EURESCOM mess@ge 3/2010
The magazine for telecom insiders

includes CELTIC N • E • W • S

Cloud Computing

Events
ICT 2010 in Brussels

European issues
The Future Internet and innovation in Europe

A bit beyond
Rare earths

3rd OMEGA Open Event 2011

Rennes, France
23 – 24 February 2011

Purpose of the event
The 3rd Open Event will present an outlook on the evolution of home networking technologies and make the participants familiar with OMEGA's concepts and technological solutions. At the event, OMEGA will demonstrate its main final results.

For industry participants, the Open Event particularly provides the opportunity to get first-hand information about OMEGA's home networking solutions.

Target audience
The target audience of the Open Event includes:
- Experts and decision-makers from network operations
- Experts from other ICT research projects working on related issues
- Representatives from standardisation organisations

Topics
The Open Event will cover the following topics:
- Radio
- Power Line Communication (PLC)
- Wireless Optics
- Inter-Mac

Registration
The deadline for registration is 31 January 2011. The number of participants is limited to 80. Participation in the event is free of charge, but registration via the event web pages is required.

Further information
Further information is available on the Open Event web pages at *www.ict-omega.eu/events/open-event-2011.html*.

Celtic-Plus

The complementary programme for Future Internet projects

Call deadlines in May and October 2011

Good news for proposers of Future Internet projects: Celtic-Plus, the successor of EUREKA Cluster Celtic, will start in 2011 and launch two calls for proposals. The first call will have a submission deadline of early May 2011 (planned date: 8 May), and the second call deadline will be in early or mid October 2011.

Future Internet use case factory
The two calls in 2011 aim particularly at establishing the "Celtic-Plus Future Internet use case factory". The "factory" is complementary to the first Future Internet PPP Call under the EU's Seventh Framework Programme (FP7). There are many more excellent Future Internet use case projects to be expected than can be funded under FP7, and Celtic-Plus offers another opportunity to realise some of these.

Fast call process
For both calls full proposals are required, showing the ambition of the proposal from the objectives through the time plan and partners, to the expected results.

The projects will be evaluated, and those reaching the required standards will be retained and given the CELTIC label. The start of the selected projects is scheduled to be within 4 to 6 months after the Celtic-Plus labeling. Please check the Celtic website for call details and the Celtic-Plus Purple Book.

Further information
For further information, please contact Heinz Brüggemann, director of the Celtic Office, at *brueggemann@celtic-initiative.org*.

www.celtic-initiative.org

Dear readers,

Cloud computing is becoming a mass-market phenomenon in Europe. However, the global market leaders in cloud computing are based in the United States. This made us, the editorial team, curious to find out more about what is happening in Europe. As there are also two current Eurescom studies on cloud computing from a telco perspective, the cover theme for this issue was decided.

Apart from reports about these two Eurescom studies, you will also find in this issue an article from the FP7 flagship research project on cloud computing, RESERVOIR, which is coordinated by IBM and consists of 13 leading industrial and academic partners. The introduction by Eurescom's cloud computing expert Adam Kapovits rounds off the cover theme.

If there is a topic as fashionable as cloud computing at the moment, it is definitely the Future Internet. It has been one of the central themes at the ICT Event in September 2010, which is featured in this issue. At this occasion, European Commissioner Neelie Kroes even called the Europen Future Internet public-private partnership her "baby". The first walking attempt of the newborn child is the Future Internet PPP call, whose deadline is 2 December 2010. Eurescom director David Kennedy, one of the drivers of the Future Internet on the industry side, provides in his article an inside view on how the Future Internet could become a driver of innovation in Europe.

After reading about Europe's energetic drive to shape the Future Internet, you may need some sobering facts that put the global competitiveness and dependencies of the European ICT industry back into perspective. Read the "A bit beyond" article about rare earths, and you will see what I mean. Normally, this section features an entertaining article to cheer up our readers. I apologise in advance, if this time we fail to entertain you, but the editorial team regarded the issue too important to be neglected.

While this issue of Eurescom mess@ge was in production, several major European newspapers featured rare earths prominently, which underlines the importance of the topic.

Despite these serious topics, I hope you enjoy reading this issue of Eurescom mess@ge. My editorial colleagues and myself would appreciate your comments and suggestions for future issues.

Milon Gupta
Editor-in-chief

Events calendar

2 December 2010
ACTIVE Industry Showcase
Vienna, Austria
Co-located with ESTC – European Semantic Technology Conference 2010
www.active-project.eu/events

6 – 10 December 2010
IEEE Globecom 2010
Miami, Florida, USA
www.ieee-globecom.org

13 – 15 December 2010
ITU-T Kaleidoscope event: Beyond the Internet? – Innovations for future networks and services
Pune, India
www.itu.int/ITU-T/uni/kaleidoscope/2010

13 – 17 December 2010
Future Internet Conference Week
Ghent, Belgium
www.fi-week.eu

16 – 17 December 2010
Future Internet Assembly, Ghent 2010
Ghent, Belgium
www.fi-ghent.eu

23 – 24 February 2011
3rd OMEGA Open Event
Rennes, France
www.ict-omega.eu/events/open-event-2011.html

29 – 30 March 2011
Celtic Event 2011
Heidelberg, Germany
www.celtic-initiative.org

Sn@pshot

Family TV

At the ICT 2010 in Brussels from 27 to 29 September 2010, FP7 research project TA2 (Together Anytime, Together Anywhere) demonstrated how people in different locations can still communicate naturally and enjoy common activities. The TV usage of the future may become more interactive and family-driven.

Further information about TA2 is available at *www.ta2-project.eu*.

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3D TV or not to be

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I recently got excited about the arrival of 3D TV into the home and the fact that you could watch movies and sports events by having the right satellite subscription.

I have updated my satellite receiver and am contemplating investing in a TV that will probably cost more than my first car and, even more probable, would be bigger than my first car.

However, from a research point of view I find the TV set manufacturers have managed to put a fly in the ointment.

Special glasses for every TV

To watch 3D TV you need special glasses. Where manufacturers have been a bit slow is that there is no standard communication between the TV and the glasses. This means, if you buy a Samsung TV you need Samsung glasses, for a Sony TV you need Sony glasses, you get the picture – and the glasses are expensive. Why could they not have made this interface standard instead of annoying customers with proprietary interfaces?

But then I look back a little and see that they have been chipping away at the freedom of the users to use their devices as they wish.

Interface issues

I have a perfectly good HD digital satellite receiver that cannot work with a modern TV, as it does not have the HDCP protocol. In fact, most high-beam projectors were available before the HDMI interface was created, so there is an emerging market for HDMI converters to allow modern satellite receivers work with older displays. In the same way I have several satellite receivers that are artificially throttled to only allow the channels on one specific subscription package to be received. The degree of restriction varies from country to country and from provider to provider. Many are now so restricted that you have to take the receiver from the content provider – how fair is that?

I was offered one TV recently here in Germany which looked great, as it had a triple tuner inside, which could receive digital terrestrial TV, digital satellite TV, and digital cable TV. However, it did not work with the coding system of the local cable TV company, it could not receive the package of German HD TV channels on the satellite, as they had used special, non-standard coding for both the channels and the CAM interface (CI+).

As I think about this mess, I realise that the motivation for many of these is the attempt to protect their product and income. I fully agree that the generators of content and the distributors must be compensated, but is this the best way?

I will probably buy an expensive 3D TV with HDMI 1.4 inputs protected with HDCP and I will connect it to a proprietary digital satellite receiver that is only allowed to see a few of the channels it could. I might connect a Blu-ray player or a PlayStation 3 that will do its electronic best to make sure I cannot copy the game or movie I have paid for onto any other

platform, like the iPhone, even though it would just be me enjoying the content I have paid for. I once bought an audio book in the Apple App Store that would not run on my iPhone – and I still haven't found out why.

And even though I will buy these things, I will still feel cheated in some way, as I know the capabilities of the products I am buying are artificially restricted to what the providers will allow me to do.

Need for a new approach

The more I think about it, the more I feel that newer generation products, in their attempt to protect markets and products are working against the customer. They are making it more and more difficult for users to enjoy what they buy.

We need to change this approach, or the users will stop buying new and go for the hacked versions, as they are simply easier to live with.

Eurescom study programme

More studies in 2010

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The Eurescom study programme is a unique way of performing collaborative research between telcos. It was established about 20 years ago and continues to be attractive for its members for addressing emerging topics in a short time frame. Two more studies started in 2010 that address some very important issues in the telecoms sector.

Quick study results

The Eurescom study programme continues to be popular among the engineers and scientists of its member organisations. Especially in view of the diverse initiatives and activities on the Future Internet, the members of the programme can benefit from the studies. They can help them to quickly and flexibly define work items on topics that emerge and which need to be discussed and elaborated with engineers and scientists in other telecoms companies to develop a common opinion, position or statement. The programme is financed by its subscribing member companies, and their commitment is underwritten by their upfront payments to the programme's budget.

Competitive advantage

The fundamental working principle within the Eurescom study programme is collaboration. Any network operator or service provider may become a subscriber of the study programme and participate in it, if they share the interest of addressing the substantial issues facing the telecoms industry in a collaborative way. The results of the studies are exclusively available to the members of the programme so that the study subscriber organisations benefit from a direct competitive advantage from collaborative work. Following the second call for proposals in 2010, a number of very interesting study proposals were evaluated. These have started or will start shortly and deliver their results by mid 2011.

Virtual Customer Premises Equipment

Virtual Customer Premises Equipment (Virtual CPE) is a disruptive architecture in which intelligence moves from the local area networks towards the operator network. The functional model is identical to that of the current architecture, however network organisation differs. Functions that are currently embedded in the CPE are transferred partly to the operator network and partly to a simplified layer 2 network termination or on optional plug-ins inserted in the customer's local area networks. The study analyses the potential impacts from several different perspectives.

- Functional, such as upstream QoS, and end-to-end availability
- Operational, such as delivery chain and troubleshooting
- Business model, such as integrated operator model and wholesale offers
- Regulatory constraints.

The work takes into account general assumptions about the evolution of services in the local area networks as well as visions about the evolution of technologies. Among others the study will:

- Define a virtual CPE architecture
- Propose a virtual CPE component distribution and localisation
- Elaborate on the architectural challenges for a virtual CPE
- Identify regulatory issues

The results of the study could be presented to other operators and standards bodies in order to prepare standardization. The virtual CPE architecture addresses the residential market for future optical access deployments in a time frame of 3 to 5 years.

Unified Standardisation Framework for Telecommunication Network Enablers

In view of the different activities and initiatives in the Future Internet, a solid standardisation framework is needed to significantly simplify system integration, service composition, and applications development.

This study aims at the development of a unified standardisation framework that allows the consolidation of existing standards and identifies the necessary standards for "white spots" in the standards landscape. Thus, such a standardisation framework could act as a meta-standard that can outlive standards that address individual parts of the overall landscape and still does not render invalid other dependent standards and interfaces.

The goal can be achieved by identifying the basic functionalities and enablers and the types of interfaces that such functionality needs in order to be usable in the long term. The study will help telecommunication companies to define their specific telecommunication network enablers and interfaces and to identify the missing parts for further software development. These network-operator-specific enablers and interfaces can be offered to developer communities and ecosystems such as the Wholesale Application Community (WAC). The standardisation framework or meta-standard developed within this proposal will in particular provide developer communities, e.g. WAC, and standardisation bodies such as 3GPP, ETSI, IETF with a future-proof and easy-to-use reference for utilising network and device capabilities across multiple platforms.

Conclusion

These new studies complement earlier studies on various topics that provide a competitive advantage for the member organisations of the Eurescom study programme. More information about the ongoing programme as well as past studies can be found at *www.eurescom.eu/activities/studyprogrammes.*

An introduction to cloud computing

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Cloud computing is almost daily in the technology news. This brief introduction highlights the main benefits of cloud computing and the underlying business case as well as the most critical open issues.

What cloud computing is

Simply put, cloud computing is information technology (IT) as a service, whereby instead of building your own IT infrastructure to host databases and software, a third party hosts them for you in its large server farms, and data and services are accessed via the Internet. In this scenario IT joins electricity and water as another utility.

The idea of cloud computing is not new. Its concept dates back to the 1960s, when John McCarthy said that "computation may some day be organised as a public utility". Subsequently, many of the modern day characteristics of cloud computing and a comparison to the electricity were explored in 1966 by Douglas Parkhill in his book "The Challenge of the Computer Utility".

Cloud computing is not confined to business use. Many very successful consumer services use cloud computing, including Hotmail, Flickr and Facebook. Therefore, cloud computing should not be new to many Internet users, as they have already used it, but probably without knowing or noticing it.

Main characteristics and benefits

Cloud computing has characteristics similar to other utility services: elastic provision, online, illusion of infinite supply. These characteristics translate to a number of benefits for users. Users pay only for what they actually consume, and there is no need for up-front capital investment – which in the past used to be often quite significant. Furthermore, in contrast to the past, when large and geographically diverse corporations faced the problem to manage a very diverse set of IT infrastructures and applications, the cloud offers a unified environment, much easier to support and maintain, and less stressful to use for the workforce.

The unification and homogenisation offers other advantages, including faster deployment of upgrades and the guarantee that those updates are implemented uniformly. Users of cloud services having cyclic high demand with intermittent idle or low demand periods can benefit from the elasticity. They do not have to invest any longer into infrastructure and/or services that are not utilised for considerable periods. In addition, if your business is growing fast, your increased demand for computing services can be met seamlessly. Finally, cloud services are designed to be accessed remotely, so if you have a mobile workforce, your staff will have access to vital data and services on the go.

There is one additional factor that is worth mentioning, namely that the current restrictive economic climate also favours cloud computing and contributes to its increased uptake.

Issues with cloud computing

So far a lot of very positive effects were listed regarding cloud computing. However, there are a few issues which still need to be solved. One of these is that standardised solutions are needed to avoid user lock-in. This is extremely important on the medium to long term for the health of the cloud computing market. Other issues that are almost always brought up in relation to cloud computing are privacy, trust, and security. At present, the significance of the effect of the trust issue on cloud computing is very difficult to assess.

Clearly, a certain level of trust is needed for the decision to switch to cloud computing. However, users who have embraced cloud computing are reportedly happy and satisfied, and overall not concerned. The ease, speed and guaranteed uniformity of updates of systems speak in favour of cloud computing. However, the concentration of resources and potentially interesting information makes cloud-hosted applications and data an attractive target for malicious attacks.

Finally, an aspect needs to be mentioned that is particular to Europe, but exactly because of this needs to be considered. That is the non uniform legal environment. This is not to say that the somewhat aged European legal framework cannot be used with a bit of effort, especially if we consider past ruling in similar issues as precedents to how to interpret certain roles and responsibilities.

However, only a minimum is defined on the European level as a penalty for misbehaving, and it is left in the hands of national legislation to apply more restrictive measures. This results in a segmented market, where national boundaries act as boundaries for providers as they are reluctant to face the risks associated to the differences in national legislations – they are comfortable in their home market, but reluctant to extend their service offerings across national borders.

Conclusion

Cloud computing is more than just another hype. Many of its characteristics fit extremely well with today's business demands. Thus, cloud computing is a solution expected to stay, even after when the present hype wave will have subsided.

Telco perspectives on cloud computing

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Eurescom study P1951 has analysed the cloud computing service delivery model and the related service offerings. We focused mainly on Infrastructure as a Service, Platform as a Service, and Software as a Service. The study aimed to understand how cloud services will impact the future of IT and networking, the evolution required for telecom networks and datacenters to enable cloud service delivery, and the strategic positioning of telcos in the new business environment.

The technical analysis, combined with a better understanding of the cloud service business, allowed us to identify emerging research and standardization topics, shape the evolution of telecom networks and datacenters, identify emerging businesses and provide recommendations for telcos.

By analysing the impact of cloud computing on IT and networking, we have identified a set of open research and standardization problems. We have also studied the need for telecom assets to evolve to meet requirements brought up by cloud services. We were able to position telcos in the cloud service environment with a SWOT analysis (strengths, weaknesses, opportunities, threats), key strategic choices, and recommendations. In light of this study, the cloud service environment appears to be largely favourable to telcos, with the potential to play a key role in the operations of cloud infrastructures, the possibility to add value to existing services and explore new services.

IT research and standardisation

Further research is needed regarding cloud service security, data location and privacy issues, datacenter management and automation, software licensing, programming tools and techniques for high-performance distributed computing in virtualised environments, open and interoperable clouds, and many others. These efforts concern almost any organization involved in IT and the networking industry, including technology research and developers, those operating these technologies to offer services, and those using these technologies and services.

Commonly agreed cloud standards are critical for the adoption of cloud services by telcos. Several initiatives are under way to create open and interoperable clouds, which support the seamless migration of cloud applications and data from one provider to another and can be programmed via standard application interfaces (APIs).

Evolution of networks and datacenters

Telcos have a major technical and investment advantage with their existing service infrastructure, which can be used to support cloud services. However, in most cases telcos need to adapt their networks and datacenters. For some specific properties, telcos need to conduct research, establish collaborations with the networking and distributed computing research communities, and develop novel standards. Examples for actions telcos need to undertake to strengthen their competitive advantage are:

- Transform their datacenter networks into a LAN-based distributed system, with reliable high-speed and direct communications between servers.
- Adopt network and server technologies that will enhance server scalability.
- Develop techniques to reduce latencies and guarantee low delays.

Telcos in the cloud service environment

Telcos can use their global network and service management expertise to stimulate R&D on new techniques for the global management of telecom clouds. This can lead to securing cloud services with a more holistic approach towards security threats, and to ensuring the dependability of cloud infrastructure services. In addition, existing telco businesses can be augmented with cloud services to add value to the existing. However, there is a need to study which services can benefit from being transferred into the cloud. Some key elements emerging from the SWOT analysis are:

- Strength: the existence of a strong market position and customer base,
- Weakness: difficulties for telcos to innovate in software and their lack of agility,
- Opportunity: the use of telco assets for cloud services,
- Threat: the operators' role may be squeezed to become a mere bit-pipe business.

Conclusion

Cloud computing will generate demand for dependable and low-latency distributed computing services. Further investigating end-to-end latency reduction, especially for critical applications and high-performance computing, and developing open and interoperable clouds are of primary importance. Telcos need to adapt their networks and datacenters, establish collaborations with the networking and distributed computing research communities, conduct research and develop novel standards to enable the coverage of the full spectrum of cloud services.

Further information is available at *www.eurescom.eu/Public/Projects/P1900-series/P1951.*

RESERVOIR

Deploying complex multi-tier applications on a federated cloud infrastructure

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RESERVOIR is a three-year project in Cloud Computer infrastructure, partially funded under the European Commission's Seventh Framework Programme. Its main objective is to seamlessly enable deployment and management of complex IT services across distributed administrative domains and geographies.

It is envisioned that the RESERVOIR innovation will serve the European community in the development of next-generation data centres, demonstrating significant improvements in service delivery productivity while reducing software complexity and costs. As a result, RESERVOIR will improve reliability and enhance accessibility to government and business services.

Context

The emerging model of Cloud Computing is characterised by elastic and location-independent resource pooling. What this means is that resources can be obtained from the cloud without requiring knowledge of where the resources actually reside, and with the ability for the cloud to handle fluctuations in demand on the infrastructure, maintaining a pay-per-use model. In today's technology, applications are typically hosted on clouds at large data centres, which may have tens or even hundreds of thousands of physical machines. The RESERVOIR approach, however, contends that no single compute cloud can be large enough to meet rapidly scaling demands on its infrastructure without having to expensively overprovision its physical infrastructure. RESERVOIR's research has been focused on solving this problem by enabling the migration of virtualized resources across federated clouds, while guaranteeing security, and meeting QoS (Quality of Service) requirements.

Achieving the RESERVOIR vision

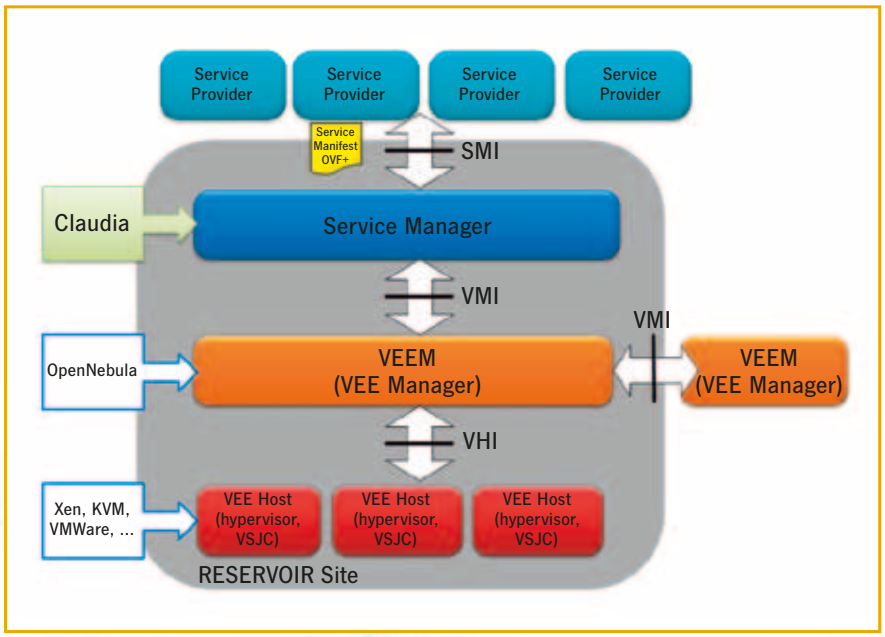
Started in January 2008, the RESERVOIR consortium is led by IBM, and consists of thirteen leading industrial, research and academic partners from across Europe. RESERVOIR requirements were derived from use cases brought by industrial partners in the project, and cover eGovernment, utility computing, business computing, and telco applications.

RESERVOIR, which is an acronym for "Resources and Services Virtualization without Barriers", has demonstrated the ability to create an infrastructure which allows for live migration of virtual machines, moving to physical hosts which may not share common storage, or may reside on different subnets or even different clouds.

In addition to its research goals, another aim of the project is to create technologies which can be exploited by the European community to build an infrastructure for a cost-competitive, service-based online economy by merging virtualization and business management technologies. These results are available in the form of the RESERVOIR Framework, which is downloadable from the RESERVOIR website, *www.reservoir-fp7.eu*. This framework groups all the open source software and the detailed specifications of the proprietary code that are necessary to help the user build a RESERVOIR cloud.

The RESERVOIR architecture

RESERVOIR supplies an architecture for a service-oriented infrastructure, built on open standards and new technologies. The architecture is composed of three main layers, with functionality such as security and a messaging bus cutting across all layers (see figure).

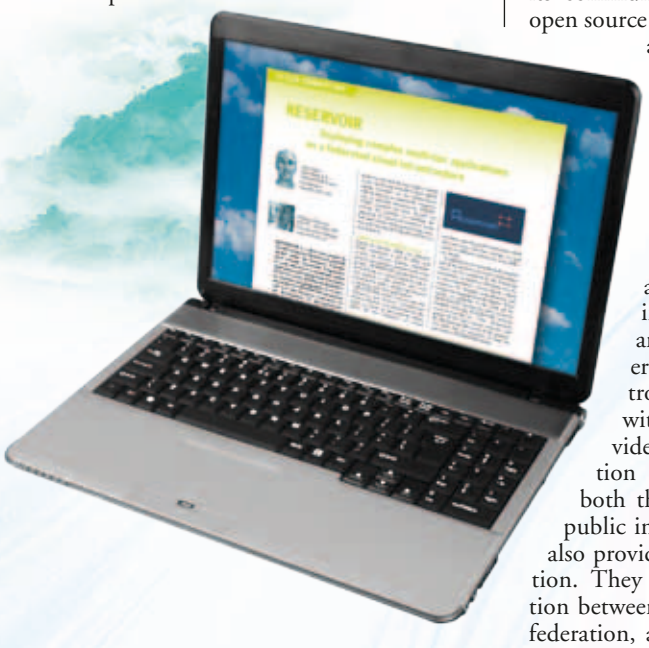


The RESERVOIR Framework

At the lowest layer resides the Virtual Execution Environment (VEE), which supplies an encapsulation and interfaces to the virtualization entity (e.g. virtual machine, storage). Users are allotted a VEE without needing to be aware where physical resources are physically located. This layer supplies the infrastructure required to support and manipulate these VEEs, such as techniques for allowing relocation of a VEE across sub-network boundaries while retaining connectivity to underlying storage.

The VEE Management layer (VEEM) was developed to provide dynamic deployment and re-allocation of VEEs on underlying physical resources, based on quality of service requirements coming from a Service Level Agreement (SLA). Sophisticated algorithms were developed for the placement of virtualized resources on maintaining physical hosts, as well as techniques for admission control – statistically allowing for overbooking of resources which SLA commitments. Additionally, the VEE Management layer provides mechanisms to federate management domains, allowing the management of VEEs across administrative domains, such as multiple service sites.

The highest layer in the RESERVOIR stack is the Service Management layer, which provides the interface to requirements from the business world, including support for billing for services used, composition of the definition of the service required, and the monitoring of SLA compliance.



Open source components

RESERVOIR defines an open federated infrastructure cloud architecture and delivers a framework of open source components and design documents one can download from the RESERVOIR website and integrate to build one's own cloud infrastructure.

Several key components of the RESERVOIR architecture are being released as open source services in middleware.

The Claudia platform offers a Service Management toolkit to deploy and control the scalability of a public, private or hybrid IaaS cloud. It provides a Dashboard and a standard TCloud API (application interface) based on OVF (Open Virtualization Format) to support provisioning of PaaS (Platform-as-a-Service) and SaaS (Software as a Service). The Claudia platform is available through the Morfeo open source community. The Claudia platform can also be integrated with the OpenNebula cloud management framework.

OpenNebula is an open source toolkit, with excellent performance and scalability to manage tens of thousands of virtual machines, with high integration capabilities to fit into any existing data centre, and with the most advanced functionality for building private, public and hybrid clouds. It provides the most common cloud interfaces to expose its functionality for virtual machine, storage and network management. The OpenNebula platform is available under the Apache license on its community site and on the Morfeo open source community. Explanations are available on how to integrate the Claudia and the OpenNebula platforms.

To help secure the integrated Claudia and OpenNebula platforms, security services are also planned for release on Morfeo. The security services will provide access control for the public interfaces of the IaaS cloud, and allow securing an IaaS federation. Role-based access control is provided in combination with X509 certificates to provide authorisation, authentication and integrity checks across both the Claudia and OpenNebula public interfaces. Security services are also provided to secure the IaaS federation. They allow providing authentication between data centres within a cloud federation, and enforcing global security policies in a federation.

Conclusion

The project has become a success by bringing together key technology providers and users to define and build a next generation virtualized service platform. RESERVOIR's internal collaboration process, involving EU companies, research centres and universities, ensures that these platforms meet key EU technology users' needs. RESERVOIR has placed high emphasis on aligning research results closer to the market, with accessibility to all. To this end, RESERVOIR technologies are built on open standards, avoiding vendor lock-in and ensuring access for all. From a business perspective, RESERVOIR's technological advances enable large companies as well as SMEs to build a Compute Cloud. Given the project's scope, the European Technology Platform NESSI has identified RESERVOIR as a Strategic NESSI Project in the service infrastructure area. RESERVOIR's research has resulted in creating an architecture and a reference implementation of a service-oriented infrastructure that is built on open standards and new technologies and is providing a dependable framework for delivering services as utilities. RESERVOIR can demonstrate how this infrastructure supports the deployment of complex service scenarios that are not otherwise supported by today's technology.

For further information, visit the RESERVOIR website at *www.reservoir-fp7.eu*.

Accessible through the project website, the RESERVOIR Framework explains how RESERVOIR open source software and specifications are used to build a federated cloud infrastructure.

Mobile cloud computing

New opportunities and challenges for operators

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Mobile cloud computing (mCC) represents a relatively new and fast growing segment of cloud computing. mCC is about provisioning mobile applications and services in the cloud, enabled through cloud service providers and delivered to end-users' mobile handsets over the Internet. In a recent study by Juniper Research, annual revenues from cloud-based mobile applications are expected to reach $9.5 billion in 2014, from $400 million in 2009. The numbers of mCC subscribers worldwide are forecasted to grow to almost 1 billion in 2014, about 20% of total mobile subscribers, according to a study by ABI Research.

Growth of mobile cloud computing

Currently, most mobile applications are being provided directly from online application stores for immediate download and installation in supported smartphones, either against payment or free of charge. Examples of this are apps for the iPhone that are exclusively downloadable from Apple's App Store and, likewise, Android apps from the Android Market. Smartphones have steadily become more powerful to improve the user experience and provide faster processing of larger and more resource-intensive handset-centric applications.

Contrarily, in mCC both the data processing and storage is primarily being transferred from the handset itself to the cloud provider, i.e. the handset will be used as a network device to display apps in a mobile browser or through a thin-client interface. Numerous services and apps are already being provisioned in this manner, including Gmail and Facebook for mobile users. The aforementioned ABI Research study forecasts that by 2014, mCC will become the leading mobile application development and deployment strategy, displacing today's native and downloadable mobile applications. Even new versions of smartphones, called mobile cloud phones, that are specifically designed for mCC applications and services will soon start to emerge.

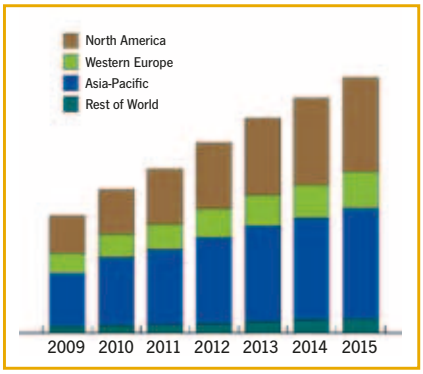
Mobile cloud computing issues and limitations

At the same time it is obvious that mCC is not going to be the best solution for every need. It poses challenges due to the intrinsic nature and constraints of wireless networks and devices. This is especially true when it comes to rich-internet (RIA) and immersive mobile applications, e.g. online gaming and augmented reality that require high-processing capacity and minimum network latency. These will most probably continue to be processed locally on powerful smartphones and mobile tablets. Mobile broadband networks generally require longer execution times for a given application to run in the cloud and network latency issues may render certain applications and services unfit for the mobile cloud. In summary, some of the most critical issues related to mCC include:

- Network latency and limited bandwidth in the mobile network.
- Limitations for bandwidth-hungry apps/services.
- Restrictions in utilising handset features, e.g. GPS and Bluetooth.

How will MNOs manage in the mobile cloud?

From a mobile network operator (MNO) point of view, and despite the often confusing nature and intangibility of cloud computing concepts, it seems evident that mCC is going to contribute to a dynamic shift in the delivery of remote services. When it comes to the provisioning of cloud-based applications and services, the function of MNOs falls into a similar pattern as of operators in the fixed-network domain, namely primarily providing network connectivity and Internet access.



Mobile cloud computing revenue by region, forecast: 2009-2015 (Source: ABI Research)

Most current mCC applications and services are provisioned by global players like Google, Facebook and Dropbox and mostly bypass the MNO value-chain. Relying primarily on revenues from surge in data traffic seems unsustainable in the long term, especially as data revenues do not increase proportionally with data traffic. In fact, according to ABI Research, while data traffic is expected to increase at a compound annual growth rate (CAGR) of 42% until 2015, data revenues will only grow at a CAGR of about 15-18%, in sharp contrast to the increase in usage.

Several ideas have emerged that might benefit MNOs for assuming a greater role in the mCC domain in addition to providing network connectivity and access. These include various mash-up services by integrating network-centric data, such as identity and location data, with third-party applications and to provide cloud intermediation, aggregation and arbitration through cloud brokerage.

The aim of an ongoing Eurescom study (P2051) on "Opportunities and challenges for MNOs in the mobile cloud" is to understand how the mobile cloud is developing and to determine MNOs position and opportunities in the value-chain of mobile cloud service provisioning and, finally, to provide recommendations to participating MNOs as a starting point for further analysis and strategic decision making.

Further information about P2051 is available at *www.eurescom.eu/public/projects/P2000-series/P2051.*

CELTIC N • E • W • S
Telecommunication Solutions

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EDITORIAL

Dear reader,

In June 2010, Celtic-Plus was approved by the EUREKA High-Level Group as an extension of Celtic for another eight years. In this issue, we will provide some details on the expected work areas of Celtic-Plus and some important topics for project collaboration, including grand challenges like the Future Internet, Green ICT and CleanTech. In addition, the new, shorter call for proposals and some related new work processes will be further explained.

The first edition of the Celtic Cluster is currently running its last call, and the last projects before Celtic-PLus will be launched in 2011. There is a final Celtic call this year and the first Celtic-Plus call at the beginning of next year. This is a good opportunity for looking back at the achievements, results and impact of the already closed Celtic projects. The figures collected from the project data and the feedback of the involved companies and experts prove that Celtic has been successful.

This issue present new results from Celtic projects which are about to complete work soon and our latest public activities aimed at showing Celtic's work to a broader audience. For this issue we have selected two very challenging projects, MOBILIA and SCALNET.

I hope you enjoy reading this issue, and I would be interested in your feedback.

Heinz Brüggemann
Director Celtic Office

Celtic-Plus

The follow-up of Celtic

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After around eight years of successfully running the EUREKA cluster Celtic, an application to extend the work for another eight years until the end of 2019 was submitted and approved in June 2010 at the EUREKA High-Level Group meeting under the German EUREKA chairmanship.

Celtic projects have been assessed on their results and achievements. The high number of new products and the overall return on investment of the finished projects have contributed to the decision for a follow-up Cluster.

Celtic-Plus – A continuing effort

Over the past eight years, the telecommunications area has dramatically changed. The Internet has become the global hub for information and communication, where different actors, including citizens, share their contents and connect with each other. They are connected to social networks and virtual worlds, sharing knowledge within their communities. They want all those features to be accessible anywhere, anytime and on any device. But it has also become more and more obvious that the traffic volumes and services quality will be difficult to assure with the current Internet platforms. Thus, new strategies for a better Internet need to be found and implemented rather soon.

As the traditional boundaries between networks, service platforms and applications have become increasingly blurred, the traditional separation of these domains will disappear. Therefore, Celtic-Plus will take a different look to the whole communications system. The two main research areas of Celtic-Plus will be called "Get connected" and "While connected".

Get connected

"Get connected" addresses everything needed to establish, run and secure the communication, basically, the infrastructure and connectivity aspects. Key topics of Celtic-Plus projects will be related to network elements and infrastructures. This includes wireless, optics and energy efficiency, as well as network architecture and connectivity, like networking and autonomic networks.

While connected

"While connected" tackles all aspects while a communication is running, including all requirements for new end-to-end services and applications. Celtic-Plus projects will deal with future end-to-end services, like digital home, digital enterprise, digital city, digital school, digital transport, and e-health, as well as horizontal services, like security, public safety and identity. The latter is particularly relevant for protecting the privacy rights of European users. "While connected" also includes business aspects, like the evolution of value networks in telecommunications, forecasting the changes in value networks and business models, and user modeling. In addition, energy saving solutions for and by telecommunications will be further explored.

Future Internet

Celtic-Plus projects will particularly focus on the architecture and challenges of the Future Internet (FI) and intends to collaborate with the activities run under the Future Internet Public-Private-Partnership programme of the EU (FI-PPP). This could be especially interesting for subjects that are complementary or additional to the FI priorities and which are suitable to enlarge and enhance the whole FI research activities. It is therefore envisaged to consider in Celtic-Plus additional Future Internet use cases, Future Internet technology foundation or FI capacity building and infrastructure that could either not be part of the FI-PPP or which are directly addressed in Celtic-Plus. In particular, additional FI use cases could increase the impact of Future Internet activities. Celtic-Plus even considers establishing for new use cases a sort of "Use-case factory", providing harmonized definition, implementation and evaluation rules.

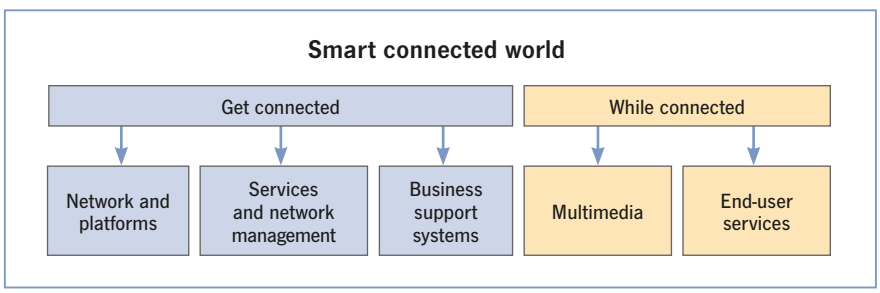

Figure 1: Celtic-Plus – main research areas

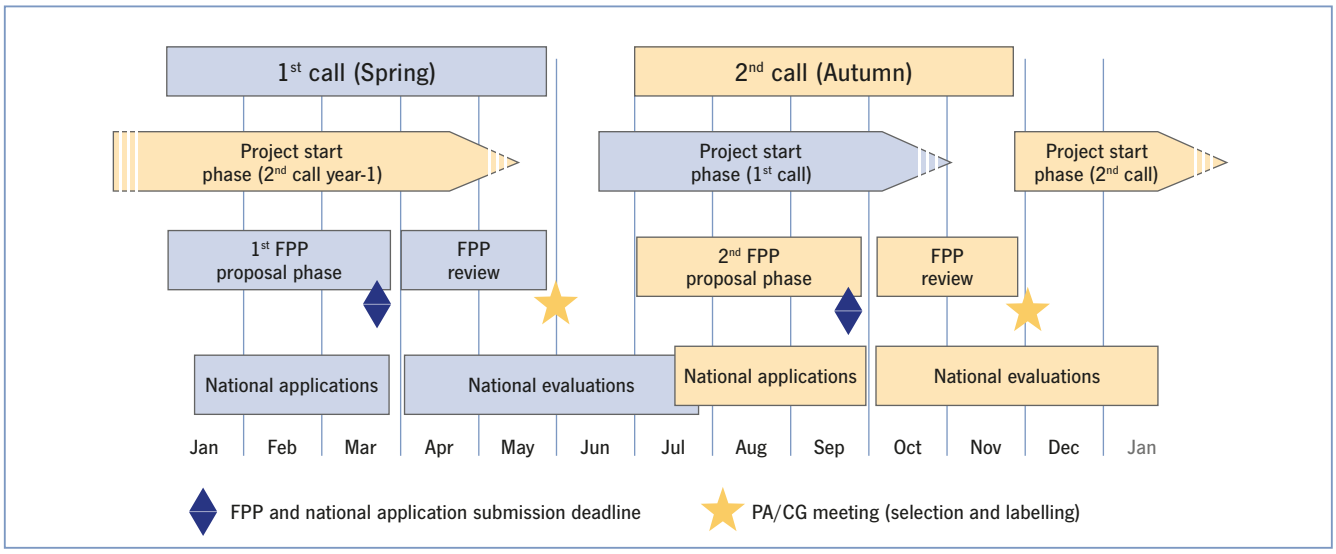

Figure 2: Timing of the Celtic-Plus calls

Green Internet

Celtic-Plus intends to be a driving force in Europe and beyond for future "greener" telecommunications. The aim is to address two major challenges in this area: first to make environmental issues a priority in the telecommunications sector, and encourage improvements in this sector in order to get better energy efficiency; and second to develop multidisciplinary solutions by promoting liaisons with other areas in order to help in tackling the climate change by saving energy in other sectors. Telecoms and ICT can indeed be used to manage and control the best use of energy in other business areas, e.g. health, transport, energy, e-government, urbanization, and cleantech.

To respond to societal challenges, solutions are required at multidisciplinary level. Celtic-Plus is already looking at ways to liaise with initiatives in other areas than telecommunications in order to address global solutions. The other EUREKA clusters in energy, water technologies, and manufacturing industry, but also the other ICT clusters, are the first candidates.

New call process

Even if, at the time of writing, the new call process has not been finally approved, it is to be expected that Celtic-Plus will basically focus on two calls for proposals per year, each considering only full project proposals (FPP). This means that proposal outlines (PO) will, most likely, not be considered any longer. In addition, proposers must already apply for national funding upon FPP submission and not after assignment of the Celtic label. This new process should reduce the call duration of one year to around 6 months and should add more flexibility to the funding agencies as well as opening more possibilities to consider new project ideas without too long delays.

Celtic-Plus
Smart Connected World

The first new 6-month Celtic-Plus call submission is expected in early May 2011. Then all following calls will consider a call deadline of early October and end March (see figure).

Conclusions

The companies driving Celtic are committed to shaping the future of telecommunications and to securing the good position of European industry in the changing telecommunications market. Participating in Celtic offers the advantage of being directly involved in an international network of highly innovative companies working on common goals. Through the Cluster it is assured that projects follow a common research vision, and funding is being provided to projects that are considered useful. Clusters are an excellent instrument to assure Europe's competitiveness in the world.

The bottom-up approach of Celtic allows adapting very fast to new challenges and new research topics. In the follow-up programme Celtic-Plus, the focus will be even more directed to the challenges of the Future Internet and its impact on networks, service platforms and completely new applications. In this way, Celtic-Plus will continue the work of Celtic to advance Europe's technological position in telecommunications.

Achievements and impact of Celtic projects

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In 2011, Celtic will be succeeded by Celtic-Plus. So now is a good opportunity to look back at the achievements and impact of Celtic projects. As an illustration of the success of Celtic projects, this article highlights two SMEs that were created partly based on results of the Celtic projects BUGYO and TRAMMS.

Summary of important results and impact of closed projects

In autumn 2010, the number of finished Celtic projects has been 51. An overview on the results they achieved is given in the following table.

These figures were communicated to Celtic by the project partners in most cases during the final review meetings. The 51 finished projects have so far generated 190 new or improved products; some are already commercially available and some others are planned and still need to be implemented and commercialised. The creation of 160 new jobs is also the already visible result and most of them are directly related to Celtic projects. It is estimated that the indirect impact on jobs two or three years later would be about two orders of magnitude higher. This number is, however, difficult to gather, as in larger organisations the project consortium has already fallen apart, the researchers work on other subjects, and the results are often used in new business without the direct reference to the projects.

Achievements of Celtic (as of end 2010)

New products or improved products	175
Number of newly created (direct) jobs	150
Prototypes/field trials	80
Number of standards contributions	370
Number of publications/conferences	800
Number of PhD/Master thesis	130
Estimated Points of Impact: between 20 and 50	€ 6 to 15 bn

Figure 1: Key figures of achievements of 51 finished Celtic projects.

It is not always easy to detect in a new product 'Celtic inside'. However, 'Celtic inside' is key to estimate the return of investments, i.e. the money spent in a project related to the money earned from project results. When taking the average of the estimation from the different projects, its value is estimated to be around 50 times higher than the cost of the projects. This means that for the 51 projects that have used a budget of 300 million euro a return of around 15 billion euro can be expected. Regarding the impact, 430 contributions to standards have been made. This indicates that Celtic projects will leave their mark in tomorrows emerging technologies.

The evaluation of the business impact of Celtic projects is the most interesting but also the most difficult task. It is illustrated with the examples of two SMEs that were partly created on results of the Celtic projects BUGYO (6.2 millon euro) and TRAMMS (4.4 million euro) – see text box.

Examples of successful Celtic project spin-offs

itrust consulting

itrusts managing director Carlo Harpes explains that his company was founded in 2007. In the years before its creation, Carlo gained experience in participating in the award wining Celtic project BUGYO. When his former employer, Telindus, decided not to continue the work in the follow-up project Bugyo-Beyond, Carlo took this opportunity to create his company itrust consulting. itrust consulting has the ambition to become an important player in the domain of telecommunication security. Thanks to a sound business case for its participation in its first long-term research project Bugyo Beyond (supported by Luxinnovation and the Ministry of Economy from Luxembourg); the company has today seven employees. From these 1.5 engineers are working on Bugyo-Beyond, whereas other staff members are already working on beta tools of this project, in particular a risk assessment tool and an XML-based CMS for security information that are developed for several customers. More information can be found at *www.itrust.lu*.

Naudit

Led by Valentin Vicente his company Naudit is a spin-off from Universidad Autónoma de Madrid and Universidad Publica de Navarra, Spain. The company is effectively commercialising results of the Gold award winning Celtic project TRAMMS. With a team of three full-time and eight part-time employees composed of PhDs and engineers, the mission of Naudit is to provide advanced tools and solutions in network monitoring and desktop supercomputing. Naudit features monitoring equipment with specific hardware to achieve high-precision measurements. The products offer accuracy of tens of nanoseconds and works on data rates of 1 to 10 Gbps. Regarding desktop supercomputing, Naudit performs code acceleration based on highly concurrent low cost systems (FPGA or GPU based) with applications to industry (aerodynamics simulation), banking (financial algorithm acceleration) and bioinformatics (sequencing and matching). More information can be found at *www.naudit.es*.

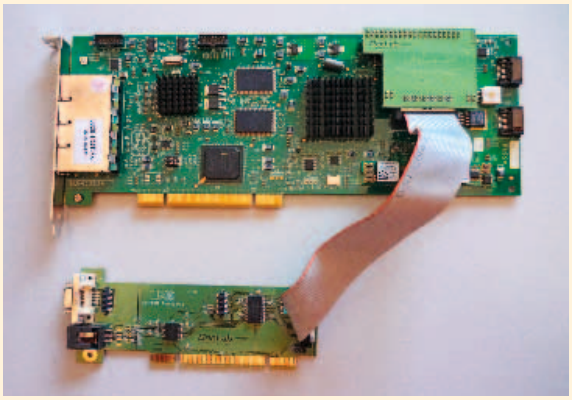

Figure 2: The Accu-QoS from Naudite shows a device able to measure delays in the IP network with nanosecond precision, using a GPS reference.

Conclusion

About half of the projects that will be realized under Celtic have been finished, and there is already an impressive amount of results with a high commercial potential. It is expected that many more examples of outstanding business impacts exist. This becomes clear in the case of itrust, where the Celtic Office learned only by chance, in the project review of the follow up project Bugyo-Beyond, that the company existence was related to the Bugyo project. The Celtic office is very interested in receiving this type of information for products with 'Celtic inside' as well in small and in big enterprises.

Scalnet

Scalable Video Coding on Networks

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Ever thought it would be nice to send a video to different clients through heterogeneous networks without storing multiple versions of the same video? Scalable Video Coding (SVC) is an interesting technology that can exactly do this and even more.

An SVC video file can include multiple layers of detail that may be automatically combined to produce streams of different picture quality and resolution depending on the network conditions and user choices. The additive nature of the layers avoids having to store multiple versions of the video, providing space and management advantages.

SVC has many different uses, including enhanced streaming to mobile devices, efficient archiving, and easing network congestion during demand peaks. Within the SCALNET project, we have built tools to create, play and transcode SVC files.

SVC history

SVC has its roots back in October 2003, when the Moving Picture Experts Group (MPEG) issued a call for proposals for SVC technology. Today, SVC is an extension to the popular H.264/MPEG AVC standard, and the various necessary encoding tools, streaming servers, transcoders and video players are now beginning to mature.

Moving around

One intriguing example, where we think this technology could come into play, is when someone wants to watch a video programme through a connection that has variable network throughput – perhaps if the user is moving between a Wi-Fi and a 3G network. We have shown that we can automatically adapt the stream to the bandwidth available by selecting which layers of detail are sent. And not only that, we can adapt the stream at various points in the network through the use of filters (see figure 1).

The fact that SVC streams can be filtered within the network opens many interesting possibilities.

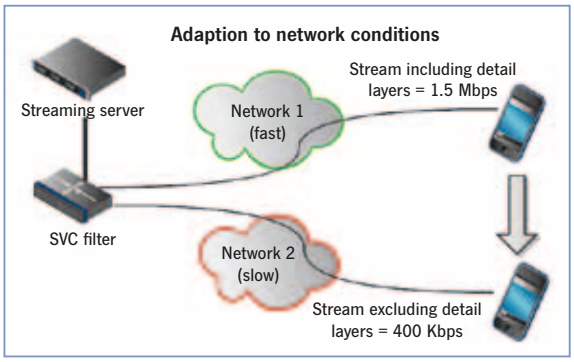

Figure 1: Dynamic adaption

Multi-channel streaming

SVC is not only useful for dynamic adaption, but can also come into play in other situations. Imagine a user who has a reliable connection with limited bandwidth and a secondary channel that is less reliable, but can be used to add quality to the picture (see figure 2). We are again thinking mostly of mobile devices. Interestingly, it turns out we can split the layers of the SVC video, and transmit the basic video on the reliable channel, and extra detail layers over the less reliable one. The player will use whatever it gets from the secondary channel to enhance the picture quality, but the basic picture is always guaranteed to be of a certain quality.

SVC is coming

In the Scalnet project we have created a framework which is optimised for the transport of SVC content, along with mechanisms to fully exploit the advantages of SVC when dealing with network issues, session mobility and continuity. As SVC technology matures we expect to see products coming to the market that use it in innovative and interesting ways.

Further information about Scalnet is available at *www.celtic-initiative.org/Projects/SCALNET.*

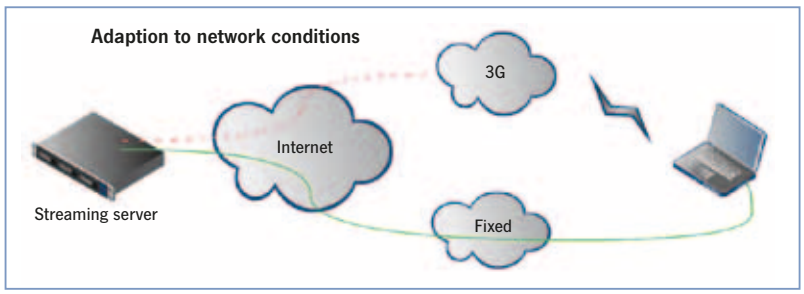

Figure 2: Multi-channel streaming

MOBILIA

Mobility concepts for IMT-Advanced

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The MOBILIA project has tackled some of the most relevant challenges which are foreseen for the forthcoming wireless networking scenarios.

During its 30 months life-time and thanks to the combination of complementary expertise from its eight partners, it has provided a number of results which establish the roadmap to future wireless access systems. The technical activities have spanned almost across the whole protocol stack, ranging from the lower layers (PHY and MAC) up to the service and management planes. The main goal was that both the end user as well as network operators would benefit from the project results; the end user would perceive a higher quality of experience, and the operators would likely obtain higher loads, due to the increased satisfaction from their costumers.

Advanced MIMO and reconfigurability techniques

Important research has been carried out in the framework of reconfigurable power amplifiers, which were designed, evaluated and implemented (see figure 1). Those amplifiers were tailored to the specific characteristics of future broadband systems, more specifically WiMax, which was selected as the core technology during the MOBILIA project life-time.

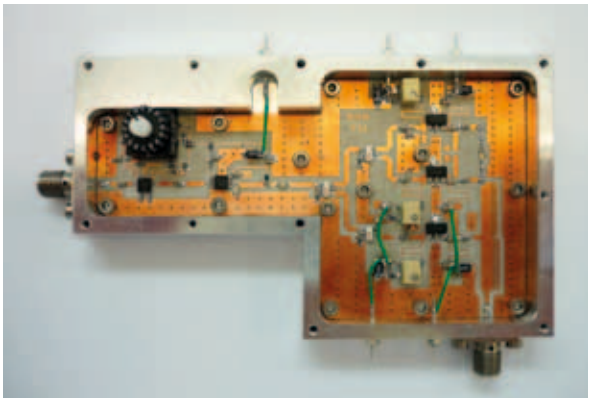

Figure 1: Reconfigurable power amplifiers

Another technical aspect, which will characterise future wireless technologies, is MIMO (Multi-Input Multi-Output). Mobilia has addressed it by proposing smart mechanisms to modify the coding schemes depending on particular link qualities. Furthermore, a thorough study of the performance gains which could be achieved by means of a distributed antenna system (virtual-MIMO) has been carried out, using accurate channel models, thanks to the use of a proprietary ray-tracing simulator.

Two additional topics have been covered: a study of the performance of a cooperative ARQ scheme applied over a scenario with both hidden and exposed terminals (which is rather likely in future mesh topologies); and the analysis of a System Division Multiple Access (SDMA), which has been integrated into a Dynamic Resource Allocation entity to be used over WiMax.

All these analyses conclude that the end-users would benefit from remarkable performance gains, and even with some energy-awareness considerations.

Heterogeneous wireless access architecture

On the other hand, considering the upper layer entities and aspects, the main outcome of the project is the proposal of an architecture (see figure 2) which is able to handle the large heterogeneity expected to characterize future wireless systems. This architecture is based on various entities and follows the framework of the most relevant standardisation group in this area (i.e. IEEE 802.21). In this sense, all signalling between the different entities is completely based on compliant IEEE 802.21 messages.

The architecture encompasses an abstraction entity, which hides the particularities of the subjacent technologies as well as the smart component in charge of taking the decision. It has been designed

to be integrated either at an end-user terminal or at a network node, and incorporates some functionalities which entails it to be used for functions such as an access broker. Finally, it also considers mobility issues. A flexible and customized design has been carried out so that the particular mobility solution could be interchanged without requiring any drastic change over the whole system.

The MOBILIA architecture brings about several benefits from the perspective of both the user and the network operator, by enabling the Always Best Connected paradigm. By using linear programming techniques, we obtained an idea of the performance boundaries for a particular scenario. Furthermore, two different system level simulators have been developed. The first one compared the performances achieved when the access selection decision was taken by either the network or the end-user (each of them having different preferences). The second one has proposed a location-based handover mechanism to be used between WiMax and WiFi, illustrating the possibilities of the Mobilia architecture.

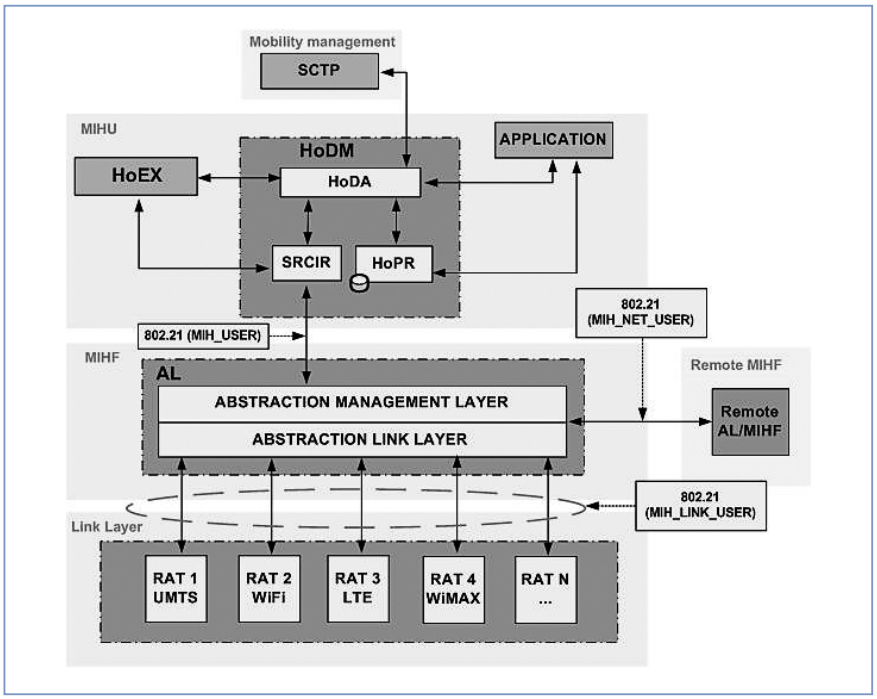

Figure 2: MOBILIA architecture

Conclusion

The MOBILIA project has not been limited to theoretical or simulation-based analysis, but it has provided results based on real implementations. The reconfigurable power amplifier has been implemented and tested, and the MOBILIA architecture has been deployed over off-the-shelf components. Various public demonstrations have been conducted, in which the feasibility of handover events triggered by either the end-user (link quality change) or the network (temporary overload) was assessed.

More information about the MOBILIA project, deliverables and related publications can be found at *www.mobilia-project.org*.

IMPRINT

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About Celtic

Celtic is a Eureka cluster, which initiates and runs privately and publicly funded R&D projects in the field of telecommunications. The cluster, which runs until 2011, is supported by most of the major European players in communication technologies. Celtic projects are focusing at telecoms networks, applications, and services looking at a complete system approach. The size of the Celtic budget is in the range of 1 billion euro. Celtic is open to any kind of project participants from all Eureka countries.

Is there an Internet of Things?

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In the late 1980s, the term 'ubiquitous computing' was coined by Mark Weiser, chief scientist at Xerox PARC. He advocated that the best computer is a quiet, invisible servant. In his vision, he described several scenarios that are still reference scenarios for what is generally called the Internet of Things (IoT). How much closer are we today to Mark Weiser's vision, and to what extent is IoT a new technology or just an evolution?

Recently, I read some old documents from the late 1990s, originating in Eurescom projects, studies and workshops that discussed smart devices and their integration into IT infrastructures. It was interesting to read about the challenges and opportunities that the authors were outlining in their reports and presentations. Many of them were just extrapolations into the micro-world of appliances and were dealt with largely as a problem for software. Today's work on IoT still addresses pretty much the same fundamental questions.

Large number of objects

The large number of objects continues to be a major concern. Related deployment and management issues are being intensively researched. However, if we compare the number of mobile phone subscriptions worldwide that, according to the ITU, will reach 5 billion by the end of 2010, we have a mismatch in perception. Furthermore, the number of mobile broadband subscriptions will reach 1 billion at the same time. Such subscriptions are used with so-called smart phones that include a number of additional devices ranging from multiple wireless interfaces such as Bluetooth, WiFi or Zigbee, to other sensor devices like GPS, accelerometers, gyroscopes, and others. If I add the software capabilities of each smart phone, then the aggregation of devices and software objects easily reaches the mark of 10 billion. So, it looks like mobile network operators and device and equipment vendors have today the technology and the business models in place to manage and operate this very large amount of devices and objects.

The question that needs to be addressed is the limit of growth. Today, all business models assume a certain average revenue per user (ARPU). The sum of all revenues will reach a boundary that is related to a certain percentage of the GDP of societies. Whatever this limit is, it will be reached, and the only way to increase the number of devices and objects will be to significantly lower the costs per unit. These costs relate to both the capital expenses (CAPEX) for developing, manufacturing and deploying the devices and the supporting infrastructure as well as the operational expenses (OPEX) for operating them. Hence, it makes sense to try to find ways to automate a large number of steps required to manage the services. This is why the whole area of autonomic computing and networking plays a vital role in the further evolution of the IoT. However, it should be noted that autonomics had emerged as a topic due to the system complexities in most other areas of IT and is not specific to IoT.

Security and privacy

Another area that needs significant research is the area of security and privacy. Today, the security and privacy properties of almost all devices and related services are left to the user who has to properly configure tens or even hundreds of options manually that in most cases he doesn't even understand. The preconfigured options are mostly unsuitable. But is this a new challenge? The ever increasing amount of software on the desktop and services on the web have reached the limits of what a human is capable to manage and configure. IoT makes a bad situation just a bit worse.

Energy and environmental footprint

The requirement related to energy consumption of devices that need to operate autonomously over longer periods of time is as old as the invention of batteries and the first battery powered transistor radios. Unfortunately, the technological progress in battery lifetime was very modest in comparison to the evolution of microelectronics, which significantly increased performance. However, this had the effect that new developments were aiming at increased performance for the same amount of energy, rather than trying to increase the period of autonomous operation. This trend has changed recently in particular due to the requirement to deploy devices that must autonomously work for years or decades.

Additional requirements have emerged, namely that some of the deployments of sensors are not recoverable if, for example, deployed in the sea, desert or woods. These requirements not only call for very energy-efficient micro- and nano-electronics, but also for bio-degradable materials, including electronics and batteries. The contribution of IoT with respect to this topic will mostly come from material research and less from software optimisation.

Conclusion

Trying to analyse the different arguments of why the Internet of Things is something different, I failed to find something that justifies the creation of a new technology domain. IoT is for me indeed an extrapolation of today's and tomorrow's technologies into ever smaller artefacts. If we keep treating IoT as something special, we risk developing new technology fragments that we would have quite a hard time to integrate back into the infrastructure of the Future Internet as it evolves. So, I suggest to stop treating IoT as a new technology domain. The Internet of Things is just a marketing term and should be treated as such.

eMobility General Assembly in Venice

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The sixth General Assembly of the European Technology Platform eMobility took place at Telecom Italia's Future Centre in Venice on 16 September 2010. It attracted 65 participants, who witnessed reports about recent activities and achievements and presentations on eMobility's plans for 2011. In addition, keynotes from the European Commission and special sessions with in-depth presentations from selected application domains provided interesting insights.

Wider scope

In his opening speech Werner Mohr from Nokia Siemens Networks, chairman of the eMobility Steering Board, reported about the activities and achievements of the last year. His main message was that eMobility, in the light of converging fixed and mobile networks, is widening its scope to also encompass fixed optical networks in order to maintain a complete network view. A liaison with the Photonics21 platform is planned. The extended scope will facilitate cross-sector research, and is also in line with the new scope of the Future Networks & Mobile Summit. Since 2009, eMobility has grown to 671 members with a good balance of members from industry, research, and SMEs.

Spectrum trends

Ruprecht Niepold, Advisor Radio Spectrum policy at the European Commission, gave his personal view about the need of spectrum management, about trends in spectrum usage and scarcity, and presented conceptual features of spectrum sharing models. In spite of the widespread opinion that there is a growing shortage of radio spectrum, this seems to be the case only in the band below 2 GHz. However, scarcity depends largely on the conditions for access, i.e. supply and demand. There are also new spectrum usage patterns. For example, usage areas are getting smaller and thus allow a higher reuse of spectrum geographically. Further trends include, for example, nomadic and occasional use and higher tolerance of applications against variating transmission quality. Shared use of spectrum will have a strong impact on regulation, and regulators should become active to gradually develop an enabling regulatory environment.

Werner Mohr opens eMobility General Assembly 6

FP7 work programme

Rainer Zimmermann from the European Commission briefed the audience about the The EC's FP7 research work programme 2011-12. The structure of Challenges has been maintained. The Future Internet will be the key enabler for the upcoming commercial services for which Europe needs to secure its share. From a technical point of view, next-generation networks (NGNs) will enable the knowledge based society. Topics like net neutrality, new architecture paradigms and efficient content distribution are topics currently discussed. Conceptual programme characteristics of the Future Internet public private partnership (FI PPP) call include large-scale projects (i.e. larger than current Integrating Projects), flexibility (phased approach), the requirement that projects must contribute to the programme and uniquely address its aspects, the open sharing of foreground, and the inclusion of large-scale trials.

eMobility vision 2022

Fiona Williams from Ericsson gave an overview on the eMobility vision 2022. It has three views: on the individual, on the society, and on the technologies supporting them. People will have a life in the cloud, have a voice in the communities, and will trust their services. Multi-disciplinary research and innovation will be in focus for 2022. New concepts for networks will be needed to support the huge volume of data traffic and to support applications in the various sectors. In spite of the growing complexity of systems, their usage will have to be simplified.

Alfred-Jäkel, www.pixelio.de

eMobility
Connect to the network community

Outlook on the 8th Framework Programme

Regarding the 8th Framework Programme (FP8), Fiona Williams said, the general structure and budgets will be defined in the coming months, and there are signs that budgets might be reduced. The focus will be in line with the Digital Agenda, the Innovation Union, and the Grand Societal Challenges. ICT has an essential role in enabling other sectors, for example health and transport, to address these challenges. Europe still has the lead in communications infrastructure, according to Mrs. Williams, but future research activities will be needed in order to maintain this lead.

Werner Mohr added that eMobility will provide feedback during the preparation of FP8 in order to represent the interests of the eMobility community. This includes promotion of identified research topics and contributions to instruments in FP8 based on eMobility's experience in the ICT programmes. eMobility members are invited to contribute to this process.

A summary report on the General Assembly and all slides can be downloaded from the eMobility website at *www.emobility.eu.org*.

Participants from the European Commission

fiona Laufersweiler, www.pixelio.de

Plenary session at eMobility GA Venice

ICT 2010 in Brussels

Showcase of European ICT research

Milon Gupta
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This year's ICT Event was held at Brussels Expo from 27 to 29 September 2010 under the motto "Digitally driven". The slogan reflected the ambition of the European Commission and the Belgian Presidency to make information and communication technologies the driver for societal and economic progress in Europe. The event demonstrated that there is still a gap between words and deeds, but also a serious intention to close that gap.

Big words

There was no lack of big words at the ICT Event. In her opening address, Neelie Kroes, European Commissioner for the Digital Agenda, praised the EU for "bringing people together to think big and act big". Ms Kroes made it clear that Europe needs to invest substantially in ICT to stay competitive in the global economy and "to ensure a sustainable society and economy in the future". She warned the EU Member States not to slow down the development of ICT in Europe by cutting down research funding.

In addition to the public investments by the EU and the Member States, she demanded a matching investment by industry. In this context Ms Kroes put high emphasis on public-private partnerships (PPP), mentioning particularly the Future Internet PPP, which she called "my baby".

Big investment

In order to underpin the big words with big figures, the European Commission announced on the second conference day that ICT project funding in 2011 will amount to 780 million euro. This sum will be invested in the Future Internet, robotics, smart and embedded systems, photonics, ICT for energy efficiency, health and well-being in an ageing society, and many other areas. Under the Digital Agenda for Europe, the Commission has committed to maintaining the pace of a 20% yearly increase of the annual ICT R&D budget at least until 2013.

"The Future Internet Partnership is my baby" – Commissioner Neelie Kroes at the opening of the ICT 2010

Big results

If you wanted to see what past ICT research investment had generated, the exhibition at the ICT 2010 was the place to go. About 200 projects demonstrated their results. The exhibition was structured into twelve zones, of which seven were devoted to technical areas. The technical areas were categorised into Smart Systems, ICT Inside, Green ICT, ICT Connects, Digital Society, Content & Knowledge, and Safety & Security.

Exhibition: TA2 and OMEGA

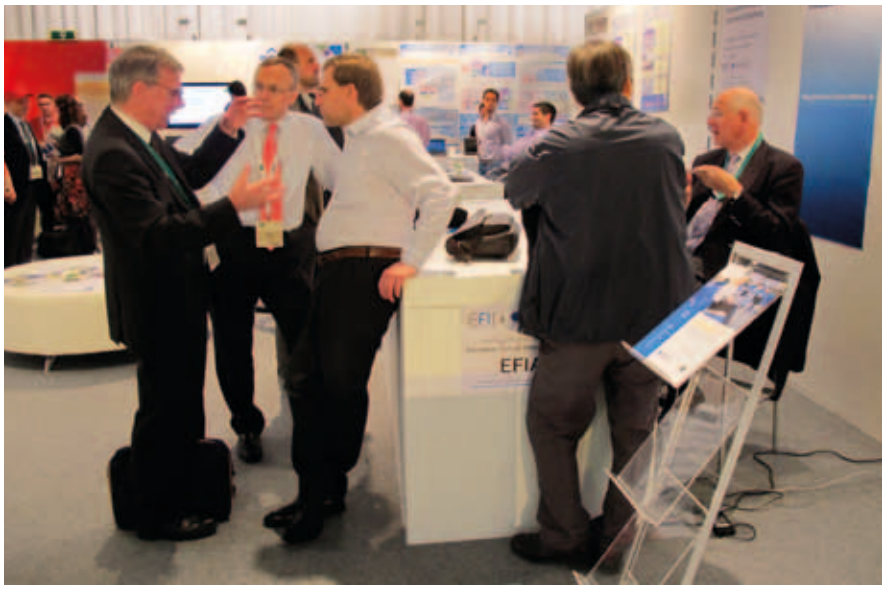
Among the exhibition stands were two projects, in which Eurescom is proud to be involved. Both projects are focused on advancing communication in the home.

The TA2 project (Together Anytime, Together Anywhere – *www.ta2-project.eu*) demonstrated in two living rooms how ICT can improve communications and engagement among groups of people separated in space and time. At the demo visitors could communicate between the rooms in a natural way and enjoy activities together, for example playing a board game. A crucial issue to achieve natural communication is "orchestration", where the scenes presented at the other side are selected and put together automatically. The TA2 demo at the ICT Event was the worldwide first demonstration of automated orchestration. A visitor said "it is like a virtual director is working in the background".

Seamless home networking at the OMEGA stand

The other project, OMEGA (*www.ict-omega.eu*), demonstrated its solution to support the seamless integration of heterogeneous communication technologies to deliver high-bandwidth connectivity inside a home. The realisation of an inter-MAC convergence layer is at the heart of the OMEGA solution. A high-definition video stream was used as an application example to showcase the capabilities of the system.

Both projects enjoyed considerable interest by the audience. Nevertheless, several ICT Event veterans had the impression that this year's exhibition had overall less visitors than in the years before. Assuming that the official number of more than 5,000 participants at the ICT Event 2010 is true, this impression is quite surprising. One reason could be that the attention for the exhibition was seriously challenged by the tight conference programme, which consisted of more than 100 networking and plenary sessions with little time for visiting the exhibition.



Lively discussions at the European Future Internet Alliance (EFIA) Andrew Houghton from the European Commission explaining his views on the Future Internet to David Kennedy, Eurescom, and Thomas Bohnert, SAP (from left). Sitting on the right: Yves-Marie Le Pannerer from Technicolor.

Big talks

Traditionally, ICT Events are known for their parallel networking sessions, in which lengthy presentations based on text-ridden Powerpoint slides drive the information-overloaded audience into an anoxic state of drowsiness. This ICT Event continued the tradition and offered a broad spectrum of networking sessions on numerous application areas, from e-government to ambient-assisted living, and on the unofficial central theme of the conference, the Future Internet.

The most remarkable session on the Future Internet was probably the one on a public-private partnership in this area chaired by the journalist Francis Pisani from Le Monde. The session featured a number of illustrious speakers, including Malcolm Harbour (European Parliament, Internal Market and Consumer Protection Committee, United Kingdom), Gee Rittenhouse (Bell Labs, Research, France), Nicolas Demassieux (France Telecom, Orange Labs – R&D, France), Herbert Weber (Fraunhofer-Institut fuer Software- und Systemtechnik ISST, THESEUS Joint Research, Germany), and Joan Batlle (Barcelona City Council, Municipal Institute of Information Technology, Spain).

Mr Rittenhouse gave a good overview on the technological challenges and opportunities of the Future Internet, while Mr Harbour made it clear how important it is to get politicians into the Future Internet boat. The Barcelona case study presented by Mr Batlle demonstrated on a local level what it takes for a successful public private partnership.

Those who wanted to continue their talks about the future of the Internet found ample opportunity at the stand of the European Future Internet Alliance, which was organised by the EX-FI project.

Big organisation

Organising such a large event is a big task. At this ICT Event both the ups and downs were easily noticeable. Contrary to previous ICT Events, there was no Wireless LAN available in the whole exhibition area. Even at the work spaces in the exhibition area. Given that the Future Internet was one of the major themes, it was sadly ironic that even the current Internet was not available.

The social event on the evening of day 2 was organised at a very nice place, the Royal Galleries of Saint-Hubert close to the Grande Place. However, the venue was far too small for the number of people invited and, hence, so crowded that it was hardly possible to squeeze in, not to speak of having a conversation with others or getting a drink. It was really a shame that many people left disappointed and missed

the excellent chocolate desserts, which were presented by the many local chocolate manufacturers later in the evening.

Another big organisational challenge was to provide lunch for several thousand people, which was very well managed during the first two days. Unfortunately on the last day the amount of food was so small that many people didn't get anything to eat. Many participants who stayed until the end of the event were left with a bad aftertaste.

Conclusion

The ICT Event 2010 did not provide earth-shattering insights. However, it was a good showcase on where European ICT research stands and where it is heading. The main benefit participants got out of the event was the social networking with peer researchers and people from the Commission rather than the information presented, which can also be accessed otherwise. In this respect, the Commission would be well advised to reconsider the format of the conference and facilitate more interaction between participants. The knowledge and the technologies to enable a more innovative event format are available.

Further information about the ICT 2010 is available at *http://ec.europa.eu/information_society/events/ict/2010/index_en.htm.*

The future of communication at the TA2 stand

Audience at a networking session

The Future Internet and innovation in Europe

David Kennedy
Director of Eurescom
kennedy@eurescom.eu

The Future Internet is a central part of the Europan Union's innovation strategy. A public-private partnership has been launched to ensure that research investments in the networks of tomorrow will lead to innovative products and services , benefitting European citizens and industry.

At the time of writing, we are heading through the project preparation phase of the first call under the Future Internet public-private partnership (PPP) in Europe. Many companies are concerned, as they have not got themselves into the best consortia, they have not found soul mates to work with, or they have simply missed the boat.

But why is there so much hype over one research area? Cost-wise it is a very small fraction of the FP7-ICT work programme, but impact-wise, most people have realised, it could be big.

As we take the discussion about the Future Internet in Europe we are actually talking about moving into the next era of a fully supported life. We have now good data connections and networks and the network owners are working as fast as they can to keep offering us ever increasing capacities as our appetite for data based services continues to grow.

Old needs – new service delivery

There are many discussions about what is the competitive advantage in the European Future Internet scenarios, and the answer is clear. The competitive advantage is in working out how people will want their services delivered. We have to abandon sacred cows and rethink what are the assets, if we really want to succeed in the next wave of selling advanced services.

First off, please don't get misled by packaging – Amazon is a book store, Twitter is a lot of messages to a lot of people, Facebook is sharing common interests. These are not new human behaviours – we have been doing these things for years. What is different now is that eBay and the Internet allow me to find oldtimer car parts from around the world. Our spheres of influences have dramatically increased in the past few years.

Growing circles

A hundred years ago the average person travelled little and had little in common with people outside his area. This has changed. Now we can find people with common interests across the globe. There are people on Twitter with over a million people listening to them. However, the reciprocal is not true – they are not listening to the million. And this is where we see the actual truth of the model. It is a broadcast network where, like tuning to a TV station, you chose what you want to see.

And Amazon is a book store – one where you are nearly guaranteed to find the book you want because of its global coverage. Amazon has exploited its good selling format to sell lots of other things and the winners are the consumers, who can find a good price, and the transporters, who now have a growing market of many millions of remotely sourced products that need to be shipped to the consumers.

These, too, have joined the information age, and they now share access to their tracking info. The customer is allowed to see where his package is and when it will be delivered.

The Eureka moment

Suddenly it becomes clear what the Future Internet is all about. It is not a black art of dramatic new business models, but it is a skilled assessment of where value is and how the value can be extracted and commoditized. This does mean many business models will change as people start to behave differently.

The home users can now think, if they need to buy software for the once in their life they will edit a video or something similar. For the first time, the network will have the bandwidth and service providers will have the reputation for trust and confidence that the user will be able to chose to upload his video, edit it online and have the final version packaged and sent to him. This is already happening with online photo services taking your photos and guiding you to print them in a book.

If we apply this to a business sector, we can see that companies may chose to have bookkeepers who enter all their transactions into a standard approved system. This will then allow them to upload the year's transactions to an accounting service that will calculate their annual accounts, tax returns, and more.

When you take these examples and extrapolate them to the wide variety of private and professional services that no longer need to be purchased systems but have a future as leased services, you now understand what the Cloud is and how it will follow and support us in everything we want to do.

European activities

So what do we have to do to make this vision work for Europe? The main problem is to change our behaviours, and the first signs are now emerging that we have the capacity to do this.

The European Commission has launched a dedicated Future Internet programme, as part of the 7th Framework, focusing on enabling the advanced services domain.

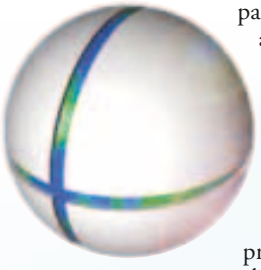
The key point is to break down the traditional barriers where the sectors worked on their business strategies and the ICT sector worked on abstract communications. The new ambition is that the ICT services are tailored to support the individual wishes and needs of customers in different sectors.

This is supported by a parallel activity in the European Institute of Technology (EIT) which should encourage innovation based on education and research.

There is still a huge gap in this concept, as the step from research and the acquisition of IPRs to the innovation and exploitation of these IPRs is still not well supported.

This has been highlighted in a recent communication from the EC on the Innovation Union where the need for reform to tackle fragmentation was identified and proposals are presented for addressing it.

Making it happen



Some of the concepts in the innovation agenda are so obvious that it seems we have been negligent over the past few years for not addressing these and allowing opportunities to slip away.

Some, like the need for a European Patent, can have such a direct impact on a company's ability to protect and exploit their newly developed IPRs that it is almost a crime that this has not been achieved to date.

Others, like having understandable IPR regimes where the impediments to the exploitation of collaborative work are minimized and capital is made more available for the exploitation can have a direct impact on the new products reaching the market.

The need for public spending policies to support innovation is also critical. There are horror stories in every country where projects into new technologies have gone wrong or been way too expensive. But these are not reasons to shy away from development. These are the very reasons we need to have better programmes and even competitive projects in national programmes to come up with working solutions to the advanced services.

The way ahead

By accident or design, we have in Europe the Digital Agenda, the Innovation Agenda and the FI-PPP programme underway. Complementing these are a range of national programmes. We need to take the opportunity that this landscape presents to try to align the programmes and work to have the positive impact of synergy making a real impact on the economic wellbeing of the consumers and the service providers in Europe within 5 years.

There is a new community emerging from the active players in many of these discussions called EFIA: the European Future Internet Alliance. It hopes to work on the holistic strategy that can help with the identification of what is being done in the different programmes and, hopefully, contribute to achieving the clarity of perspective that will make the European Future Internet momentum produce a result that is greater than the sum of its components.

Europe has a great opportunity to innovate and become a driver of the Future Internet. However, it takes commitment and persistence to exploit the opportunity.

Further information:
European Future Internet Portal – *www.future-internet.eu*
Innovation Union – *http://ec.europa.eu/research/innovation-union*

+++ News in brief +++ News in brief +++

First robot hospital opened in the UK

On 2 August 2010, the UK's first hospital to use robots opened in Larbert, Scotland. The new Forth Valley Royal Hospital uses the robots to deliver and retrieve a wide range of supplies. The five foot tall robots will carry clinical waste, deliver food, clean the operating theatre, and dispense drugs.

The self-guided robots use laser technology to find their way around. The technology is similar to that already used in car plants and industrial shop floors as well as in hospitals in some parts of Europe and the USA. The machines will be loaded and unloaded in a basement area and make their deliveries to wards via a number of special lifts with separate flows for clean and dirty goods, to minimise the risk of cross contamination.

Hospital robots in Scotland

In the event that a robot fails, an electric vehicle can be summoned to tug the robot out of trouble. And should there be problems with one particular lift the robots can be re-routed through a special sensor system.There will also be a fleet of 13 separate robots to help meet demand during peak periods and provide back-up, if required.

The fleet of moving robots is complemented by a fully robotic pharmacy system, capable of labelling medicines as well as stocking supplies and picking up drugs. The system is expected to make the dispensing process faster and safer. Robotic equipment will also be used to clean the hospital's 16 hi-tech operating theatres. In addition, the hospital will be equipped with two of the most advanced CT scanners, an MRI scanner and seven digital X-Ray rooms, a first for Forth Valley.

Similar robot-equipped hospitals already exist in France and Japan.

www.nhsforthvalley.com/ForthValleyRoyalHome/fvr_home.html

Commission proposes measures against cyber-attacks

On 30 September 2010, the European Commission presented two new measures in order to improve Europe's defense against attacks on key information and communication systems. The Commission proposes a Directive to deal with new cyber-crimes, such as large-scale cyber attacks and a Regulation to strengthen and modernise ENISA, the European Network and Information Security Agency.

Under the proposed Directive, the perpetrators of cyber attacks and the producers of related malicious software could be prosecuted, and would face heavier criminal sanctions. Member States would be also obliged to quickly respond to urgent requests for help in the case of cyber-attacks, rendering European justice and police cooperation in this area more effective.

Strengthening and modernising ENISA aims to help the EU, Member States and private stakeholders develop their capabilities for preventing, detecting and responding to cyber-security challenges.

ENISA headquarters in Heraklion, Crete

The proposals have been forwarded to the European Parliament and the EU's Council of Ministers for adoption.

http://ec.europa.eu/information_society/newsroom/cf/itemlongdetail.cfm?item_id=6190

Study reveals: Social networking more popular than e-mail

Internet users worldwide spend on average more time on social networking sites such as Facebook and LinkedIn than on e-mail. This is the result of a global study on drivers of online behaviour, conducted by research firm TNS, who interviewed about 50,000 consumers in 46 countries.

In rapid growth markets such as Latin America, the Middle East and China, the average time spent, per week, on social networking is 5.2 hours compared to only 4 hours on e-mail. Online consumers in mature markets remain more reliant on e-mail, spending 5.1 hours checking their inboxes compared to just 3.8 hours on social networking. The heaviest users of social networking are in Malaysia (9 hours per week), Russia (8.1 hours per week) and Turkey (7.7 hours per week).

Growth in social networking has been fuelled by the transition from PC to mobile. Mobile users spend on average 3.1 hours per week on social networking sites compared to just 2.2 hours on e-mail.

When it comes to who has more online friends, Internet users from Malaysia top the list with an average of 233 friends in their social network, closely followed by Brazilians with 231. The least social on the Web are the Japanese with just 29 friends and Tanzanians, who have, on average, 38 in their circle of friends. Surprisingly, Chinese consumers only have an average of 68 friends in their networks despite being heavy users of social networking sites.

Activities such as blogging and social networking are gaining momentum at huge speed in rapid growth markets. The research shows four out of five online users in China (88%). Over half of those in Brazil (51%) have written their own blog or forum entry, compared to only 32% in the US. The Internet has also become the default option for photo sharing among online users in rapid growth markets, particularly in Asia. The number of online consumers who have ever uploaded photos to social networks or photo sharing sites is 92% in Thailand, 88% in Malaysia and 87% in Vietnam, whilst developed markets are more conservative. Less than a third of online consumers in Japan (28%) and under half of those in Germany (48%) have uploaded photos to such sites.

The study also found that digital sources are overtaking TV, radio and newspapers as the media channel of choice: 61% of online users surf the Internet daily against 54% for TV, 36% for radio and 32% for newspapers.

http://discoverdigitallife.com

China inside

The ICT industry's critical dependence on rare earths

Source: http://images-of-elements.com

Not so rare: ultrapure neodymium under argon

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Mobile phones consist of numerous materials. Typically, 80 percent of a mobile phone are plastic, copper, and glass or ceramics. The remaining 20 percent consist of more than a dozen elements. Ironically, the smallest and least-known ingredients of a mobile phone may soon become a serious risk in the supply chains of major ICT manufacturers in the Western world: rare earths. This is a group of chemical elements with unique properties that have enabled the miniaturisation of electronic components including capacitors, lasers and powerful magnets.

Rare earth minerals are not only used in the production of mobile phones, but also for many other ICT devices, like PC hard drives, cameras, communication satellites, and electric car batteries. There are 17 rare earth elements in the periodic system: 15 within the chemical group called lanthanides as well as yttrium and scandium.

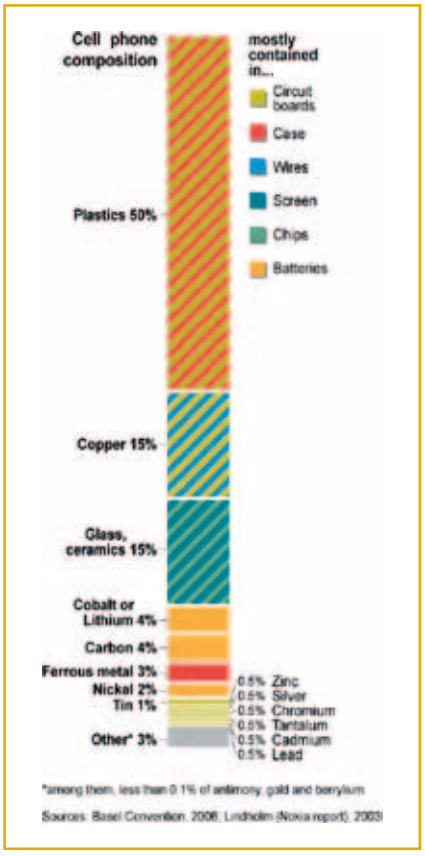
Not so rare

In fact, most rare earth elements are widely distributed in the Earth's crust. The so-called "light" rare earth elements, like cerium, an ingredient in enamels and glasses, are abundantly available. Only the "heavy" rare earth elements, such as europium, used to produce colour in TVs and other screens, are actually hard to get.

So, in general, rare earth minerals are not so rare. There is just one catch: digging out rare earth minerals involves a significant labour effort and is potentially hazardous, due to radioactive emissions in the mining process.

Source: Greenland Minerals and Energy

Rare earth mining in Kvanefjeld, Greenland



Chinese domination

In contrast to Western countries, the hazards of rare earth mining have not kept China from systematically expanding its rare earth mining since the mid-1980s. On the contrary, Deng Xiaoping, China's leader from 1978 to the early 1990s, had made the exploitation of China's own rare earth sources (about 60 percent of the world's sources) and the control of the global rare earth market a strategic priority. "The Middle East has oil, and China has rare earths," he said.

At the same time as China expanded its rare earth extraction, the US and other Western countries have practically stopped their rare earth mining. Today, China is controlling 97 percent of the global rare earth production – currently 124,000 tons per year.

The Chinese domination of rare earth supplies has not been a problem until July 2010, when the Chinese ministry of commerce announced to cut China's export quota of rare earth minerals by 72 percent. The background for this measure is the rising domestic consumption in China. It is estimated that by 2012, domestic consumption will exceed domestic production of rare earth minerals in China. Driven by Chinese growth, world demand is expected to rise to 180,000 tons annually.

Gobal response

Not surprisingly, the Chinese export restrictions have created serious concerns in the US, Europe, Japan, and South Korea, who heavily depend on rare earth supplies for a wide range of industries, including ICT and consumer electronics, car manufacturing, energy and defence.

In Japan, Toshiba and Sumitomo have each launched rare earth joint ventures in Kazakhstan over the past year. Australia's Lynas had signed a deal in 2010 to supply a major Japanese company with rare earths from its Mount Weld project in Western Australia. South Korea plans to spend 17 billion won (about 11 million euro) by 2016 as part of a long-term plan that seeks to secure 1,200 metric tons in rare earths reserves.

The European Union has also become aware of the issue. In July 2010, a European Commission task force released a report, which lists 41 critical minerals and metals that could soon be in short supply. Rare earths are at the top of the supply-risk scale. The task force recommended trade and policy measures for the European Union to ensure steady imports and the promotion of exploration and recycling in the EU.

The US government has also woken up to the challenge. A report by the US Accountability Office published in April 2010 warned of the vulnerabilities and did not give much hope of reducing the supply risk anytime soon. Developing a domestic rare earth supply would take 7 to 15 year, according to the report. Despite that, the US Congress is discussing measures, like for example loan guarantees, in order to facilitate rare earth mining.

In Europe, there is no major rare earth site. Only in Greenland, an autonomous country under the administration of Denmark, there are rich rare earth deposits.

Apart from increasing their own rare earth mining, the main alternatives for Western countries in order to lower their dependency on rare earth supplies from China is to improve the recycling of rare earth supplies and to explore substitutes for rare earths.

Whatever Western countries will do, the critical dependency on China's rare earth supplies will remain a strategic vulnerability for the next decade. This can severely affect not only the ICT industry, but also the automotive industry and national defence.

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