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.

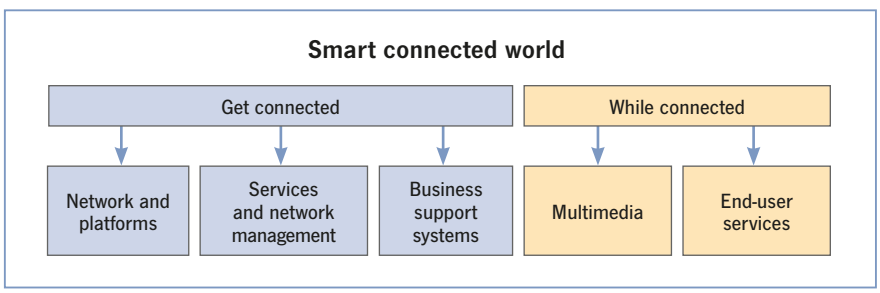

Figure 1: Celtic-Plus – main research areas

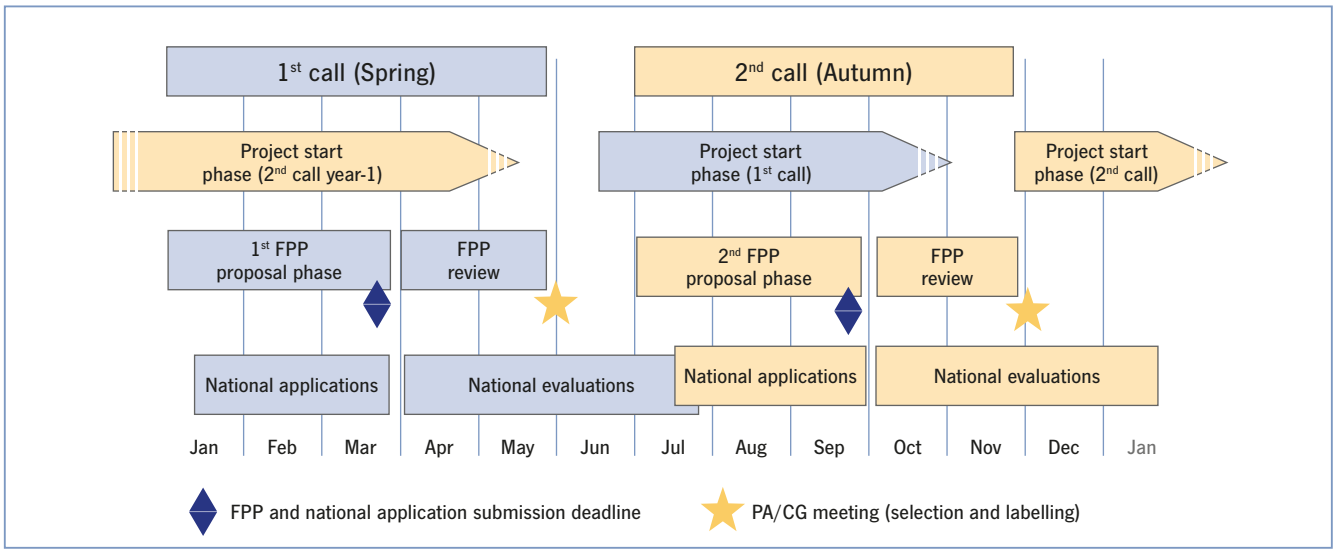

Figure 2: Timing of the Celtic-Plus calls

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*.

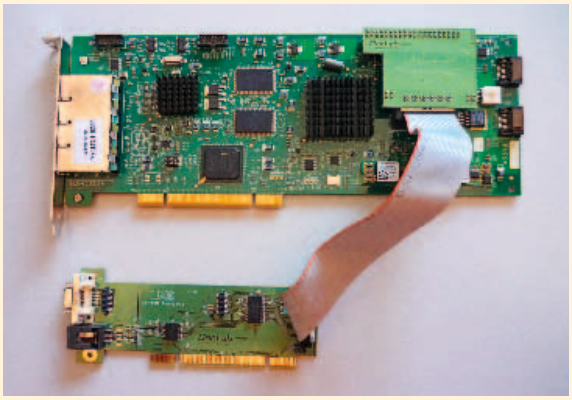

Figure 2: The Accu-QoS from Naudite shows a device able to measure delays in the IP network with nanosecond precision, using a GPS reference.

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.

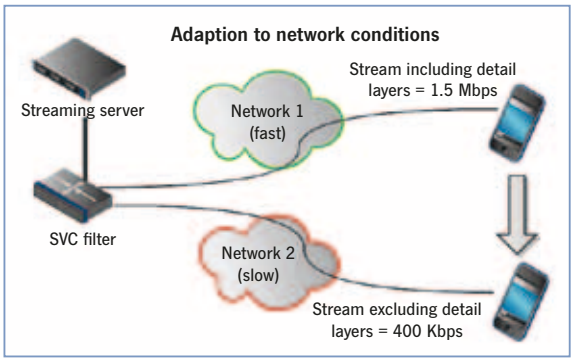

Figure 1: Dynamic adaption

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.*

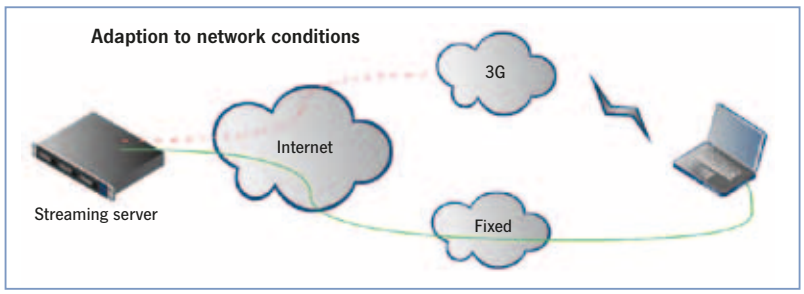

Figure 2: Multi-channel streaming

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.

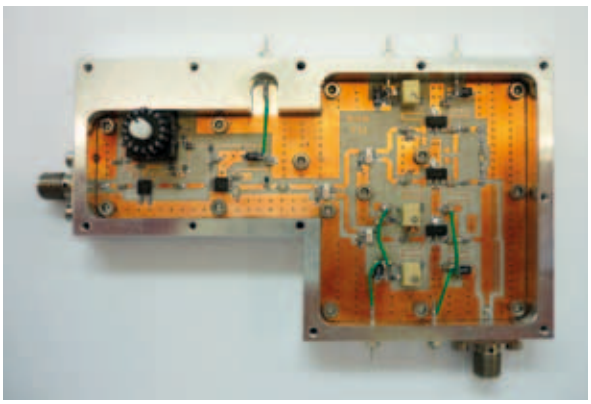

Figure 1: Reconfigurable power amplifiers

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.

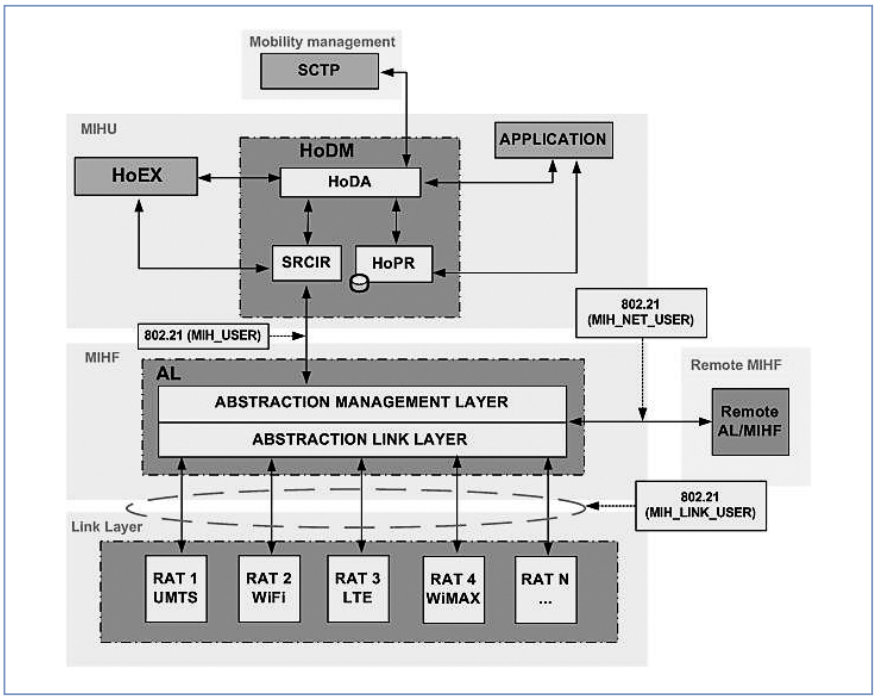

Figure 2: MOBILIA architecture

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.