

EURESCOM mess@ge

The magazine for telecom insiders

NEWS



Big Data

The Kennedy Perspective
Mind your own business!

Events
**The Future Internet PPP at
the Mobile World Congress**

A bit beyond
Print your skull



NEM Summit 2013

Nantes, France

28 – 30 October 2013



The NEM Summit, organised every year since 2008 by the NEM Initiative in close cooperation with leading industrial and academic players worldwide, is the “not-to-be-missed” annual event for all those interested in Future Internet developments and in the fast paced evolution of the networked and electronic media industry.

Over the years, the NEM Summit has grown to become the key conference and exhibition to meet and network with the most active stakeholders, access up-to-date information, discover the latest technology and market trends, identify research and business opportunities, and find partners for upcoming EU-funded calls.

The event traditionally involves up to 400 attendees, 20 sponsors, 50 exhibitors and 40 speakers and authors selected following a competitive call for papers.

Call for Papers

Submission deadline: 3 June 2013

Venue

Cité Nantes Events Center

5 Rue de Valmy

44000 Nantes

France

Further information and registration

NEM Summit Website – <http://nem-summit.eu>

Funding Opportunity for European R&D Projects

Celtic-Plus Spring Call for Proposals – Deadline: 23 April 2013

Celtic-Plus is a EUREKA Cluster dedicated to realising the vision of a smart connected world through an industry-driven R&D programme. There are two calls per year, in spring and in autumn, with a total funding of up to 100 million euro. The funding is orchestrated via the Celtic-Plus programme and provided by Public Authorities from 47 EUREKA member countries.

Eligible topical areas

Get Connected

- Infrastructure and connectivity aspects
- Fixed/Wireless, optics, energy-efficiency
- Network architecture, autonomic networks

While Connected

- End-to-end services and applications, like
 - Digital home, digital enterprises
 - Digital City (incl. digital school, digital transport)
 - E-Health
 - Security, privacy, identity

Future Internet relations

- Complement Future Internet (FI-PPP) program by
 - Making the Internet a high-quality service platform
 - Introduce the ‘Celtic-Plus Use-Case Factory’
 - Extend the program by additional use cases not covered in the FI-PPP program
 - Contribute to future internet capacity building and test cases/ platforms

Green-Internet relations

- Consider environmental issues in ICT
- Encourage better energy efficiency
- Consider Smart Grid, Water management & ICT
- Develop multi-disciplinary approach

User friendly call process

The Celtic-Plus programme gives proposers the opportunity to submit proposals twice in the year – Spring Call and the Autumn Call. **The Autumn Call submission deadline is 14 October 2013.** Celtic-Plus has an accelerated one-stage call process to ensure the shortest possible time between proposal submission and start of selected projects.

Celtic-Plus proposals should be complete and clearly present the technical objectives, timescales, participants, manpower, and expected results. These proposals are evaluated by independent evaluators and the proposals meeting the required standards will be retained and given the Celtic-Plus label. To be eligible for funding, project partners need to be located in EUREKA member countries.

Further information

Please visit the Celtic-Plus website at www.celticplus.eu for call details and the Celtic-Plus Purple Book for details on the R&D priorities of Celtic-Plus. For further information, please contact Heinz Brüggemann, director of the Celtic Office, at brueggemann@celticplus.eu



www.celticplus.eu

Dear readers,

One of the hottest topics in ICT is nowadays big data. Despite the hype, the definition of big data is still fuzzy. In this issue, we try to shed some light on the matter. The authors of our cover theme have a closer look at the opportunities and challenges of big data and explore the future directions of big data.

In the introductory article, Eurescom's big data expert and Eurescom mess@ge editor Anastasius Gavras gives an overview on the subject and tries to sort out what is hype and what is substance. Prof. Roberto Zicari from Goethe University Frankfurt provides a definition of big data and explores its challenges and opportunities. Stamatis Karnouskos from SAP Research highlights the application area of Smart Grid Cities as an example of applying big data ana-

lytics for complex infrastructures. Finally, Anastasius Gavras analyses the long-term cost of big data for the society.

The editorial team is aware that the cover theme is only scratching the surface of the big data topic. The application areas for big data are almost unlimited. Nevertheless, we hope that the contributions give you some useful insights, or even stimulate interesting discussions on the further evolution of big data.

Another hot topic in ICT is currently cybersecurity. In February 2013, the European Commission presented the EU's Cybersecurity Strategy. The article under "European issues" explains and analyses the EU's Cybersecurity Strategy and provides comments for further discussion.

This issue also includes a variety of further articles on different, ICT-related topics, including event reports on recent FI-PPP events. See also the "The Kennedy Perspective" on how ICT services compromise our privacy and freedom as well as the "A bit beyond" article on the 3D printing revolution. I hope you enjoy reading our magazine.

My editorial colleagues and myself would appreciate your comments on the current issue as well as suggestions for future issues.

Milon Gupta
Editor-in-chief



Events calendar

8 – 10 May 2013

Future Internet Assembly

Dublin, Ireland
<http://www.fi-dublin.eu>

13 – 15 May 2013

eHealth Week 2013

Dublin, Ireland
<http://worldofhealthit.org/2013/>

27 – 31 May 2013

IM 2013 – The 13th IFIP/IEEE Symposium on Integrated Network and Service Management

Ghent, Belgium
<http://www.im2013.org>

9 – 13 June 2013

ICC 2013 – IEEE International Conference on Communications

Budapest, Hungary
<http://www.ieee-icc.org>

3 – 5 July 2013

Future Network & Mobile Summit 2013

Lisbon, Portugal
<http://www.futurenetworksummit.eu/2013/>

6 – 11 September 2013

IFA 2013

Berlin, Germany
<http://b2c.ifa-berlin.de>

28 – 30 October 2013

NEM Summit 2013

Nantes, France
<http://nem-summit.eu>

6 – 8 November 2013

ICT 2013 Event

Vilnius, Lithuania
http://ec.europa.eu/information_society/newsroom/cf/dae/itemdetail.cfm?item_id=9153

Sn@pshot

Print your lunar base



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3D printing may soon go into space. Industrial partners including architects Foster+Partners have joined with ESA to test the feasibility of 3D printing using lunar soil. The goal is to set up a future lunar base, as illustrated.

Here is how it should work: The base is first unfolded from a tubular module that is brought by a space rocket. An inflatable

dome then extends from one end of this cylinder to provide a support structure for construction. Layers of regolith – a loose, heterogeneous material consisting of dust, soil, broken rock, and other related materials – are then built up over the dome by a robot-operated 3D printer (right) to create a protective shell.

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Mind your own business!

How ICT services compromise our privacy and freedom



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I have been very annoyed recently with several leading ICT products and services that simply don't work unless you create an account and subscribe to the closed services of the product owner. This is a violation of my freedom and I want the EU competition authority to tell these guys to leave me alone.

A first example is the new iTunes – the damn programme keeps asking me to sign up for its cloud services every time I run the programme. I don't want iTunes cloud services, so please stop asking me! I only use iTunes as I can't communicate between my PC and iPhone/iPad without it. Now, I know I can load other apps to bypass these problems, but why should I?

I recently bought a Windows 8 machine for my daughter, and it also refuses to let me add her mail account without first creating a Windows mail account. It refused to let me sign into the bundled Skype account with her Skype address, as it wanted the Windows account only. I complained about Apple being too restrictive, but at least I can put my own mail account on my Apple devices without creating another account. Well done Microsoft – you have made the restrictive Apple environment look user-friendly!

Let me see you contacts!

My new pet hate is the increasing number of applications that want to see my contacts to see if they recognise anyone in the list. Guys, please! I want to have some programmes for private use and some for professional use and I don't want these domains mixed. If I let LinkedIn look at my contacts, it will assume I want my social contacts included in LinkedIn. I don't want this – LinkedIn is for my business contact only. The opposite is true of Facebook. I will only use Facebook for contacts with friends and family and don't want my business connections seeing my Facebook rubbish.

This came to a head a while ago when my daughters suggested we all get Whatsapp to send messages. This damn programme refused

to work if it was not given full access to my contacts. They may have cured this idiotic approach in the meantime, but I am not going to give them another try – it was quickly deleted. I have also seen that they have been keeping the contact details once they have seen them. This means they probably have me somewhere in their database. The probability that someone who knows me has let them see their contacts is very high. How can we even control who has our info in this context?

Who owns the stuff I bought?

The next challenge of the digital era is identifying what you actually own. I have bought a few online versions of magazines recently, and I have found they are really intangible assets. I cannot find where the files are stored on my iPad, so I cannot transfer them to another device; even if I did I would not be able to see them, unless I had the appropriate reader. So are they really mine? Well, it appears the answer is no. I have only got the right to read them as long as I behave myself.

Bruce Willis is famous for many things, but maybe his real fame will come from an urban myth about his problems around wanting to leave his digital collection of music to his children. The story goes that he has paid for the music but is

realising the licences are not transferrable to his family on his demise. This story is not substantiated, but it highlights that most of us have no idea what we agreed to when we clicked "I agree".

The reality is we have no rights over the digital goods we buy. Contracts and laws were written to prevent piracy, but they actually treat everyone as a thief. Is this the digital future?

What needs to be done

There are a couple of important issues here which need to be resolved if we are ever to succeed in the digital era.

The first is to protect my freedom to use the products and services I have bought and paid for, as I want to. Companies putting restrictions on how I can use my purchases unless I subscribe or give my info to their communities must be censured. It destroys freedom of choice and infringes my privacy. The second issue is to address the more complex issue of digital ownership. It must be possible to have simple sharing algorithms that recognise legitimate use and allow me to own the digital assets I have purchased.

The digital future does not have to be so unfriendly!



Big data – Overview on a much-hyped concept



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In the last years, especially in information and communications technologies, it has become increasingly difficult to distinguish between the really important breakthroughs from the marketing hypes. In this article I will try to shed some light on the subject of “big data” and let you decide for yourself, if the trend is real or just over-hyped. Possibly the conclusion is: we have been there for years and didn’t notice.

Definition of big data

What is striking is that there does not seem to be an agreed definition of what big data really is. A search via Google or Wikipedia – typical examples of big data by themselves – reveals a lot of references but no agreed definition. Especially in Wikipedia, I found some recent references which provide only a comparative definition based on some state of the art of how data is stored, processed or transmitted.

One definition for big data that I often found is that of “... data sets so large and complex that it becomes difficult to process using desktop database management tools or traditional data processing applications ...”, which is a slightly modified version of Wikipedia’s definition. I was not very happy with this definition, especially in view of Moore’s law, which is still valid and is expected to remain valid until at least 2020. With this assumption in mind we need to assess whether the pace at which we collect data is higher or lower than the pace of the improvements in technology to handle them.

A more reasonable approach seemed to me to consider the cost factor as the measure of scale, whereas cost is a function of complexity, dimension and environmental conditions. This leads me to a definition that would postulate that big data denotes data sets of which the cost for

storing, processing and transmitting exceeds the cost of a typical state of the art data management system at any given point in time by several orders of magnitude. In other words we should not denote the data sets by peta-, exa-, zetta-, or yotta-bytes but rather how much does it cost to handle them. To my knowledge a metric prefix to denote something bigger than 10^{24} bytes (yottabyte) has not been defined yet.

The roots of big data

Many areas in science have been producing large data sets already for many decades, including, among others, meteorology, astronomy, genomics, the full range of finance and business intelligence as well as environmental and climate research, just to name a few. Digital data has been around since the early days of computing. Scientists and engineers always had to deal with data sets larger than they could reasonably handle.

This phenomenon can be explained with the Jevons Paradox, which states that technological progress that increases the efficiency with which a resource is used tends to increase (rather than decrease) the rate of consumption of that resource. Although the English economist William Stanley Jevons postulated this in 1865 in the context of consumption of coal, it can be easily transposed to computers, networks and data. So, the more efficiently we capture, store and process data, the more data we capture.

Where we are today

In the not-so-distant past, access to large amounts of data was a rather expensive and cumbersome task, and also the collection of data had its price. However, recent advances in computing, networking, storage and particularly in software engineering have provided us the infrastructure and the tools that allow easy generation, processing, and transport of a vast amount of data. Similar tools allow us easy access to these data in a commonly affordable way. The politically motivated openness of existing data has fuelled this trend enormously.

On the other hand, data mining has been around for years, but it was rather a discipline for specialists. The commonly affordable and easy to use tools led to manifold experiments by the average digital literate person to find out what knowledge we can actually extract from this data, triggering the belief that the next generation of Internet entrepreneurs will build their businesses on big data. However, even today we are not yet sure whether and how we can lift all the hidden treasures. The simple example for me was my initial failure to get a precise answer from Google and Wikipedia about the term “big data”. This fact today denotes perhaps the most important characteristic of big data, namely that the data are unstructured. Even if the answer is somewhere out there, it is extremely difficult and time-consuming to find it.

Conclusion

Big data has been with us since the early days of computing and electronic communications. From a niche appearance it stepped on to the big stage, due to many big and small advances in all areas of ICT that primarily brought down the cost of data handling. It is also due to marketers who came up with simple words to denote a trend that already existed and that will likely have a large effect on the next generation of entrepreneurs.

For the existing large players it will be a big challenge to identify and occupy the right link in the value chain, which leverages every player’s own core competency and at the same time promises revenue and profit increases. For the society as a whole the challenges will be even bigger. Dealing with the hidden knowledge in big data is an issue of far-reaching political and societal implications. Just think of how big data may affect privacy and the ensuing ethical and regulatory issues.

Despite the hype about big data, the issue of how to manage and exploit vast amounts of digital data will stay, and solutions that help utilise large data amounts will meet a rising demand over the coming years.

The challenges and opportunities of big data



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Every day 2.5 quintillion bytes of data are created. This data comes from digital pictures, videos, posts to social media sites, intelligent sensors, purchase transaction records, and cell phone GPS signals, to name a few. This is big data. There is no doubt that big data, and especially what we do with it, has the potential to become a very significant driving force for innovation and value creation.

Definition and opportunities

What is big data? I have selected a definition, given by McKinsey Global Institute (MGI): “big data refers to datasets whose size is beyond the ability of typical database software tools to capture, store, manage and analyse.”

Where do we find big data? Data in general, and increasingly big data, is an important production factor for all industries and business processes. MGI estimated that 7 exabytes of new data were stored globally by enterprises in 2010. Interestingly, more than 50% of IP traffic is non-human, and Machine-to-Machine communication (M2M) will become increasingly important.

So what is big data supposed to create? The simple answer is: value. But what value exactly? Big data per se does not produce value. According to McKinsey Global Institute, the value that can be derived from analysing big data can be summarised as follows:

- Creating transparencies
- Discovering needs, expose variability, improve performance
- Segmenting customers
- Replacing/supporting human decision making with automated algorithms –Innovating new business models, products, services.

David Gorbet, Vice President Product Strategy at US database provider MarkLogic, considers being able to combine interactive data exploration with analytics and visualization to be the major benefit of big data, as this can produce new in-

sights that would otherwise be hidden. According to Mr Gorbet, organisations could glean new insights about their products, customers, and services from various applications being able to comb through large volumes of complex data from multiple sources via interactive queries.

Gorbet’s concept of “Big Data Search” implies that:

- There is no single set formula for extracting value from big data; it will depend on the application.
- There are many applications where simply being able to comb through large volumes of complex data from multiple sources via interactive queries can give organizations new insights about their products, customers, services, etc.
- Being able to combine these interactive data explorations with some analytics and visualization can produce new insights that would otherwise be hidden.

Where will big data be used? According to McKinsey Global Institute, big data can generate financial value across sectors. They identified the following key sectors:

- Healthcare – a very sensitive area
- Public sector administration – for example the Open Data in Europe
- Global personal location data – very relevant for mobile devices
- Retail – obvious for large Web shops like eBay and Amazon
- Manufacturing

I would add to the list the area of social data, both personal and professional, from social media platforms like Facebook and Twitter.

There are plenty of examples of big data use cases. Most relevant are log analytics, fraud detection, social media and sentiment analysis, risk modelling and corporate management as well as energy management.

Currently the key limitations in exploiting big data, according to McKinsey Global Institute are shortage of talent necessary for organizations to take advantage of big data and shortage of knowledge in statistics, machine learning, and data mining.

Three major challenges

The above are the business promises about big data. But what is the reality today, and what are the challenges?

We can group the challenges of dealing with big data into three dimensions: Data, Process, and Management.

Data challenges

- *Volume*: the main challenge is how to deal with the size of big data.
- *Variety*: combining multiple data sets: the challenge is how to handle multiplicity of types, sources and formats.
- *Velocity*: one of the key challenges is how to react to the flood of information in the time required by the application.
- *Veracity*: data quality, data availability: How can we cope with uncertainty, imprecision, missing values, misstatements or untruths? How good is the data? How broad is the coverage? How fine is the sampling resolution? How timely are the readings? How well understood are the sampling biases? Is there data available, at all?
- *Data discovery*: this is a huge challenge: how to find high-quality data from the vast collections of data that are out there on the Web?
- *Quality and relevance*: the challenge is determining the quality of data sets and relevance to particular issues (i.e. is the data set making some underlying assumption that renders it biased or not informative for a particular question).
- *Data comprehensiveness*: are there areas without coverage? What are the implications?
- *Personally identifiable information*: Can we extract enough information to help people without extracting so much as to compromise their privacy?
- *Data dogmatism*: Analysis of big data can offer quite remarkable insights, but we must be wary of relying too much on the numbers. Domain experts and common sense must continue to play a role.
- *Scalability*: This includes according to Shilpa Lawande, VP Engineering at analytics platform provider Vertica: “techniques like social graph analysis, for instance leveraging the influencers in a social network to create better user experience are hard problems to solve at scale. All of these problems combined create a perfect storm of challenges and

opportunities to create faster, cheaper and better solutions for big data analytics than traditional approaches can solve.”

Process challenges

A major challenge in this context is how to analyse. Shilpa Lawande from Vertica explained that “It can take significant exploration to find the right model for analysis, and the ability to iterate very quickly and ‘fail fast’ through many (possible throw away) models – at scale – is critical.”

According to Laura Haas from IBM Research, process challenges in regard to deriving insights include:

- Capturing data
- Aligning data from different sources (e.g., resolving when two objects are the same)
- Transforming the data into a form suitable for analysis
- Modelling it, whether mathematically, or through some form of simulation
- Understanding the output, visualizing and sharing the results, considering how to display complex analytics on a mobile device.

Management challenges

The main management challenges are related to

data privacy, security, governance, and ethical issues.

The main management related challenges are ensuring that data is used correctly, which means abiding by its intended uses and relevant laws, tracking how the data is used, transformed and derived, as well as managing its lifecycle.

According to Michael Blaha, “Many data warehouses contain sensitive data such as personal data. There are legal and ethical concerns with accessing such data. So the data must be secured and access controlled as well as logged for audits”.

Conclusion

Big data has definitely made it beyond the buzzword status. It is key for innovation and has a high potential for value creation. There are huge opportunities, for example concerning healthcare, location related data, retail, manufacturing, or social data. There are also challenges, for example concerning data volume, data quality, data capturing, and data management, such as privacy, security or governance.

I would like to conclude this article mentioning an interesting opportunity for big data:

“As more data become less costly and technol-

ogy breaks barriers to acquisition and analysis, the opportunity to deliver actionable information for the civic purposed grows. This might be termed the ‘common good’ challenge for big data.” (Jake Porway, DataKind)

Further information

- “Big Data for Good”, Roger Barca, Laura Haas, Alon Halevy, Paul Miller, Roberto V. Zicari. ODBMS Industry Watch June 5, 2012, <http://www.odbms.org/blog/2012/06/big-data-for-good/>
- Managing Big Data. An interview with David Gorbet, ODBMS Industry Watch, July 2, 2012. ODBMS Industry Watch, <http://www.odbms.org/blog/2012/07/managing-big-data-an-interview-with-david-gorbet/>
- McKinsey Global Institute (MGI), Big Data: The next frontier for innovation, competition, and productivity, Report, June, 2012, http://www.mckinsey.com/insights/mgi/research/technology_and_innovation/big_data_the_next_frontier_for_innovation.html

Big data analytics for Smart Grid Cities



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The emerging Smart Grid Cities constitute complex ecosystems of heterogeneous entities that densely interact. The huge amount of data generated by the billions of envisioned interconnected devices will need to be analysed in a timely manner and is expected to provide new insights. Advanced business services will take advantage of the near real-time information flows among all participants and provide new innovative functionalities that will impact the way we design, develop and operate complex infrastructures as well as the associated provision of applications.

Big data infrastructures

In an era where advanced networking capabilities are built in everyday appliances, any device that can communicate its energy production or consumption can be considered as a smart meter. However, in conjunction with such energy measurements, additional information with respect to the device’s status, its processes as well as other task- or device-specific information could be shared. This transforms smart cities into a big data infrastructure that provides detailed information at multiple layers (device, network, application, etc.) and where services and applications can now tap into and enhance their own capabilities.

As we can see in the figure (next page), devices, systems, and services will take part in “flat” and information-driven interactions; the latter will be done not only in a peer-to-peer method, but also assisted via advanced cloud services that will make the benefits of big data analytics available to all stakeholders. As an

example, the IMC-AESOP project (www.imc-aesop.eu) is designing cloud-based SCADA/DCS systems that are in the heart of modern industrial infrastructures, and which rely on a mix of on-device and in-cloud services to do monitoring and management of the real-world processes.

Big data analytics

The huge amount of data acquired will be amalgamated in the cloud, enriched with context-specific and system-wide aspects as well as business relevant information, and enable us through analytics to better understand the physical world, its processes, the impact on the business side and eventually take more informed decisions. Although big data existence and analytics don’t guarantee better decisions, potential new insights that may be acquired may materialize to more effective problem tackling and business advantages.

As an example, in the smart grid, analytics empower scenarios of grid infrastructure optimi-

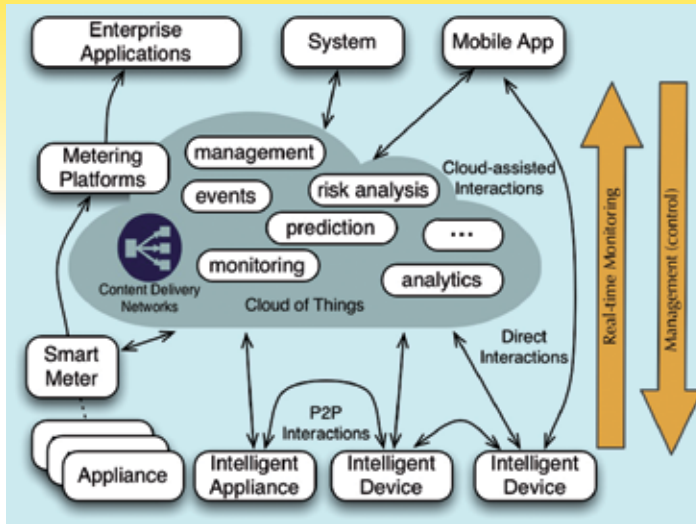


Figure: Value-added services empowered by big data analytics in the Cloud of Things

zation, energy management scenarios with participation of residential prosumers (energy producers and consumers), energy trading, and better planning of energy infrastructure in cities. Big data analytics is seen also as the key to understanding complex systems of systems, such as the emerging smart cities. The SmartKYE project (www.smartkye.eu), for example, aims at enabling municipalities to better understand and manage aspects of a smart city via a business cockpit. The SmartKYE solution is based on analytics that can be done on massive data obtained from energy management systems and other infrastructure and business systems.

Challenges

There are significant challenges when big data analytics in such complex cyber-physical infrastructures are considered. For instance, designing software solutions for such infrastructures, and analysing the impact, e.g. of malfunctions, at system-wide level can be assisted by big data analytics. A new generation of data exploration tools as well as sophisticated algorithms considering context-specific information at several levels for very large-scale systems will need to be designed, developed, and piloted. A major challenge is extracting and understanding the busi-

ness-relevant information under temporal constraints and being able to effectively build in solutions that utilize the monitor-analyse-decide-manage approach for a multitude of domains. The high heterogeneity of systems and models, the varying quality of data and associated information as well as the uncertainties and complex system-wide interactions will need to be investigated to identify business opportunities and realize a business benefit. Considering also that in smart cities much of this data will be directly attributed to their citizens, data lifecycle management approaches will need to be investigated.

Conclusion

Massive data generated by billions of devices, users and their interactions will need to be acquired and analysed in specific contexts, such as the smart city, in order to better understand and manage the increasing complexity. This implies a paradigm shift on how we design, realize and operate software services, applications and systems. New insights based on big data analytics may lead to better decision-making and business advantages.

Further information:

- IMC-AESOP project – www.imc-aesop.eu
- SmartKYE project – www.smartkye.eu

The cost of big data – An inconvenient truth



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There is a widespread expectation that big data offers tremendous opportunities. The potential economic value to be generated from the vast amount of data is given in tens or even hundreds of billions of euros per year. However, the cost of big data is rarely mentioned.

In my non-exhaustive research I hardly found figures explaining the long-term cost of big data. Yet, there must be a price tag attached to the in-

vestments needed for handling big data, including operational expenses for maintaining the data and making them available in the long term.

At the EIT Foundation Annual Innovation Forum that took place end of March 2013 in Brussels, Commissioner Neelie Kroes said that every two days we create as much information as was created from the dawn of civilisation to 2003. In addition she claimed that big data is growing by 40% per year, a figure that is hard to correlate to the previous statement and in fact even harder to believe if we accept that Moore's law will likely continue to be valid until at least 2020, implying that most likely the growth of big data is higher.

In 2011, data management provider EMC claimed that the world's data volume is growing faster than Moore's law, and that 1.8 trillion gigabytes would be created and replicated in 2011.

Expectations

The traditional big stakeholders in very large database management systems see a great opportunity and a new market potential. However, a large share of the value to be created will come from new types of data use which are unprecedented. There are tremendous investments to be made in storage, computation and transmission capacity; and there are undoubtedly costs for keeping the systems running, including energy costs.

High expectations are put in non-ICT sectors that so far, although users of ICT, had little exposure to big data because it was not easy and it was costly due to highly specialised solutions. Sectors often mentioned include energy, environment, agriculture, medicine, government and many others. The sectors today are either in-



Editorial

Dear reader,

Celtic-Plus, the extension of Celtic, has just finished its second full year. The project calls in 2011 and 2012 had been rather successful. In particular the new, shortened call process turns out to be a real improvement by speeding up the project set-up time by more than 6 months. We hope that we can continue in 2013 with similarly satisfactory submission numbers. The two submission deadlines in 2013 are 23 April and 15 October.

The Celtic-Plus Event 2013 took place in Kayseri, Turkey, from 6 to 7 March 2013. With the strong support from the current Turkish EUREKA chairmanship, for the first time ever, a cluster event was co-located with the EUREKA meeting of National Project Coordinators (NPC) and the High-Level Group (HLG). The exhibition, in parallel to the event sessions, offered an excellent opportunity to demonstrate the results from cluster projects to the national NPC and HLG representatives.

As always we give again the floor to four interesting Celtic projects that are approaching their closure:

- **MEVICO** on the evolution of mobility management for the LTE mobile networks
- **ENGINES**, describing a new prototype of BBC R&D's 'halfRF' MIMO (Multiple-input Multiple-output) radio-camera system used in real TV productions.
- **HIPERMED** about the latest development status of a High Performance Telemedicine Platform
- **IPNQSIS** about a service-aware architecture to improve the Quality of Experience on multimedia services
- **UP-to-US** about personalized and context-aware IPTV

Enjoy reading this issue.

Heinz Brüggemann
Director Celtic Office

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Celtic-Plus Event 2013 in Kayseri

Smart Connected Cities – Smart Connected World



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About 150 people attended the Celtic-Plus Event in Kayseri, Turkey, from 6 to 7 March 2013. The Event was complemented by an exhibition of around 20 Celtic-Plus projects and the EU's Future Internet programme, as well as exhibitions and support from our Turkish Core Group companies Türk Telekom and Turkcell who also sponsored the event.

For the first time ever a Cluster Event was co-located with meetings of high-level national EUREKA representatives (NPC – National Programme Coordinators) and HLG (High-Level Group). This co-location offered an excellent opportunity to show the current results of the successful Celtic-Plus Cluster during the exhibition to around 250 people, including the NPC and HLG decision-makers. Especially the NPC and HLG delegates appreciated this opportunity very much to see some real achievements from running cluster projects.

The Celtic-Plus Event in Kayseri was supported and co-organised by TÜBİTAK, the Turkish Governmental Agency responsible for public R&D funding. Turkcell sponsored the event.



Conference sessions

The main part of the Celtic-Plus Event was the conference, where several high-level representatives presented their views on the future challenges of ICT research in this fast changing world.

In the opening session the EUREKA High Level Group chairman, Okan Kara from TÜBİTAK, presented his views and new strategies to maintain the currently strong technological position of Turkey.

Several Celtic Core Group members presented their views and strategies for their future research activities. All Core Group members assured in their presentations the high commitment to carry on research and to work on projects within Celtic-Plus.

During a very challenging and interesting panel discussion the current status, challenges and perspectives for smart connected cities projects and the inclusion in a common use-case scenario with Future Internet/FI-PPP activities were discussed.

From the FI-PPP side it was expressed that there would be a real interest to include additional use-case scenarios via the Celtic-Plus Use-Case Factory concept and to link them to FI-PPP platforms. Additional regulations and agreements should be found to use the FI platform and to integrate these use cases.

After the panel session the Celtic-Plus Innovation and Excellence Awards were presented to representatives of the winning projects, and all award winners had the opportunity to explain their project achievements.

The recently launched flagship project SASER gave its first public presentation at international level. The project has an overall budget of around 80 million euro and around 400 person years of effort.

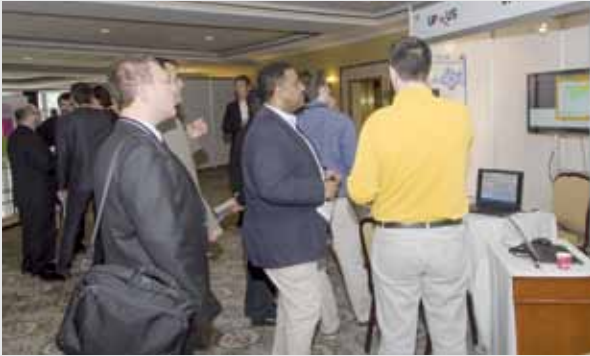
Celtic-Plus Proposers' Day

On the second day of the Event, the Celtic-Plus Proposers' Day took place. The meeting was intended for proposers to present and discuss new project ideas, in this case, ideas which could become a proposal to be submitted for the Celtic-Plus spring call (deadline: 28 April) or autumn call (15 October 2013). Besides the presentations of new project ideas, this meeting aimed to establish new connections with other potentially interested project partners. There had been very useful networking discussions with other experts, as well as with exhibitors working on related ideas. The Celtic-Plus web site offers links to the presented proposals, and Celtic will help to establish additional liaisons where needed.

Project exhibition

Another important highlight of the Celtic-Plus Event was the exhibition of project demos. These demonstrations and the discussions of results with the project experts highlighted how many good and impressive projects are currently on their way and may have good chances to gener-





ate real impact and new business.

In total 22 interesting and impressive Celtic projects demonstrated their current results and some preliminary new products. Some of the products may come to the market in a relatively short time. This again proves the high impact of Celtic projects on busi-

ness and the competitiveness of the European ICT industry.

Further information about the Celtic-Plus Event is available on the Celtic-Plus website at <http://www.celticplus.eu>

Celtic Innovation and Excellence Awards 2013

For some years Celtic has honoured the most successful and most promising finished projects with an excellence award. This year, the prestigious Celtic-Plus Innovation Award was given to the very successful project 100GET. In the Celtic Excellence Awards category, the 4GBB project received the Gold Award, MEVICO received the Silver Award, and HOMESNET the Bronze Award. "We are very proud to have such impressively successful projects within our programme portfolio, which clearly demonstrates how successful the EUREKA clusters perform," said Celtic-Plus chairman Jacques Magen.

Celtic Innovation Award Winner 2013: 100GET

100GET, actually should be more considered as a cluster project as it was composed of 6 separate but linked subprojects, each in the size of a rather big Celtic project:

- 100GET-AL
- 100GET-E3
- 100GET-ER
- 100GET-es
- 100GET-METRO
- 100GET-Horizontal

In the 100GET project 40 organizations from 5 countries participated between October 2007 and December 2010. This 65 million euro proj-



Celtic-Plus Award winners 2013 with Celtic-Plus officials

ect was coordinated by Kurt Loesch from Alcatel-Lucent, Germany and Rainer Derksen from Nokia Siemens Networks, Germany.

The project was focusing on the development of 100 Gbps Ethernet based carrier-grade transport networks ("Ethernet across the entire network"). The project has realized an impressive work that was worth the investment and performed world class research especially on the area of optical layers where a number of new devices have been developed. Also in the area of networking the results have been very promising as they cover a broad field in optical communica-

tions. Attention was given to different important aspects including multilayer planning, advanced switching and routing, techno-economic evaluation, etc.

The project realized 21 new products, improved another 15 products, filed 56 patents, contributed to 32 standards and performed 53 pilots to mention only the most important achievements.

Further information about the project is available at www.celtic-initiative.org/Projects/Celtic-projects/Call4/100GET/Project-default.asp



Celtic Excellence Awards 2013

Every year Celtic selects the three best finished projects for the gold – silver and bronze excellence award.

The selection criteria are looking in particular at the business impact, including especially new products traceable from the project results, and strong other impact like creation of new business lines, new jobs, strongly influencing standards. The difference with the “innovation award” that was awarded earlier today is that we are looking here mostly at the expected impact because the projects were just completed; however some projects already have industrial impact even during their life time or shortly after they are finished.

The awards are mainly based on successful mid-term and final reviews and impact assessments. The final selection on the gold, silver, and bronze award winners is then taken by the Celtic Core Group members.

Celtic Gold Award winner: 4GBB

The 4GBB project has shown that Gbit/s bandwidths can be reached over copper-based access lines in the range of up to 250 meters. The project could convince the Broad Band Forum (BBF) and the ITU to standardise this “hybrid fibre-copper” solution under the brand name “G.fast”. 4GBB has provided to this standard 87 contributions that represents more than 1/3 of the total standardisation effort. It is in the reach of this technology to multiply the bandwidth of residential access by a factor of 10 compared to VDSL at a cost levels that are affordable for operators.

The business relevance is high and 4GBB project has shown that a hybrid fibre-copper system, as a virtual fiber-to-the home (FTTH) solution, is technically achievable and is cost efficient for Gb/s range home access service. It is very plausible that this technology can generate a mass market with a clear advantage for the European companies that are at the origin of this technology. The very fast uptake of the subject and the important success in standardisation also proves the business relevance of the project results.

The project was led by Per Ola Börjesson of Ericsson AB in Sweden. 12 companies from 6 countries participated in this project. The total budget was about 7.9 million euro.

Further information about the project is available at www.celtic-initiative.org/Projects/Celtic-projects/Call6/4GBB/4gbb-default.asp

Celtic Silver Award winner: MEVICO

The MEVICO project focused on the network aspects of the 3GPP LTE-mobile broadband network and its future evolution. The goal was to contribute to the technical drive and leadership of the Evolved Packet Core (EPC) network (3GPP), and thus support the European industry to maintain and extend its strong technical and market position in the mobile networks market. The Project studied new network architectures and connectivity concepts for the future of the Evolved Packet Core of the 3GPP mobile broadband networks.

The business relevance of the project results is very high and strategic; first results have already been transferred to products. The project results are likely to directly influence investments and exploitation plans for operators. It brings European stakeholders in a more favourable position, especially when compared with IP giants CISCO and IBM as well as the CDN providers like AKAMAI. The outcome of the project includes 6 new products and 10 product improvements.

The MEVICO project was led by Jari Lehmusvuori, Nokia Siemens Networks Oy, Finland. 23 companies from 8 countries participated in this project. The total budget was about 15.3 million euro.

Further information about the project is available at www.celtic-initiative.org/Projects/Celtic-projects/Call7/MEVICO/mevico-default.asp

Celtic Bronze Award winner: HOMESNET

Finally, the Bronze Award went to the HOMESNET project. The HOMESNET project was focusing on the development and integration to realize a Home Base Station (HBS), also known as “Femto cell”, which is a small cellular station. It is characterized by very low costs, plug-and-play installation, low transmission power, use of existing fixed broadband (typically, digital subscriber lines) backhaul and usually limits access to a closed user group, such as, household members.

The optical backhauling technology could become very interesting for the market. It incorporates a photonic antenna allowing a Femto-cell type powered only by the light from the fiber. The underlying technology of the photonic antenna is highly innovative quantum microwave photonics.

The achieved results are especially valuable in terms of novelty with respect to the current Femto to market that is growing rapidly. These prototypes are key elements to develop “next generation” Femto that will go beyond coverage extension only.

In addition, to these prototypes, the work conducted in the project addressed the key issues in Femto network deployment and operation, including architecture, interferences avoidance and mitigation, self-configuration. The partners delivered analysis and solutions with proven performance through simulations. Several dedicated technology (Green, VL-DAS) have been developed in the scope of HOMESNET.

The HOMESNET project was led by Olivier Marcé from Alcatel-Lucent Bell Labs, France. 13 companies from 4 countries participated in this project. The total budget was about 7.95 million euro.

Further information about the project is available at <http://www.celtic-initiative.org/Projects/Celtic-projects/Call6/HOMESNET/homesnet-default.asp>

MEVICO

OpenFlow Control in Evolved Packet Core Packet Forwarding Elements



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Mobile broadband networks are expected to face dramatic growth of data traffic in the future. Evolution of the LTE (3GPP) core networks for very high capacity is being studied in the Celtic project MEVICO. One approach to tackle the challenges of distributed and centralized architectures at the same time is to separate control plane functionalities from the distributed forwarding elements. A software defined networking (SDN) type control protocol, for example OpenFlow, would be used between these planes.

It is foreseen that the current centralized network architecture will face excessive traffic concentration on a single gateway element and possibly unoptimized routing. Distributed gateway architecture for increased capacity would not be without challenges either: the current mobility management procedures are not always optimal, for example frequent handovers might lead to relocation of the distributed gateway elements in order to maintain the optimized routing. As a consequence the signalling load would increase.

SDN approach in Evolved Packet Core (EPC) Packet Gateways

OpenFlow, or more broadly software defined networking (SDN), is an approach that enables a logically centralized control plane with a view of the whole network and actual packet forwarding in the distributed switches.

S- and P-GWs are the packet forwarding elements in the 3GPP LTE network architecture. Both of these elements have also functionalities other than pure user data processing/forwarding, such as signalling termination, IP address allocation, maintaining mobile user contexts and charging. When SDN approach is applied on EPC

packet gateways, the functionalities of S- and P-GWs are split in a new way: the intelligence, decision making and signalling termination is in the centralized part, while only the packet forwarding capability is distributed.

The S/P-GW element with OpenFlow control is expected to be 3GPP compliant regardless of the new functional split. Standard MME, eNB and all other mobile network elements communicate with it by using standard interfaces and protocols as shown in the figure 1. The OpenFlow interface is considered to be a GW internal interface.

the states of the mobility management procedures for a mobile device. Mobile specific flow(s) are created during an attach procedure of a mobile device, the flow is modified during a handover event, and deleted when the mobile device goes to the idle mode. The behaviour of the forwarding plane can be dynamically modified in this way during a session of a mobile device.

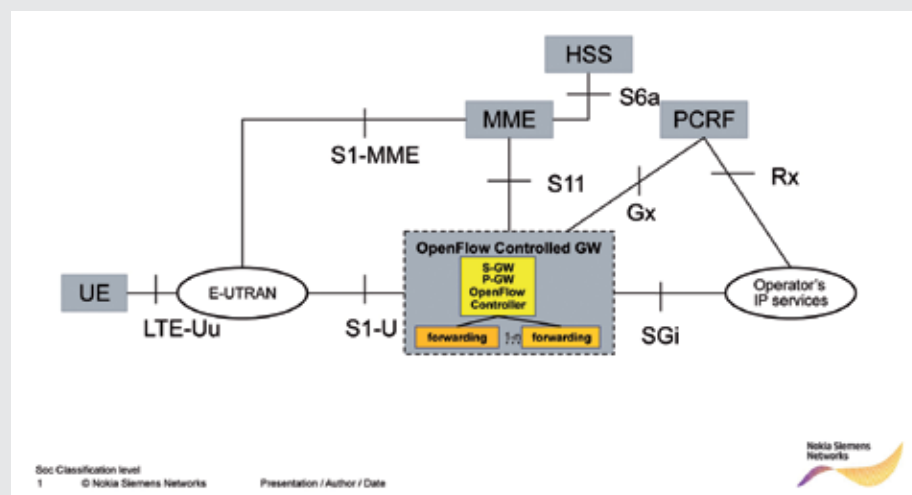


Figure: 3GPP compliant OpenFlow controlled gateway architecture

Mobility Management

The functional split to logically centralized control function and distributed packet forwarding function changes the nature of mobility management procedures. With a view on the whole network, the centralized control element can select an optimal forwarding element for each mobile attaching to the network. The selection criteria can be either optimized routing and traffic optimization, or special processing in an element capable of deep packet inspection and lawful interception. The gateway selection algorithm is thus extended to include the forwarding element selection. 3GPP specific tunnelling mechanisms may require support in forwarding elements and potentially extensions to the OpenFlow protocol or usage of proprietary protocols.

The forwarding network elements are aware of

Conclusion

OpenFlow control in the S- and P-GWs of a 3GPP mobile network splits the functionalities of these elements in a new way. The centralized control element has a wide view on the network. It learns the properties of all the existing switches and their ports via the OpenFlow interface and protocol. Port and/or flow based statistics provide means for collecting information about the network traffic. In addition to this, the centralized element has knowledge about all active packet data network connections. It can utilize this information when it makes the routing and mobility management related decisions and inserts relevant flows to the distributed packet forwarding elements.

Further information about the project is available at www.celtic-initiative.org/Projects/Celtic-projects/Call7/MEVICO/mevico-default.asp



ENGINES

BBC R&D MIMO halfRF System



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The 11th of December 2012 was the launch of the BBC's important Christmas TV schedule and it also marked a very significant day for BBC R&D where the new prototype 'halfRF' MIMO (Multiple-input Multiple-output) radio-camera system was used in a live programme, The One Show, for the first time.

Multiple broadcast cameras are normally used in a live programme to get different angle shots and some can be radio-cameras where cabling is not feasible. The halfRF is a low-latency spectrally efficient radio-camera system using multiple antennas and a successor to the world's first digital radio-camera developed here at BBC R&D. Figure 1 shows the transmitter of the halfRF system attached to the rear of a broadcast camera.

A wireless challenge

Digital radio-cameras are widely used in broadcasting for news-gathering, sporting events and



Figure 1: transmitter of the halfRF system attached to the rear of a broadcast camera

other live programme-making events, but it uses frequency spectrum which is also of interest to other wireless systems such as Wi-Fi, Bluetooth, and mobile phone networks. This inherently puts pressure on broadcasters to make use of allocated frequency spectrum more efficiently.

The halfRF system is a plausible solution to this. It has multiple antennas at both the transmit and receive ends, and the default arrangement is to have 4 transmit antennas and 4 receive antennas providing diversity at both ends. The biggest advantage in this system is that it can transmit a robust video (and audio) in half the required frequency bandwidth of conventional systems, hence the name halfRF. In other words, producers can use twice as many radio-cameras with the same frequency resource as before. This system incorporates techniques adopted in the broadcasting standards of DVB-T, DVB-T2 and DVB-NGH.

DVB-NGH and the Celtic ENGINES project

DVB-NGH is a new broadcasting standard to address reception on handheld devices, and it is the first standard to use MIMO techniques in broadcasting. The technical group in DVB-NGH held the main technical debates on the MIMO



Figure 2: Capturing a live interview

aspects of the standard and the Celtic ENGINES project has been facilitating these discussions by making extra resources available to the group. These technical discussions have helped in maturing the halfRF system and the adoption of a very clever 4x2 MIMO coding scheme which improves the robustness of the system without adding significant complexity.

The One Show programme trial

The BBC launches an important TV Christmas Schedule every year, and last year, 2012, it was launched during The One Show programme on the 11th of December. This live event was surrounded by a large audience and so radio-cameras were particularly well suited.

The prototype halfRF MIMO system was used on this occasion where the radio-camera was situated amongst the audience to capture live interview (figure 2) and other general shots (figure 3). This first programme trial using the halfRF system was a huge success and further trials are being arranged. The use of this spectrally efficient prototype halfRF MIMO system is a significant milestone for BBC R&D and possibly for the broadcast industry.

Conclusion

The BBC halfRF system can be considered the first use of MIMO in a radio-camera system employing the well-proven architecture of having separate source coding (video compression) and channel coding (forward error correction, FEC). It is also a spectrally efficient system where it can deliver up to 24.5Mbps payload data in 5MHz



Figure 3: General shots with the halfRF system

bandwidth, and in the very near future this payload data can reach up to 36.8Mbps in the same 5MHz frequency bandwidth.

There is still more that can be done to fully maximise the potential of MIMO technology in the halfRF prototype system and future research includes looking at new modulation techniques, antenna designs, ad-

vanced channel coding, receiver architecture, etc. This enabling technology is paving the way for a radio-camera system that could carry Ultra High Definition content to our living rooms.

Further information:

On the BBC R&D MIMO halfRF System

<http://www.bbc.co.uk/rd/projects/advanced-rf-for-radio-cameras>

On the ENGINES project

<http://www.celtic-initiative.org/Projects/Celtic-projects/Call7/ENGINES/engines-default.asp>

HIPERMED

High Performance Telemedicine Platform



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Availability of high performance telemedicine systems has been for a long time a goal for most medical universities and centres of excellence. This technological advancement is considered a fundamental asset for those institutions with interest in dissemination of their expertise but also as a way to continuously keep their professionals updated on the most novel techniques. Also, second opinion type of services as well as distantly located collaborative activities between different medical disciplines may also benefit from this technological solution.

Up to now the costs of existing technical solutions with a high level of quality were a barrier for a number of centres. To the best of our knowledge, no comparable approach to the one followed by HIPERMED exists at present. HIPERMED holds the promise to fundamentally reverse the current state-of-affairs by facilitating access to the high quality telemedicine facilities to networked centres. This can transform significantly current professional-to-professional practices and professional-to-patient ones.

Technical aspects

The HIPERMED platform is an extension of the High Definition (HD) videoconferencing system proposed in a previous Celtic project named HD-VIPER. The videoconferencing service, based on such standards as Session Initiation Protocol (SIP) and Real-time Transport Protocol (RTP), has been extended by specific medical services deployed using an Enterprise Service Bus (ESB). This enables patient-to-professional and professional-to professional interaction utilizing various sets of medical services. Consultations are one of the most common cases of remote collaboration between doctors, and the HIPERMED platform provides tools to perform this task. Using HIPERMED services the professionals can collaboratively work on medical images in the DICOM format. Each of the doctors can connect an additional computer with a DICOM viewer installed. This can be a workstation connected to a medial PACS system or, as is usually the case, the doctor's personal laptop.

The HIPERMED platform enables the doctor to share the view from the DICOM viewer with all his colleagues. Furthermore, all participants can



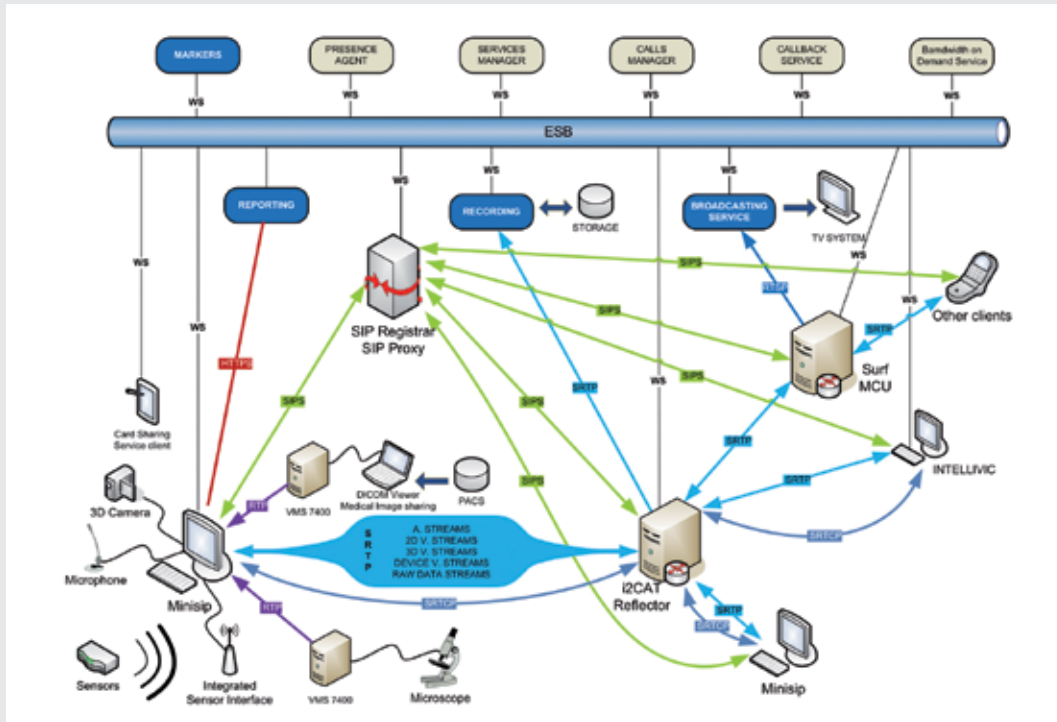


Figure: HIPERMED architecture

remotely control the DICOM viewers to enable more efficient collaboration. Doctors can also remotely pause video streams and mark areas of interest. They can make snapshots of the videos and store them locally or automatically upload them to a service allowing collaborative work on medical reports. The HIPERMED platform utilizes a Multi-Point Control Unit (MCU) that allows more than two sites to join a videoconferencing session. Each session can be also recorded for later playback or streamed live over the Internet.

The patient-to-professional scenarios mostly focus on the supervision of rehabilitation where the transmission of data coming from various monitoring devices is important. Such data can be added as additional data stream to a videoconferencing session and send to all participants. The HIPERMED platform also provides the capability to include in a videoconferencing session multiple video streams coming from additional cameras or medical equipment. Medical video can be acquired from endoscopes, microscopes, surgical robots and can be both 2D as well as stereoscopic (3D).

Conclusions

The main focus of HIPERMED is the provisioning of advanced healthcare services in an integrated and interoperable way among all the European companies and organizations which already now are investing efforts in this field.

There exists a plethora of healthcare applications in the market, without a framework that makes them interoperable. HIPERMED comes up to fill this gap, by testing and validating an open SOA and SIP services platform where several healthcare applications will be designed, implemented and used by real users in real scenarios.

The platform with basic services already exists, and it is the outcome of the CELTIC-EUREKA HDVIPER project. HIPERMED will take this and will give added value in the healthcare environment, by analysing which are the new specific requirements healthcare users need, and designing and implementing the needed modifications to the existing architecture (gap analysis), and designing and developing applications adapted to several use cases to be tested and validated. This focus on the added value of the healthcare

applications in this interoperable and integrated framework will allow a deeper impact in the core interests of the different actors participating in the project, and hence, the European healthcare service providers.

From a service/application point of view, the research contributions of HIPERMED will be focused on:

- security and signalling solutions to store and transport medical data over public networks;
- especially authenticated and encrypted video communications;
- stereoscopic technologies to be adapted to medical requirements and environments;
- DICOM and HL7 standards.

From an infrastructure point of view, research will be focused on:

- virtualized and scalable router architectures based on optimized open source software for routing;
- use of medical instrumentation directly connected to Internet-enabled devices.

Regarding Living Lab aspects, doctor’s avatars, virtual trainers and virtual motivation will be studied in order to find out how they impact on patients and technological solutions will be adapted accordingly.

Further information is available at www.hipermed.org

IPNQSIS

Service-aware architecture to improve the Quality of Experience (QoE) on multimedia services



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An important goal for improving telecommunications services is to get a clear picture about how customers perceive the quality of the multimedia services. To achieve this goal quality indicators are required to monitor the experience of the customers while using the services of an operator. With those indicators necessary measures can be implemented to improve the productivity of the applications, and, consequently, increase the customer satis-

faction. IPNQSIS (IP Network Monitoring for Quality of Service Intelligent Support) is developing a platform to evaluate the experience of users in order to improve the productivity of applications and the quality of services. This technology will enable the monitoring of data and the implementation of tools to achieve greater correlation between the quality of the service and the actual customer experience.

The IPNQSIS project, in which 18 companies and institutions from Spain, France, Sweden and Finland are collaborating, develops next generation management architectures to improve the QoE-driven network management

- Monitor video services within a multi-domain framework through several countries in Europe.
- Enhance algorithms to combine QoE-QoS analysis with network operation and traffic modelling.
- The project updates European collaboration projects -TRAMMS (CELTIC), MOMENT (FP7) and national initiatives- and Future Internet

studies to assure video services from customer perspective.

- Multimedia services management platform to assure the QoE delivered to end users, see in figure 1 the Customer Experience Management System (CEM) approach

Customer Experience Management (CEM)

The aim of IPNQSIS is the definition of the requirements, the design and the implementation of a CEM prototype, which will be composed of three different levels: data sources (for example, probes), monitoring tools and a control module. This way the objective is to develop the mechanisms that will allow to monitor and manage services offered on Next Generation IP Networks, such as video services, videoconferencing, IPTV, Mobile TV and VoIP from a customer perspective, i.e. assuring the optimal levels of Quality of Experience (QoE).

The results of the analysis will be applied to the integrated management of network resources to improve the user's experience. The technology will also make it possible to develop tools to

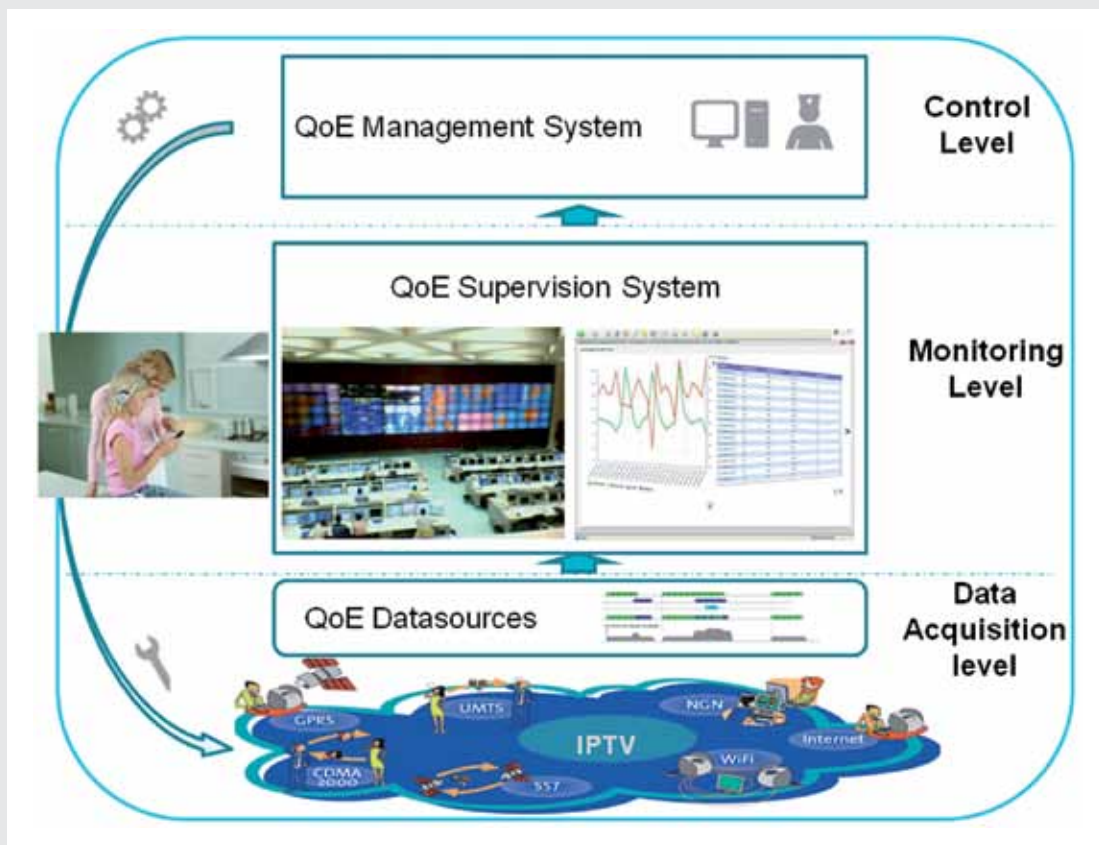


Figure 1: Customer Experience Management System (CEM) approach





Figure 2: IPNQSIS at the exhibition of the Celtic-Plus Event 2012 in Helsinki

enable greater correlation between the quality of the service and the actual experience of the user, thereby ensuring greater customer satisfaction.

Achievements

This project ends in April 2013 and its main objectives have already been achieved, from the definition of a general Customer Experience Management (CEM) architecture to IPNQSIS prototypes focused on IPTV multimedia services. The results that came out of the project comprise Quality of Service (QoS) measuring tools, mechanisms to quantify the Quality of Experience (QoE), its correlation with the QoS parameters, and their influence on QoE. The outcome of the analysis will be applied to the integrated management of network resources to improve the user's experience. Our technology will also make it possible to develop tools to enable greater correlation between the quality of the service and the actual experience of the user, thereby ensuring greater customer satisfaction.

The achievements of IPNQSIS can be considered to be of great quality given the amount of papers (40) published in leading international symposiums, publications and conferences (IEEE ICC, WWIC, IEEE ICCIT, IM IEEE, QoMEX,

TRAC IEEE, Future Network & Mobile Summit, and Telecom I+D, among others) and the seven standards (HomePlug, IEEE and VQEG) it has generated.

Outlook

The IPNQSIS consortium led by Indra, Spain's number one IT multinational, consists of 18 members belonging to major companies, universities and research centres. The project has been partially funded by the CDTI in Spain under PRINCE project, DGCIS in France, VINNOCA in

Sweden and Tekes in Finland.

Future research in this area will extend its scope to next generation services such as OTT (Over The Top) services. Specifically, the project NOTTS (Next generation over-the-top multimedia services), which obtained the Celtic label in December 2012, will continue the activities regarding QoE management on a task dedicated to this purpose.

You can find more information on IPNQSIS at <http://projects.celtic-initiative.org/ipnqsis/> and <http://www.ipnqsis.org>



UP-TO-US

Personalized and context-aware IPTV



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The Celtic-Plus project UP-TO-US has explored the area of personalized and context-aware IPTV. The context-awareness paradigm is still a relatively new area of research for IPTV services.

“Context” is any information that can be used to characterize the situation of an entity. Personalization of services by context-awareness is well known in the Internet world. Popular on-line commerce services propose products based on our previous purchases, while some websites display advertisements profiled to our search topics and network localization.

A context-aware service automatically adapts its behavior to the current context. As an example, an IPTV portal would display a selection of several movies taking into account our preferences, time of day, localization, etc., out of thousands of items in the whole VOD (Video On Demand) catalogue. Thus, the TV service becomes more “intelligent”, enabling easier and user-centric content discovery.



Context-awareness system

The UP-TO-US project has designed a modular context-awareness system for gathering, processing and delivering situational information to context-aware TV applications. Project partners agreed on a generic context model, extending standard TV Anytime metadata description format. It provides unified data structures for storage and exchange of situational data. Low-level context information from a set-top box (STB), network and service platform is mapped to this generic context model. A context providing API has been defined for exposing it to upper layers by simple and easy to use web services interfaces.

User lifestyle modelling

The project has elaborated methods for analyzing user's consumption traces matched with consumption context, to produce a dynamic user profile comprising user preferences and habits. The precision of this dynamic profile may be additionally enhanced with information from user's social networking sites, e.g. what the user likes, his preferred activities and friends data.

IPTV experience personalization

UP-TO-US has deployed a system for producing personalized recommendations of IPTV content, considering the user's lifestyle, context and infra-

structure constraints, ensuring good QoE (Quality of Experience). The recommendation algorithm combines the user's dynamic profile with dynamic context (user location, device capabilities, bandwidth constraints) in an innovative way for producing a list of content propositions that best fit to the current situation.

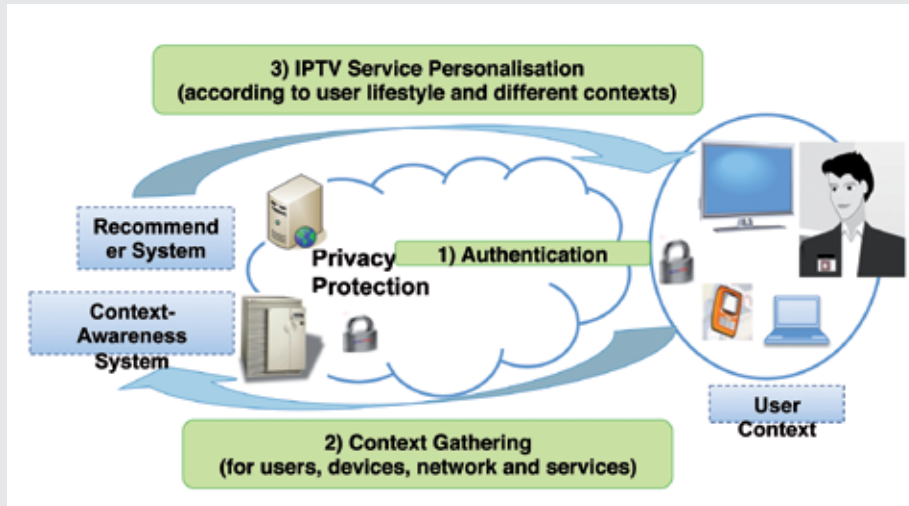
Contextualized mobility and nomadic access

UP-TO-US studied advanced methods for context-aware management of the users' mobility within their domestic sphere. Terminal mobility and session mobility procedures may be activated based on context, e.g. currently available devices in the user's vicinity and their capabilities. Nomadic access is also supported, enabling access to my IPTV services from my friend's house, or from a hotel room, served by a different IPTV provider.

Data privacy and security

The UP-TO-US system relies on data that is provided by the user or collected implicitly from the user domain, and thus, it has to be carefully protected for retaining the user's trust and acceptance of the service. A privacy protection subsystem has been introduced to manage collection, storage and access to this information, ensuring a determined level of data disclosure chosen previously by the UP-TO-US user.





tric and privacy-aware IPTV services solutions from telecom operators, industrials, and IT vendors. The collaborative work produced very interesting and practical results in the areas of managing context information, modelling the user's lifestyle, and applying situational and profile data in a novel way for achieving personalized IPTV experience.

You can find more information on UP-TO-US at <https://up-to-us.rd.francetelecom.com>

Testbeds

A prototype UP-TO-US system has been implemented as proof of concept and deployed over testbeds of project partners. Validation experiments and demonstrations, including limited tests with real users, confirm the potential to deliver personalized and context-aware TV services. It is worth noticing that a common UP-TO-US data model has been applied for different deployment types: managed IPTV (with experimental IMS-based platform and commercial non-IMS platform) as well as for webTV system destined

for open Internet. Despite quite different architectural principles, the generic UP-TO-US data model and interface APIs proved their value for managing contextual information in all cases.

Conclusion

UP-TO-US allowed to disseminate and share the experience of the partners on IPTV and audio-visual applications at the European level, through providing prototypes for personalized, user-cent



IMPRINT

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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.



creasingly engaged in collecting new data, or engaged in opening their archived data under the open access legislative initiatives. Current economic sectors are able to provide a cost-benefit analysis, although the benefits are rather expectations today and depend a lot on yet unknown applications that may emerge, while there is a lot of uncertainty.

Big data players

Let us have a look at the players in the field of big data who have emerged around open platforms that support knowledge exchange and sharing of largely unstructured data. In 2008, data platform provider Pachube – today known under the name cosm (www.cosm.com) – was one of the first grassroots initiatives to find its way into the global business news. Since then several initiatives and companies have picked up this basic idea and try to support people in managing their unstructured data. However, the landscape is currently very unclear and full of buzzwords.

The fact that new data management companies emerge means there is a certain complexity which has a cost. Those who find ways to efficiently manage the data complexity at low cost will be able to sustain a viable business. We probably have to wait for another few years, until the next yet unknown spin-off grows to the size of today's big Internet firms like Google, Amazon, eBay, or Facebook.

Cost versus value

Admitting that there is a management cost due to the sheer volume and complexity of big data, even considering the dropping cost of enabling technology, inevitably raises the question about the break-even point. The following general considerations are meant to highlight the challenge.

Figure 1 illustrates the increasing management cost, which roughly translates to operational expense (OPEX), versus the dropping technology cost, which roughly translates to capital

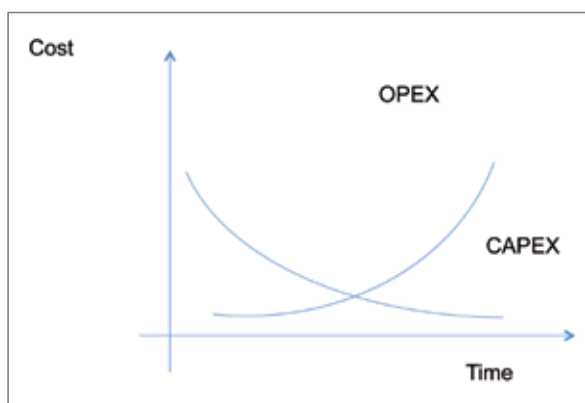


Figure 1: The increasing management cost of big data

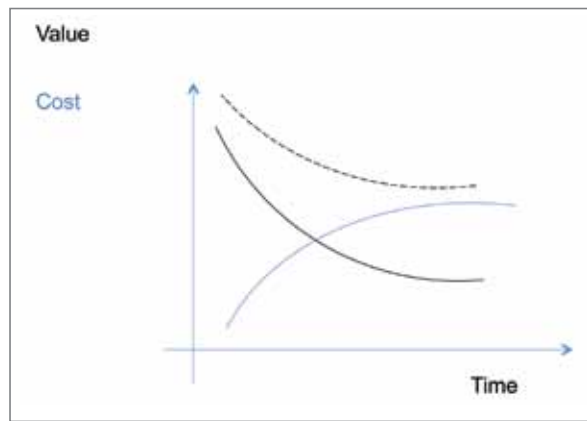


Figure 2: The increasing management cost of big data

expenses (CAPEX) over time.

Figure 2 illustrates the aggregate cost (CAPEX+OPEX) as compared to the value for society. The dotted black line indicates an unanticipated scenario in which the total cost of ownership exceeds in the long run the value provided to society. We still don't have a complete picture of the overall cost of ICT in general and big data in particular, including the physical resource consumption and its environmental sustainability. Just to give you an idea of the scale we are talking about, Google claimed in 2011 that an average search query translates to roughly 0.2 g of carbon dioxide. Now try to imagine what CO₂ levels other big data operations add to the total.

Skills

Until recently, our society has been quite selective of what is stored to provide long-term value and what is archived and made available for future generations. We created dedicated professions to master this complex task, for example archivist and librarian. We have quite clear rules of what artefacts must be assessed, collected, organised, preserved, maintained and made accessible to provide a long-term value.

Today almost anyone can collect and make accessible digital data, mainly because the technology exists and is affordable. Terabyte hard disks are nowadays in the 50-euro range, very small scale PCs running Linux are available for under 30 euro, and broadband subscriptions are in the 20 euro per month range. With these components at hand each digital native is capable of building a system that collects, temporarily stores, eventually processes and maybe makes available arbitrary

data virtually without limits. But is everyone able to assess, organise, preserve and maintain the data in the long term? And what is the long-term cost and value for him or her?

Conclusion

My prediction is that at a certain point in time the cost of processing and querying big data stores will be economically unaffordable. Around this point in time we will find ways to intelligently distil useful knowledge

out of a passing stream of data and just drop the rest. The challenge lies in identifying what we can extract from this stream of raw data, and which will provide also in the future opportunities for yet unforeseen use of historical data.

We need to transpose the skills of archivists and librarians into the world of big data. The skills might be called differently, but ultimately the skills must allow the assessment, organisation, preservation and maintenance of knowledge to provide long-term value. The development of these skills is also a cost, but I believe that cultivating these skills is an essential investment in our future capability to deal with the ever increasing amount and complexity of big data.

Further information:

- Speech by Commissioner Neelie Kroes on "The big data revolution" at the EIT Foundation Annual Innovation Forum in Brussels on 26 March 2013
http://europa.eu/rapid/press-release_SPEECH-13-261_en.htm
- EMC press release on Big Data (28 June 2011)
www.emc.com/about/news/press/2011/20110628-01.htm

The Future Internet PPP at the Mobile World Congress in Barcelona



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In February, the Future Internet Public-Private Partnership (FI-PPP) community organized several activities around the Mobile World Congress (MWC 2013) in Barcelona. The two main activities were the participation in the MWC exhibition and a dedicated FI-PPP event held in the vicinity of the MWC venue.

The activities in Barcelona aimed at raising the awareness for FI-PPP results among target audiences from the ICT industry. Another goal was to further develop the FI-PPP community by engaging targeted stakeholders. This was done by communicating phase 1 results and providing an outlook on phase 2 and phase 3 of the FI-PPP.

FI-PPP at the Mobile World Congress exhibition

All phase 1 projects participated in the Future Internet PPP activities at MWC 2013 in Barcelona from 25 to 28 February 2013. In Hall 8.1 (Apps planet) of the Fira Gran Via they presented their results at a joint FI-PPP stand via presentations, videos, and interactive demos. Thus, the FI-PPP community highlighted the value of engaging in the FI-PPP ecosystem. Based on open

interfaces, the FI-PPP enables the development of third-party services and applications, helping to create new markets.

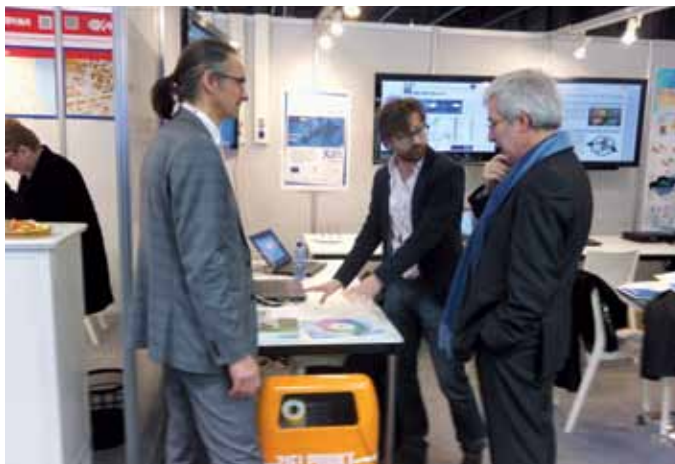
The FI-WARE project (www.fi-ware.eu), which has developed the technological foundation of the FI-PPP programme, showed and explained its generic enablers, covering technical areas like Cloud, M2M/IoT, Apps management, Data/Context management, and security. In addition, FI-WARE described practical examples of how building blocks could be exploited by entrepreneurs. The INFINITY project (<http://www.fi-infinity.eu>) complemented this by showing a demo of the XiPi portal on infrastructures relevant for the Future Internet, or "The search engine for Future Internet developers and experimenters", as the project itself calls it.

All eight FI-PPP use case projects showed their results:

- The **Instant Mobility** project (<http://instant-mobility.com/>) was present with three different demos: Personal travel companion, Smart City logistics, and traffic control in the cloud.



Jacques Magen (middle) from the INFINITY project explaining XiPi to interested visitors of the FI-PPP stand.



Visitors from the European Commission: Peter Fatelnig (left) and Mario Campolargo (right).

- The **FINSENY** project (<http://www.finseny.eu/>) showed through some videos how Future Internet technologies will play a critical role in the development of Smart Energy infrastructures, enabling new functionality while reducing costs. FINSENY also showed how the project results contributed to the emergence of a sustainable Smart Energy infrastructure, based on new products and services.
- The **SmartAgriFood** project (<http://www.smartagrifood.eu/>) displayed the Tailored Information for Consumers demo, which provides information related to a product in a tailored way for each use, based on a set of preferences established previously by the consumer.
- The **FI-CONTENT** project (<http://www.fi-content.eu/>) showcased project specific enablers as well as the validation of generic enablers in the following five demonstrations: Content Discovery, Device-to-device content sharing, Networked virtual character, Content Enrichment, and Generic Enabler validation demonstrator.
- The **FINEST** project (www.finest-ppp.eu) showcased the business value of Finest in one of the project scenarios: the fish export from Norway to Brazil, via the port of Rotterdam.
- The **SafeCity** project (www.safecity-project.eu) used a video and a virtual poster to explain projects results and to link Safecity to the rest of FI-PPP activities.

- The **OUTSMART** project (<http://www.fi-ppp-outsmart.eu>) showcased its results via four different applications: TravelSmarter, The intelligent waste paper basket, SuperHeroSoftware (teaching the future internet to SCADA systems) and Smart City applications (a suite of Internet of Things enabled applications).
- The **ENVIROFI** project (www.envirofi.eu) showcased three different applications: The Biodiversity Survey Application, The Personal Environmental Information System (PEIS), and The Marine Asset decision Support Tool (MAST).

In the four exhibition days, the FI-PPP presented the great variety of application areas for the technical results of the programme and provided a glimpse of future developments that will impact the Future Internet and the European ICT industry in general.

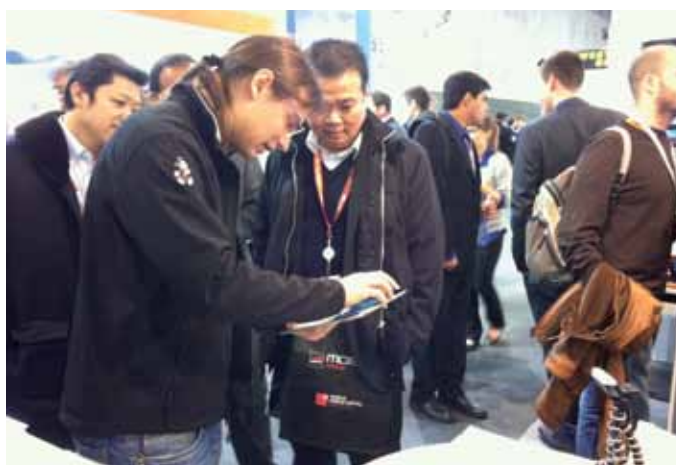
The FI-PPP stand attracted considerable interest by many different stakeholders, including developers, innovation agencies, standardization bodies, and ICT industry representatives from Europe and abroad, particularly from Asia.

Future Internet PPP event

The FI-PPP community and a number of stakeholder representatives from cities, regions, SMEs, and research organisations met for a dedicated Future Internet PPP event at Barcelona's Palau the Congressos after the MWC on 28 February and 1 March. The main objectives were to communicate phase 1 results to the audience and engage targeted stakeholders in phases 2 and 3 of the FI-PPP, in order to further develop the FI-PPP community.

The event was opened with a series of presentations by distinguished speakers. The speeches covered the broader European context for the FI-PPP, provided insights of what the PPP is doing, and offered the city and regional view of the Future Internet. Speakers included Mario Campolargo (Director Net Futures, European Commission DG Connect), Prof. Wolfgang Wahlster (Chairman of the FI-PPP Advisory Board), Manel Sanroma (Director del Institut Municipal de Informatica. Ayuntamiento de Barcelona), and Carles Flamerich (Director General Telecomunicacions i Societat de la Informacion. Generalitat de Catalunya).

Peter Fatelnig, Deputy Head of the Net Innovation unit at the EC's DG Connect, provided details of the more concrete elements of the FI-PPP, covering different aspects of phase 1 and the upcoming phase 2 and phase 3. All the phase 1 projects presented their achievements from the first phase of the programme in a day joined by around 90 to 100 participants.



The second day of the FI-PPP event included two interesting workshops, held by FI-WARE and INFINITY, as well as a panel discussion with FI-PPP users. The event was closed with an engagement session focused on the opportunities of phase 2 and phase 3.

A demo and information area besides the conference area provided on both days of the event plenty of opportunity for the audience to engage with specific projects, who presented demos, showcases and videos of their results.

Videos, photos and presentation slides from the FI-PPP presence at MWC 2013 and the FI-PPP event are available on the FI-PPP website at www.fi-ppp.eu

Environmental observation and the Future Internet

ENVIROFI Day in Dublin



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The ENVIROFI Day was held in Dublin on 6 March 2013 as part of a whole week of co-located events. ENVIROFI, the Future Internet Public-Private Partnership's use case project on environmental observation, used its final event to present its results and discuss future Internet services based on environmental observations.

Three environmental conferences in one place

The week of three related conferences was united by the theme "Potentials of geospatial information to meet the challenges of a changing world" and took place under the Irish EU presidency at the Convention Centre Dublin. Between 4 and 8 March 2013, the Eye on Earth User conference (4-6 March 2013), the ENVIROFI Day, and the EUROGI ImaGIne Conference (7-8 March 2013) offered an excellent opportunity for social networking across different expert communities and for exploring the future of environmental services.

About 400 participants, including researchers, environmentalists, industry representatives from SMEs and large companies, EU officials, user associations, and other stakeholders met in the Irish capital to discuss how geographic information can be used to address environmental and economic developments as well as governance issues.

The First Eye on Earth User conference, organised by the European Environment Agency (EEA), kicked off the week centred on environmental data sharing in general and focused in particular on the use of the Eye on Earth platform, which aims to collect and use environmental data for sustainable development policy making, programming and project operations.

The imaGIne conference, organised by the European Umbrella Organisation for Geographic Information (EUROGI), explored the opportunities offered by existing geographic information and technologies for addressing economic growth, governance and environmental issues in the near to mid-term future. As part of the paral-

lel sessions, the Joint Research Centre had an opportunity to discuss the evolving European Union Location Framework in connection with the Digital Agenda for Europe.

Placed between these two conferences, the ENVIROFI Day was held on 6 March 2013 as the final event of the ENVIROFI project, a European funded project within the Future Internet Public-Private Partnership (FI-PPP) programme of the EC's FP7 research programme aimed to leverage the environmental observation web and its service applications within the Future Internet.

Vision and results of ENVIROFI and the FI-PPP

Jose Lorenzo, ENVIROFI project coordinator from Atos, opened the event and gave an overview of ENVIROFI and the agenda. This was followed by a keynote speech in which Peter Fatelnig from the EC's DG Connect gave an outlook on the envisaged transition of the FI-PPP programme towards an ecosystem of Future Internet enablers and technologies to make public and private service infrastructures smarter and more sustainable. Mr Fatelnig briefly outlined the structure of the FI-PPP as a whole, showing some examples of use case projects from FI-PPP phase 1, and introduced what is expected in the subsequent two phases of the FI-PPP, which are particularly addressing Internet innovators and SMEs. According to Mr Fatelnig, "the ultimate aim is that SMEs connected with regional initiatives leverage and expand the ecosystems of enablers, services and applications".

The ensuing part of the first session focused on the results of ENVIROFI. Jose Lorenzo out-

lined the vision and main results of the ENVIROFI project. He explained that in the context of the FI-PPP, ENVIROFI sought to capture the requirements and needs from the environmental usage area and to define proper reusable building blocks in the form of Specific Enablers. These Specific Enablers are designed to collect, manage, access, discover, and publish environmental observations through the Internet in standardised formats.

Thomas Usländer from Fraunhofer IOSB presented the ENVIROFI architecture and how it is related to the Generic Enablers developed by the FI-PPP core platform project FI-WARE. Dr. Usländer described how the ENVIROFI architecture is driven by a set of challenges to map the requirements and capabilities of the environmental usage area in a systematic way. Finally, Dr. Zoheir Sabeur from IT innovation gave an overview on the definition and use of the Specific Enablers as one of the major outcomes of the ENVIROFI project. In his presentation he explained mediators, geo-referenced data collection services, and fusion tools for environmental and spatial data sources.

ENVIROFI demonstrators

The late morning session looked into a wide variety of environmental apps and demonstrations in the areas of biodiversity, air quality, and marine assets. Introducing the ENVIROFI demonstrator session, Dr. Denis Havlik from the Austrian Institute of Technology (AIT) pointed out the challenges posed by the environmental "Observation Pile", meaning unstructured, heterogeneous data, to create situational awareness and forecast

applications based on the environmental enablers and Future Internet technology.

Dr. Katharina Schleidt from the Environmental Agency of Austria (EEA) presented a step-by-step demonstration of the Biodiversity Survey mobile app for community-driven biodiversity data collection and preservation,



Opening session (from left): Thomas Usländer (Fraunhofer IOSB), Zoheir Sabeur (IT Innovation), Peter Fatelnig, (European Commission), ENVIROFI coordinator José Lorenzo (Atos).



Keynote speech by Professor Fiona Regan, Dublin City University



Discussing the future of environmental services (from left): Fiona Regan, Peter Fatelnig, Gearoid O'Riain, Clemens Portele, Denis Havlik, and Milon Gupta.



High interest in ENVIROFI's demonstrators during the breaks

which has been tested in the cities of Vienna and Florence.

Dr. Jasmin Pielorz (UBIMET) presented the Personal Environmental Information System (PEIS), a mobile app capable of accessing a variety of data sources such as pollen data, air quality data, and weather data from the cities of Oslo and Vienna to offer personal notifications on air quality.

Finally, Dr. Conor Delaney from the Irish Marine Institute (MI) demonstrated ENVIROFI's web portal for decision support in marine asset management, which combines sea model outputs and real-time data on weather conditions to

predict weather timeframes for managing wave energy assets in Galway Bay, Ireland.

Opportunities for future innovation

The afternoon sessions were particularly addressed to SMEs, innovators and stakeholders interested in the opportunities of innovative environmental services. Professor Fiona Regan from Dublin City University prepared the ground with her keynote speech on smart sensing and services for empowering the environmental domain. "ENVIROFI enablers and Future Internet technologies are critical as data integration hubs on the web for managing the environment and making informed decisions", she said.

This was followed by a use case session featuring representatives from SMEs and stakeholders in the area of environmental and geospatial information, services, and applications. Presenters of this session included Paul Gaughan of SmartBay Ireland Ltd, Gianluca Vannuccini of the City of Florence, and Gearoid O'Riain of Compass Informatics. According to the speakers, ENVIROFI technologies could serve as cross-cutting enablers to foster new application and service development.

Gearoid O'Riain, Denis Havlik, and Clemens Portele, Managing Director of interactive instruments.

Panellists and audience found themselves quickly immersed in a lively discussion on a variety of topics. After almost two hours, the discussion had provided all participants with new insights on the power of social networks, citizen science and the use of volunteer geographic information in environmental services. Further topics included the current bottlenecks for data access and usage, the ever-increasing importance of data fusion and integration services, as well as the challenges of business models for leveraging innovative services. Another lesson from the panel discussion was that it would be too narrow to just think in terms of environmental services. The participants agreed that a plethora of new services in many domains could be enabled through the use of environmental observation data.

Outlook

One of the main take-away messages from the ENVIROFI Day was that Specific Enablers were conceived as Future Internet tools serving not only the environmental domain but also other sectors, for example the domains of manufacturing, resource efficiency, and healthcare.

The environmental enablers and applications developed during the ENVIROFI project along with the corresponding documentation will be available in an online catalogue (<http://catalogue.envirofi.eu>). Jose Lorenzo explained that the ENVIROFI catalogue is intended to serve potential users and SMEs interested in using the ENVIROFI results after the closure of the project.

Further information about ENVIROFI is available at <http://www.envirofi.eu> and <http://catalogue.envirofi.eu>



Presenting ENVIROFI's demonstrators (from left): Katharina Schleidt (EAA), Jasmin Pielorz (UBIMET), Conor Delaney (MI), and Denis Havlik (AIT).

The EU cybersecurity strategy

Why Europe needs a more concrete plan



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On 7 February 2013, the European Commission and the High Representative of the Union for Foreign Affairs and Security Policy presented their Cybersecurity Strategy of the European Union. It presents a reasonable vision and acceptable goals, but is lacking a concrete plan on how to move forward.

In view of the enormous Internet-related security challenges, Europe definitely needs a strategy to deal more effectively with them. Just think of cybercrime, disruption of critical infrastructures, cyber espionage and cyber warfare. The annual damage for cybercrime alone amounts to 750 billion euro per year, according to a McAfee study.

Does the strategy presented by Neelie Kroes, Catherine Ashton, and Cecilia Malmström meet the challenge? This depends on what you expect. First of all, it is debatable, whether the 20-page document really describes a strategy. In large parts it consists of good intentions, decent goals and vague plans for action.

Strategic priorities

The EU's cybersecurity strategy is based on five "strategic priorities":

- Achieving cyber resilience
- Drastically reducing cybercrime
- Developing cyberdefence policy and capabilities related to the Common Security and Defence Policy (CSDP)
- Develop the industrial and technological resources for cybersecurity
- Establish a coherent international cyberspace policy for the European Union and promote core EU values.

These five "strategic priorities" are definitely worthwhile to achieve. They reflect the EU's more defensive approach to cybersecurity, compared to the rather aggressive approach taken by the United States.

The main flaw of the "strategic priorities" is that they have not been defined as measurable goals and, thus, leave more room for interpreta-



Neelie Kroes, European Commission Vice-President for the Digital Agenda; Catherine Ashton, High Representative of the Union for Foreign Affairs and Security Policy; and Cecilia Malmström, EU Commissioner for Home Affairs (from left to right)

tion than would be good for an effective strategy. What does achieving "cyber resilience" really mean? What does it mean to drastically reduce cybercrime? Given that the share of unreported cybercrimes is supposedly substantial, we may rather expect an increase in the reported cases, even if measures against cybercrime are successful.

Network and information security

Reporting of network and information security (NIS) incidents is one of the central measures of a proposed EU Directive on NIS, which is at the core of the EU cybersecurity strategy. This is the most concrete part of the EU strategy, and one of high importance. Without getting a clear picture on EU level about the dimension and specific features of cyber incidents, it is hard to take adequate action.

Parts of industry are not really enthusiastic about such a reporting obligation, as it would mean bad PR in the case of incidents that could have otherwise been kept private, and because it would mean additional effort and cost for handling the reporting. Although this attitude is understandable, everyone would finally benefit from detailed Europe-wide statistics on cyber incidents.

The other major point of the Directive is that all Member States should be required to adopt an NIS strategy and designate a national NIS authority. This also makes sense, although having 27 national NIS strategies would not automatically lead to a common strategy that enables coordinated responses to cyber threats.

Other parts of the actions summarised under the EU cybersecurity strategy are the revamping of the European Network and Information Security Agency (ENISA - <http://www.enisa.europa.eu/>), and the recent launch of the European Cybercrime Center (EC3 - <https://www.europol.europa.eu/ec3>) at Europol. What remains to be seen is how well ENISA and EC3 cooperate with each other and with their counterparts at Member States. Not having one main responsible

body on EU level may make coordination of cybersecurity activities difficult.

The strategy is particularly vague where it describes how to "improve preparedness and engagement of the private sector". The document suggests that the private sector should create their "own cyber resilience capacities and share best practices across sectors".

Conclusion

Most of the measures appear to be steps into the right direction. However, central parts of the proposed "strategic priorities" are too vague to be actionable, like, for example, the ideas on strengthening the private sector's cyber resilience.

In that respect, the EU cybersecurity strategy should be rather seen as a vision document for discussion among all relevant stakeholders, rather than a mature plan whose implementation will bring about an "An Open, Safe and Secure Cyberspace", as the strategy document is entitled.

The European Commission and the Member States would be well advised to put substantial effort into agreeing and implementing a more concrete plan for strengthening Europe's cybersecurity. This updated plan should also include concrete steps for coordinating global cybersecurity endeavours more closely with NATO, the US government, and other key global players. Although this will be difficult, as there are different views on the relationship between "open" and "secure", it is necessary, as many threats to cybersecurity are global.

Further information:

- EC web page on the cyber security strategy - <http://ec.europa.eu/digital-agenda/en/news/eu-cybersecurity-plan-protect-open-internet-and-online-freedom-and-opportunity-cyber-security>
- Storm cloud emerges from EU cybersecurity strategy - EurActiv, 8 February 2013 <http://www.euractiv.com/infosociety/storm-cloud-emerges-cloud-safety-news-517658>

News in brief



Agreement on Unified Patent Court signed



At the European Council meeting in Brussels on 19 February 2013, 24 EU member states signed the agreement establishing a Unified Patent Court (UPC). This is one of the final steps towards establishing a unitary patent system in Europe.

The agreement is part of a package which also includes two EU regulations, on unitary patent protection and associated translation arrangements, which were adopted by 25 EU member states in December 2012. Together, the three parts of the package provide the legal basis for the future European Unitary Patent system. After 30 years of discussion at European level, the unitary patent system will become effective in 2014. Compared to the already existing European pat-

ent, the unitary patent offers several advantages. Today's European patent is not a unitary title but a bundle of national patents with no single jurisdiction for disputes. The unitary patent, on the other hand, is a single patent which does not re-

quire validation or translation in other participating member states and is administered under a single jurisdiction.

Thus, the unitary patent system is expected to make obtaining a European Patent less complex and cheaper while ensuring legal certainty throughout the entire single jurisdiction.

The European Council and the Commission expect that this more affordable Europe-wide patent protection will encourage EU businesses, especially SMEs, to increase their innovation activity, thus boosting competitiveness and enhancing the Single Market.

http://ec.europa.eu/internal_market/indprop/patent/index_en.htm

EU innovation report: improved performance, widening gap

Between 2008 and 2012, innovation performance in the EU has improved, despite the continuing economic crisis. At the same time, the innovation gap between Member States has become wider. These are the main results of the European Commission's Innovation Union Scoreboard 2013, which ranks the innovation performance of EU Member States.

While the most innovative countries have further improved their performance, others have shown a lack of progress. The overall ranking within the EU remains relatively stable, with Sweden at the top, followed by Germany, Denmark and Finland. Estonia, Lithuania and Latvia are the countries that have most improved since last year. Drivers of innovation growth in the EU include SMEs and the commercialisation of innovations, together with excellent research systems. However, the fall in business and venture capital

investment over the years 2008-2012 has negatively influenced innovation performance.

From a global perspective, the EU is still lagging behind the world's innovation leaders. In Europe, Switzerland continues to outperform all EU Member States. The US, Japan and South Korea have a performance lead over the EU27, with South Korea joining the US as most innovative country. Although this lead has been increasing for South Korea, the EU27 has been able to close almost half of the gap with the US and Japan since 2008.

The full report is available for download at http://ec.europa.eu/enterprise/policies/innovation/facts-figures-analysis/innovation-scoreboard/index_en.htm

New mandate for ENISA

After two years of negotiation, the Council and the European Parliament have agreed on a new mandate for the European Union Network and Information Security Agency, ENISA.

On 1 February 2013, Member States agreed on a compromise which paves the way for the adoption of the draft regulation. To enter into force, the text needs to be formally approved by the Parliament, whose vote in plenary is expected to take place before summer 2013, and the Council, which is due to take its decision after the vote in Parliament.

The new regulation became necessary, because ENISA's current mandate expires on 13 September 2013, and the defined scope of tasks was no longer considered appropriate in view of the increased cybersecurity challenges Europe is facing.

ENISA was set up in 2004 with the goal of ensuring a high level of network and information security across the EU. Since then, the challenges for the security of electronic communications have grown, with increasing levels of cyberattacks and cybercrime. Against this background, and also in view of the role ENISA is supposed to play in the EU's cybersecurity strategy, the new regulation aims to enhance the efficiency of the agency.

ENISA's new mandate will cover a period of 7 years, with the option to extend the duration of the mandate. The agency's tasks have been set out in more detail. They will now include support for capability building and, in particular, for the operation of computer emergency response teams. Furthermore, upon request by member states or EU bodies, ENISA may provide advice in the event of breach of security or loss of integrity. There are also changes on an organisational level. A branch office has been established in Athens for operational business, besides the agency's headquarters in Heraklion, Crete. In addition to the management board, an executive board will be established, with a remit of preparing administrative and budgetary decisions to be taken by the management board.

<http://www.enisa.europa.eu>

Print your skull

How 3D printing is revolutionising the world



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Almost three decades after its invention 3D printing has now reached a level of maturity that will fundamentally change the world as we know it. 3D printing has now gone far beyond the production of garden gnomes and other non-essential objects, but also beyond rapid prototyping of car and airplane designs. Soon, 3D printers may be a household staple. There is almost no area, in which 3D printing could not be used, ranging from manufacturing to healthcare, food production, and even space travel.

In 1986, Charles Hull patented the solid imaging process known as stereolithography, the first commercial technology for additive manufacturing. Stereolithography has been used for producing models, prototypes, patterns, and production parts. While the application areas in the early days of 3D printing were very limited and only available at high costs in an industry environment, the application areas are now almost endless, and practically anybody who has a computer at home could afford a 3D printer. 3D printing may soon become a mass market for consumers and prosumers. However, the revolutionary changes go far beyond the home printing of spare parts and more or less useful objects.

One of the most innovative domains for 3D printing has been the medical area.

Printing arteries and bones

Already in 2011, researchers at the Fraunhofer Institute for Interfacial Engineering and Biotechnology IGB had developed a solution which uses 3D printing and a technique called multi-photon polymerisation for producing artificial blood vessels. This can have a huge impact on patients waiting for a transplant. As there are not enough donor organs, the way out could be lab-made organs. For them to function, they need to be equipped with artificial blood vessels, tiny and extremely complex tubes that connect the organ to the blood circuit.

3D printing has also been used for face transplants. In January 2012, Belgian surgeons at

the University Hospital of Ghent, successfully performed the world's first full-face transplant that was fully planned using digital planning and 3D printing. The medical team consisting of 65 people executed a virtual pre-operative plan. After scanning the patient's face with a computed tomography scanner, they used custom 3D-visualising software to examine the facial defects. Based on this analysis, they custom-printed anatomical models of healthy bones for use as a reference during surgery.

In early March 2013, a man in the United States underwent cranial surgery and had 75% of his skull replaced by a 3D-printed implant. The implant was produced by Oxford Performance Materials (OPM), a medical technology company based in Connecticut. In February 2013, the 3D-printed implant had gained regulatory approval by the US Food and Drug Administration (FDA).

Synthetic steaks

3D printing also works with organic material. US start-up Modern Meadow is working on the production of artificial raw meat using a 3D bio-printer. The 3D printer cartridge contains bio-ink made of hundreds of thousands of live cells. Once printed in the desired shape, the bio-ink particles naturally fuse to form living tissue.

Theoretically, this process could be used to create organs for implants. However, this does not work yet. Nevertheless, the process is good enough for producing a synthetic steak, which is a much simpler task. In the longer term, it will be challenging to produce such meat on an industrial scale and persuade consumers to accept it. For StarTrek fans this is nothing new. The starship crew got their food from a replicator that synthesized meals on demand.

Apart from nutrition space travel provides additional challenges which can be addressed with the help of a 3D printer.

A lunar base from the printer

The European Space Agency, ESA, is exploring how to set up a lunar base using a 3D printer to build the base from local materials. Together with industrial partners, ESA is testing the feasibility of 3D printing using lunar soil.

Architects Foster + Partners devised a weight-bearing dome design with a cellular structured



Model of 3D-printed lunar station (© Copyright ESA/ Foster + Partners)

wall to shield against micrometeoroids and space radiation. The base's design was guided by the properties of 3D-printed lunar soil, with a 1.5 tonne building block produced as a demonstration. The building block was produced by Monolite's D-Shape printer, with a mobile printing array of nozzles on a 6 m frame to spray a binding solution onto a sand-like building material.

Print your future

Like all technologies, 3D printing not only gives reasons for euphoria. The public debate on printing weapons already highlighted some of the risks 3D printing may include. Another area where 3D printing can have detrimental consequences is waste. Think of all the additional waste that is produced once there is a 3D printer in every household.

A further interesting aspect of 3D printing is self-replicating machines, as they are explored in the RepRap project (<http://reprap.org>). As harmless as this may sound, you don't have to be a science fiction author to imagine some unwanted side effects of machines that have the ability to self-replicate.

Whatever direction 3D printing will take, it will certainly change our society, as previous printing revolutions did.



3D-printed skull replacement
(© Copyright Oxford Performance Materials)



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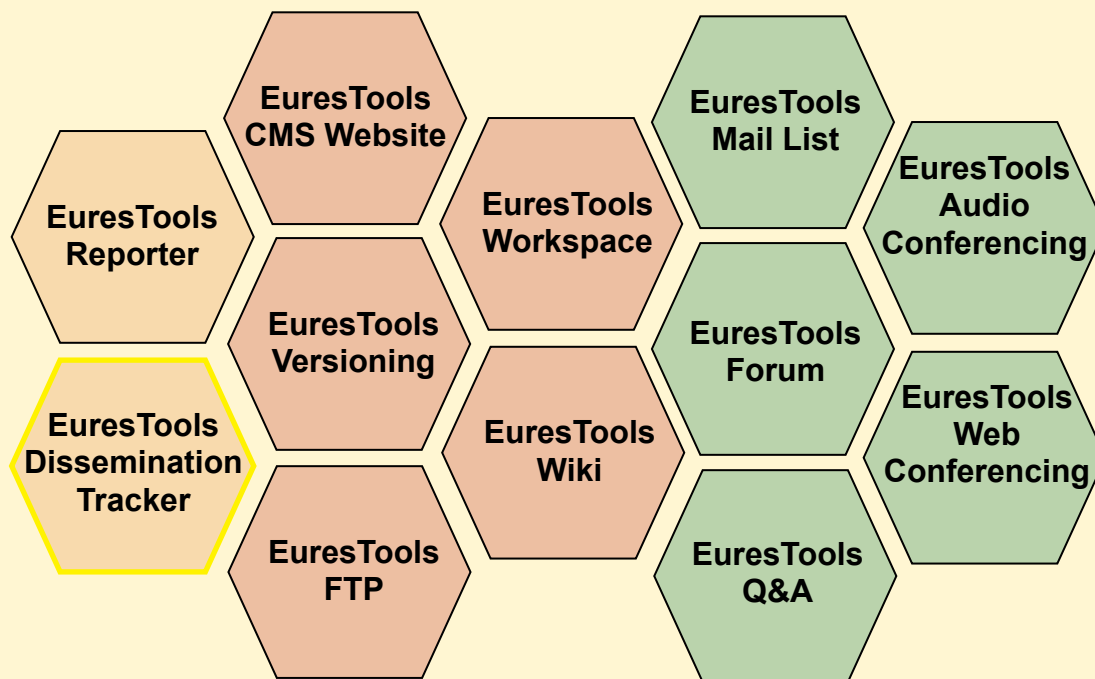
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