CETIC

Centre of Excellence in Information and Communication Technologies
Your Connection to ICT Research

As an applied research centre in the field of ICT, CETIC's mission is to support economic development by transferring the results of the most innovative research in ICT to companies, particularly SMEs. CETIC helps companies integrate these technological breakthroughs into their products, processes and services, enabling them to innovate faster, save time and money and develop new markets. CETIC develops its expertise in key technologies, including Big Data, Cloud Computing, the Internet of Things, software quality, and trust and security of IT systems. These innovations are applied in domains of primary importance to society, such as health, smart mobility, energy and industry. This expertise is continuously supplemented through CETIC's active involvement in European and regional projects. CETIC is located on the Aeropole of Charleroi, in the Walloon region, Belgium.

2013 AT A GLANCE

Change was a major keyword of 2013 for CETIC, with a change of director which saw Simon Alexandre handing on the baton after successfully leading the development of CETIC over the last 5 years. A new president of the board of directors was also appointed at the end of the year: Bruno Schröder is already well known in the Walloon ICT ecosystem. As Technology Officer for Microsoft, he brings a strong worldwide vision on the future of ICT.

2013 was also the year in which two technology trends have reached the masses: Big Data and the Internet of Things. Beyond the buzz, what matters is the value these technologies will bring to end users and businesses, and CETIC has worked hard in collaboration with numerous actors in order to make things concrete and identify the opportunities these trends will present for local ICT companies. The first results were made visible in December with a Big Data summit (Assises du Big Data) co-organised with the competitiveness clusters, INFOPOLE Cluster TIC and AWT.

CETIC is a major Walloon actor in the European research landscape, which is highly competitive, especially in ICT. CETIC was very successful in the last FP7 calls with 2 new projects starting in 2013: ASCETIC, in the field of GreenIT, and POLCA, on efficient use of computing systems, and two more starting in 2014.

A new European framework program for research is being launched – H2020 – and our goal is to further develop the role of CETIC as a bridge between the R&D activities of major European players and local companies.

Establishing fruitful collaborations is more than ever at the root of our actions. Throughout the year, CETIC's experts have participated in numerous events (competitiveness clusters, FeWeb, BetaGroup, CCI, Coworking spaces, etc), leveraging their innovation perspectives and the daily practice of the business actors. New approaches and methods for applied innovation are also being developed, and via Creative Wallonia CETIC is establishing the first Living Labs of Wallonia.

Throughout 2014, the pace of change will certainly be kept up and all CETIC employees are deeply committed to embrace these changes, their motivation being to always serve our industrial partners better.

Damien Hubaux
General Manager

For a convenient reading, this report is divided in 3 sections:
the Facts and Figures, CETIC Expertise and our Project Portfolio.

FACTS AND FIGURES

BOARD OF ADMINISTRATORS

- Mr Bernard Bolle, M-team
- Mr Giacomino Bonsignore, NRB
- Mr Serge Boucher, UMONS
- Mr Patrick Donnay, Haulogy
- Mr Jean-Luc Hainaut, UNAMUR
- **Mr Benoît Hucq, Océ Software Laboratories Namur** - Vice-President
- Mr Jean-Didier Legat, UCL
- Mr Benoît Macq, UCL
- Mr Roger Malchair, Evadix
- **Mr Pierre Manneback, UMONS** - Treasurer and Secretary
- Mr Manuel Pallage, NSI
- Mr Lucyan Papiernik, IGRETEC
- **Mr Bruno Schröder, Microsoft** - President
- **Mr Philippe Toint, UNAMUR** - Vice-President
- Mr Olivier Verbeke, idealy
- Mr Christian Verdonck, BizzDev
- Mr Pierre Villers, DGO6, is the observing member appointed from Wallonia on the Board of Administrators and in the General Assembly.
- Mr Damien Hubaux is the General Manager, appointed by the Board of Administrators.

MEMBERS AND ORGANISATIONS

CETIC is a non-profit organisation (ASBL under Belgian law). Its General Assembly is composed as follows:

Five corporate bodies:

- Université catholique de Louvain (UCL), represented by Mr Benoît Macq,
- University of Namur (UNAMUR), represented by Mr Philippe Toint,
- University of Mons (UMONS), represented by Mr Serge Boucher,
- IGRETEC, represented by Mr Marc Debois,
- Agoria, the Federation for the Belgian Technology Industry, represented by Mr Thierry Castagne.

Fourteen individuals:

- Mr Simon Alexandre, The Faktory
- Mr Bernard Bolle, M-team
- Mr Jean-Christophe Chapelle, UNAMUR
- Mr Patrick Donnay, Haulogy
- Mr Benoît Hucq, Océ Software Laboratories Namur
- Mr Jean-Didier Legat, Professor, UCL
- Mr Roger Malchair, Evadix
- Mr Philippe Fortemps, Professor, UMONS
- Mr Naji Habra, Professor, UNAMUR
- Mr Jean-Luc Hainaut, Professor, UNAMUR
- Mr Pierre Manneback, Professor, UMONS
- Mr Manuel Pallage, NSI
- Mr Daniel Tuyttens, UMONS
- Mr Christian Verdonck, BizzDev

TECHNICAL COMMITTEE

- Mr Thierry Bingen, Haulogy
- Mr Jean-Louis Bolsée, Thales Alenia Space
- Mr Patrick Crasson, BeNovate
- Mr Laurent Cuvelier, Thales Alenia Space
- Mr Michaël Demeyere, AGC
- Mr Jean-Christophe Deprez, Scientific Coordinator, CETIC
- Pascal Devincenzo, Open Engineering
- Mr Denis Flandre, UCL
- Mr Naji Habra, UNAMUR
- Mr Jean-Luc Hainaut, UNAMUR
- Mr Patrick Heymans, UNAMUR
- Mr Damien Hubaux, General Manager, CETIC
- Mr Benoit Hucq, Océ Software Laboratories
- Mr Christian Huvelle, Atos IT Solutions and Services
- Igor Klapka, FN Herstal
- Mr Pierre Leclercq, Microsoft Innovation Center
- **Mr Jean-Didier Legat, UCL** - President
- Mr Alain Leroy, Pentacle
- Mr Benoit Macq, UCL
- Mr Pierre Manneback, UMONS
- Mr Philippe Massonet, Scientific Coordinator, CETIC
- Mr Kim Mens, UCL
- Mr Yves Moulart, ST Microelectronics
- Mr Dominique Orban, REVER
- Mr Emmanuel Ottevaere, BizzDev
- Mr Frederic Peters, Thelis
- Mr Etienne Pourbaix, Skywin
- Mr Frédéric Robert, ULB
- Mr Bruno Schröder, Microsoft
- Mr Daniel Tuyttens, UMONS
- Mr Luc Vandendorpe, UCL
- Mr Christian Vanhuffel, Agoria
- Mr Christian Verdonck, BizzDev
- Mr Axel van Lamsweerde, UCL

HUMAN RESOURCES

GENERAL MANAGEMENT

D. Hubaux

BUSINESS DEVELOPMENT

M. Van Der Straeten

O. van de Werve

F. Bregadze

OPERATIONS MANAGEMENT

F. Fleurial Monfils

SCIENTIFIC MANAGEMENT

Ph. Massonet

J-C. Deprez

S. Waha

ADMIN & FINANCES

L. Lepied

P. Romain

L. Marciano

COMMUNICATION

B. Fally

SUPPORT

QUALITY

F. Fleurial Monfils

TRAINING

V. Ramon

IT

S. Mouton
E. Charlier
D. Diakodimitris

SOFTWARE & SYSTEM ENGINEERING

Ch. Ponsard

R. De Landtsheer

G. Dallons

R. Michel

A. Majchrowski

R. Ramdoyal

S. Saadaoui

D. Durieux

J. Flamand

Y. Guyot

A. Michot

SOFTWARE & SERVICES TECHNOLOGIES

S. Mouton

R. Viseur

N. Devos

D. Diakodimitris

E. Charlier

J. Roumier

O. Cassano

F. Estiévenart

F. Steels

N. Matskanis

M. Van de Borne

M. Boukhebouze

EMBEDDED & COMMUNICATION SYSTEMS

Ph. Drugmand

J. Nsenga

L. Guedria

L. Deru

V. Ramon

L-M. Croisez

G. Florence

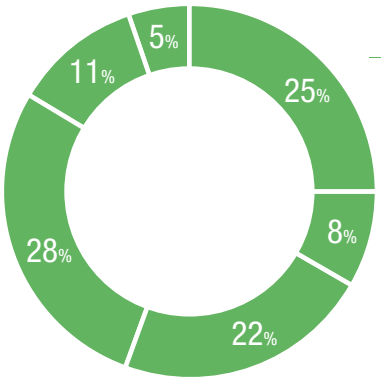
M. Ocaña

J. Simon

S. Dawans

KEY FIGURES

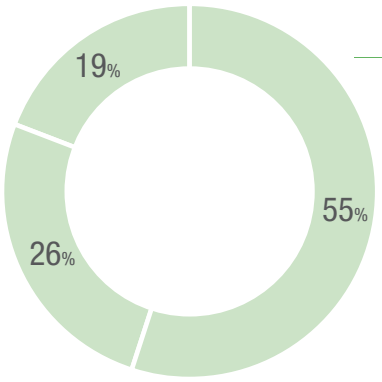
SOURCE OF REVENUE



Source of revenue

- 25% Technology transfer
- 8% European framework programs
- 22% Convergence ERDF
- 28% Wallonia
- 11% Federal
- 5% Other

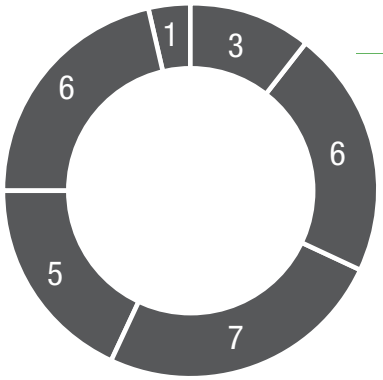
TECHNOLOGY TRANSFER



Technology transfer

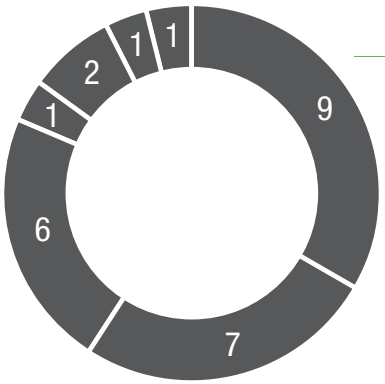
- 55% SME
- 26% GE
- 19% Public / Non-profit

R&D PROJECTS



Source of funding

- 3 Convergence ERDF
- 6 Competitiveness clusters
- 7 DGO6 Regional programs
- 5 DGO6 International programs
- 6 European Framework programs
- 1 Other

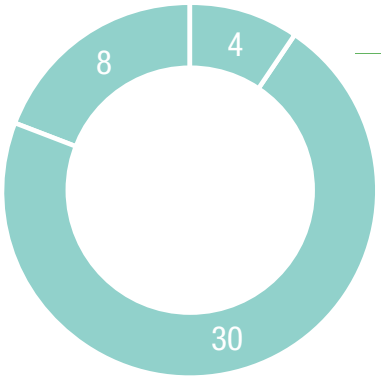


Primary application domain

- 9 ICT
- 7 Health
- 6 Transport
- 1 Energy
- 2 Industry
- 1 Aerospace
- 1 Telecommunications

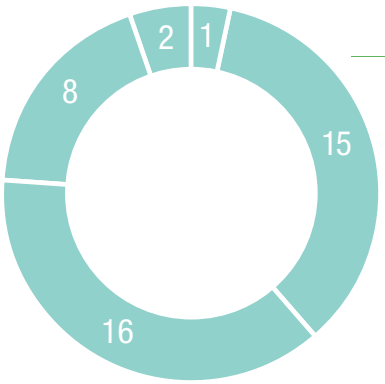
« ICT » means methods, languages, generic technologies and software components, etc; other entries identify the use of ICT innovations in various sectors taking their specificities into account.

HUMAN RESOURCES



Education

- 4 Bachelor
- 30 Master/ Engineers
- 8 PhD



Age

- 1 <25
- 15 25-34
- 16 35-44
- 8 45-54
- 2 >=55

DISSEMINATION

600
FOLLOWERS

Twitter – more than 600 followers
twitter.com/cetic (French)
and **twitter.com/cetic_be** (English)

580
FOLLOWERS

LinkedIn – 580 followers
linkedin.com/company/cetic

21
BLOG ARTICLES

www.cetic.be/blog

3
NEWSLETTERS

CETIC published 3 newsletters
(March 28, July 2, December 19)

3
TECHNICAL WORKSHOPS

CETIC organised three technical workshops targeted to local SMEs, covering:
- Software Product Lines
- DevOps
- eHealth technological developments

www.cetic.be/agenda?type=119

66
CONFERENCES, FAIRS AND EVENTS

CETIC's experts made contributions to 66 conferences, fairs and events in Belgium and throughout Europe
www.cetic.be/agenda

SCIENTIFIC PUBLICATIONS

- Annick Majchrowski, Christophe Ponsard, Mathieu Ocaña, Confrontation d'un modèle d'échange de données dosimétriques avec l'état des pratiques franco-belges, Journal d'Ingénierie des Systèmes d'Information, Hermès, Décembre 2013
- Nicolas Devos, Dimitri Durieux, Christophe Ponsard, Technical debt KPI for driving software quality evolution Feedback from an industrial survey, BENEVOL 2013 (12th edition), Mons (Belgium), December 16-17, 2013
- Christophe PONSARD, Nicolas DEVOS, Dimitri DURIEUX, Félix BREGADZE, Managing technical debt in IT start-ups – an industrial survey, in Proc.25th International Conference on Software and System Engineering and their Applications (ICSSEA), Telecom Paris-Tech, Paris, November 4-6, 2013
- C. Ponsard, J.C. Deprez, R. De Landtsheer, Manager Guidelines for the Industrial Deployment of Formal Methods, 18th International Workshop on Formal Methods for Industrial Critical Systems, Madrid, Spain, September 23-24, 2013
- Laurent Deru, Sebastien Dawans, Mathieu Ocaña, Bruno Quoitin and Olivier Bonaventure, "Redundant Border Routers for Mission-Critical 6LoWPAN Networks", in Proceedings of the Seventh Workshop on Real-World Wireless Sensor Networks, 2013
- Christophe Ponsard, Pascal Beaujeant, Jean Vanderdonckt, Augmenting Accessibility Guidelines with User Ability Rationales, IFIP Conference on Human-Computer Interaction (INTERACT), September 2013
- Ravi Ramdoyal, Christophe Ponsard, Myriam-Amina Derbali, Gabriel Schwanen, Isabelle Linden and Jean-Marie Jacquet, A Generic Workflow Metamodel to Support Resource-Aware Decision Making, 15th International Conference on Enterprise Information Systems, Angers (France), July 4-7, 2013
- Isabelle Linden, MyriamDerbali, Gabriel Schwanen, Jean-MarieJacquet, Ravi Ramdoyal, and Christophe Ponsard, Supporting unexpected situations in business process management using the BEM framework, EWG-DSS Thessaloniki-2013 Workshop, Greece, May 29-31, 2013
- Christophe Ponsard, Mathieu Ocaña, Annick Majchrowski, Confrontation d'un modèle d'échange de données dosimétriques avec l'état des pratiques franco-belges, INFORSID 2013, Paris, May 29-31, 2013
- Jean-Christophe Deprez, Christophe Ponsard, Renaud De Landtsheer, Evidence-based Assistance for the Adoption of Formal Methods in the Industry, book chapter of "Industrial deployment of system engineering methods providing high dependability and productivity", A. Romanovsky, M. Thomas (Eds), Springer, April 2013
- Renaud De Landtsheer, Christophe Ponsard, OscaR.cbls : an open source framework for constraint-based local search, 27th ORBEL Annual Meeting, Kortrijk, February 7-8, 2013

PARTNERSHIPS AND STRUCTURED COLLABORATIONS

Collaborative work exchanges with key partners are at the heart of CETIC's activities. CETIC constantly aims to ensure that these exchanges are conducted in a sustainable manner in order to ensure that the expertise of all concerned will be mutually enriching and broadly shared through joint projects.

Structured Collaborations

CETIC has established numerous structured collaborations in order to better support the development of businesses. CETIC is able to leverage the impact of applied research by referring to specialised actors, and to identify partners for companies via several networks of enterprises. CETIC collaborates with local and international partners aiming at developing knowledge and competences in the field of ICT.

FACTS AND FIGURES

Wal-Tech

Accord-Wallonie is changing its name to become Wal-Tech. This association incorporates Wallonia's 22 accredited research centres, including CETIC. Its role is to support technological innovation amongst Walloon enterprises, providing them with easy access to all the competencies of the Wal-Tech members.

http://www.wal-tech.be/

Technology Guidance

To accelerate Wallonia's economic growth, Walloon SMEs in all sectors should integrate the latest Information and Communication Technologies into their products/services/operations whenever possible, as these technologies are key to competitiveness and productivity. These companies can be helped in the adoption process by Wallonia's ICT applied research centre. At CETIC, Technology Guidance consists in raising the awareness of companies, finding the best path toward the solution, and transferring knowledge and technology.

Walloon Competitiveness Clusters

The Competitiveness Cluster groups together companies, training centres and public or private research units in leading sectors of the Walloon economy. ICT being cross-disciplinary, CETIC actively collaborates with all the Walloon Competitiveness Clusters in order to align its R&D directions with the industry needs.

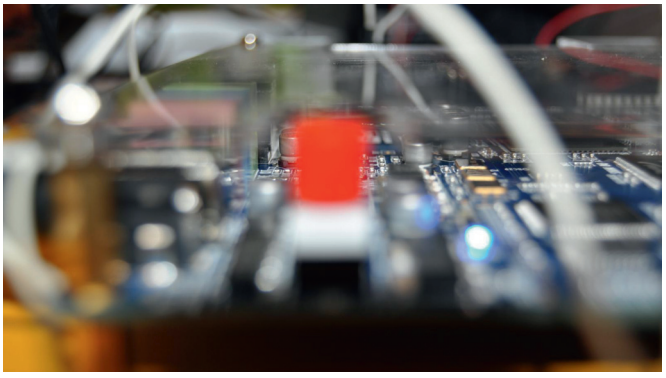
http://clusters.wallonie.be

ICT EQUIPMENT

To be effective, methodological research must be supported by state-of-the-art tools. CETIC provides access to these tools, and to the associated support services as well.

CETIC's ICT Equipment includes:

- a **Software engineering laboratory**:
  - Walloon SMEs active in IT development will have access to state-of-the art tools and guidance on advanced tools for code analysis – targeting specific properties such as maintainability, security and reliability – as well as requirements engineering, business modelling, testing and effort estimation tools.



- a **Wireless laboratory** and a **Wireless Sensors Network testbed**;
  - The Wireless laboratory is equipped with software and hardware tools to support the prototyping and test of embedded wireless systems, encompassing the emerging technologies, especially those related to new standards introduced to increase throughput and range, reduce power consumption and optimise performance trade-offs that make the choice of an appropriate solution so difficult.
  - CETIC deployed a Wireless Sensor Network (WSN) testbed consisting of 25 modules deployed over a 500m2 office space, aiming at testing and debugging. The modules are using instances of CETIC's 6LBR project, which will allow to design a full scale Internet of Things solution from the Cloud to the sensor.
- a **Private Cloud**,
  - CETIC operates an advanced IT infrastructure designed for experimenting with Cloud Computing and other distributed software applications and middleware. The cluster is used for research projects and is also available for experimentation conducted by its partners and other enterprises.

QUALITY POLICY

ISO 9001 Certification

CETIC is ISO 9001 certified. The certified activities are the technology transfer activities, as well as the set-up and the implementation of R&D projects.

ISO 9001, an internationally recognised quality standard, details the principal compliance requirements for a company's quality management system (QMS). Meeting these requirements ensure the enforcement of the quality procedures set up by that company, constituting a proof of trust.

CETIC Quality Policy

CETIC's mission is to improve the efficiency and competitiveness of Walloon companies by helping them integrate Information and Communication Technologies (ICT) into their products and services quickly and effectively.

From this perspective, and in order to ensure the satisfaction of all its partners (companies, universities and public authorities), CETIC is committed to:

- Developing cutting-edge expertise in ICT;
- Delivering innovative results with high added value for companies through continuous improvement of the technological innovation process;
- Ensuring objectivity and quality results, thanks to its independent position, international recognition, and strict adherence to ethical and scientific protocols;
- Ensuring the quality of its competencies and technical capabilities by conducting on-going training and appropriate recruitment;
- Promoting the development and satisfaction of its employees by promoting a healthy environment, which is conducive to creativity, professional achievement and teamwork.

CETIC also invests in the definition of quality norms related to ICT, such as ISO/IEC29110 (Systems and Software Life Cycle Profiles and Guidelines for Very Small Entities); and participates in related standardisation working groups such as ISO JTC1/SC7 (Software & System Engineering Standards).

CETIC VALUES

Customer

CETIC is the trusted third party when partnering with companies, helping them integrate the latest technologies designed to innovate and address new markets. CETIC employees are approachable and forthright, and regard the quality of their relationship with their partners as a point of honour. They take the time to understand the needs of their clients, and provide them with the solutions that best meet those needs.

Excellence

CETIC applies its expertise to achieving the highest level of software quality to yield maximum benefit for both companies and partners. Thanks to the close ties among its research teams, CETIC maintains control of all phases of a project.

Transfer

CETIC actively contributes to the development of Wallonia by supporting and stimulating innovation in the local economy, particularly its SMEs.

Innovation

CETIC teams demonstrate initiative, creativity and curiosity in the research topics they select, using their complementary skills to ensure an innovative, high-quality result. Strong links with industry (including those maintained by the Technical Committee) ensure the relevance of the research projects they select.

Collaboration

Thanks to its status as a private, non-profit organisation, CETIC is able to collaborate with industry and the public sector in total independence, within a framework of trust and in a spirit of cooperation without competition.

"CETIC's values match its commitment to operational excellence, and enable this Centre of Excellence to achieve a high level of partner and customer satisfaction."

ABOUT CETIC

As an applied research centre in the field of ICT, CETIC's mission is to support economic development by transferring the results of the most innovative research in ICT to companies, particularly SMEs. The knowledge developed by CETIC is made available to companies to help them integrate these technological breakthroughs into their products, processes and services, enabling them to innovate faster, save time and money and develop new markets.

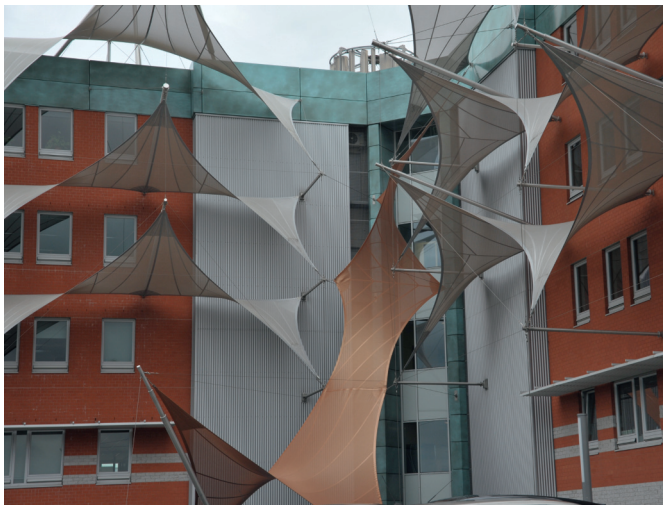
CETIC is continuously expanding its expertise through its active involvement in European and regional research projects.

CETIC is a non-profit organisation, accredited as Applied Research Center by the Walloon authorities.

CETIC's board is composed of industry representatives from the ICT sector and universities.

CETIC is located on the Aeropole of Charleroi in Wallonia, Belgium.

CETIC was founded in 2001 by the Université catholique de Louvain (UCL), the University of Namur (UNAMUR) and the University of Mons (UMONS).



CETIC'S RANGE OF EXPERTISE

THE SUCCESS OF AN ICT PROJECT DEPENDS ON:	CETIC'S RANGE OF EXPERTISE	
The use of proper practices in order to meet requirements, budget and timing	Methodological research, with a view to enhancing the quality, efficiency, security and safety of new and increasingly complex ICT systems. CETIC helps IT companies to produce high quality software products and services. It focuses on the use of lightweight approaches specifically adapted to SMEs, while ensuring compliance with international standards.	Software Quality (SSE department)
Proper choices amongst rapidly evolving Information Technologies	CETIC provides companies with advanced technological expertise by taking advantage of the newest distributed, dynamic and web-oriented architectures, which strongly impact the way software and data are assembled, deployed and managed. CETIC helps companies in the adoption of new paradigms such as Cloud Computing and Big Data.	Future Internet (SST department)
The ability to exploit the huge potential of numerous smart connected objects around us	CETIC has developed exceptional prototyping skills in embedded systems and wireless technologies to help industry build new and innovative products.	Internet of Things (ECS department)

HOW TO WORK WITH CETIC

CETIC is a trusted and skilled partner in research and innovation in the application of ICT in various fields of expertise. For each assignment with a company, CETIC will put together a multi-disciplinary team dedicated to understanding its unique requirements and delivering what is required to achieve the defined goals.

Companies can collaborate with CETIC in 3 different ways:

Innovation (R&D&I) Activities

CETIC offers its expertise to companies wishing to externalise or needing assistance to integrate breakthrough technologies into their R&D&I process. Activities include knowledge transfer and consulting, feasibility study, design and engineering, proof-of-concept, prototyping and testing. CETIC helps its customers reducing risk and accelerate time to market for new growth opportunities.

Financing Innovation

An SME conducting R&D activities and which is ready to innovate can quickly obtain simple and flexible financial support through several funding instruments offered by local authorities.

- For SMEs established in Wallonia, the most efficient and lightweight instrument are the technology vouchers provided by the Agence de Stimulation Technologique (AST). When working with an accredited research centre like CETIC, an SME is eligible for reimbursement by Wallonia of up to 75% of the total cost of R&D through the Chèques Technologiques program. These technology vouchers are available up to a maximum amount of €20,000 per SME annually. Further information about these vouchers can be found at www.ct.innovons.be.
  The software feasibility studies from the regional research administration (DGO6), also provide up to 75% of required funding.
- Brussels-based SMEs can benefit from regional funding for their R&D activities as well. Funding is available from INNOVIRIS, the Brussels Institute for Research and Innovation.
- CETIC is also accredited under the Crédit Impôt Recherche programme in France, which is a favourable tax credit scheme that enables any French company to enter into a contractual R&D agreement with CETIC.

Regional and Collaborative Research Projects

Another means for companies to innovate is to set up collaborative research projects. One of CETIC's goals is to involve companies, especially SMEs, in collaborative R&D programs funded by European and regional authorities, strengthening their market position, and helping them improve their existing products and acquire new expertise.

Setting up Collaborative Research Projects

CETIC offers its comprehensive experience in building projects, large and small, from proposal elaboration to setting up and coordinating consortia. CETIC has an excellent track record in the context of competitive calls for proposals, such as FP7, ERANET, or Competitiveness Clusters, for example.

Trusted Third-Party Auditing and Advice

As a research centre and non-profit organisation working in close proximity to academic institutions, CETIC is often asked by public and private organizations, from its neutral point of view, to:

- Help with needs identification, choosing technologies and suppliers, contract follow-up, evaluation of software development costs, etc.
- Conduct technological and methodological audits of software product and development life cycle processes, and providing recommendations on the adoption of best practices, architectural change, code refactoring, etc.
- Escrow procedure, including source code quality assessment, replication of the tool chain,...
- Provide support as regards the adoption of software related norms and standards, in order to anticipate a possible certification process.

"Backed by the extensive expertise they have gained over many years in European and Walloon research projects, our team of highly qualified researchers is ready to help companies to be more innovative and competitive."

Business Ethics

While performing technology transfer, CETIC takes all possible measures:

- to protect IP between companies potentially competing with each other. By applying strict confidentiality rules, and focusing on the technology, CETIC lets companies develop their own competitive advantage in their business field.
- to avoid any conflict of interest between CETIC itself and ICT providers. Especially, CETIC does not deliver mainstream software products. Any state-of-the-art proof-of-concept made by CETIC is transferred to the company itself, if it has internal IT skills, or to their chosen ICT provider. CETIC does not operate or maintain any software product.

SOFTWARE QUALITY

Helping Enterprises Reach Higher Levels of Quality in Their Software Development Processes and Products

Creating high quality software on time and within budget is a risky endeavour. If this risk is not well managed, major rework and maintenance costs will be incurred. With its strong software engineering expertise and its status as trusted third party, the **Software an System Engineering (SSE)** department actively helps organizations effectively manage the software product development and maintenance life-cycle.

CERTIFICATION AND STANDARDS

Certification is required in a number of industrial domains as a condition for accessing a particular market or to comply with regulatory provisions. However, integrating certification constraints into a development process can result in very large overheads.

Mastering the certification process is not a trivial task, and requires knowledge of the standard concerned and how to integrate it into the software life-cycle.

CETIC is actively developing expertise and experience in these areas (IEC 62304 for medical devices, EN-50128 for railways, DO-178B for avionics, Common Criteria for security), as well as mastering a number of support tools, providing the organisation with the necessary independent insight on the best standards to integrate and how to achieve certification with minimum overhead in their business context. The SAT project (see project portfolio), for example, is developing incremental certification support.

SOFTWARE BEST PRACTICES ASSESSMENT

Software process models like CMMI and ISO/IEC12207 are designed to improve software product quality through better processes. For SMEs and VSEs, however, these standards are too expensive to implement. Most cannot afford the resources, in terms of employees, cost or time, or see a net benefit in establishing software life cycle processes. To overcome these difficulties, a dedicated standard, ISO/IEC 29110 (i.e. Software Lifecycle for Very Small Entities) has been developed and published.

CETIC, a key contributor to this new ISO/IEC 29110 standard, has extensive expertise in the assessment of application development practices, and has created a lightweight process assessment to demonstrate their process maturity to its customers and to efficiently improve their own practices.

SOFTWARE CODE QUALITY

Business demands, time-to-market pressures and resource constraints drive development teams to make trade-offs. These trade-offs have a direct impact on the quality of software design and code, and, if they are ill-considered, they can result in structural risks to an application, increased development and maintenance costs, and loss of market share.

For the past decade, CETIC has acquired extensive expertise in the application of quality models based on ISO9126/SQuaRE that is the foundation of its tooled application code analysis expertise with targeted quality attributes, such as maintainability, security and reliability. CETIC has also developed specific quality models and tool chains for Open Source ecosystems and security critical applications.

Using CETIC's methodology and best-of-breed tooling, the quality of an application is measured in terms of cumulative technical debt, an expression which quantifies the cost of the non-quality of an application and is a figure on which both manager and developer can agree.

This expertise enables companies to monitor and control the structural quality of their applications cost-effectively, without significant impact on the delivery cycle. Direct benefits include a lower cost of delivered projects, better time-to-market and increased team productivity. The customer is then able to install a quality gate in order to control application delivery. From the supplier side, this is the opportunity to set up a long-lasting relationship of trust with their customers. It also provides better risk control over the IT maturity of new businesses.

EXPERTISE

SOFTWARE DEVELOPMENT SIZING

Many projects fail because their development effort has been incorrectly sized. This has a major impact on the project's organisation and schedule. The risk of failure is even greater in the outsourcing market: for the customer, who expects a high-quality product having the required functionalities to be delivered on time; and for the supplier, who must satisfy customer needs while achieving a reasonable profit margin.

CETIC's expertise in this area is founded on COSMIC (ISO/IEC 19761), a widely used method for estimating software functional size. The COSMIC function point estimation method is based on objective criteria. It allows measures to be repeated, and it is applicable to requirements documents early in the software life-cycle. Using the ISBSG project cost database, the functional size generated by COSMIC is then converted into development effort. With these estimates, project managers can plan and budget their development projects more accurately.

REQUIREMENTS ENGINEERING AND SYSTEM MODELLING

Poor requirements gathering and modelling practices are all too common in enterprises, and they lead to poor effort estimates, costly requirements and design-related bugs, and more laborious testing and acceptance, which ultimately put project success at risk.

CETIC's expertise in Requirements Engineering and System Modelling covers the whole spectrum of methods and application contexts. Lightweight methods combining structured templates and UML-based notations provide a good level for SME and in non-critical application domains. Model-based approaches help in automating specific development steps and provide greater design assurance. They also support business decision-making and process optimisation, especially in the medical and logistics domains (PIPAS, BEM and SimQRI: see project portfolio). CETIC has developed a specific expertise and Open Source toolset for the optimisation which is able to efficiently manage large business systems. They also enable a software product line approach (CALiPro), the development of greener IT systems (ASCETIC) and more efficient Human-Computer Interfaces (QualIHM) (see project portfolio). Finally, fully formal models enable a deep reasoning on the system as required in specific safety critical domains such as transportation.

CETIC advises organisations regarding the best methods and tools to adopt in order to achieve the best return on investment, properly manage risks in this process and achieve better governance.

SECURITY ENGINEERING AND ASSESSMENT

Today, IT system and software security has become critically important, because increasingly sophisticated technologies and ever-greater interconnectivity is empowering malicious users whose actions can have a dramatic impact on the privacy of both enterprises and individuals. Security expertise addresses these concerns specifically, throughout the software engineering life-cycle, with audit based security requirements engineering, security policy modelling, secure architecture design, security-oriented code analysis and preparation for security certification, such as the Common Criteria.

FUTURE INTERNET

Exploiting Distributed Resources, Giving Meaning to Data

The **Software and Services Technologies (SST)** department covers key areas shaping the Future Internet: Service-Oriented Architectures (SOA) – also known as the Programmable Web, Cloud Computing, Semantic Web, Big Data and Open Source software technologies.
CETIC helps companies to take advantage of the latest trends and technological advances in these fields and in particular to build scalable and flexible applications and infrastructures.

SEMANTIC WEB RESOURCES

Exploiting Semantic Web resources is about linking together the increasingly large amounts of unstructured data and annotating them with meaningful information.

CETIC masters the Semantic Web standards used to model, query and link data, as well as to create ontologies. CETIC also contributes towards powerful and interoperable content management solutions, which serve end-users or other software components.

These skills have been used to analyze information extracted from the Internet in Deciweb

In PONTE (see project portfolio), CETIC studied and modelled several health-related data sources as ontologies, and published them on a Web platform, making them available for consultation and linking.

SECURITY IMPLEMENTATION AND DEPLOYMENT

Threats to IT infrastructure are growing at a time when companies are increasingly required to provide access to their data and resources. To maximise security, CETIC has developed expertise on the PEP-PDP architecture, in which Policy Enforcement Points (PEP) are melded into the infrastructure middleware to intercept user requests and query the Policy Decision Point (PDP) engines that make decisions on accessing and using the requested resources.

In I2MSteel, CETIC evaluated the use of the PEP-PDP security implementation of software service applications in steel industry. Feedback from this usage case allows CETIC to advise on deployment of PEP-PDP security framework in industrial contexts.

CETIC will continue its efforts to improve decentralised security architectures, in order to develop the capability of modelling ever more advanced access-control techniques.

CLOUD INFRASTRUCTURE MANAGEMENT

CETIC masters Open Source Cloud infrastructure managers, as well as open standards for infrastructure definition and interoperability. Cloud infrastructure managers are used to aggregate local and remote IT resources in order to provide scalable infrastructures as a service (IaaS).

In the SaaS-WMS project (see project portfolio), CETIC started implementation of self-adaptation of infrastructure based on OpenStack orchestration capabilities.

EXPERTISE

PROGRAMMABLE WEB

The Programmable Web provides composable Web services, which are small pieces of software available through the Internet, for next-generation applications. CETIC adapts the architecture of applications that are consuming, or providing, Web services, in order to make them scalable and ready to be delivered as a service (SaaS).

Mastering SOA shortens the time-to-market of innovative solutions, thanks to the composition of the Web services, and consequently reduces the overall development effort. Providing efficient and well-designed Web APIs that are in line with standards is a key factor in the adoption of these services by third parties.

In the I2MSteel project (see project portfolio), CETIC defined and implemented key Web services that combine data sources in steel production process and provide interoperability between existing isolated applications.

CLOUD-READY SOFTWARE DEPLOYMENT

Cloud Computing is about scalability and flexibility, and requires specific software architectures. The deployment of the application also has to be taken into account from its inception. CETIC designs software architectures, which are ready to be deployed on countless servers.

The ability to make the right choice of architecture or provider of the Cloud Computing infrastructure, is important when validating proofs-of-concept which are vendor-independent and which take advantage of IaaS and PaaS offerings. Both in PaaSage and goCloud (see project portfolio), CETIC helped automate application deployment in the Cloud.

SCALABLE DISTRIBUTED STORAGE

The advent of cloud technology has made available abundant inexpensive storage resources, but they are often scattered and unstructured. As a result, database management systems, such as NoSQL databases, are responsible for handling huge amounts of data, as well as the required redundancy and load balancing capabilities. CETIC maintains a state of the art of distributed storage solutions and a taxonomy of NoSQL databases, which enables CETIC to help companies find the right storage solution based on the kind of data to be managed.

BIG DATA MANAGEMENT

The promise of Big Data is the possibility of managing all the data available to companies by means of a scalable data management infrastructure. This infrastructure allows the management of the three Vs: the volume of data to be managed, the velocity (speed) at which the data should be processed, and the variety (heterogeneity) of data formats that should be taken into account. CETIC experiments with different Big Data installations and distributions, in order to deploy relevant use cases.

OPEN SOURCE SOFTWARE

Questions are still being raised about the Open Source movement, in terms of the availability of local support, the quality of the software developed and the compatibility of licenses. Interest in open data and open hardware is also growing.

CETIC has expertise in the process of selecting Open Source licenses and an understanding of its impact on business models, all of which enables them to help companies release their applications into the Open Source realm and select the license that aligns best with their own business model.

INTERNET OF THINGS

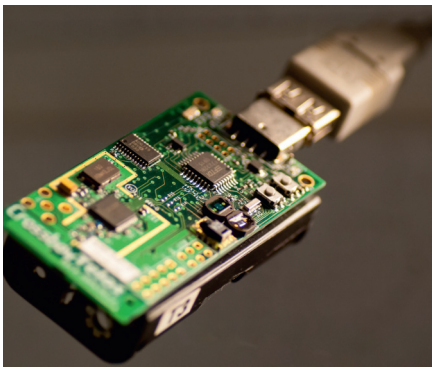
Innovative Technologies Enabling Smart Devices for the Internet of Things

The Internet of Things refers to an intelligent association of uniquely identified objects that are transparently accessible on the Internet. The underlying technologies will enable these systems to seamlessly collaborate over the Internet, making overall Internet services much more dynamic, scalable and powerful.
The **Embedded and Communication Systems (ECS)** department examines emerging technologies that will enable the Internet of Things, including methodologies, hardware and software design and prototyping, and wireless telecommunication.

METHODOLOGIES

There is a great temptation, when studying a system, to focus only on the result viewed from the perspective of the demonstrator. However to systematically and efficiently achieve the highest level of performance of these systems, it is vital to consider their entire life cycle. CETIC's purpose is to transfer technologies to enterprises in such a way that their use can be extended beyond the study or prototype stage. This presupposes mastery of the methodologies involved and of their associated tools.

In the CE-IQS project (see project portfolio), CETIC studies the all-important teething (test) phase of the life-cycle of an embedded system more closely. It is also broadening its expertise in code quality analysis to the specific case of embedded software.



SMART GRIDS

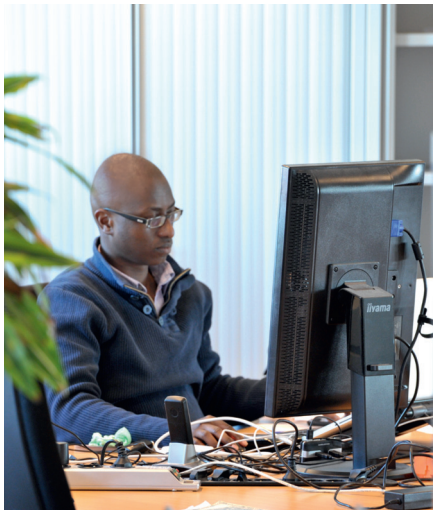
Research on Smart Grids is receiving a strong impetus driven by multiple factors: the need to use renewable energy more efficiently, the need for more effective energy management to lower the cost of energy and the current state of electrical infrastructures, which cannot evolve significantly because of the huge costs involved. Smart Grids can also optimise the energy cost for enterprises exposed to complex management of their consumption in the face of highly variable pricing policies for energy.

ICT is, of course, key to the development of Smart Grids, and CETIC's contribution in this area is twofold: intelligent application of ICT to optimise the energy production/consumption balance, and the establishment of a telecommunications network to enable the metering and control of the related equipment.

CETIC studies Smart Grid architectures and solutions for industry. It collaborates with enterprises for internal solutions (at plant level, for example), and for external solutions, like micro-grids, on which enterprises rely to power their renewable energy production units.

MODELLING AND SIMULATION

CETIC has integrated advanced tools for modelling and simulating embedded systems into its Software Engineering laboratory and its Wireless laboratory. CETIC offers advice and services to enterprises using these methodologies and the tools that support them. The Software Engineering Lab and the Wireless Lab are equipped with advanced modelling and simulation tools, and CETIC can assist in the process of selecting the best solutions, as well as in seamlessly integrating them into the environment of the enterprise, and then facilitate their efficient and rapid adoption.



EXPERTISE

IPV6 SENSOR NETWORKS

IPv6 is the cornerstone of communication in the Internet of Things (IoT), and is required for addressing objects globally. 6LoWPAN, the emerging standard for IPv6 wireless communication, and the Contiki operating system enable Wireless Sensor Networks (WSN) for the IoT.

These new technologies, among others, will soon transform the classical WSNs – home automation, eHealth, energy management, etc. – by turning the actual sensors into smart devices connected to the Internet. This will revolutionise the services offered by these systems.

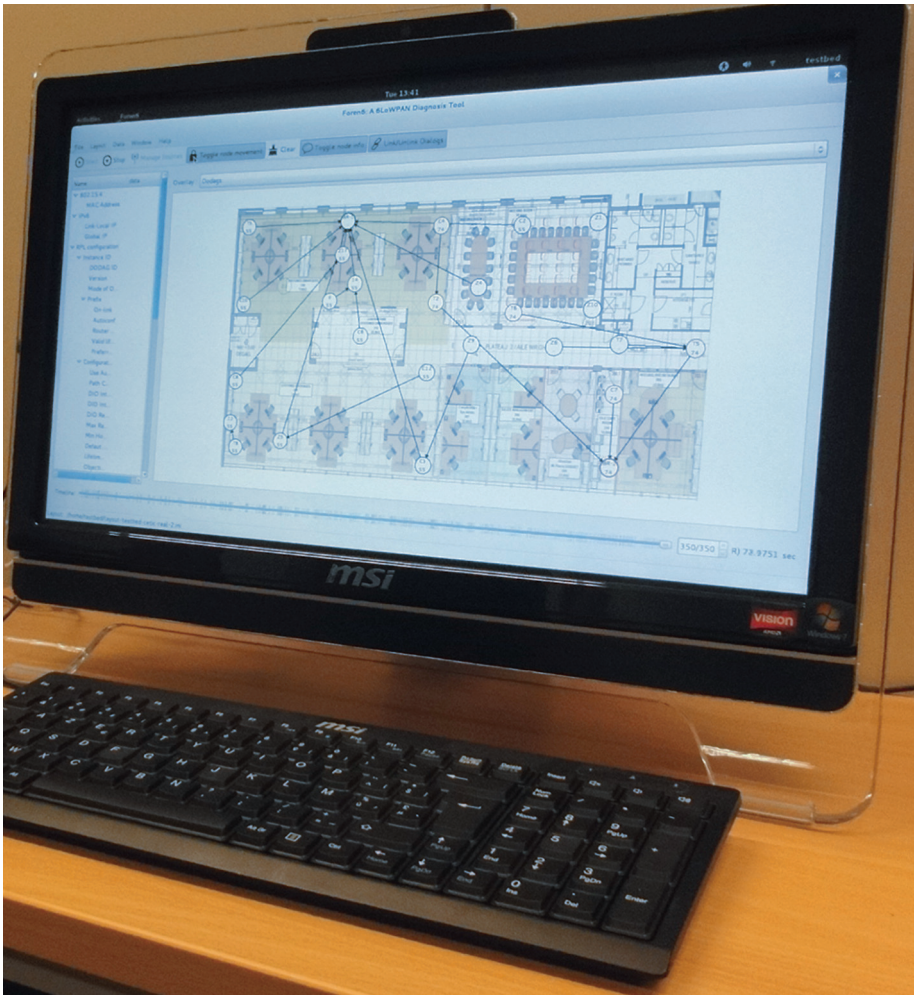
The MidFlex project (see project portfolio) explores the capabilities of these technologies and experiments with advanced routing algorithms in large scale academic WSN, like INRIA Lille's SensLab and TU Berlin's TWIST. CETIC collaborates in this area with SICS in Sweden, at the origin of Contiki.

ADVANCED ARCHITECTURES

The increasing complexity of embedded systems can lead to performances that are not optimised, as well as unexpected issues that arise in the final stages of development. It is essential that the non-functional aspects of systems, like power consumption, reliable upgrade processes and overall performances with advanced architectures (multi-core, rich OS, etc.), be mastered at the design stage.

The huge rise expected in the number of functionalities and the overall complexity of future embedded systems in the world of the IoT will require advanced design techniques, to the point where the key differentiators for successful solutions will ultimately be autonomy, reliability and performance.

In 2013, CETIC started on the design of an highly efficient electronic patch merging advanced monitoring features with Ultra Low Power capabilities (see project e-Patch in the project portfolio).



FPGA

An FPGA is a hardware programmable circuit that offers huge possibilities in terms of architectural configurability and flexibility. It can dramatically simplify the design of circuit boards and make them more generic, particularly in terms of allowing input/output interface reconfiguration. But the FPGA has two significant drawbacks that limit its adoption: the level of expertise and the design time required.

ECS studies the tools and techniques, like porting C to HDL, that will make it easier to develop HDLs, facilitate the use of FPGAs and shorten development time. In the POLCA project (see project portfolio), CETIC, with its partners, studies new approaches based on mathematical transformations to improve the efficiency of parallelization in embedded systems and high performance computing. The practical tools will be designed to implement the generation process. Ultimately, CETIC will focus on the definition of methodologies supporting these tools and guide enterprises in the use of advanced FPGA solutions.

CETIC PROJECT PORTFOLIO 2013

	ACRONYM	TITLE	APPLICATION DOMAIN	COLLABORATION
1	CE-IQS	Centre of Expertise in Engineering and Quality of Systems	ICT	Wallonia
2	CELLaVI	Center of Expertise in Open Source Software	ICT	Wallonia
3	goCloud	Helping SMEs go to the Cloud	ICT	Wallonia
4	QualIHM	A Requirement Engineering Toolkit for Efficient User Interface Design	ICT	Wallonia
5	PaaSage	Model-Based Cloud Platform Upperware	ICT	Europe
6	POLCA	Programming Large Scale Heterogeneous Infrastructures	ICT	Europe
7	DeciWeb	Taking better decisions with Web data	ICT	Wallonia
8	NAPLES	New Agile Platform for a Lifelong Engineering of Software	ICT	Wallonia
9	CALiPro	Automated configuration of software product lines	ICT	Wallonia
10	eHealth for Citizens	ICT serving patients	Health	Wallonia
11	e-Patch	Development of an Electronic Patch for Geolocation and Fall Detection of People with Mental Deterioration	Health	Wallonia
12	DapCare	Patient Dosimetry eBook	Health	Wallonia
13	SPES	Support Patients through E-Service Solutions	Health	Europe
14	PIPAS	Adaptative Piloting of Hospital Processes	Health	Wallonia
15	AMACS	Automatic Monitoring of Activities Using Contactless Sensors	Health	Europe
16	PONTE	Efficient Patient Recruitment for Innovative Clinical Trials of Existing Drugs to other Indications	Health	Europe
17	NweRIDE	North West Europe Dynamic Ridesharing	Transport	Europe
18	Numericanal	Using technology for more efficient management of inland waterways	Transport	Europe
19	Locotrac	Low cost train automatic control	Transport	Wallonia
20	GIR	Integrated Risk Management of Supply Chain	Transport	Wallonia
21	C2A	Connect to All	Transport	Europe
22	BEM	Business Event Manager	Transport	Wallonia
23	SaaS-WMS	Migrating a Warehouse Management System software onto the cloud	Industry	Wallonia
24	I2MSteel	Intelligent Integrated Manufacturing for Steel	Industry	Europe
25	ASCETIC	Adapting Service lifeCycle towards EfficienT Clouds	Energy	Europe
26	MidFlex	A flexible middleware for IPv6-based low-power embedded systems	Telecommunications	Wallonia
27	SAT	Smarter Airborne Technologies	Aerospace	Wallonia
28	Living Lab	Laboratory for Open Innovation by Creative Wallonia	ICT and co-creation	Wallonia

Activities

- **Applied Research**
- **Technology Transfer**
- Innovation
- Prototyping
- Industry

Application Domains

- Mechanical Engineering
- Aeronautics & Space
- Transport & Logistics
- Media
- Energy
- Telecommunications
- **Software Industry**
- **eHealth**

Thematics

- Open Source
- Accessibility
- **Development Life Cycle**
- Human-Computer Interaction
- Methodologies
- Standards
- Complex & Optimising Algorithms
- Design & Programming Languages

Software & System Engineering (SSE)

- Software Development Effort Estimation
- Source Code Analysis
- Requirements Engineering
- Model Driven Engineering
- Software Product Lines
- **Software & Processes**
- Software Certification
- Software Process Quality
- Computer Security & Trust
- Safety
- Model-based Testing
- Formal Methods

Embedded & Communication Systems (ECS)

- Electronic Design
- FPGA
- Ultra Low Power
- Embedded Systems
- **Internet of Things**
- Networks
- Wireless Technologies

Software & Services Technologies (SST)

- **Future Internet**
- Cloud Computing
- Service Oriented Architecture
- Linked Data
- Search Engine & Indexing
- Semantic Technologies
- Web Services
- Big Data Management

CENTRE OF EXPERTISE IN ENGINEERING AND QUALITY OF SYSTEMS

The CE-IQS project encompasses several topics in the field of system engineering. Activities are grouped in 5 topics dedicated to methodologies, quality and certification with a technology focus on embedded and distributed systems.

OBJECTIVES

The purpose of the Centre of Expertise in Engineering and Quality of Systems is to help enterprises successfully anticipate the rapid evolution of the ICT sector through Research and Development (R&D) actions based on strong research topics but also aligned according to the programmatic requirement of enterprises. The 5 topics are:

1. Methodologies for Development and Evolution of Systems
2. Verification, Validation and Quality Assessment
3. Certification
4. Embedded and Distributed Systems
5. Intelligent Content and Semantics

RESULTS

The evolution of ICT systems will be studied through the strengthening of methodologies for the complete life-cycle and the integration of Software Product Line engineering. CE-IQS will provide enterprises with methods and tools for improving the control of their systems for the whole lifespan.

Embedded and distributed systems evolve according to the new paradigms induced by the Internet of Things (IoT) and consequently by the technological developments in the areas of intelligent objects, networks, Cloud and Big Data.

ADDED VALUE

The project is finely attuned to the ICT enterprises that are encouraged to propose their own Use Cases. The technologies are then implemented and demonstrated on this basis in order to validate their level of maturity and their accuracy in view of practical requirements in the field. Enterprises can then integrate these technologies with better confidence. They can also rely on CETIC and their partners to support and reduce the time-to-market of their products.

■ SOFTWARE CERTIFICATION ■ SOFTWARE PROCESS QUALITY ■ STANDARD ■ SOFT DEV EFFORT ESTIMATION ■ SOURCE CODE ANALYSIS ■ COMPUTER SECURITY AND TRUST ■ SAFETY ■ SOFTWARE SERVICES TECHNOLOGIES ■ EMBEDDED & COMMUNICATING SYSTEMS ■ SOFTWARE AND SYSTEM ENGINEERING ■ EMBEDDED SYSTEMS ■ SEARCH ENGINE AND INDEXING ■ SEMANTIC TECHNOLOGIES

Partners:	UNAMUR-PRECISE, CRIDS, Cenaero, UMONS - Pôle TI, UCL-ICTEAM, UCL-INGI, ULB-BEAMS
Type of project:	Structural funds in Wallonia - Convergence programs
CETIC budget:	€7,131,576
Start date:	1 July 2007
Duration:	2008-2014
Contact:	philippe.drugmand@cetic.be

CENTER OF EXPERTISE IN OPEN SOURCE SOFTWARE

More and more IT solutions are using open source software at some stage. However, the path to successful adoption is not straightforward due to technological, economic and licensing reasons. On the other side, there are also good practices emerging from open source communities that can suit the needs of local IT companies.

OBJECTIVES

The CELLAVI project supports the specific needs of companies that want to make business use of Open Source software. Indeed, more and more IT solutions are using open source software at some stage. Many companies are interested in open source, from both the technological and economic perspectives, but the path to successful adoption is not straightforward, as the Open Source paradigm involves new licensing schemes and requires that clear economic choices be made.

RESULTS

CELLAVI enables CETIC to develop the required expertise, aligned with local business needs. On the technological side, the project focuses on middleware and “frameworks”, as well as the IT infrastructure (software management, deployment, data management,...). The project also takes into account open formats and interoperability and emerging fields, such as open hardware and automated software analysis.

The project also operates a proof-of-concept software forge tailored to the needs of typical SMEs, called Pallavi.

As regards dissemination, contributions are made to events, such as Les Jeudis du Libre and the Rencontres Mondiales du Logiciel Libre.

ADDED VALUE

CELLAVI allows companies to assess the potential benefits of free software, including the technical economic and legal aspects.

The experience gained from operating a forge suited to the needs of SMEs has drawn significant interest from companies inspiring them to enhance their development and collaboration processes. CETIC can also provide software quality insurance, based on open source tools and methodologies.

■ OPEN SOURCE ■ STANDARDS ■ METHODOLOGIES ■ SOFTWARE SERVICES TECHNOLOGIES ■ SOFTWARE AND SYSTEM ENGINEERING

Partners:	CRIDS, Multitel
Type of project:	Structural funds in Wallonia - Convergence programs
CETIC budget:	€3,056,390
Start date:	1 July 2007
Duration:	2008-2014
Contact:	philippe.drugmand@cetic.be

GOCLOUD - HELPING SMES GO TO THE CLOUD

The goCloud project aims to help enterprises in the IT field benefit from Cloud Computing by allowing them to offer their solutions, more easily, faster and with reduced legal risks.

OBJECTIVES

SMEs in the IT sector should be able to exploit the opportunities offered by Cloud Computing in order to offer their online services faster, more efficiently and to a larger audience. However, use of the Cloud requires specific skills which are insufficiently mastered by SMEs. On the technological side, enterprises willing to put their software online, with a pay-per-use basis while maintaining levels of service, must gain expertise to adapt their software to the Cloud, handle lack of standardisation among Cloud providers, and manage Cloud infrastructures or platforms. On the legal side, lack of knowledge of the rights and obligations of the parties involved which results in legal uncertainty is slowing the adoption of the Cloud. The goCloud project aims to helps IT companies to handle the problem globally, in relation to both technical and legal aspects.

RESULTS

The project aims to guide enterprises at each step of their adoption of the Cloud and to help them build their own software toolbox for Cloud migration. To this goal, the project is defining a methodology, backed by tools, allowing to provide software, either new or legacy, more easily in SaaS mode, without imposing a specific technology.

ADDED VALUE

Tools and recommendations issued from the project will allow companies:

- to reduce uncertainty and risk by validating legal constraints both from software providers to their customers and on the link between the software provider and Infrastructure (IaaS) or platform (Paas) Cloud providers,
- to obtain a new revenue channel by efficiently adapting existing software for use on the Cloud,
- to increase productivity by preparing their software for automatic deployment on the Cloud,
- to increase reliability and availability of provided services by being able to automate management of redundant Cloud environments used to run their software.

■ SOFTWARE INDUSTRY ■ CLOUD COMPUTING ■ METHODOLOGIES
■ WEB SERVICES ■ SOFTWARE SERVICES TECHNOLOGIES

Partners:	CRIDS
Type of project:	Walloon programs - Collective Research
CETIC budget:	€413,029.40
Start date:	1 July 2013
Duration:	24 months
Contact:	stephane.mouton@cetic.be

A REQUIREMENT ENGINEERING TOOLKIT FOR EFFICIENT USER INTERFACE DESIGN

The QualiHM project aims to help UI developers design their user interfaces as dynamic and evolving prototypes integrating the collection, discussion and validation of UI related requirements. The resulting QualiHM toolkit also complies with essential consistency and usability criteria.

OBJECTIVES

An effective User Interface (UI) is a key success factor for interactive systems. Hence, particular attention should be paid to the UI design during the Requirement Engineering (RE) process. In this context, the QualiHM project aims to develop a LGPL3 and multi-platform toolkit for efficient UI Design. The toolkit deals with the limitations of the existing RE tools by supporting the description of requirements in different formats. In addition, QualiHM facilitates the UI design by transforming requirement formats from one to another, generating the UI code and providing feedback about the consistency and usability and of the UI.

RESULTS

The intensive collaboration of CETIC, LILAB and Defimedia, as industrial sponsor of the project, led to the development of the first version of the QualiHM toolkit. This version integrates several modules that enable:

- The description of requirements in different formats to ensure the completeness of UI requirements;
- The management of the traceability between these different requirements formats to strengthen the consistency of UI requirements;
- The evaluation of the quality of UIs by providing feedback regarding their aesthetics.

ADDED VALUE

The QualiHM toolkit ensures the completeness and consistency of UI requirements as well as the quality of the UI. It answers a need the majority of ICT enterprises faces, helping them to improve the quality of their requirements specifications and the resulting UIs. This project will have a significant impact as the User Interface is the most visible part of an application the end user faces.

The resulting tool, with its LGPL3 license, will help ICT enterprises to increase their competitiveness, and potentially avoid unnecessary complex combinations of non-interoperable tools.

■ MODEL DRIVEN ENGINEERING ■ USER INTERFACES
■ SOFTWARE DEVELOPMENT LIFE CYCLE ■ REQUIREMENTS ENGINEERING
■ SOFTWARE AND SYSTEM ENGINEERING

Partners:	UCL-LILab
Type of project:	Walloon programs - Collective Research
CETIC budget:	€421,590
Start date:	1 September 2012
Duration:	30 months
Contact:	mohamed.boukhebouze@cetic.be

MODEL-BASED CLOUD PLATFORM UPPERWARE

To avoid situations of vendor lock-in in Cloud Computing, PaaSage is developing a methodology and tools to support model-based development of software applications independently of the characteristics of the target Cloud infrastructures. It also offers support for their optimized deployment in a multi-Cloud environment.

OBJECTIVES

Currently, developers benefit from the savings derived from the use of Cloud Computing but are not able to take full advantage of its flexibility because, clouds, so far, work in silos. In this context, the developer's dream is "develop once, deploy many times on various Clouds". PaaSage will make this dream come true.

In order to fulfil this vision, the project aims to develop a modelling language, CAMEL, capable of describing the components of an application and the targets or constraints formulated by the developer for its deployment and execution. PaaSage is working on a dedicated platform offering the tools for the development and modelling of applications independently of cloud characteristics as well as the selection of an optimized multi-cloud deployment solution corresponding to the goals set (costs, availability, location of data,..). For optimized deployment across various Clouds, the platform will benefit from information gathered by the users, describing their own deployment scenarios.

RESULTS

The project will deliver an integrated platform, embedding the PaaSage methodology, language and tools. The first prototype will be released in October 2014. It will be under Open Source license and supported by a community of users.

ADDED VALUE

PaaSage will break the silos in which clouds are currently running. The platform will give the power back to the developers by offering tools for writing and describing applications that can run on various clouds without being rewritten and for deploying them optimally in cross-cloud scenarios. The platform will drastically increase flexibility and reduce costs of implementation and migration.

■ REQUIREMENTS ENGINEERING ■ DESIGN AND PROGRAMMING LANGUAGES ■ PROOF OF CONCEPT ■ CLOUD COMPUTING ■ WEB SERVICES ■ METHODOLOGIES

Partners:	HLRS, INRIA, ERCIM, Be.wan, FORTH, STFC, SINTEF, Flexiant, Sysfera, Evry, Lufthansa Systems, ASCS, GWDG
Type of project:	European Framework programs - FP7 - ICT
CETIC budget:	€694,960
Start date:	1 October 2012
Duration:	42 months
Contact:	stephane.waha@cetic.be

PROGRAMMING LARGE-SCALE HETEROGENEOUS INFRASTRUCTURES

POLCA project aims to develop a new approach to address programmability concerns in embedded systems and high-performance computing. Based on mathematical transformations, POLCA will defines annotations and develop a tool chain to transform source code efficient execution on the target architecture.

OBJECTIVES

Specialized processor and reconfigurable architectures such as FPGAs and networks of dataflow-based micro-kernels are difficult to program. However, no programming model or language fully answers the needs of developers. Hence, they usually mix different programming models or use specific frameworks that try to provide the necessary functionalities, but do so at the expense of performance.

With POLCA, a first attempt will be made to jointly address the programmability challenges of embedded and high-performance computing infrastructures. POLCA aims to develop a mathematically-based approach, coupled with a toolchain that supports the right compilation, deployment, and execution configuration on the target architecture optimally exploiting its heterogeneous resources.

RESULTS

Project started in September 2013 with a first focus on the elaboration of the mathematical foundations and the requirements for the targeted use cases. CETIC will build up on the results and experience acquired from the PSOPP project, to develop relevant use cases that can benefit from FPGA based parallelization and acceleration. Signal processing and bioinformatics applications are primarily foreseen.

ADDED VALUE

For CETIC, the development of POLCA approach is oriented toward improving the design process for complex and hybrid FPGA-based embedded systems. The benefits consist of a better design space exploration for those architectures, better management of the complexity and a quicker development cycle.

■ EMBEDDED SYSTEMS ■ FPGA ■ EMBEDDED & COMMUNICATING SYSTEMS ■ METHODOLOGIES

Partners:	University of Stuttgart, University of Ulm, MAXELER Technologies, University of Twente, Recore Systems, IMDEA Software Institute, Universidad Politécnica de Madrid
Type of project:	European Framework programs - FP7 - ICT
CETIC budget:	€710,015
Start date:	1 September 2013
Duration:	36 months
Contact:	lotfi.guedria@cetic.be

PROJECT PORTFOLIO

DeciWeb

TAKING BETTER DECISIONS WITH WEB DATA

DeciWeb aims at enhancing traditional Business Intelligence analyses by retrieving and integrating relevant data from the Web.

OBJECTIVES

Business intelligence (BI) is a discipline that provides support to decision-makers, based on the analysis of large datasets. This process can detect new trends, predict the emergence of new competitors or compare information from various data sources. These data sources are internal to the company, i.e. the data are produced, controlled and mastered internally. At the same time, data available on the web have dramatically increased and represent an interesting data source for companies to enrich their own data.

DECIWEB's objective is to propose an approach to allow companies to perform BI analyses such as Online Analytical Processing (OLAP) on corporate but also on external data sources available on the web.

RESULTS

The integration of web data into the corporate data warehouse is time and effort-consuming. To tackle this challenge, the proposed approach applies technologies of distributed databases to data warehousing, thus considering web data sources as part of the federation (i.e. combination).

CETIC produced a report on the state-of-the-art in the integration of web data inside corporate data warehouses. CETIC also designed a language to express the schema of this federated/augmented data warehouse.

ADDED VALUE

SMEs will be able to enhance their business intelligence in a simple and powerful way thanks to the service-oriented Cloud API developed by CETIC which facilitates the integration of web data into their business analyses.

■ SOFTWARE INDUSTRY ■ SOFTWARE SERVICES TECHNOLOGIES ■ BIG DATA ■ OPEN DATA ■ LINKED DATA ■ FUTURE INTERNET

Partners:	ULB, Universitat Politècnica de Catalunya
Type of project:	Walloon programs - Fisrt DoCA
CETIC budget:	€212,800
Start date:	1 January 2013
Duration:	24 months
Contact:	orlando.cassano@cetic.be

NAPLES

NEW AGILE PLATFORM FOR A LIFELONG ENGINEERING OF SOFTWARE

The NAPLES platform allows SMEs to standardise application development according to the international standard ISO 29110 through workflow-oriented software development.

OBJECTIVES

NAPLES promotes the standardisation of software development and project management through workflow-oriented software development, and allows SMEs to standardise their development according to ISO standards. The project increases awareness of the ISO 29110 standard and promotes its adoption through the implementation of workflow covering the standard's entry profile in an online platform.

RESULTS

- Integration of software engineering tools for project management and requirement management in the NAPLES platform;
- Implementation of workflow templates based on the ISO 29110 entry profile for execution by the Bonita Open Solution workflow engine;
- Implementation of a portal to provide information to different users according to their role in a given project. The portal also provides summarised information on project data via dashboards.

ADDED VALUE

In the software industry, SMEs have difficulty standardising their development process, owing to the complexity of the jargon and structure of the ISO standard on development life-cycle processes. As a result, SMEs cannot be officially recognised as companies providing good software in their field which therefore limits their growth potential.

The NAPLES platform helps SMEs to standardise their software development tasks according to the international standard ISO 29110 at a greatly reduced cost.

■ SOFTWARE INDUSTRY ■ DEVELOPMENT LIFECYCLE ■ SOFTWARE AND SYSTEM ENGINEERING ■ PROOF OF CONCEPT ■ SOFTWARE TOOLS AND ENVIRONMENTS

Partners:	UNAMUR-PRECISE, Océ Software Laboratories, Atos IT Solutions and Services
Type of project:	Competitiveness clusters - Technological Innovation Partnership
CETIC budget:	€606,338.25
Start date:	1 March 2010
Duration:	42 months
Contact:	jean-christophe.deprez@cetic.be

CALiPro

AUTOMATED CONFIGURATION OF SOFTWARE PRODUCT LINES

CALiPro aims to improve and automate the configuration phase of software product lines through the development of innovative tools, services and methods.

OBJECTIVES

Increasingly, software products are designed to include many variants, collectively constituting a software product line (SPL). In mass consumption products, this software flexibility has become necessary in order to achieve the level of customisation required to meet the needs of an ever more demanding market (e.g. ERPs, telecommunication services, e-business, e-government services, open source software, etc).

CALiPro is focusing on the improvement of the Application Engineering phase, which is the phase during which a product is assembled and configured from intermediary reusable components. There is a lack of tool support in that phase confirmed by several companies that have engaged in such an approach.

RESULTS

The CALiPro project produces a set of innovative tools, services and methods to provide support for modelling and reasoning on SPL of industrial size. The tooling is also supporting reasoning on any product line. More precisely:

- definition and formalisation of a TVL2 supporting key industrial features like cardinalities and richer types;
- support of the configuration process through efficient queries and verification checks across definition, filtering, propagation, validation, and explanation operations;
- definition of a generic solver interface and integration of powerful SMT solver implementing the above verification checks, based on experience acquired in collaboration with the CSAIL lab of MIT;
- validation on several case studies including a very large industrial problem in the electrical engineering domain.

ADDED VALUE

CALiPro contributes to the industrial adoption of product lines in the software domain but is not restricted to it as it mostly focuses on the design stage. It helps reducing the cost in engaging in a product line approach by providing faster return on investment through better and systematic reuse, faster time-to-market of product variants and more efficient quality control.

■ SOFTWARE INDUSTRY ■ SOFTWARE PRODUCT LINES ■ MODEL-DRIVEN ENGINEERING ■ SOFTWARE AND SYSTEM ENGINEERING

Partners:	UNAMUR-PRECISE, MIT
Type of project:	Walloon programs - First DoCA
CETIC budget:	€210,000
Start date:	1 January 2010
Duration:	48 months
Contact:	raphael.michel@cetic.be

eHealth for Citizens

ICT SERVING PATIENTS

In response to the ageing of society, the increase in chronic illnesses and the shortage of caregivers, this project is developing innovative IT-based services designed to respond to the needs of patients, healthcare professionals and IT providers in this sector.

OBJECTIVES

In response to the challenges posed by the evolution of healthcare, eHealth for Citizens project is aimed at designing and implementing a service-oriented platform capable of combining and supporting innovative eHealth services. The services designed during the project aim to improve the quality of life of patients at home. Several specific research topics are addressed by the project team: user Interface usability, dynamic service composition, data interoperability and security.

The designed technologies are integrated and being validated through pilot projects realized in collaboration with healthcare professionals.

RESULTS

In 2013, the focus was on finalizing the first pilot project started in 2012 and analysing its results. The first version of eHealth platform developed by CETIC integrates the following key features: health telemonitoring service with automatic alert generation, communication and entertainment services for elderly persons and specific decision support services for the Caregivers. The prototype is connected to Walloon Health Network (RSW) to enable easy and direct access to telemonitoring data by healthcare professionals.

The positive results of the pilot project allowed the CETIC team to design new components that will be added and tested in 2014.

ADDED VALUE

The technologies developed by this project can be used to build new and innovative eHealth applications. CETIC has also developed extensive experience in the creation of applications that call for multidisciplinary expertise: various profiles in the health sector, providers of technological solutions, etc.

■ EHEALTH ■ WEB SERVICES ■ SOFTWARE SERVICES TECHNOLOGIES ■ EMBEDDED & COMMUNICATING SYSTEMS ■ SOFTWARE AND SYSTEM ENGINEERING ■ STANDARDS ■ COMPUTER SECURITY AND TRUST

Partners:	UNAMUR-PRECISE, CRIDS, Immunehealth, UCL-ILSM
Type of project:	Structural funds in Wallonia - Convergence programs
CETIC budget:	€1,205,509
Start date:	27 October 2009
Duration:	2009-2015
Contact:	philippe.drugmand@cetic.be

PROJECT PORTFOLIO

DEVELOPMENT OF AN ELECTRONIC PATCH FOR GEOLOCATION AND FALL DETECTION OF PEOPLE WITH MENTAL DETERIORATION

The e-Patch project aims to study and develop an electronic patch equipped with long-range wireless communication allowing for geolocation and fall detection. E-Patch will be designed to improve the tele-monitoring of people with mental deterioration and to optimise their support in case of critical incidents like fall or loss.

OBJECTIVES

In the current context of an ageing population with an increase of the number of people with mental deterioration (memory impairment, dementia, Alzheimer's disease, cognitive disorders, etc.), the need is more and more stressed for monitoring and supporting services with appropriate handling of the specific demands of this category of persons.

To address this problem, the e-Patch project aims to provide an innovative technological tool consisting of an intelligent electronic patch that can detect falls reliably, locate the wearer and then provide remote and automatic messaging for quick and effective support to the affected person.

RESULTS

The project partners are designing an electronic patch, optimizing the resource usage - lowest cost, lowest electric consumption -, and providing the best comfort for the wearer. To achieve these goals, flexible printed circuits are used. The project also focuses on integrating electronics in a medical grade patch, and solving the corresponding manufacturing issues. A proof of concept is currently being tested.

CETIC is primarily responsible for the design and prototyping of the electronic component of the patch.

ADDED VALUE

CETIC ensures technology transfer to the industrial partners of the project that will further push the project results through the industrialization and commercialization of the prototype. An advisory committee, made up of health professionals and industrials has been established to oversee the research.

The project will also help CETIC deepen its expertise in design of Ultra Low-Power embedded systems which will apply and benefit to many application domains beyond the project.

■ EHEALTH ■ EMBEDDED & COMMUNICATING SYSTEMS ■ ELECTRONIC DESIGN ■ EMBEDDED SYSTEMS ■ ULTRA LOW POWER ■ WIRELESS TECHNOLOGIES

Partners:	Nomics, Centexbel, Sioen
Type of project:	Competitiveness clusters - MecaTech
CETIC budget:	€325,469
Start date:	1 March 2013
Duration:	2013-2016
Contact:	lotfi.guedria@cetic.be

PATIENT DOSIMETRY EBOOK

DAPCARE is aimed at developing the Patient Dosimetry eBook, a standardised solution for archiving and sharing dosimetric data for patients receiving medical ionising radiation delivered in various departments of healthcare institutions.

OBJECTIVES

As medical practices frequently use ionising radiation for diagnostic and therapeutic purposes, this project is developing tools for collecting, archiving and optimising patient dosimetry data. The goals are to propose practical solutions to specific problems encountered in the radiation protection domain and to promote the exchange of standardised data.

While the safety of healthcare professionals exposed to the dangers of ionizing radiation has long since been regulated, the monitoring of patient dosimetry is still in its infancy and is an emerging problem due to the rapid development of medical imaging techniques.

RESULTS

The software solution produced by CETIC embodies the following key features; a state-of-the-art dosimetric data exchange to enable access to dosimetry harvested locally at individual institutions and those stored at other institutions via web services and a comparative analysis of Belgian and French and international standards, KMEHR-Bis and IHE-REM and DICOM RDSR (Radiation Dose Structured Report) respectively. Hospital practices for managing dosimetric data have also been collected and analysed in the light of these standards, to identify shortcomings with the aim of improving the interoperability of dosimetric data within Belgium and France. For Belgium, the software necessary to manage dosimetries and an application server exchange between sites to integrate the standards and technologies in Walloon Health Network, is being implemented. For France, the Patient Dosimetry eBook will be used to exchange patient dosimetric data.

ADDED VALUE

The DAPCare software for healthcare institutions enables the exchange of standardised patient dosimetry at both national and international levels.

■ EHEALTH ■ SEMANTIC TECHNOLOGIES ■ STANDARD ■ EMBEDDED & COMMUNICATING SYSTEMS ■ SOFTWARE AND SYSTEM ENGINEERING

Partners:	Centre Oscar Lambret, CIGES, CCML, CHBM, ISLOG
Type of project:	International programs - ERANET - LEAD ERA
CETIC budget:	€164,394
Start date:	1 October 2011
Duration:	36 months
Contact:	annick.majchrowski@cetic.be

SUPPORT PATIENTS THROUGH E-SERVICE SOLUTIONS

SUPPORT PATIENTS THROUGH E-SERVICE SOLUTIONS

SPES aims at transferring the approach and results achieved in the implementation of OLDES project to support patients from four European locations through e-service solutions, especially tailored to manage respiratory problems, dementia, handicapped people and social exclusion.

OBJECTIVES

For people who already encounter difficulties in their daily life (cognitive, functional, financial,…), the evolution of Information and Communication Technologies (ICT) may initially appear as a contributing factor to their isolation. However, these technologies can also enable them to increase their autonomy and social interaction and to safely stay as long as possible in their familiar environment.

The objective of the OLDES project was to develop and evaluate a tele-care and entertainment platform prototype involving patients and their caregivers. SPES has also allowed to transfer and extend the results achieved in OLDES.

SPES was designed around four pilots: the province of Ferrara (Italy), the city of Vienna (Austria), the city of Brno (Czech Republic) and the city of Kosice (Slovakia), focusing respectively on the following: respiratory problems, dementia, handicapped people and social exclusion.

RESULTS

CETIC has specified, designed and developed the SPES platform prototype. This mainly consists of an intuitive software solution for the patients of the different target groups that can be used on a touch screen computer, a classical laptop or a tablet. The SPES platform also includes a web portal to enable the patients' monitoring by their caregivers (physicians, social workers in day-care centers,…).

The positive patient feedback was a major result of the project. In addition, some services, like the geo-location and tracking by authorized operators of seniors with dementia, will continue to be used and evolve following the end of the project.

ADDED VALUE

Telemedicine favours the emergence of a new market of healthcare service providers that can support the delivery of health and social care at home. SPES has demonstrated ICT-based solutions that are replicable and generalizable by other actors.

The involvement of CETIC allows one to transfer these results to Wallonia where telemedicine and eHealth are also emerging: this field is open to innovative enterprises proposing adapted solutions that are an answer to the economic pressure on the healthcare costs.

■ EHEALTH ■ SOFTWARE SERVICES TECHNOLOGIES ■ EMBEDDED & COMMUNICATING SYSTEM ■ SOFTWARE AND SYSTEM ENGINEERING ■ EMBEDDED SYSTEMS ■ WIRELESS TECHNOLOGIES ■ WEB SERVICES

Partners:	ENEA, CVUT, CUP 2000, AUSL, Universität Wien, Kosice, Technical University of Košice, ProDeep, Provincia di Ferrara, Vienna Social Fund
Type of project:	European Framework programs - Central Europe
CETIC budget:	€275,875
Start date:	1 April 2011
Duration:	39 months
Contact:	valery.ramon@cetic.be

PIPAS

ADAPTATIVE PILOTING OF HOSPITAL PROCESSES

The PIPAS project aims at developing a software solution to help in modelling, piloting and supervising healthcare processes for treating patients, in the area of cancer care.

OBJECTIVES

The hospital world is facing increasing challenges regarding care quality, notably in the cancer domain, where patients suffering from multiples pathologies have to follow complex treatments, and rely on shared infrastructure. The modelling of clinical pathways is increasingly used to explicit the key steps of those treatments and contribute to answer their inherent challenges.

The objective of the project is to support the implementation of process management systems for driving clinical pathways, and overcome the limitations of current systems. Current systems are based on imperative workflows which are unable to take into account the interferences between workflows. The proposed approach is based on mixed imperative-declarative models, operators enabling the engineering of complex workflows and tools for the optimal process enactment wrt. declarative constraints such as timing constraints.

RESULTS

PIPAS project produced a toolset supporting:

- the definition definition of imperative and declarative models of care processes;
- the execution of models to pilot the care team and manage resource conflicts occurring at runtime, based on the OscaR.CBLS engine;
- The monitoring of executing processes using indicators derived from the model and dashboards views.

ADDED VALUE

The produced software meets real needs faced by hospitals to ensure care quality with limited resources and clinical processes growing in number and complexity.

The principles and tool developed by PIPAS for piloting hospital processes and clinical pathways can be exploited by medical software editors addressing this domain or directly by large hospitals which are managing the integration of IT innovation themselves.

The underlying principles are reusable by hospitals managing their IT infrastructure and support themselves, as well as by broader workflow management system editors.

■ EHEALTH ■ OPTIMISATION DE SYSTÈMES COMPLEXES ■ MODEL-DRIVEN ENGINEERING ■ SOFTWARE AND SYSTEM ENGINEERING

Partners:	UCL-INGI, Centre du Cancer
Type of project:	Walloon programs – WIST 3.0
CETIC budget:	€274,505
Start date:	1 April 2011
Duration:	41 months
Contact:	christophe.ponsard@cetic.be

AUTOMATIC MONITORING OF ACTIVITIES USING CONTACTLESS SENSORS

AMACS in an EraSME project whose goal is to develop and evaluate in real-life situations an ICT-based system that can automatically monitor the activities of daily living (ADLs) (sleeping, cooking, making a phone call,…) of elderly people living alone at home.

OBJECTIVES

AMACS develops and evaluates in real-life situations an ICT-based system that can automatically monitor the activities of daily living (ADLs) of elderly people living alone at home. Some examples of such activities are: sleeping, cooking, making a phone call, visiting the toilets, washing… The monitoring is based on measurements of various contactless sensors that are installed in the elderly person's home environment: home security sensors (presence or motion detectors), sensors that measure the consumption of public utilities (electricity, water, gas) and video cameras. The goal of this project is to allow elderly people presenting age-related risks or pathologies (e.g. risk of fall, cognitive decline) to remain safely in their home environment for as long as possible.

RESULTS

Together with the other Walloon partners, CETIC is in charge of the definition, design and development of the exchange platform which collects the information about ADLs and changes in seniors' behaviour and adequately communicates this information to the senior citizens, their medical records and their caregivers (including the general practitioner and the visiting nurse). They also implement the adaptations of software solutions used by the general practitioner and the nurse to take into account this extra information.

The prototype is evaluated in real-life situations, i.e. based on the measurements done in the living quarters of a few senior citizens.

ADDED VALUE

The project results can be of interest for companies providing ICT services in the healthcare sector and in particular those proposing health telemonitoring systems.

■ EHEALTH ■ EMBEDDED & COMMUNICATING SYSTEMS ■ WIRELESS TECHNOLOGIES ■ STANDARDS ■ LINKED DATA

Partners:	Smolinfo, PCsol, Intersysto, KHK-Mobilab, Fontys, WENK, KU Leuven
Type of project:	International programs – ERANET - ERA-SME
CETIC budget:	€149,800
Start date:	1 October 2010
Duration:	33 months
Contact:	philippe.drugmand@cetic.be

EFFICIENT PATIENT RECRUITMENT FOR INNOVATIVE CLINICAL TRIALS OF EXISTING DRUGS TO OTHER INDICATIONS

PONTE supports the entire clinical trial process, so that it is easier to create a research hypothesis, define the protocol and select the right patients. As a result, the public has quicker access to better, safer and cheaper drugs.

OBJECTIVES

PONTE is aiming to develop a Service Oriented Architecture (SOA) and Semantics Web platform for the identification of patients for clinical trials dedicated to drug repositioning. The solution had to mitigate safety risks and improves clinical trial costs and efficiency. CETIC has contributed to standardisation, Semantic Web research and development, security, and the SOA. CETIC was also the project coordinator.

RESULTS

The PONTE outcomes cover the clinical trial design process, as well as patient recruitment from many hospitals and the results of active investigation and implementation of security and legislative requirements for patient health. The design is supported by a semantic search engine that retrieves information from the clinical literature and from linked data (and Open Data), uses an online authoring tool capable of identifying suitable patients and provides decision support to clinical investigators.

ADDED VALUE

The health and pharmaceutical industries are searching for ways to improve clinical trial design in terms of cost, time and patient safety. Semantic Web concepts, carefully integrated into applications designed in close collaboration with domain experts, are helping to improve the efficiency of clinical trial design.

■ EHEALTH ■ COMPUTER SECURITY AND TRUST ■ SEMANTICS ■ SOFTWARE SERVICES TECHNOLOGIES ■ SOFTWARE AND SYSTEM ENGINEERING

Partners:	CNR, NTUA-ICCS, TUDresden, LSMU, CUH, NKUA, LUH
Type of project:	European Framework programs - FP7 - ICT
CETIC budget:	€694,875
Start date:	1 March 2010
Duration:	36 months
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NweRIDE we share

NORTH-WEST EUROPE DYNAMIC RIDESHARING

Today, carpooling platforms have a very tight supply in terms of information, number of users and journeys, especially across borders. NweRIDE proposes to improve the adoption of carpooling via an exchange platform for carpool operators.

OBJECTIVES

NweRIDE aims to interconnect carpool and public transport operators in order to increase the relevance of carpooling offers, hence promoting ridesharing. This interconnection is done thanks to an IT platform that is focused on dynamic carpooling, i.e. for non-scheduled trips, especially for cross-border journeys (Netherlands, Belgium, UK, France, Germany).

RESULTS

CETIC implements the interconnection platform using the RDEX standard. This standard enables carpooling systems to share carpooling offers in a secure way via Web services.

CETIC also participates in the development of high value-added services using semantic web data sources promoting Open Data.

Finally, CETIC leads a pilot project that aims to foster carpooling among companies located in the same business park thanks to the sharing of their business events agendas.

ADDED VALUE

The project aims to offer a new one-stop-shop solution for carpooling based on mobile technologies, using web data sources, able to adapt itself to the users needs, updated in real time, and able to offer alternatives based on public transport when needed.

The expertise acquired during the project will allow CETIC to better support SMEs as regards advanced problems related to the interconnection of web-based IT systems, in order to provide new value-added services.

■ TRANSPORT ■ WEB SERVICES ■ OPEN DATA ■ LINKED DATA ■ SEMANTIC TECHNOLOGIES ■ BIG DATA ■ SOFTWARE SERVICES TECHNOLOGIES ■ EMBEDDED & COMMUNICATING SYSTEM

Partners:	VIM, SESTran, Sellmark, Stellwerk, Taxistop, Staffordshire County Council
Type of project:	International programs – InterReg IV B NWE
CETIC budget:	€279,099
Start date:	28 June 2013
Duration:	27 months
Contact:	frederic.fleurialmonfils@cetic.be

NUMERICANAL

USING TECHNOLOGY FOR MORE EFFICIENT MANAGEMENT OF INLAND WATERWAYS

The Numericanal project aims at connecting regional and national strengths, knowledge and experience of 7 organizations active in the field of ICT and waterways management to create a transnational strategy for the development of e-services along waterways.

OBJECTIVES

Numericanal aims at developing innovative approaches using ICT in order to improve sustainable modes of transport and tourism along waterways. The project will help to strengthen waterways management systems through use of ICT and e-services. In addition, the project will help strengthen the economic influence of the waterway within the territory. CETIC is the ICT partner of the project. Its role is to recommend, validate and coordinate the ICT solutions of the project.

RESULTS

Several ICT solutions will be developed during the project, including:

- A transnational framework in North West Europe in relation to mobile access and Internet connectivity in rural and urban areas;
- A series of model approaches for online services and information (geolocalisation of the place of interest, online booking...);
- A series of model approaches of Intelligent Transport Systems (management of the stopover and nautical ports, management of traffic and bottlenecks...);
- Local pilot actions to implement the above approaches and to increase the potential of commercial and leisure along the waterways, and waterways as a tourism destination.

ADDED VALUE

The project will provide innovative tools to effectively manage waterways while respecting their social, economic and environmental needs. These innovative tools will help strengthen the water-based economies of and water-side industries e.g. leisure, industry and therefore of local areas. In addition, the project will help to reinforce the boating potential and the tourism economy by offering innovative e-services along waterways.

The expertise acquired during the project will allow CETIC to better support SMEs to develop interconnected e-services that allow data exchange, especially in areas where communication technologies are less available.

■ TRANSPORT ■ TELECOMMUNICATIONS ■ REQUIREMENTS ENGINEERING ■ NETWORKS ■ WEB SERVICES ■ EMBEDDED & COMMUNICATING SYSTEMS

Partners:	Canal & River Trust, Voies Navigables de France, Gemeente Eijsden-Margraten, Midland Regional Authority, SRN, Gemeente Eindhoven
Type of project:	International programs – InterReg IV B NWE
CETIC budget:	€116,580
Start date:	28 June 2013
Duration:	35 months
Contact:	frederic.fleurialmonfils@cetic.be

LOCOTRAC

LOW-COST TRAIN AUTOMATIC CONTROL

Locotrac project aims to develop low-cost technologies to secure regional and local railway lines including mechanisms of ATP (Automated Train Protection). The project will integrate these new technologies into onboard products, track products and telecoms specially adapted to these lines.

OBJECTIVES

The project objectives are:

- Better understanding of the specific market needs of European regional and local railway lines (but also worldwide due to the standard ERTMS);
- The search for new system concepts that aim to meet their needs with a low cost LCC (Life Cycle Cost);
- Integration of new technologies (security architecture, localization technique, new telecom technology,...) in the specification and development of new products;
- Finding the highest level of compatibility with the ERTMS standard ensuring a level of interoperability between these lines and trunks;
- To prepare adequately the development of new standards, prerequisite to actually open market (harmonization of specifications and developed by European industrial solutions);
- Demonstrate these new concepts through a mock-up of the new systems, subsystems and produce a full-scale experiment on the railway site;
- To validate these new concepts by taking into account performance level, RAMS (Reliability, Availability, Maintainability, Safety) level and ERTMS interoperability level. The research undertaken by the CETIC in this project concerns software hardening. This technique makes possible to reach a high level of safety for software-executing security function.

RESULTS

Hardening algorithms have been specified and a development compatible with a critical use (SIL4) is under development.

ADDED VALUE

The hardening algorithms will allow ALSTOM to deliver low-cost equipments and so to increase his competitiveness on the international market.

■ TRANSPORT ■ SAFETY ■ SOFTWARE AND SYSTEM ENGINEERING

Partners:	UMONS, UCL-ICTEAM, Alstom, ACIC, Logiplus, CE+T, MITRA Innovations, Q3S, SEE, STIB, Infrabel
Type of project:	Competitiveness clusters - Logistics in Wallonia
CETIC budget:	€383,255
Start date:	1 April 2011
Duration:	48 months
Contact:	gautier.dallons@cetic.be

GIR
Gestion intégrée des risques

INTEGRATED RISK-MANAGEMENT OF SUPPLY CHAIN

The GIR project aims to provide an effective ICT solution to improve the security of hazardous goods transport. The software tool developed during the project will assist safety advisers in managing compliance with transport regulations and also exploiting information related to transported goods, the communication of which can be extremely useful in the event of an accident. This information will be communicated by modules embedded in transport containers.

OBJECTIVES

The massive volume of regulations applying to different means of transport of hazardous goods (road, rail, maritime, waterways) and various national adaptations and amendments to these regulations makes the tasks of safety advisers extremely difficult.

The main objective of the project is to assist safety advisers in their management of hazardous goods transport by automating protocols monitoring, conformity checking, reports generations, products compatibility verification, and critical events handling (accident).

CETIC is mainly responsible for developing the embedded alert module and its integration with the overall solution.

RESULTS

CETIC elaborated a survey on the embedded alert systems detailing their characteristics and respective usage context. In addition, a study on the traceability techniques applicable to hazardous goods transport was conducted with special focus on systems and solutions related to RFID technology.

In addition, the specifications of the embedded application were elaborated and a comparative analysis of various generic hardware platforms allowed the selection of the module to be used for the alert.

The development of the different building blocks of the alert system is in progress.

ADDED VALUE

The GIR solution will have a positive impact on work of the safety advisers responsible for ensuring compliance with regulations in companies which transport hazardous goods. The tool will help them to save time by automating tedious and human-error-prone tasks such as checking, monitoring, protocols validations, report generation, etc. The automatic alert module will also allow quicker response and better management of serious incidents like transport accidents.

■ TRANSPORT ■ EMBEDDED & COMMUNICATING SYSTEMS
■ EMBEDDED SYSTEMS

Partners:	Océ Software Laboratories, DN&T, PRAYON, SPRL Luc Beyers, Joassin sa, ULg - ANAST
Type of project:	Competitiveness clusters - Logistics in Wallonia
CETIC budget:	€321,572.22
Start date:	1 April 2012
Duration:	36 months
Contact:	lotfi.guedria@cetic.be

PROJECT PORTFOLIO

CONNECT TO ALL

The C2A project aims to design, develop and implement an intelligent interconnection system between embedded hybrid equipment in transport vehicles. The project goal is to optimize and extend the use of embedded resources which will allow for the composition of new innovative services.

OBJECTIVES

Various embedded equipment are becoming more and more numerous inside transport vehicles. Apart from mandatory devices such as the tachograph, various other equipment is available such as radio communication systems (GSM / GPRS), localisation devices (GPS), and a variety of miscellaneous tools and equipment for specific needs (data loggers, PC tablet, cameras, mobile phones, on-board computers, etc.). However the lack of interoperability results in duplication of services, redundancy of system features and sub-optimal utilization of available hardware and software resources.

The C2A project aims to develop a generic technology for interoperability ("intelligent communicating bus") allowing communication and resource sharing between embedded devices in the vehicle.

RESULTS

The project had two main components:

- R&D activities consisting of design, development and implementation of an embedded system prototype allowing connection and automatic recognition of a wide range of peripheral devices.
- A dissemination action of which the objective is to implement a structured communication involving both ICT services companies and transport and logistics operators around the R&D work in the project. The Proof-Of-Concept illustrated some of the innovative features of the system such us the automatic recognition of peripherals, the continuous monitoring of the status of available resources and the activation of simple services based on the gathered data.

ADDED VALUE

The ICT companies can develop new features and services by interfacing their solutions to the C2A system and accessing an extended data set. They could also implement their own services on top of C2A architecture or integrate the C2A building blocks into their own solutions. Companies and operators of transport and logistics field can deploy these new services and benefit from a flexible system easily adaptable and extensible.

■ TRANSPORT ■ EMBEDDED & COMMUNICATING SYSTEMS ■ EMBEDDED SYSTEMS

Partners:	Smolinfo, INFOPOLE Cluster TIC, Carinna, DOCledge, CRESTIC
Type of project:	International programs – Interreg IV-A FWVL
CETIC budget:	€327,000
Start date:	1 September 2008
Duration:	54 months
Contact:	lotfi.guedria@cetic.be

BEM - BUSINESS EVENT MANAGER

The BEM solution helps enterprises to minimise the fallout resulting from unexpected events, especially in the transportation and distribution sectors, thanks to an affordable yet optimised implementation of intelligent workflow management to solve complex problems and deal with unexpected situations.

OBJECTIVES

The goal of the BEM project is to develop and validate a new IT approach to manage unexpected events in the transportation and distribution sectors. Such events can deeply affect physical and organisational flows, requiring complex process re-alignment and re-optimisation to bring the system back into normal operation.

BEM proposes a process management solution built on top of state-of-the-art artificial intelligence engines and fitted with temporal coordination capabilities. The goal is to minimise the negative consequences of incidents and simplify flow management.

RESULTS

The BEM tool is deployable in logistic environments and integrates the following key elements:

- a process manager based on events and integrating temporal coordination aspects,
- the description of logistic processes using specific business rules,
- a method for describing the management of unexpected events.

For the project, CETIC notably produced a goal-oriented requirements analysis using the KAOS approach and the Objectiver tool, as well as a tool-supported methodology to describe the different processes, activities, events, exceptions and resources involved in a specific application domain. This methodology includes:

- a meta-model to structure this type of information,
- an interview template to discuss with stakeholders and capture this information, as well as specific business rules and constraints to consider,
- a tool support based on YAWL to facilitate the encoding and transmission of these specifications to the intelligent reasoning engine.

ADDED VALUE

BEM provides enterprises with:

- Minimal detrimental fall-out resulting from accidents,
- An affordable yet optimised implementation of intelligent workflow management to solve complex problems and deal with unexpected situations.

■ TRANSPORT ■ MODEL-DRIVEN ENGINEERING ■ SOFTWARE AND SYSTEM ENGINEERING

Partners:	Smolinfo, NSI, UNAMUR-EGES, UNAMUR-FOCUS, UNAMUR-SLC
Type of project:	Competitiveness clusters - Logistics in Wallonia
CETIC budget:	€274,850
Start date:	1 May 2010
Duration:	36 months
Contact:	ravi.ramdoyal@cetic.be

MIGRATING A WAREHOUSE MANAGEMENT SYSTEM SOFTWARE TOOL ONTO THE CLOUD

Industrial legacy software sometimes comes with responsiveness and availability constraints that is barely compatible with the cloud SaaS model. SaaS-WMS aims to demonstrate how such an application can be adapted to a cloud usage through a Warehouse Management Software usage case.

OBJECTIVES

INGRIF is releasing a warehouse management and supply chains software (WMS). Such software comes with response time and availability constraints, which could only be fulfilled by installing the computer server within the customer's infrastructure. However, user expectations have changed, and are turning towards online software in the cloud.

The project aims to demonstrate the technical feasibility of adapting such a demanding application into an SaaS mode. However, the Internet network comes with no guarantee about response time. The application will then be adapted to compensate for the lack of responsiveness guarantee, and its virtual infrastructure auto-adapts itself to keep the same performance level.

RESULTS

At the end of the project, our partner INGRIF will benefit from a software tool in SaaS mode so that cloud VMs can be automatically adjusted according to the workload while respecting responsiveness requirements. Meanwhile, CETIC will have implemented an infrastructure management and auto-adaptive framework. Moreover, CETIC will improve its methodology in assisting SMEs to port their software to the cloud, and will enhance its expertise in orchestration and optimization of services.

ADDED VALUE

Such a proof of concept responds to an actual demand:

- either because the solution aims to a new market, made of SMEs which are reluctant to invest in an overly expensive solution;
- or because it offers an answer to companies looking for a turnkey solution, freeing them from the constraints of IT management.

■ SOFTWARE INDUSTRY ■ CLOUD COMPUTING ■ SOFTWARE SERVICES TECHNOLOGIES

Partners:	Ingrif
Type of project:	Walloon programs - CWality
CETIC budget:	€127,226.80
Start date:	1 October 2013
Duration:	18 months
Contact:	stephane.mouton@cetic.be

I2MSteel

INTELLIGENT INTEGRATED MANUFACTURING FOR STEEL

To remain competitive, the European steel industry requires improvement of its processes. The project aims to develop a new paradigm where software agents, at each step of the steel manufacturing chain, negotiate between them and dynamically optimize production.

OBJECTIVES

A completely new paradigm of automation and information technology systems for intelligent and integrated manufacturing in steel production (I2MSteel) is envisioned to overcome the current production challenge, which is to combine the large variety of existing processes and plants into a single, highly interlinked process chain. The suggested solution is the application of holonic agent technology to build this new paradigm. A holonic agent is an autonomous and flexible computational system operating in a particular environment. Agents have 'social' abilities, allowing them to engage with other components through communication and coordination. Two other technologies are also required: a Service-Oriented Architecture (SOA) to create an underlying framework to provide the agents with all the necessary information; and semantic techniques (ontologies, in this case) to give the agents an 'understanding' of their environment and of the data coming from the SOA.

RESULTS

In I2MSteel, CETIC is identifying shortcomings in data exchanges and SOA deployment in an industrial environment, while exercising semantic skills in a new domain (the steel industry). The experience gained can be directly applied to help solve problems of local SMEs, especially subcontractors, in the industrial sector.

ADDED VALUE

In I2MSteel, CETIC is identifying shortcomings in data exchanges and SOA deployment in an industrial environment, while exercising semantic skills in a new domain (the steel industry). The experience gained can be directly applied to help solve problems of local IT companies, especially subcontractors, in the industrial sector.

■ SERVICE ORIENTED ARCHITECTURE ■ CLOUD COMPUTING ■ WEB SERVICES ■ SEMANTIC TECHNOLOGIES

Partners:	ArcelorMittal Research, Centro Sviluppo Materiali, BFI, Siemens, AIT
Type of project:	European Framework programs - RFCS
CETIC budget:	€412,886
Start date:	1 July 2012
Duration:	42 months
Contact:	stephane.mouton@cetic.be

ADAPTING SERVICE LIFECYCLE TOWARDS EFFICIENT CLOUDS

The ASCETIC project is focused on providing novel methods and tools to support software developers aiming to optimise energy efficiency and minimise the carbon footprint resulting from designing, developing, deploying, and running software in Clouds.

OBJECTIVES

The project has the following main objectives:

- Development of models for green and efficient software design, supporting sustainability and high quality of service levels;
- Development of methods for measuring, analysing, and evaluating energy use in software development and execution, complementing quality measures;
- Energy and quality efficiency integration into service construction, deployment, and operation leading to an Energy Efficiency Embedded Service Lifecycle.

RESULTS

ASCETIC will result in the implementation of an open-source Cloud stack providing energy efficiency at software, platform, and infrastructure levels. The project will provide incremental versions of its solution, with respect to energy efficiency, and demonstrate its use in two commercial use cases.

ADDED VALUE

ASCETIC results will enable software service providers to operate their services with a lower energy footprint. Transitively, this reduction will translate in cheaper operation costs. Furthermore, developers will benefit from the ASCETIC development environment plugins to produce software services with reduced energy needs while maintaining other quality services at the desired level.

■ ENERGY ■ CLOUD COMPUTING ■ SOURCE CODE ANALYSIS
■ SOFTWARE SERVICES TECHNOLOGIES

Partners:	Atos, TUBerlin, University of Leeds, HP, BSC, ATC, GPF, AUEB
Type of project:	European Framework programs - FP7 - ICT
CETIC budget:	€493,230
Start date:	1 October 2013
Duration:	36 months
Contact:	jean-christophe.deprez@cetic.be

A FLEXIBLE MIDDLEWARE FOR IPV6-BASED LOW-POWER EMBEDDED SYSTEMS

MidFlex aims to develop a middleware to facilitate the design and deployment of IPv6-based sensor network applications in the scope of the Internet of Things.

OBJECTIVES

This PhD thesis aims to provide a middleware harnessing the flexibility and configurability of underlying technologies and protocols to achieve end goals such as minimal energy consumption of a network, or the support for device mobility. Furthermore, in light of the Future Internet initiatives and the upcoming Internet of Things, this thesis has a strong focus on the interconnection of networked objects to the Internet and common consumer devices such as smartphones and tablets.

RESULTS

CETIC studies the implementation and deployment of WSN application based on technologies currently in standardisation, such as 6LoWPAN and RPL, IETF's IPv6 Routing Protocol for Low Power and Lossy Networks. These studies rely on three distinct test environments: a software time-accurate simulator for wireless sensor networks (COOJA), physical sensor platforms part of CETIC's Wireless Lab, and large-scale academic wireless sensor testbeds open for experimentation. In particular, tests on the SensLAB testbed of INRIA Lille and the TWIST testbed of TU-Berlin validated the stability of RPL and the embedded IPv6 stack of Contiki.

The middleware components were made available in the public domain, with CETIC as an enabler for technological transfer. It mainly concerns an implementation of a 6LoWPAN Border Router, the 6LBR component.

ADDED VALUE

This research project has a direct impact for local Walloon companies keen to integrate Internet of Things solutions in their products. As of today, CETIC's expertise is already guiding companies in design choices for sensor network hardware and software.

■ TELECOMMUNICATIONS ■ NETWORKS ■ INTERNET OF THINGS
■ EMBEDDED SYSTEMS

Partners:	SICS, IP Networking Lab
Type of project:	Walloon programs - Fisrt DoCA
CETIC budget:	€170,240
Start date:	1 January 2011
Duration:	48 months
Contact:	sebastien.dawans@cetic.be

PROJECT PORTFOLIO

SMARTER AIRBORNE TECHNOLOGIES

The SAT project is developing new technologies for aircraft and smarter airborne systems. This project puts CETIC at the forefront of innovative research to support incremental and recertification processes, with a view to reducing the high costs of complying with the safety-critical aeronautics standards.

OBJECTIVES

The goal of the SAT project, coordinated by Thales Communications Belgium, is to develop new technologies for smarter aircraft systems. The project is composed of five parts. CETIC is coordinating the Certif_2 sub-project which aims to improve certification following the critical embedded software standards RTCA DO-178B (or 178C) and equipment (RTCA DO-254) systems. The focus of research is on incremental certification in a product line context using models-oriented techniques both in terms of process and variability modelling.

RESULTS

CETIC's work is focused on coordination, requirements gathering, integration and validation of the Certif_2 sub-project. A process model of incremental certification was produced and articulated on three key aspects: a variability model, certification process workflow and safety objectives. A tool has been developed to effectively support the incremental certification process. It is deployable in both commercial and open source tool chains.

ADDED VALUE

Certification costs for enforcing safety standards applicable in aeronautics are very high and can increase development costs by up to 150%. Moreover, this extra cost does not decrease when the system needs to be recertified to address the needs of new clients. The incremental process proposed will help Walloon companies to develop efficient reuse strategies and result in substantial savings, in turn improving competitiveness and providing better access to key markets.

■ AEROSPACE ■ SOFTWARE CERTIFICATION ■ SOFTWARE PRODUCT LINES
■ STANDARD ■ SOFTWARE AND SYSTEM ENGINEERING

Partners:	UNAMUR-PRECISE, Multitel, UCL-ICTEAM, Thales Alenia Space, CISSOID, Thales Communications Belgium, M3 Systems Belgium, Gillam FEI, Dardenne, Barco Silex, ULg IPNAS
Type of project:	Competitiveness clusters - Skywin
CETIC budget:	€321,166
Start date:	1 September 2010
Duration:	48 months
Contact:	christophe.ponsard@cetic.be

LIVING LAB BY CREATIVE WALLONIA

The Creative Wallonia initiative places creativity and innovation at the heart of Wallonia's economic development. In this context, the Living Lab concept is a laboratory for open innovation. Beyond the simple validation of concepts by mere consumers for new products and services, the Living Lab is a place for the appropriation of new technologies and the emergence of new usage scenarios where users/citizens become actors and contributors.

OBJECTIVES

As part of the Creative Wallonia initiative, CETIC has been appointed to coordinate the implementation of two Living Lab pilot projects, the first of their kind in Wallonia.

The Living Lab places the user at the heart of the co-creation concept to design and develop products and/or innovative services in order to better meet society's needs and expectations.

RESULTS

The positive outcome from different Living Lab initiatives around the world led to a reflection on the value of implementing such dynamics in Wallonia and raise the region's innovation capacity.

In 2013, CETIC launched a call for proposals to fund two Living Lab pilot projects. These two pilots will be centred either on the eHealth theme or on the Open Domain one. On the one hand, eHealth is key to addressing Wallonia's upcoming societal challenges. The focus is on telemedicine, on technologies and process enhancing the autonomy of elderly people, and on the sharing of medical data. On the other hand, Open Domain aims at experimenting with usage scenarios for new standards, practices or innovative technologies.

ADDED VALUE

Through the deployment of the two Living Lab pilot projects, CETIC will enhance its expertise in open innovative technologies and co-creation methodologies. CETIC will ensure the knowledge transfer towards local businesses for integration of co-creative concepts and technological innovations into their process.

■ INNOVATION ■ PROOF OF CONCEPT

Type of project:	Walloon programs - Creative Wallonia
CETIC budget:	€1,250,000
Start date:	1 January 2013
Duration:	2013-2016
Contact:	berengere.fally@cetic.be