensure starting of project proposals, headed by Peter Herrmann.

- Strategic programme planning, programme promotion and awareness, liaison and representation, proposal stimulation, headed by Peter Stollenmayer.

Celtic-Plus chair is Jacques Magen, InterInnov. Vice-chairs are Valérie Blavette, Orange, and Jukka Salo, Nokia.

This split into operations and strategy reflects the trend towards increased cross-programme cooperation, and increased horizontal cross-sector collaboration. Taking into account the limited resources of the European ICT research community we have to ensure that we generate as much synergy between the different activities as possible. Particularly towards the increased impact of the European Horizon 2020 Programme, and towards the other EUREKA Clusters, a lot of mutual benefit seems to be possible.

The full picture of the Celtic-Plus organisation becomes clear when we link the Celtic Office and Celtic Core Group via the Management Team. This structure supports and works closely with the national representatives of the EUREKA participating countries (see figure).

We expect that with this new structure, and particularly with the increased emphasis on strategic planning, a better awareness of the great benefits, which the Celtic-Plus Programme offers to European industry and research organisations, can be achieved.

In the medium term we intend to widen the community participating in Celtic-Plus projects.

We also want to intensify the contact within the existing Celtic-Plus community, including the Core Group members, the Public Authorities, and of course the participants in Celtic-Plus projects, where the added value is actually created. We from the Celtic Office are available to help project proposers and running projects to make the best out of this excellent collaborative research opportunity.

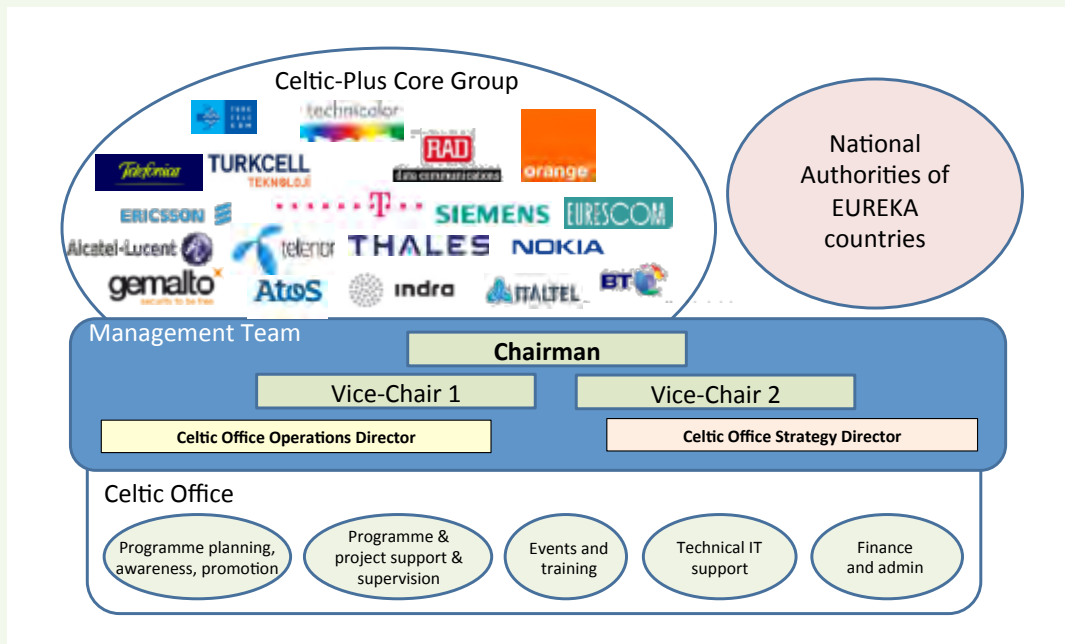- Further information
Celtic-Plus Website: http://www.celticplus.eu/

Figure: Celtic-Plus organisation with renewed Celtic Office

HIPERMED – The high-performance low-cost telemedicine platform

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HIPERMED (HIgh PERformance low cost teleMEDicine platform) was the first CELTIC cross-domain project including partners from both ICT and e-health in all project stages from definition to validation. It has designed a common open high performance low cost telemedicine platform providing services over IP, and minimizing deployment costs by reusing in-home infrastructures. HIPERMED has a huge commercial potential. First real deployments of HIPERMED technology are happening. The HIPERMED project won the prestigious EUREKA Innovation Award and also received the EUREKA Award in the Category 'Added Value'.

Deployment and service cost reduction are the key factor to allow telemedicine at home and between regional and reference hospitals. The HIPERMED platform was implemented with a common methodology that allowed to generate 8 new products and to improve 8 existing products (see figure 1). HIPERMED has been tested and validated in healthcare systems of five EUREKA countries (France, Poland, Spain, Sweden and Turkey).

Video quality assessment

HIPERMED has enabled the development of the PROMETEE living lab in Nancy, France, dedicated to subjective image/video quality assessment by medical experts. The impact of lossy video compression for medical usages has been estimated. Results have shown that low bandwidth remote consultation connections could be allowed while maintaining the quality of ear, nose & throat (ENT) videos for medical decision making by using compression techniques (AVC/H.264), reducing the video bitrate from 3Gbps to just 3Mbps. Finally, the video sequen-
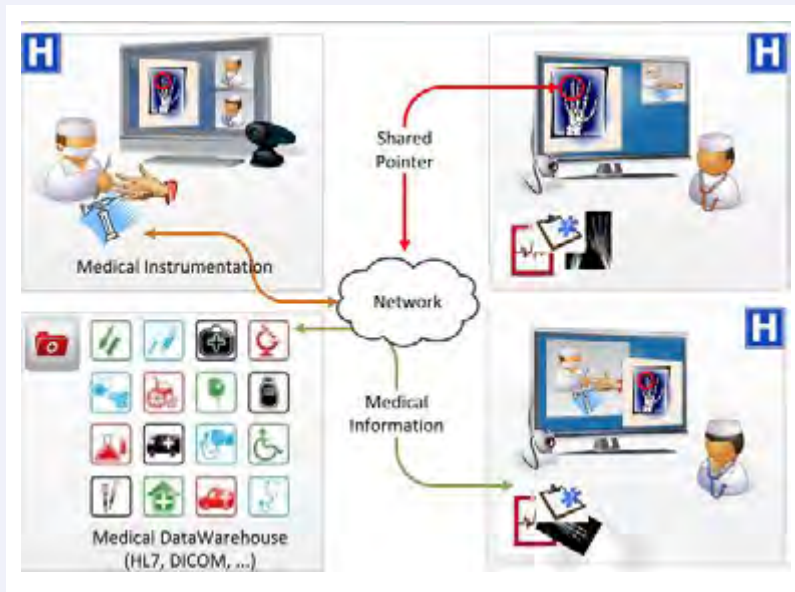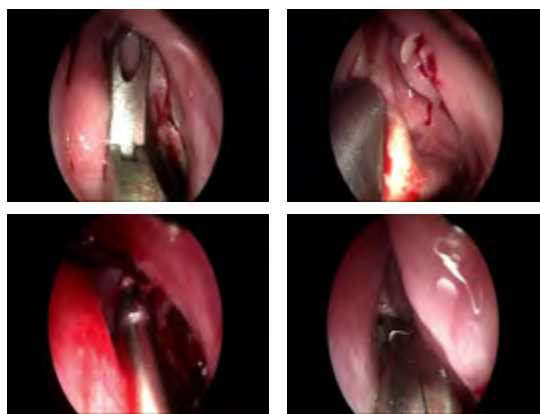

Figure 1: HIPERMED platform overview

Figure 2: HIPERMED video test sequence

ces (see figure 2) have been proposed to the MPEG standardization group to be included as test sequences in the HEVC profile for screen content medical video.

Commercial deployments

Sweden: HIPERMED results are considered for deployment in the Swedish public sector.

Turkey: Turk Telecom is deploying HIPERMED Speech Therapy solutions connecting remote regions to regional hospitals, for example in Anatolia.

Spain: The Red Cross is deploying a professional-to-patient videoconferencing system, while several mutual occupational accident insurance companies are deploying a remote consultation system between primary care and reference hospitals.

France: ENT Department of Nancy University Hospital is going to deploy HIPERMED Videoconference solutions for learning purposes before possible massive deployment in other departments and hospitals of Lorraine Region. 30 elderly persons' homes and two hospitals in Paris are deploying HIPERMED Videoconference solutions for remote consultation.

Poland: Deploying HIPERMED remote consultation solutions in the Otolaryngology Department Clinical Hospital of the Poznan University of Medical Sciences before a possible massive deployment using the PIONIER Network interconnecting all clinical hospitals in Poland.

Conclusion

HIPERMED has developed 16 medical services based on a common open platform that offers high-performance low-cost professional telemedicine services and reuse in-home infrastructure to minimize deployment costs. All relevant stakeholders such as doctors, patients, hospital administration, medical service operators have been included in the validation process allowing HIPERMED solutions to be widely adopted and more and more medical services and hospitals are taking up the HIPERMED solution.

■ More information is available at http://www.hipermed.org

SASER – Towards secure European telecommunication networks

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The Internet has developed into a crucial infrastructure. We have reached the point where a reliable Internet is seen as a normal part of citizens' lives. Not to forget the enormous economic impact of the Internet on all kinds of sectors. For the future telecommunications infrastructure, safety and security are amongst the most important factors. The Celtic-Plus flagship project SASER (Safe and Secure European Routing) aims at mitigating security vulnerabilities of today's IP networks and will propose a new architecture for energy- and cost-efficient networks for the time frame 2020.

The project works on the two main challenges in today's communication networks:
The new SASER system will allow more security in the network that will become less vulnerable to unauthorized procurement of information.
The new technology will provide an increased bandwidth of existing networks and will help to cope with the increasing use of the Internet that doubles its capacity every two years.
In June 2014, SASER held a high-level conference in Berlin to show their interim results, and the big potential impacts the project will have on the European telecommunications landscape.

Agreement for secure European network communications

Within and beyond the SASER project for "Safe and Secure European Routing", Alcatel-Lucent, Nokia Siemens Networks, ADVA Optical Networking, Orange and Deutsche Telekom Laboratories agreed in a memorandum of understanding (MoU) to coordinate their joint R&D efforts over the next five years for a secure, robust, and reliable network.

Figure 1: After signing the SASER memorandum of understanding (from left):Dr. Andreas Leven (Site Lead Bell Labs Germany, Alcatel-Lucent), Christoph Glingener (CTO of ADVA), Dr. Georg Schütte (State Secretary, BMBF – German ministry for education and research), Alain Maloberti (Senior VP Network, Orange France), Dr. Hermann Rodler (Managing Director, NSN Germany), Cornelia Rogall-Grothe (State Secretary, BMI – German ministry of the interior), Jacques Magen (Chairman of Celtic-Plus), and Wilhelm Dresselhaus (CEO of Alcatel-Lucent Germany). (copyright: hannibal/BMBF)

World premiere: demo of configurable network

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Software Defined Transport Networks (T-SDN), i.e. the programmability of optical transport networks, is set to revolutionize how optical networks are operated. T-SDN enables that networks can quickly be configured and adapted to changing traffic demands via network operator or customer applications. This is an important step into the virtualization and automation of future networks.

Alcatel-Lucent, coordinator of the SASER-SaveNet sub-project, exhibited a joint live demonstrator with component partners in the SASER conference exhibition in June 2014 in Berlin. It was a world premiere: for the first time a reconfigurable network was shown which consists of configurable flexible optical nodes and software defined adaptive transponders that incorporate electronic as well as optoelectronic components from the horizontal project partners Fujitsu and Finisar. In this demonstrator a central SDN controller utilizes the standardized OpenFlow protocol for packet networks with extensions towards the lower transport layers (Transport-SDN) to steer the programmable hardware like optical switches and transponders. These extensions to the OpenFlow protocol were developed by the researchers of Alcatel-Lucent within the project.

The demonstrator consists of flexible optical nodes comprising wavelength selective switches (WSS) in combination with flexible transmitters and coherent receivers. To enable an agile transport network the transmitters can adjust their wavelength, modulation format, their baud rate and thus the spectral bandwidth of the transmitted optical channels.

The demonstrator permitted the realization of different real network scenarios. For example, the network operator can adjust the bandwidth or the modulation format of the signal to achieve, e.g., either the longest possible transmission distance or transmit a higher data volume on a shorter range. Set up of a new optical lightpaths and shut down of others is possible as well as re-allocating WDM traffic to other spectral channels.

With the introduction of network virtualization, e.g. slicing of physical resources, applications can modify their own logical network. Software-defined solutions allow partitioning of the network and enable to route critical data within predetermined boundaries, a concept called network slicing. This measure can significantly increase resource utilization and enhance safety and network security.

If protocol encryption is applied in Transport-SDN additionally, e.g. by using a protocol engineering suite developed by Alcatel-Lucent within SASER, which simplifies creation and deployment of secure protocols, a further important step towards secure networking can be made.
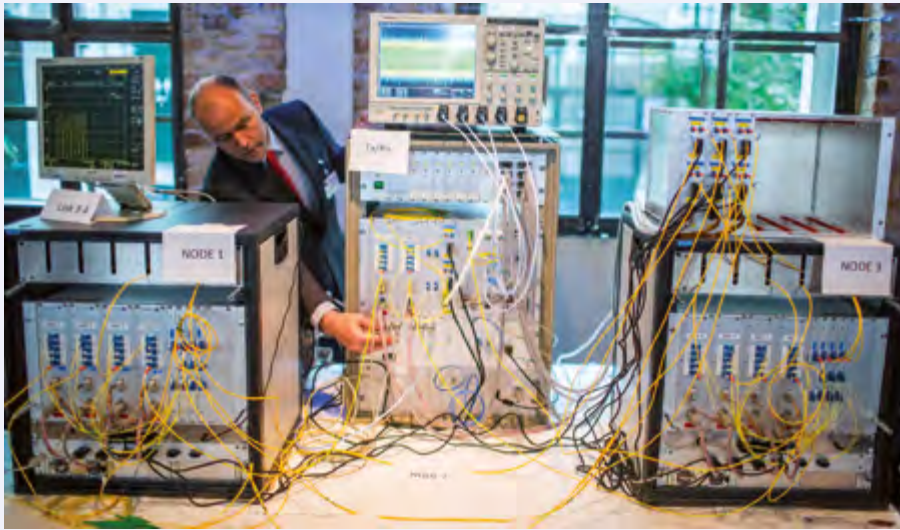
Figure 2: Demo at the SASER Event in Berlin, June 2014 (copyright: hannibal/BMBF)

Detecting known and novel attacks by analyzing SDN user and the control traffic

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Today safety and security are addressed through diverse security actions, such as encryption, software-enabled security functions, backdoor and anomaly detection, and many others. The SASER project will bring these bits and pieces together, towards the definition of a suitable security scenario that is an important step towards secure communications in Europe and in the world.

SASER's main objective is the development of secure and energy-efficient network architectures for upcoming technologies such as Software Defined Networking (SDN) and Network Function Virtualization (NFV). These new technologies are key-enablers in the future telecommunication environment but also include new security challenges. Within the project we focus on analysing and designing mechanisms to ensure secure deployment of SDN and virtualization in a Telco Cloud environment.

After a thorough analysis of the SDN architecture in a Telco Cloud environment, the threats were identified and countermeasures have been defined. This comprises mainly authentication and authorization measures as well as integrity and confidentiality protection between all involved entities (Applications, SDN Controllers, Network Hypervisors and SDN Switches). Additionally encryption techniques on the transport layer enable secret communication by protecting the confidentiality and the privacy of the transmitted user data on the network.

While today's and even more future communication networks are able to transport high volumes of data, there is a tendency that large portions of the bandwidth are misused for dubious purposes, e.g. recently there has been a dramatic growth in high volume Denial-of-Service attacks. In SASER we provide techniques to detect known and novel attacks by analysing the SDN user traffic as well as the SDN control traffic. Rapidly detecting and classifying malicious activity contained within a large amount of network traffic is a challenging task. As network operators are overwhelmed with data from the network monitoring tools, we provide visualization methods to facilitate and promote situational awareness taking maximum advantage of the fact that the human mind is capable of fast visual processing.

Software backdoors pose an extremely dangerous attack vector. It is important to employ various techniques to explicitly search for potential backdoors, to make them easier to detect and to make their insertion harder. In SASER we design and implement software architectures to prevent authentication backdoors in server applications (proactive approach). Furthermore, we design and implement an analysis tool for mostly automated detection of specific backdoors in server applications (reactive approach).

risks. To achieve this we need joint efforts in Europe. SASER is a sparkling example of how we can improve digital sovereignty through joint efforts."

About SASER

SASER (Safe and Secure European Routing) is an 80 million euro public-private partnership project comprising 61 companies, research organisations, and universities from Germany, France, Finland, Denmark, and the UK. The project runs from August 2012 to September 2015 under Celtic-Plus, the EUREKA Cluster for a Smart Connected World, and is partly publicly funded by the research ministries / agencies BMBF (Germany), DGCIS (France), and TEKES (Finland).

■ Further information
SASER Project Website:
http://saser.eu/
SASER Event news release:
http://www.celticplus.eu/Events/SASER-Event-Berlin/ReportEvent.asp
SASER information video:
https://www.youtube.com/watch?v=MD1tkNMzq6Y
SASER Demo in IEEE:
http://goo.gl/sYDkcK

Celtic-Plus opportunities for international cooperation in Germany

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Two German ministries have supported the strategic initiative for European cooperation in the telecommunication area, Celtic, within the EUREKA network since its creation in 2003. They have been member in the public authority board of Celtic and its successor Celtic-Plus ever since.

EUREKA is an intergovernmental network of more than 40 members and associated members to foster international research, development and innovation (RDI) projects. The EUREKA clusters are industry-driven bottom-up initiatives, focusing on strategic topics like telecommunication or software intensive systems. They are complementary to the instruments of the EU, though more flexible regarding the choice of partners from non-EU countries. They particularly aim at facilitating cooperation within the European Research Area (ERA). In principle they draw on national sources of European public funding for innovation.

Celtic projects in Germany since 2005

107 RDI project participations of 61 German organisations have been performed between 2005 and 2013. These projects account for a total budget of almost 130 million euro. Until 2013 finished Celtic and Celtic-Plus projects which included German partners received about 61 million euro of funding in total from the Federal Ministry of Education and Research, BMBF, and the Federal Ministry of Economics and Energy, BMWi.

One example for a successfully finished Celtic project with German participation is the flagship project "100GET", which received several awards. Another outstanding project is "CIER" (see figure 1), which deals with "Converged Infrastructure for Emerging Regions". The Celtic-Plus

Celtic-Plus project CIER – Connecting the rural areas past the fiber-reach in the rural municipality of Bruneck / South Tyrol with WiBACK (Wireless Backhaul), developed in the Finnish-French; source: Fraunhofer FOKUS

Presentation of CELTIC-Plus project CRUMBS at CeBIT 2013; source: PT-DLR

project "CRUMBS" is an example for a project funded by BMWi (see figure 2). Among the currently running projects, "SASER, Safe and Secure European Routing" is the current flagship project of BMBF-funded projects, including 61 partners from 5 countries with an overall total budget of about 80 million euro.

Funding in Germany

EUREKA is an international network and not a funding program. Project partners have to secure the financing of their project participation themselves. They may approach their national funding bodies. Funding opportunities are different in the various member countries.

Germany has no earmarked funds for EUREKA projects including the clusters. Applicants may take advantage of the complete funding landscape. According to current rules the "Bund" and the "Laender" can provide national and regional funding for German partners in Celtic-Plus projects. However two ministries are mostly involved in funding German Celtic-Plus project partners, BMBF and BMWi.

Current topics of high interest

BMBF promotes applied research and development at the pre-competitive stage. The technical scope should be on the focal topics of "Communication Systems", IT-Safety and Security" or

"Living in the Digital World". Integrative R&D approaches that are linking these topics are relevant as well. The last Calls of BMBF Unit "Communication Systems; IT Security" reveal current topics of high interest:

- Reliable Wireless Communication in Industry
- Critical Infrastructures
- Secure Cloud-Computing

In addition current topics of BMWi, Unit "Development of convergent ICT" are:

- Internet of Services
- Internet of Things
- Internet of Energy

BMWi as well promotes applied research and development at the pre-competitive stage, particularly for SMEs (Small and Medium Enterprises). The aim is to accelerate the process of transferring scientific findings into the development of marketable high-tech technologies with high potential for practical applications. All of the research projects that receive funding involve model users who pilot the developments in order to establish their technical and economic viability. The focus will be on Smart Services.

National contacts

German partners and interested parties in Celtic-Plus proposals are invited to contact directly the EUREKA/COST Bureau and/or the Project Management Agencies of BMBF and BMWi at an early stage of their proposal.

Conclusions

The Federal Ministry of Research and Education as well as the Federal Ministry of Economics and Energy have been supporting the EUREKA-Cluster Celtic and its successor Celtic-Plus from the very beginning and still invest several millions of Euros per year in funding German partners in international Celtic-Plus RDI projects. Despite these efforts project partners from industry, SMEs and academia will need continuous sup-

port in the future to contribute to European innovation and standards to keep pace with the fast technical developments worldwide.

Acknowledgements

Many thanks to Peter Herrmann, Bernhard Wybranski and Matthias Kuom for their contributions to this article.

- Find more information on Funding German Celtic participants at
http://www.vdivde-it.de/kis
http://www.pt-ikt.de/ and
http://www.eureka.dlr.de/
and on funding in Germany at
http://www.foerderdatenbank.de

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Green-T – Green mobile terminals for the future

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Today, users are enjoying a plethora of new advanced applications on their smart mobile devices, thanks to advances in the technology of mobile networks and devices. However, such advancements do not come for free: the energy consumption of mobile devices is rapidly increasing due to power hungry features, such as larger high-definition displays and more interactive applications. Unless a proactive stance is taken, the increase in energy consumption of mobile devices will continue, rapidly deplet-

ing the battery; hence confining mobile users to locations near power outlets; taking away the freedom of roaming promised by mobile networking.

There is an urgent need for intelligent solutions to reduce the energy consumption of mobile devices, if users were to fully enjoy roaming freely, while experiencing a wide range of advanced online applications. The Green-T project, a Celtic-Plus European collaborative research effort, was the vehicle to investigate innovative solutions to limit the energy consumption of mobile devices targeting two main objectives: i) decreasing the whole energy consumption of mobile networks; hence contributing to the Green targets of the EU for decreasing the carbon footprint of the ICT sector and ii) prolonging the battery lifetime of smart mobile devices, and hence increase user-friendliness.

Energy and batteries of mobile devices

Every new release of a smart phone spurs new applications and services, with advanced screens to deliver an exceptional quality of experience to

end-users. However this comes at a cost placing stringent demands on mobile battery consumption. On the other hand, the progress of the battery industry is failing to catch up with the energy demands of power hungry mobile devices and applications, with no foreseen breakthrough in the near future. It is clear there is a continuously growing gap between the energy requirements of emerging mobile devices and what can be achieved through progress in battery technology and circuit design. This gap is experienced by today's mobile users, who have to re-charge their mobile smart devices so often that they are always searching for power sockets.

Communications and energy

Despite the high energy consumption of the advanced features of mobile devices, communications functionalities still contribute to large portions of the power draining of today's mobile devices. Moreover, the trend of having multiple interfaces enhances the user experience, but adds huge burdens on the already high energy requirements of mobile devices. The Green-T approach aims at reducing the energy consumption

of communication functionalities of mobile devices.

Intelligent cooperation and roaming

Mobile systems are based on a non-cooperative networking approach, where each mobile device needs to establish a connection with a base station (BS). This concept results in differentiated levels of quality of service, favouring users close to BSs, whereas users near the edges of a coverage area usually receive degraded services requiring higher energy. Green-T exploits the concept of cooperation among mobile devices and intelligent roaming among different networking technologies. Within the Green-T approach, the resources of mobile devices and networks are treated as one pool of resources, which are collectively used to provide energy efficient connectivity to all mobile devices within the network. For instance, mobile devices can forward their data through other mobile devices, thus benefiting from better connectivity due to shorter distances.

On the other hand, Green-T takes advantage of the availability of multiple networking paradigms, by introducing smart roaming based on provided quality of service and energy requirements at the device location. This is illustrated in Figure 2, where a user is connected to an LTE network, but the connection deteriorates due to obstacles on the way. The mobile device decides to switch to WiFi experiencing better energy efficiency. When a mobile device is connected through one interface, other interfaces are switched off to save energy. All the solutions of Green-T are automated and performed without user involvement.

An Intelligent Green Networking Summer Day

For a better understanding of the concept, an example of a usual summer day is used for illustration (Figure 3). Susan is using her mobile device at home to surf the internet and download some files for work. At home, Susan has her own WiFi. The mobile device hence connects through the WiFi to the Internet. Susan then goes out to enjoy the day. She first drives to a coffee shop. On her way, the mobile device realizes that the speed is high, so it connects to the LTE network and switches the WiFi off. Susan sits at the coffee shop to enjoy her coffee. The mobile device uses its intelligence to learn about its surroundings; it finds out that the building is equipped with a shared Femto cell. The mobile device switches to Femto access.

Femto cells still use LTE technology, but with higher data rates and better energy ratings due to limited distances. Susan finally arrives at the park. Some of the downloads are still continuing, and the battery level is getting low. Understanding its surrounding, the mobile device is aware of
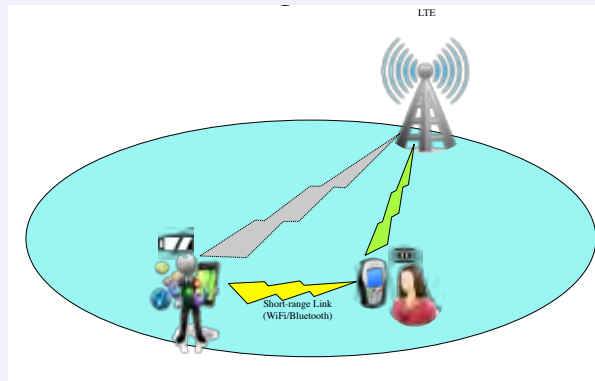

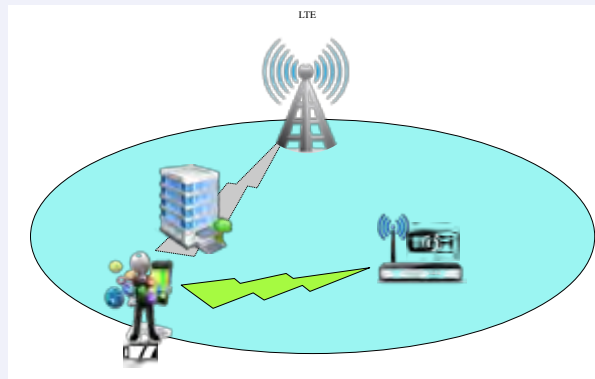Figure 1: Mobile devices forwarding their data through other mobile devices

Figure 2: Switching to other mobile systems

Figure 3: Example scenario "a usual summer day"

other nearby devices. Susan's mobile device then negotiates with other devices and reaches an agreement with one mobile device to relay its data. Now, the mobile device switches to WiFi to connect to the helping device, which uses LTE to access the network. The best part is that all the process was automated without the need for Susan's interaction. Therefore, Susan was able to enjoy the day outside downloading data without worrying about running out of battery.

Conclusion

You are able to enjoy a variety of advanced applications on your smart mobile device, but you have to manage your device energy consumption so as to avoid running out of battery and get confined to locations with access to power outlets.

Green-T offers you the freedom by providing a new intelligent cooperative and roaming concept, where mobile and network resources are pooled together to provide energy efficient services to smart mobile devices. Green-T achieves up to 40% extension in battery lifetime. All processes are automated so you do not worry about available networks or finding other devices, nor bother about switching ON/OFF interfaces to get best connectivity or save energy.

■ More information: http://greent.av.it.pt

# TILAS – Technology improvements for large-scale Smart City deployments

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The Celtic-Plus project TILAS (Technology improvements for large-scale Smart City deployments) exploits the initial outcomes of different Smart City related projects with an associated large-scale IoT test-bed deployment. The proposed innovations overcome the problems caused by moving from typical experimental laboratory tests to integrated large-scale implementations. This project aims at addressing some of these key challenges and aligning them to the particularities of the Internet of Things (IoT) paradigm.

For the definition of the main TILAS topics, the project has taken the Santander City Deployment as a reference. It can be considered a relevant case, as Santander has 180,000 inhabitants, about 12,000 IoT devices, deployed in the Smart-Santander project, and more than 25,000 downloads of the Smart City smartphone application. Based on the analysis of the existing infrastructure, two kinds of problems were detected:

- Problems derived from technical challenges – such as node testing, multihop networking, security, housing solutions for outdoors and node reprogramming.
- Challenges derived from societal aspects – such as visual impact of devices, pertinence of services created and lack of engagement

TILAS focuses on the aforementioned technical problems and additionally on solving visual impacts of devices deployed in the street. The scope of the project is to facilitate and boost the development of novel solutions based on the exploitation of the IoT paradigm in cities. The provision of reliable and efficient communication capabilities demands the improvement of current solutions on device level and network level.
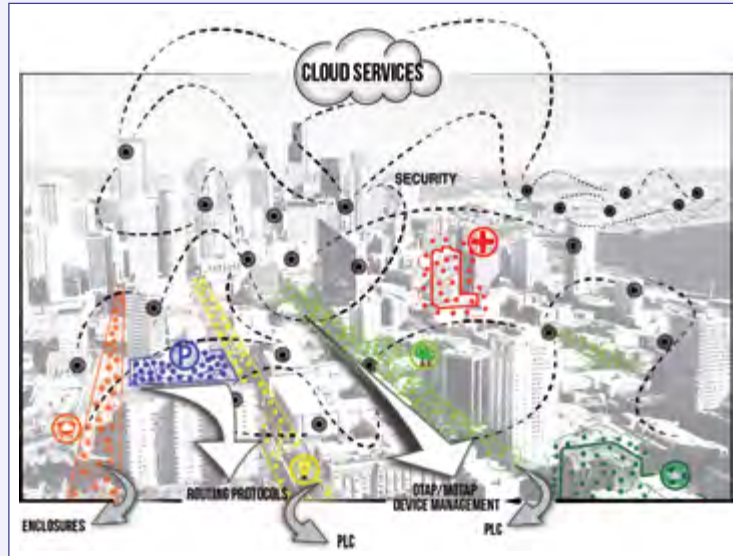
High level overview of the detected working points in Smart Cities

Security architecture

The Smart Cities and IoT concepts demand a new security approach able to deal with the huge amount of devices that will take part in the new scenario. In the traditional security model, several weak points exist due to the heterogeneity of the parties involved in the end-to-end communication. The project proposes a new element in charge of centralizing credentials, and thus avoiding the current vulnerabilities and moreover increasing the dynamic adaptation in the whole system with a capacity for granting and denying access to information.

Routing protocols

Devices deployed in Smart Cities follow the architecture of traditional wireless sensor networks; they are self-organized and multi-hop networks, demanding as a group a huge amount of resources. On the other hand there is a need for minimizing power consumption at device level. Currently, there is no universal routing solution outperforming all the others and the protocol selection is done based on some particular requirements. The main drawbacks of current procedures are the lack of mechanisms for managing communications between different networks and the limited coverage. TILAS focuses on providing solutions for continuously interoperating a large numbers of autonomous nodes in an efficient way, to guarantee the reliability with node mobility and heterogeneity and finally also to manage failures.

Remote device reprogramming

As mentioned above, multihop mesh networking is a common situation both in IoT and Smart Cities. Current device reprogramming standards work in a point-to-point way, which implies to run one full procedure per device. Nevertheless, many times the same firmware is installed in multiple devices in the same network, so TILAS focuses on providing a standard-compliant solution for optimizing the way this procedure is done, notably reducing the power consumption and the load in the network.

Housing solution for IoT devices

Device enclosure is a key topic that has not been considered in the early deployments of smart cities. The use of a standard box is not suitable for elements that will be deployed in streets. Additionally the external radiating elements provide an unsafe feeling that increase citizens' rejection of new technologies. TILAS works on a twofold approach, firstly to design novel enclosures that fit better in city streets, secondly to design novel antennas that combine different technologies and are suitable for being installed inside the enclosures.

IPv6 over PLC

Powerline communications (PLC) technology is a key player in the provisioning of Internet services in many different environments where wireless communications cannot address the existing requirements. It is also a potential enabler of cost-effective communications for metering wap-

plications. The key innovation provided by TILAS is the integration of IPv6 communication capabilities from end-to-end. This way meters will be accessible in a secure way from any point of the Internet, and additionally security is assured by the solution provided by the project.

Conclusion

The work done in the first half of the project shows the benefits obtained by the different proposals. During the second half of the project, the efforts will focus on the development of experimental trials to demonstrate the improvements of the new features in a real environment. A key aspect that will be considered is the suitability of the trials for the assessment of the benefits in a large-scale environment.

In summary TILAS is pushing state-of-the-art technologies in some of the most challenging aspects – security, efficient routing, reconfiguration of cloud resources, device reprogramming, PLC interoperability and novel antenna/housing design. Thus, TILAS will help to boost the IoT concept by overcoming its current barriers.

■ Further information on TILAS is available at http://www.tilas.eu

CIER – Connecting the unconnected

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Rural areas in emerging regions often lack sufficient or affordable access to the Internet. This is problematic, as it restricts their access to education, health, governmental services or general access to knowledge, and it leaves these regions behind, compared to urban areas. The major limiting factors are high cost (CAPEX and OPEX) due to the large distances, difficult terrains and low population densities to spread the costs.

Additional challenges for such regions are the lack of access to power and especially access to skilled labor. 24/7 operation of cell sites is therefore a very costly task. Especially technical experts are often barely available and/or expensive and might have to come a long way to a critical site. To address those issues, the Celtic-Plus project CIER has developed a carrier-grade broadband backhauling technology, which is energy efficient, self-managing and with good performance figures. This technology can complement, extend or even replace traditional operator equipment.

Typical CIER use case

Figure 1 depicts a typical use case where Internet access is typically available at the outer border of a city, but not in the surrounding villages
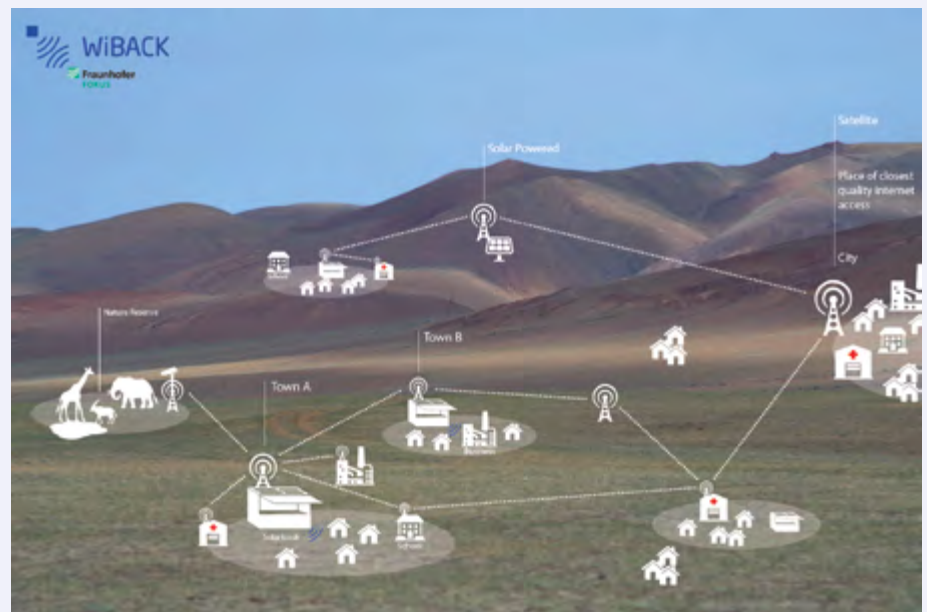

Figure 1: A typical CIER use case

or settlements. There is often no business case for covering such under-served areas due to the cost structure of the available equipment and the given rural area's specific challenges. CAPEX and OPEX are too high to be sufficiently covered by the revenue expected from the often sparse local population.

The CIER project proposes to connect one or more central locations (i.e. schools, hospitals, government offices) in each village or settlement with long distance point-to-point links via the back-haul network to bring capacity into such locations. Sometimes repeater stations might be required to bridge longer distances or to reach beyond a hill or mountain. Preferably, the physical network topology should allow for 'ring' structures to increase the network's resilience to damage, theft, or other temporary outages. In cases of permanent node failures, the plug-and-play CIER hardware can easily be replaced without the need for any manual configuration and, thus, without the need for a highly skilled technician.

The CIER low-power hardware features a typical power consumption between 6 and 10W and is therefore ideally suited for cost-effective solar/battery energy-supply solution, which is crucial if a stable power grid is not available or for repeater nodes mounted on, e.g., isolated hilltops.

Within the connected locations, customers can be reached via standard access technologies, such as WLAN hotspots, 3G/4G femto cells or even xDSL into individual homes.

The network operator or service provider may configure the capacity or QoS level available at each location. This includes the management of overbooking of 'best effort' capacity while ensuring loss-free, low-latency connectivity for voice or video conferencing services. The typical latency in the Voice Class is <2ms per hop making this technology suitable for VoIP back-hauling even in multi-hop scenarios with up to ten hops.
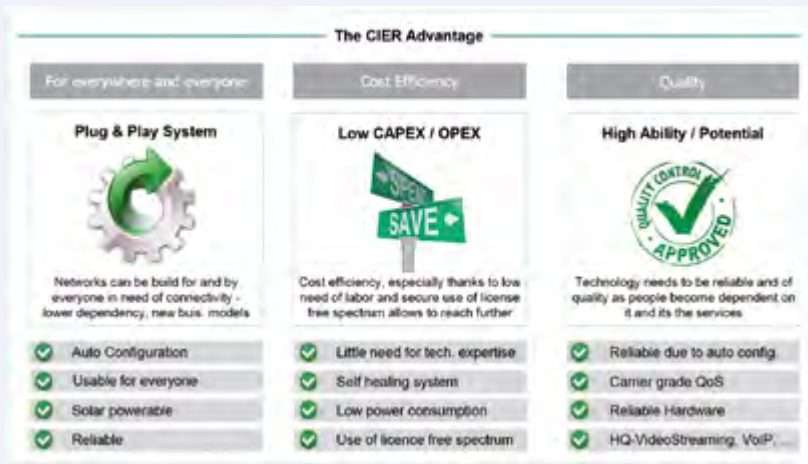
Figure 2: Advantages of the CIER technology

The CIER technology advantage

The self-management capabilities of the CIER technology are the main advantage and pose significant progress over alternative technologies. While directional radio technologies have been available for decades, being "Plug & Play" does make an important difference for its multi-hop utilization in rural areas.

This results in:
- only limited need for expensive or unavailable technical experts,
- local staff that can be trained easily in the utilization of the technology,
- very limited effort required to set up a network, which
- is running reliably in licence-free spectrum
- builds meshed networks (redundant network paths)
- includes quality ensuring mechanisms like automatic traffic prioritization or traffic load balancing
- a very reliable system, which addresses errors automatically, informs network managers or is easily repaired if necessary – exchanging a node can be done by anyone; all to be done is to mount the new node and to re-attach all cables.

With traditional directional radio technologies the setup, operation, repair, and configuration can require significant effort. Such problems had prevented a Fraunhofer FOKUS team to sustainably connect a hospital in rural Zambia. The case showed the need for an improved solution and inspired the CIER project. The resulting CIER technology requires minimal effort and technological experts and thus allows for networks that can be set up and run sustainably.

Deployments in Europe, Sub-Saharan Africa and Central America

The CIER technology is already in commercial operation in Germany, Italy, Colombia and Tanzania. A further network is to be set up in rural Namibia in November 2014. These networks connect schools, agricultural information centres, governmental offices, hospitals, companies and people.

A small network in rural Colombia is a good example for the CIER technologies' ease-of-use, see Figure 3. Here an NGO, which provides an eLearning solution to schools, uses the CIER technology to provide the required QoS-ensured connectivity. The CIER technology, being efficient and simple, allows this NGO to take on this matter by itself. Additionally, its energy efficiency allows operation in an off-grid area as the Andes.

Conclusion

The CIER project successfully developed a new solution to bring broadband connectivity at reasonable costs to rural areas and to overcome the so-called digital divide. The CIER technology is not only a cost-efficient solution, but also a tool available for everyone – not just for big telecommunication companies. Hence, smaller and more flexible companies can tackle the lack of broadband connectivity.

- For further information on the exploitation and the availability of the CIER technology, please visit http://wiback.org.
For commercial requests, please contact: info@defutech.com
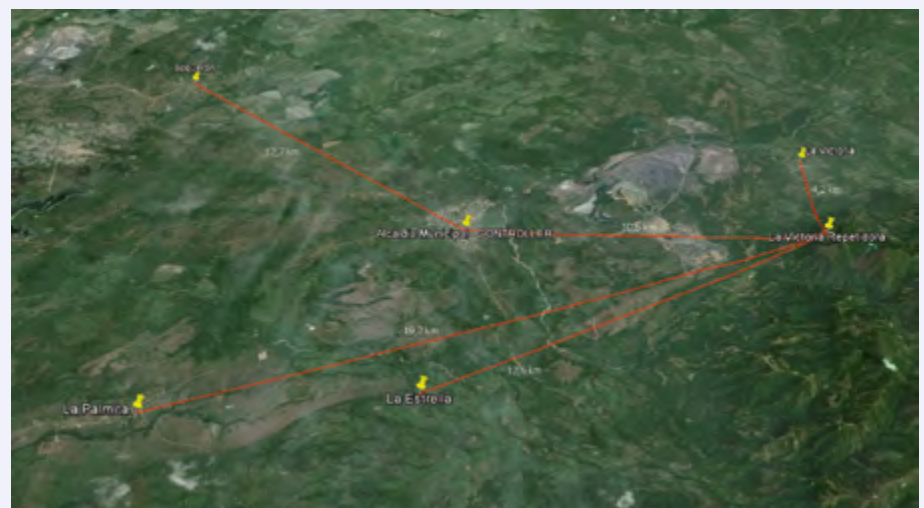
Figure 3: School network in Colombia

www.celticplus.eu

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

Figure 2: Use case overview

Figure 3: Mobile fill-level application
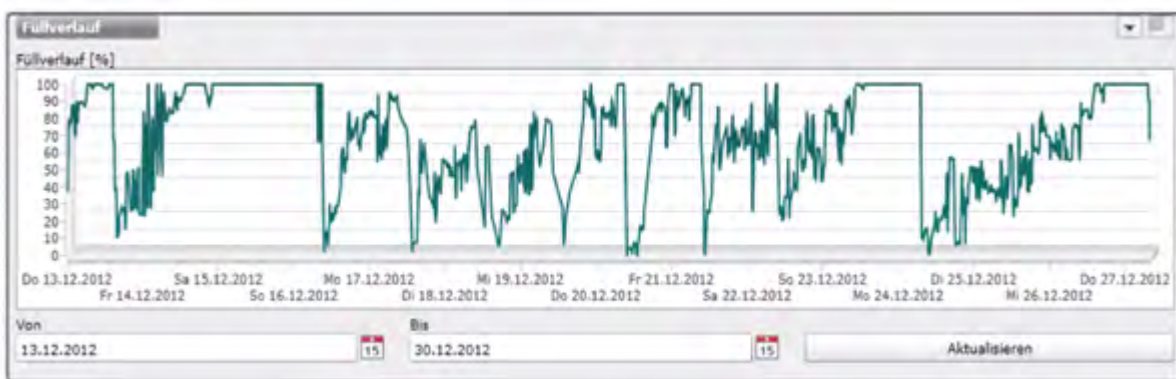
Figure 4: Fill level statistics on the Internet application

OutSmart waste bins were deployed with fill-level sensors that sent their data via the Internet to the logistics centre or directly to the approaching lorry (see figure 2).

Fill-level data which facilitate the job of employees

Many big companies in Europe have the problem that the average age of their employees is increasing. At BSR, the waste management utility provider in Berlin, the average age of an employee is 49. Especially in manual labour jobs it is a problem to maintain a high productivity level – also in the future. Therefore a tablet PC application was developed by Ymatron AG which should ease the employees´ job. Thus the employees can easily decide whether it is necessary to stop the lorry and empty the waste bins positioned next to the lorry (see figure 3).

By reducing the amount of stop-and-go during the day, fuel and CO2 emissions of the lorry are reduced. And by avoiding traffic jams behind the lorry it also reduces the fuel consumption of the other traffic participants.

Fill level data which support waste management optimisation

With the Internet application from Ymatron AG, the collection of fill-level statistics on each single waste bin becomes possible (see figure 4). In turn such statistics enable and support the decision making with respect to the necessary emptying frequency, the positioning and size of the waste bins and the route planning of the lorry.

Conclusion

Considering the above and the experience accumulated at BSR through the various initiatives we concluded that smart waste bins have a big potential in making the waste management process and the maintenance of the waste collection and removal process more efficient.

In addition to the aspects listed above, essentially covering the value proposition for a waste collection and management utility company, such as BSR the smart waste bin concept also offers advantages to the ordinary citizens, the tourists and the city administration in the form of a cleaner city with less disruptions as a result of

waste bins being optimally located in the streets and having the right capacity (garbage bins are always available for use and not filled to the brim) and an optimally designed waste collection process.

Due to the fact that waste management is a low-budget job, the new solution must come at an adequate price. BSR aims to use the available smart waste bins that are equipped with fill level sensors and move them around. Having obtained sufficient statistics over a period of several weeks and moving the bin onto the position of another existing waste bin, the positioning and size of the waste bins in Berlin shall be optimized in a step by step process. Furthermore, BSR plans to use the maintenance application not only for the 21.000 waste bins, but also for the approximately 180.000 gullies in Berlin.

Further information on FP7 research project OutSmart is available at http://fi-ppp-outsmart.eu

iCore
Enhancing IoT with cognitive technologies

Raffaele Giaffreda
CREATE-NET
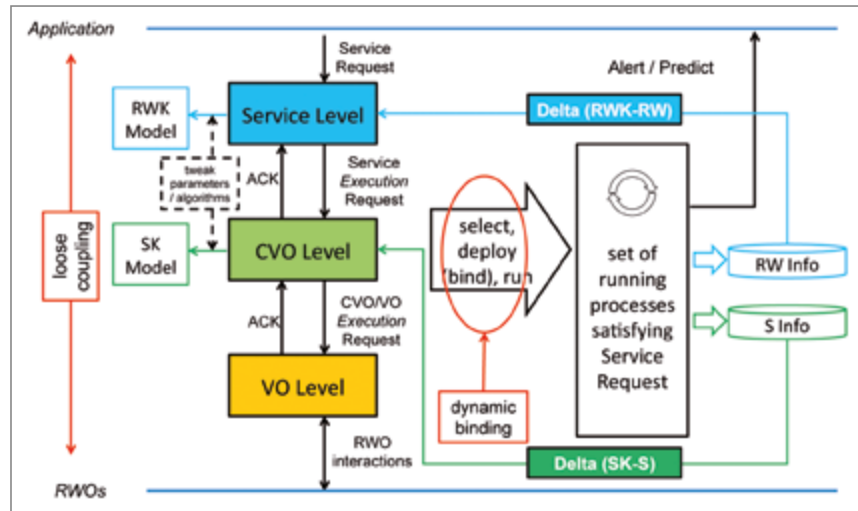raffaele.giaffreda@create-net.org

iCore proposes a cognitive IoT framework for the creation and management of smart IoT services that leverage the virtualisation of real-world objects. As a result of this, enhanced services can more easily adapt to the user needs and to the available resources of connected objects.

High-level representation of the iCore architecture

In particular, the project's main results contribute to the automated deployment and adaptation of IoT services, systematically accounting for real-world knowledge (user situations and changing needs) and system knowledge (available resources). iCore is an industrially-driven project, and its solutions have been validated through prototypes and trials in many application domain.

The basic architecture

In its most generic sense, the interaction with an iCore system is initiated through a Service Request generated for the purpose of activating data streams from IoT objects and continuously processing these to support an end-user or ICT application with a set of processes monitoring a situation and producing alerts when particular conditions are met. Such processes, derived from service templates, are orchestrated and bound to relevant IoT objects using iCore functionality. This is composed of the three main levels. The bottom one is called Virtual Object (VO) level and is meant to semantically and reliably represent real-world objects. The middle layer is called Composite Virtual Object (CVO) level and expected to provide the means for simple aggregation of VO functionality. The top level, called Service Level (SL), is expected to map availability of underlying CVO/VO features to the needs of end-users and associated IoT applications.

The figure shows the iCore architecture at a first level approximation, where a Service Request is transformed via the Service Level functionality into a Service Execution Request, which is then passed to the lower CVO/VO levels for the selection and activation of appropriate objects needed for satisfying the request. Behind this simple set of processes, iCore value stands in the loose coupling between service requests and actual IoT available objects or a combination of these, which satisfy the request as well as in the ability to select these dynamically, runtime and purposefully through the use of cognitive technologies. This value is reflected also by the ability of the iCore system to learn and adapt to changing situations the way it satisfies requests. The figure also shows the rough interactions between the iCore levels cascaded after the Service Request, resulting in a set of running processes that is expected to produce runtime notifications and alerts throughout execution.

Demonstration trials

To validate the solutions developed during the project, a number of trials have been implemented, engaging a number of external stakeholders and showing the applicability of results across many different domains.

In the first trial deployed in the smart-tourism domain, two Athens travel agents were engaged to test with their customers an iCore supported application for tourists visiting different sites around the city. Another major part of the trial exploited the SmartSantander infrastructure for conducting experiments for the large-scale evaluation and validation of the integrated iCore architecture and concepts. This trial provided feedback for the "software industrialisation" of the iCore platform and for the improvement of iCore components and interfaces.

The second trial focused on people safety in the context of VIP visits and evacuation management in a smart urban area in case of threats, such as toxic chemical cloud, crowd panic and violence. This trial was promoted and supported by big industry players and was meant to illustrate how iCore predictive modelling can be used to support decision making and optimise the usage of network resources through situation-aware surveillance.

The third trial foresaw the deployment of a smart IoT system able to continuously locate and assess status and maintenance needs of medical equipment in a large unit of a hospital in Trento and route operators to these objects in a situation-aware way. This trial was meant to show the value iCore can bring to SMEs in reducing time-to-market for deploying solutions for the management of spatio-temporal IoT generated events in a variety of application domains.

Conclusion

At a wider European scale iCore contributes to the next wave of IoT services and applications, those that can evolve autonomously fostering adoption from more "general public" users rather than just early adopters.

✈ **More information** is available on the iCore website at www.iot-icore.eu

Official launch of the FIWARE Accelerator Programme

2nd European Conference on the Future Internet in Munich

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On 17-18 September 2014, the 2nd European Conference for the Future Internet (ECFI) took place in Munich, Germany. The more than 400 participants witnessed the official launch of the FIWARE Accelerator Programme, which marks the third phase of the Future Internet Public-Private Partnership programme (FI-PPP).

16 Accelerator projects

In the third phase of the FI-PPP, 80 million euros of EC funding will be invested into fostering Internet innovation through the adoption of the FIWARE technology by SMEs. There are 16 Accelerator projects covering different business sectors, which are responsible for managing the investment in innovative products and services based on FIWARE. They presented themselves in the exhibition and the conference programme at the Technical Unversity Munich (TUM) research center in Garching.

Opening panel (from left): Nuria de Lama, Gianluca Dettori, Christoph Müller-Dechent, Dr. Alexander Tettenborn, and moderator Jonnie Turpie

Grand opening and panel discussion

The first day of the event started with the Grand Opening of the FIWARE Accelerator Programme, which was moderated by Ilkka Lakaniemi from Aalto University. Mario Campolargo, Director of the Net Futures Department at the European Commission, gave an overview on the exciting opportunities of the FIWARE Accelerator Programme. This was followed by Ramon Suarez from Betacowork, who encouraged SMEs to use the opportunities of the FIWARE Accelerator Programme. The final speaker in this session, Stefano de Panfilis from Engineering, explained why European industry is supporting FIWARE. The session was closed with the official launch of the FIWARE Accelerator Programme.

The launch was followed by a panel discussion on how FIWARE can help innovative companies succeed with new Internet services and applications. Moderator Jonnie Turpie from MaverickTV invited the panelists to present their views on how FIWARE-based services and applications can be implemented by SMEs and large businesses in a commercially successful way.

In the panel discussion, Christoph Müller-Dechent, Founder of FoodLoop, explained how he started FoodLoop in 2012, which is now in business with supermarkets across Germany. He had won the FIWARE Campus Party competition in Sao Paulo, which boosted his business. With an investment of 75,000 euro he took his product to retailers and explained that he was backed by the EU-supported FIWARE technology – this combination provided credibility and enhanced his route to market.

Exhibition

In the exhibition, the different projects showed how FIWARE can be successfully used for novel Internet services and applications in sectors like Smart Cities, e-health, transport, energy & environment, agrifood, media & content, manufacturing & logistics, and learning. The Smart Cities projects presented are already active in cities such as Málaga, Seville and Valencia. The exhibition gave participants the opportunity to learn first-hand about the progress of Future Internet platforms,

Innovation can be fun – cheerful researchers in the exhibition.

services, and applications based on the FIWARE technology as well as network with other participants and explore new ideas.

High-level panel discussion

On the second conference day the scope of the event was further extended, as key industry players headed to the Techno Brunch at BMW World. A high-level panel discussed how the Future Internet will revolutionize the manufacturing, creative industries and the automotive sectors. Sarah Cruddas interviewed the panellists individually on their perceptions on the effects of the maturing Internet on consumers and manufacturers. In the second round of the Techno Brunch, the panellists discussed the wider effects of the Internet on society and how this will have an impact on global transformation processes.

SME training day

In parallel an SME Training day was held at the TUM research center in Garching. Participants could choose between different workshops, where they received an overview on the features and services of FIWARE, FIWARE Lab, and FIWARE Ops which are available to SMEs.

In all the sessions and discussions at the conference a clear message came across: the FIWARE technology is now a reality, and it is a concrete growth opportunity for Europe to

High-level panel at BMW World (from left): moderator Sarah Cruddas; Peter Fatelnig, Deputy Head of Net Innovation at the European Commission; Caroline Norbury, Chief Executive of Creative England; Sajjad Khan, Head of connected drive on & offboard at BMW; Renzo Cicilloni, Head of Trento branch of FIAT research center; Claudia Baumgartner, Senior Consultant of VMZ Berlin.

enhance SME innovation. Through the Internet-driven boost of productivity, FIWARE is expected to facilitate technological progress and new services and applications in different European industry sectors.

Further information including presentation slides, video and photo coverage, is available on the event website at www.ecfi.eu/munich2014/

IEEE Healthcom 2014

European e-health solutions presented in in Brazil

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IEEE Healthcom is the flagship conference of the IEEE Communications Society Technical Committee on eHealth. This year's conference was organised in Natal, Brazil, from 15 to 18 October 2014, and a high number of scientists, researchers, engineers and practitioners from several related disciplines participated.

The participation of experts from the ICT domain dominated the event – the e-health sector is

The author, Anastasius Gavras, presenting results from FI-STAR in Natal.

urgently looking for solutions to deliver better healthcare services at a lower cost, as the healthcare sector is under cost pressure worldwide.

The technical programme was structured in 16 sessions in which 81 selected papers were

presented. Five tutorials, four high level keynote speakers, panel sessions and workshops framed the conference. Finally early research results were presented in a joint poster and work in progress session.

Keynotes

Michael H. Nusbaum, President of MH Nusbaum & Associates from Canada presented the importance of standards based interoperability in the sector. He presented the current state and gave an outlook on emerging trends. Prof. Henrique Martins, MD from Portugal presented the challenges and ongoing work towards patient-centric health informatics giving also an update on the European efforts in this direction based on several initiatives, such as epSOS. FI-STAR project coordinator Anastasius Gavras from Germany presented the European Future Internet public-private partnership (FI-PPP) with a focus on the e-health flagship project, FI-STAR, which is a unique opportunity to deliver standardised and certified software for the e-health sector. Finally, Edgard Morya from Brazil presented Emergent eHealth Technologies for Neuromodulation Therapies.

Tutorials

Five tutorials were given during the conference. Dr. Stefan Covaci from Technical University Berlin, Germany, gave a tutorial on the Future Internet Platform Centered eHealth Service delivery, with material based on the European FI-PPP programme and in particular the FI-STAR project. The tutorial was very well attended. Besides presenting the use of the FI-PPP technology for decentralized e-health services in smart cities, the tutorial provided insights on the effectiveness- and efficiency-gains achieved by the different stakeholders and across supply-chains centered on the FI-STAR eHealth Platform Provider.

A practical, hands-on example of the development and the deployment of a generic health-telemonitoring application using the FI-STAR Platform, was given on-line using a VPN connection from the local mobile App-developer and App-administrator notebook at the venue to the FI-STAR Development Portal and to the FI-STAR Administrator Portals in the Reference Deployment Environment in Berlin. The performance of this remote access to the FI-STAR Reference Deployment Environment in Berlin demo was excellent and convinced the audience about the viability of the FI-STAR business models.

Further tutorials addressed the following subjects:
- implementation of a new genre of e-health system in a reticent environment,
- design and implementation of usable and useful accountable e-health systems,
- novel assistive technologies for basic communication and complex applications: Designing brain-computer interfaces to fulfil end users' needs
- Cloud computing technologies for the development of novel e-health services

Anastasius Gavras, Eurescom, receiving the certificate of keynote

Stefan Covaci, Technical University Berlin, receiving the certificate of tutorial by Prof. Nazim Agoulmine, Université Evry Val Essonne

Panel discussion on emerging e-health applications: big data, analytics, telemedicine and mHealth, moderated by Marcelo Santos, Philips Medical Systems

Conclusion

The conference was organised with active contributions by members of the FI-STAR consortium, among others, Dr. Stefan Covaci, Dr. Maria Barros-Weiss, Mr. Anastasius Gavras and Prof. Christoph Thuemmler.

The significant contribution of the European FI-PPP flagship project on eHealth was highly appreciated by the participants with the result that Dr. Stefan Covaci and Anastasius Gavras were invited to be Programme Committee Members of the next IEEE Healthcom 2015 to be held in Boston, USA. Furthermore the organisation of the 2016 edition of Healthcom was awarded to Munich, Germany, based on the proposal by the FI-STAR participants.

✈ Further information is available at www.ieee-healthcom.org

The 5G Public Private Partnership
First project proposals under way

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In the spring 2014 issue of Eurescom message we have reported about selected technological aspects of 5G research, the 5th generation of mobile and wireless networks. In this article, I would like to provide an update on 5G research and innovation activities in Europe. Preparations for R&I activities in Europe are progressing with the submission of project proposals to the first call on the 5G PPP.
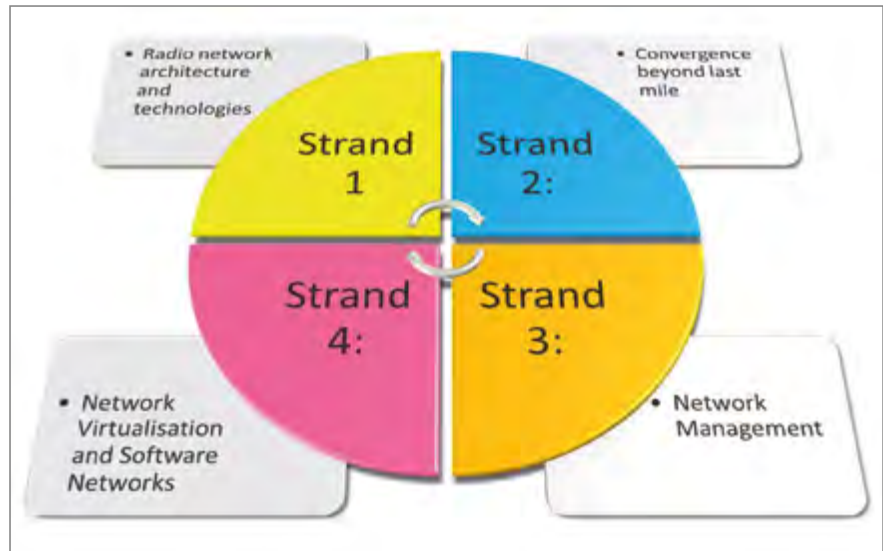
Steps towards 5G

Four research strands for 5G PPP R&I activities defined in the Horizon 2020 work programme 2014-15

Activities have started worldwide in order to design and develop the 5th generation of mobile and wireless networks. These systems will increase data rates and capacity, but also address aspects such as increasing energy efficiency. To date it seems, however, not yet fully clear what 5G really will be, what it will comprise, and what tangible benefits it will actually bring for operators and users. Defining the framework and exploring the individual aspects and technologies will be part of large research and innovation activities world-wide.

In Europe, a large Public Private Partnership on 5G, the 5G-Infrastructure PPP, has been proposed by European industry to the European Commission, and officially launched by the signing of the 5G PPP contract in December 2013. The proposal was supported by major organisations from industry (manufacturers, operators), SMEs and the research domain. The budget volume is huge: about 700 million euro will be provided by the EC, i.e. the public side, while the contribution from the private side will be in an estimated range of five times the public contribution.

Scope and focus of the 5G PPP

The proposed public-private partnership programme has clear goals and has defined a number of Key Performance Indicators (KPIs). The 5G PPP will deliver solutions, architectures, technologies and standards for the ubiquitous

5G communication infrastructures of the next decade. The following high-level KPIs are proposed to guide the research activities:

- Providing 1,000 times higher wireless area capacity and more varied service capabilities compared to 2010.
- Saving up to 90% of energy per service provided. The main focus will be in mobile communication networks, where the dominating energy consumption comes from the radio access network.
- Reducing the average service creation time cycle from 90 hours to 90 minutes.
- Creating a secure, reliable and dependable Internet with a "zero perceived" downtime for service provision.
- Facilitating very dense deployments of wireless communication links to connect over 7 trillion wireless devices serving over 7 billion people.
- Enabling advanced user controlled privacy.

This is a direct response to the call by then-Commissioner Neelie Kroes in her address at the Mobile World Congress 2013 in Barcelona for a timely initiative to further strengthen European industry's competitiveness in this area.

The 5G PPP Association

A 5G PPP Association has been set up in order to have a legal entity that could sign the PPP contract with EC. The General Assembly of the

Association is composed of the 30 members of the NetWorld2020 ETP Steering Board plus six additional members that have been elected by the NetWorld2020 members. The major tasks of the Association are

- to provide – together with the Commission – a research agenda and to propose research priorities for the 5G-PPP,
- to monitor the overall progress on the 5G-PPP roadmap and the sector in general, and
- to provide information to the to EC about leveraging of public funding in industry.

Structuring research topics for the first phase of activities

The research concept proposed by the 5G-PPP is more holistic than what some of us might think in relation to the 5G term. A pre-structuring proposal has been released by the 5G-PPP Association, based on the Horizon 2020 work programme 2014-15, which identifies four research strands (see figure).

The shared vision is that 5G is not just another generation of mobile networks but a new network concept. 5G is meant to enable the integration of a ubiquitous access continuum composed of cooperative, cognitive fixed and heterogeneous wireless resources with fixed optical access. Moreover, new functionalities shall allow simplified and unified control.

Awareness building for 5G PPP plans: 5G PPP Awareness Meeting in Brussels on 28 May 2014.

5G Infrastructure PPP Information Day, Paris, 28 April 2014: 160 participants explored the potential of the 5G-PPP and presented their research ideas.

5G PPP working structure

All projects under the 5G PPP will be expected to show programme-level awareness and commitment to joint activities, and a special clause will be included in the projects' grant agreements. Eurescom has prepared and published a document to promote this discussion and understanding among project proposers, which can be downloaded from the 5G PPP website under Plans & Papers. Among others, beneficiaries will be required to create and participate in boards and advisory structures together with representatives from complementary projects, addressing, e.g., collaboration and synchronization of activities, including issues like management of outcomes, common approaches towards standardisation, SME involvement and dissemination.

Towards the first set of 5G PPP projects

The first call for Horizon 2020 project proposals in the framework of 5G PPP has closed on 25 November 2014. The programme will consist of up to 20 different projects addressing different aspects of the call. The selected projects are expected to start in the second quarter of 2015.

Further information is available on the website of the 5G-PPP Association at http://5g-ppp.eu

Speakers at the 5G PPP Information Day in Paris.

News in brief

Largest European cyber-security exercise held in 29 countries

On 30 October 2014, more than 200 organisations and 400 cyber-security professionals from 29 European countries participated in the largest and most complex cyber-security exercise in Europe. In Cyber Europe 2014, they tested their readiness to counter cyber-attacks in a day-long simulation. The large-scale cyber-security scenario was organised by the European Union Agency for Network and Information Security (ENISA).

Participants were experts from the public and private sectors including cyber security agencies, national Computer Emergency Response Teams (CERTs), ministries, telecoms companies, energy companies, financial institutions, and Internet service providers.

More than 2,000 separate cyber-incidents were simulated, including denial-of-service attacks to online services, intelligence and media reports on cyber-attack operations, website defacements, exfiltration of sensitive information, attacks on critical infrastructures, such as energy or telecoms networks, and the testing of EU co-operation and escalation procedures.

A major aspect of Cyber Europe 2014 was to test procedures for sharing operational information on cyber-crises in Europe; enhance national capabilities to tackle cyber-crises, and explore the effect of multiple and parallel information exchanges between private-public and private-private actors on national and international level.

The background for Cyber Europe 2014 is that according to ENISA's Threat Landscape report 2013, threat agents have increased the sophistication of their attacks. In 2013, global web-based attacks increased by almost a quarter, and the total number of data breaches was 61% higher than 2012. Each of the eight top data breaches resulted in the loss of tens of millions of data records while 552 million identities were exposed. According to industry estimates cyber-crime and espionage accounted for between 300 billion and one trillion US dollars in annual global losses in 2013.

✈ http://enisa.europa.eu

French health agency warns on 3D usage for children

In November 2014, the French Agency for Food, Environmental and Occupational Health and Safety, ANSES, recommended that children under the age of six should not be allowed access to 3D content, and children up to the age of 13 should only have moderate access. The recommendations are based on a study of the possible impact of 3D imaging on still-developing eyes.

According to ANSES, the process of assimilating a three-dimensional effect requires the eyes to look at images in two different places at the same time before the brain translates it into one image.

Different potential symptoms are related to exposure to 3D audiovisual interfaces, resulting from visual fatigue caused by vergence-accommodation conflict. In order to perceive depth and relief, the eyes converge (i.e. they are directed at the same object) and accommodate (i.e. the lens of each eye changes shape to obtain clear vision) at the same distance. The creation of artificial stereoscopic effects by technical means (3D) makes it impossible for the eye to apply this physiological principle. The eyes' accommodation – to a screen, for example – and convergence on an object located in the foreground or background of the screen do, thus, not occur at the same distance.

Visual fatigue can lead to pain, the sensation of dry eyes, visual disorders – e.g. double vision, reduced sensitivity to spatial contrasts, reduced visual acuity and speed of perception – and extra-ocular disorders, like headache, neck pain, aching in the back and shoulders, lower performance in mental activities, and loss of concentration.

Other symptoms may potentially appear, including dizziness or altered perception of one's surroundings. Although these effects have not yet been sufficiently studied, they could generate a short-term risk of accidents, according to ANSES.

In children, especially before the age of six, more severe health effects related to vergence-accommodation conflict in the eyes may occur, as a result of the active development of the visual system during this period.

Italy has sought to restrict the use of 3D glasses by young children, following a similar warning from its national health agency in 2013.

✈ https://www.anses.fr/en/content/3d-technologies-and-eyesight-use-not-recommended-chidren-under-age-six-use-moderation-those

New European Commission makes Digital Single Market a priority

European Commission

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Commissioner
Agriculture & Rural Development

Commissioner
Humanitarian Aid & Crisis Management

Project Team "Digital Single Market"
(Commissioners involved in the team are highlighted)

On 1 November 2014, the new European Commission led by Commission President Jean-Claude Juncker started its work. One of the new Commission's priorities is creating a digital single market, which the EC expects to generate up to 250 billion euro of additional growth and hundreds of thousands of new jobs.

For implementing the project Digital Single Market, the EC has created the Project Team "Digital Single Market", which is tasked to pursue the following objectives:

- Rapidly concluding negotiations on common EU data protection rules.
- Giving more ambition to the ongoing reform of telecoms rules.
- Modifying copyright rules to reflect new technologies.
- Simplifying consumer rules for online purchases.
- Making it easier for innovators to start their own company.
- Boosting digital skills and learning.

The team leader is Andrus Ansip, Vice-President for the Digital Single Market and former Prime Minister of Estonia. He will be tasked with presenting legislative steps towards a connected digital single market. And he will coordinate the work of, in particular, the Commissioners for Digital Economy and Society; Internal Market, Industry, Entrepreneurship and SMEs; Employment, Social Affairs, Skills and Labour Mobility; Justice, Consumers and Gender Equality; Economic and Financial Affairs, Taxation and Customs; Regional Policy; and Agriculture and Rural Development.

Vice President Ansip and Günther Oettinger, Commissioner for Digital Economy & Society, are responsible for the Communications Networks, Content and Technology Department (DG Connect).

Andrus Ansip, Vice-President for the Digital Single Market

Günther Oettinger, Commissioner for Digital Economy & Society

Commissioner Oettinger is responsible for preparing legislative steps towards a connected Digital Single Market by breaking down national silos in telecoms regulation, in copyright and data protection legislation, in the management of radio waves and in the application of competition law. Furthermore, he is supposed to add more ambition to the ongoing reform of the EU's telecoms rules and to develop a common approach to managing radio-spectrum use across the EU.

Other objectives of Commissioner Oettinger include modernising copyright rules, developing measures to make online communications and data more secure, and supporting the deployment of a high-quality, digital infrastructure.

✈ Further information
- Digital Single Market
  http://ec.europa.eu/priorities/digital-single-market/
- Andrus Ansip
  http://ec.europa.eu/commission/2014-2019/ansip_en
- Günther Oettinger
  http://ec.europa.eu/commission/2014-2019/oettinger_en

Whacky fundraising
The surprising success of crazy crowdfunding ideas

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Since the invention of money, people have exercised their ingenuity to raise funds for realising their ideas. The Internet has made fundraising easier than ever. Through crowdfunding platforms, anybody can raise money for any project within days. Sometimes these projects can be outright whacky.

One of the biggest crowdfunding platforms on the Internet is Kickstarter (www.kickstarter.com). According to Wikipedia, the platform, which is specialised on the creative sector, has received over one billion dollars in pledges from 5.7 million donors to fund 135,000 projects. Many serious projects have been funded via the platform, like for example the Pebble smartwatch, which raised more than 10 million US dollar. And then there are a few other projects.

Salad-funding

One of the most astounding funding successes on Kickstarter was a project launched by Zack Danger Brown from Columbus, Ohio, in summer 2014. He set a fundraising goal of $10 – to make a potato salad. Somehow the plain goofiness of the project must have inspired a growing number of people on the Net, and the project went viral within a few days.

Mr Brown had made a number of tempting offers to his donors, depending on how much they would give. For a pledge of $1, he promised to post a 'thank you' on his website and to say out loud the name of the donor while making the potato salad. The reward for those who invested $110 in the platinum package included on top of the above-mentioned return service a recipe book, a shirt, a hat, a bite of the potato salad, and a photo of Brown making the potato salad.

When the project closed on 2 August 2014, the potato salad project had 6,911 backers, who pledged $55,492, which equals 554,928% of the original $10 goal.

Copycats who tried to repeat Brown's success, not surprisingly, did not come anywhere close to the amount he collected; an effect that is well-known since the first famous whacky fundraising project on the Internet, the Million Dollar website in 2005 (see Eurescom message 1/2006: From pixels to riches – The Million Dollar Homepage http://archive.eurescom.eu/~pub/about-eurescom/message_2006_01/message_2006_01.pdf).

#LOL projects

Although the simple goofiness of the potato salad project is so far unmatched, there are a number of other projects on Kickstarter that range from funny to bizarre. There are so many now that Kickstarter has created an own hashtag category: #LOL projects – for those not familiar with Internet slang: LOL means 'laughing out loud'.

The #LOL project category contains bizarre gems like "99 Ways To Die – A coloring book for Adults" (funding goal overachieved: 258 backers, $8,954), "Yoga Joes: the classic green army men doing yoga" (funding goal overachieved: 2,879 backers, $108,065), and "Gummi Bear Skeleton Candle" (funding goal overachieved: 2,879 backers, $108,065). The latter is a candle looking like a sweet gummi bear. When the candle is burning down, a rather eerie-looking bear skeleton becomes visible.

While these projects are mainly focused on things, there are also more human-centric projects. Like the 'Sleepy Hoosband Calendar' project by Karin Hammerberg from New York. As the project title indicates, Ms Hammerberg took photos of her sleeping husband, which she will turn into a 2015 calendar – one photo for every month. What makes the project challenging for her and spicy for the observer is the fact that her husband does not know about the project and might get angry, if he ever finds out. This would make a good plot for a Woody Allen comedy.

Smartphone alternative

There are also projects for the mobile communication aficionado. One of the most interesting in the LOL category is a low-tech alternative to smartphones, the NoPhone. In the words of the inventors: "The NoPhone is a technology-free alternative to constant hand-to-phone contact that allows you to stay connected with the real world." They praise the NoPhone, a mobile-phone shaped piece of plastic, as a surrogate to smartphones for phone junkies to overcome their addiction. By end October 2014, there were over 560 supporters pledging more than $11,000.

Serious lack of whacky projects in Europe

When searching for whacky projects on European crowdfunding platforms like Ulule (www.ulule.com) and FundedByMe (www.fundedbyme.com), I couldn't find any. Depending on your perspective, this allows different conclusions. First, it may appear that Americans are either more crazy or that at least the crazy innovators from the US are more adept at promoting their whackiness. The more benign view would be that Europeans do not bother to do such nonsense, but rather focus on serious projects that advance the economy and humankind.

As much as I would like to believe that Europeans deliberately chose to avoid coming up with goofy projects to focus on more promising ideas, I cannot avoid the eerie feeling that some important ingredient for disruptive innovation is missing in Europe. Many project ideas presented as innovative in Europe are failing Albert Einstein's litmus test: "If at first the idea is not absurd, then there will be no hope for it."

Crazy Conference project

Instead of just deploring the lack of whackiness in Europe, the editorial team of Eurescom message has now taken action and launched a project on Ulule to change this. In order to boost whacky projects and bold creative thinking in Europe, especially in the European ICT sector, we have launched the 'Crazy Conference' project.

The 'Crazy Conference' is planned to be held in late spring 2015 at an extraordinary, yet secret, venue in Germany. 50 donors will be invited to participate in a conference programme you have never seen before, which is highly crazy and full of surprises, to put your creative thinking on steroids. The other donors will get a chance to follow the conference per live stream or see the results later in a video summary.

Attention: this is not for the faint-of-heart and those who enjoy the regular, boring Powerpoint-heavy conferences. If you wish to support our project, go to http://www.ulule.com/eurescom-message and make a pledge. Or be bold and start your own whacky project.

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