

# ANNUAL REPORT

**o**ccetic

Your Connection to **ICT** Research

2010

**CENTRE OF EXCELLENCE IN INFORMATION  
AND COMMUNICATION TECHNOLOGIES**

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# ABOUT CETIC

## CETIC at a Glance

**CETIC is a Belgian ICT applied research centre dedicated to supporting industry by providing expertise in software engineering, innovative service-oriented technologies and embedded systems.**

**This expertise has been gained through CETIC's active involvement in Walloon and European projects for research and technological development.**

**Investing in leading sectors, such as eHealth, cloud computing, open source, security, transport/logistics, wireless and semantics, CETIC develops partnerships with technological leaders and European industries, and accelerates this technological transfer to local Belgian businesses.**

**In addition to partnerships in collective research projects, CETIC supports industries in their quest to create innovative products, providing technological advice, prototype development and feasibility studies. To strengthen the Walloon Region's competitiveness and leadership, CETIC stimulates research, offering IT support to businesses to enable them to adopt advanced technologies, innovate faster, save time and money, and respond to new demands.**

**This annual report covers CETIC's activities and achievements in 2010 through the many projects and business-support missions driven by CETIC experts.**







# About CETIC

## MEMBERS AND ORGANISATION

CETIC is a non-profit organisation (ASBL under Belgian law), established at B-6041 Charleroi, Rue des Frères Wright 29/3, and composed of the following members:

Four corporate bodies:

- Technology Industry Federation, Agoria
- Facultés Universitaires Notre-Dame de la Paix de Namur (FUNDP)
- Université catholique de Louvain (UCL)
- Faculté Polytechnique at the Université de Mons (UMONS)

Fourteen physical bodies:

- Mr Bernard Bolle, Siemens IT Solutions and Services sa
- Mr Claude Cambier, Unisys Belgium
- Mr Philippe Fortemps, Professor, Faculté Polytechnique at UMONS
- Mr Naji Habra, Professor, FUNDP
- Mr Jean-Luc Hainaut, Professor, FUNDP
- Mr Benoît Hucq, Océ Software Laboratories Namur sa
- Mr Roland Keunings, UCL
- Mr Jean-Didier Legat, Professor, UCL
- Mr Benoît Macq, Professor, UCL
- Mr Roger Malchair, Evadix.Net sa
- Mr Pierre Manneback, Professor, Faculté Polytechnique at UMONS
- Mrs Nicole Moguilevsky, Research Administration, FUNDP
- Mr Daniel Tuytens, Professor, Faculté Polytechnique at UMONS
- Mr Christian Verdonck, BizzDev sa

Members of the association have met on the following occasions:

- In statutory General Assembly on June 15, 2010, to approve the 2009 annual accounts.
- In extraordinary General Assembly on December 14, 2010, to approve the 2011 annual budget.

## BOARD OF ADMINISTRATORS

Since December 31, 2010, CETIC's Board of Administrators has been composed of:

- Mr Bernard Bolle, Siemens IT Solutions and Services sa
- Mr Serge Boucher, Faculté Polytechnique at UMONS
- Mr Claude Cambier, Unisys Belgium
- Mr Patrick Donnay, Haulogy sa
- **Mr Marc Durvaux, Thales Alenia Space – President**
- Mr Jean-Luc Hainaut, FUNDP
- Mr Benoît Hucq, Océ Software Laboratories Namur sa
- Mr Jean-Didier Legat, UCL
- Mr Benoît Macq, UCL
- Mr Roger Malchair, Evadix.Net sa
- **Mr Pierre Manneback, Faculté Polytechnique at UMONS – Treasurer and Secretary**
- Mr Lucyan Papiernik, IGRETEC
- Mr Michel Scheuer, FUNDP (replaced by Mr Yves Pouillet)
- Mr Olivier Verbeke, Whatever sa
- Mr Christian Verdonck, BizzDev sa

Mr Pierre Villers, DGO6, is the observing member, appointed by the Walloon Region, on the Board of Administrators and in the General Assembly.

Mr Simon Alexandre is the General Manager, appointed by the Board of Administrators.

## TECHNICAL COMMITTEE

The research decree published on July 3, 2008, defines the conditions and modalities for Walloon Research Centre accreditation. It states the Research Centre mission, which is to perform general industrial research that can be transferred to industry according to expressed needs and specificities.

In particular, the decree mandates that the Research Centre conducts collaborative industrial research that is general enough to be of interest to companies with similar requirements.

The Centre's areas of research are determined by these needs, coupled with the typology of the Walloon Region, under the guidance of a technical committee composed primarily of representatives of corporations and industries.

In order to align research activities with industry needs, the Research Centre has set up a permanent Technical Committee in charge of validating the R&D strategy. The CETIC Technical Committee is composed of:

- Mr Simon Alexandre, General Manager, CETIC
- Mr Thierry Bingen, Haulogy
- Mr Jean-Louis Bolsée, Thales Alenia Space ETCA
- Mr Patrick Crasson, Sun Microsystems
- Mr Laurent Cuvelier, Thales Alenia Space ETCA
- Mr Michaël Demeyere, AGC
- Mr Jean-Christophe Deprez, Scientific Coordinator, CETIC
- Mr Pascal DeVincenzo, Open Engineering
- Mr Denis Flandre, UCL – Dice

- Mr Naji Habra, FUNDP
- Mr Jean-Luc Hainaut, FUNDP
- Mr Patrick Heymans, FUNDP
- Mr Benoit Hucq, Océ Software Laboratories Namur sa
- Mr Christian Huvelle, Siemens IT Solutions and Services sa
- Mr Pierre Leclercq, Microsoft Innovation Center
- **Mr Jean-Didier Legat, UCL – President**
- Mr Alain Leroy, Pentacle
- Mr Philippe Mack, Pepite
- Mr Benoit Macq, UCL – Tele
- Mr Pierre Manneback, Faculté Polytechnique at UMONS
- Mr Philippe Massonet, Scientific Coordinator, CETIC
- Mr Kim Mens, UCL – INGI
- Mr Yves Moulart, ST Microelectronics
- Mr Dominique Orban, REVER sa
- Mr Emmanuel Ottevaere, BizzDev
- Mr Frederic Peters, DTI
- Mr Etienne Pourbaix, Thales Communications Belgium
- Mr Frédéric Robert, ULB
- Mr Bruno Schroder, Microsoft
- Mr Daniel Tuytens, Faculté Polytechnique at UMONS
- Mr Luc Vandendorpe, UCL
- Mr Christian Vanhuffel, Agoria ICT
- Mr Axel van Lamsweerde, UCL

The mission and objectives of the Technical Committee are to:

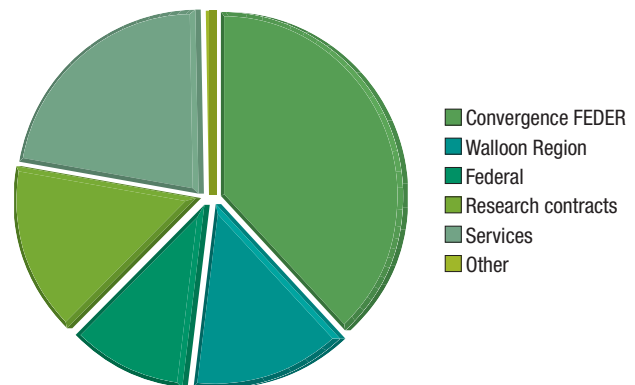
- Advise the Board of Administrators and the General Manager on the scientific and technological objectives to be developed according to the sectors' needs. The Committee works at the request of the General Manager, in particular for developing or updating CETIC's strategic plan.
- Evaluate, on request of the Board or the General Manager, proposals for new research directions. If relevant, the Committee proposes new business opportunities and/or research projects consistent with CETIC's scientific and technological orientations.
- Support CETIC in its continuous effort to remain an independent and internationally recognised applied research centre in ICT.
- Advise CETIC management on research exploitation opportunities for CETIC projects that are ongoing or likely to be initiated.
- Report annually to the CETIC Board of Administrators on its work and scientific achievements.

## KEY FIGURES

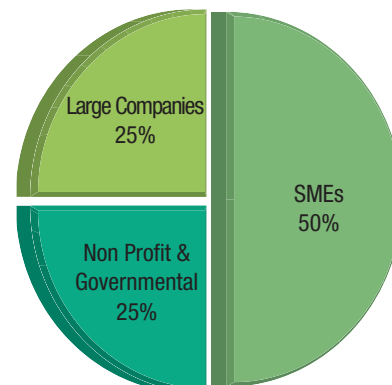
CETIC funding sources are:

- The subsidies granted by the Convergence Objective in Hainaut through two research conventions co-financed by the European Regional Development Fund (FEDER), two convention facilities and a recovery convention also co-financed by FEDER, all of which are co-financed by the Walloon Region.
- The subsidies granted by the Walloon Region in connection with the financing of the technological "guidance" cell, which co-funds Sixth Framework Programme projects and collective research.
- The turnover arising from collaborative research contracts; for example, through the Seventh Framework Programme.
- The turnover arising from research contracts and from services to third parties through the use of research results.

The distribution of CETIC's financial resources is well balanced, and the rate of CETIC's self-funding is maintained above the 50% level prescribed by the Walloon Region.



R&D activities and services offered by CETIC to industry specifically target Walloon SMEs.



# About CETIC

## HUMAN RESOURCES

In 2010, CETIC hired several new researchers to work on innovative technologies, bringing the number of employees to 41 (5 women, 36 men), divided into three departments:

- Embedded and Communication Systems
- Software and Services Technologies
- Software and System Engineering

### GENERAL MANAGEMENT

Simon ALEXANDRE

### SCIENTIFIC MANAGEMENT

Philippe MASSONET  
Jean-Christophe DEPRez

### ADMIN & FINANCES

Laurence LEPIED  
Pierre ROMAIN  
Corentine BIRON

### COMMUNICATION

Béregnère FALLY  
Corentine BIRON

### BUSINESS DEVELOPMENT MANAGEMENT

Michel VAN DER STRAETEN  
Olivier VAN DE WERVE

### IT ADMINISTRATION

Stéphane MOUTON  
Dimitri DIAKODIMITRIS  
Etienne CHARLIER

### QUALITY MANAGEMENT

Frédéric FLEURIAL MONFILS  
Mathieu DELEHAYE

### SOFTWARE & SYSTEM ENGINEERING DEPARTMENT

Christophe PONSARD

#### SOFTWARE QUALITY

Frédéric FLEURIAL MONFILS  
Annick MAJCHROWSKI  
Sanae SAADAoui  
Nicolas DEVOS  
Mathieu DELEHAYE  
Jacques FLAMAND

#### MODELING, CERTIFICATION & SECURITY

Gautier DALLONS  
Arnaud MICHOT  
Syed NAQVI  
Renaud DE LANDTSHEER  
Raphaël MICHEL

SOFTWARE ENGINEERING LAB

### SOFTWARE & SERVICES TECHNOLOGIES DEPARTMENT

Damien HUBAUX

#### SOA

Stéphane MOUTON  
Etienne CHARLIER  
Orlando CASSANO  
Fabian STEELS

#### OPEN SOURCE SOFTWARE TECHNOLOGIES

Sébastien ROUSSEAU  
Michaël VAN DE BORNE  
Robert VISEUR  
Dimitri DIAKODIMITRIS

#### INTELLIGENT CONTENT & SEMANTICS

Sébastien ROUSSEAU  
Fabrice ESTIEVENART  
Joseph ROUMIER  
Nikolaos MATSKANIS

COMPUTING CENTRE

### EMBEDDED & COMMUNICATION SYSTEMS DEPARTMENT

Philippe DRUGMAND

#### EMBEDDED SYSTEMS PROTOTYPING

Lotfi GUEDRIA  
Gérard FLORENCE  
Mathieu OCAÑA  
Sébastien DAWANS

#### EMBEDDED SOFTWARE

Valéry RAMON  
Jonas SIMON  
Jimmy NSENGA

WIRELESS LAB



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## QUALITY POLICY

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### ISO 9001 CERTIFICATION

In September, 2010, CETIC obtained ISO 9001 certification. Following the implementation of its quality management system, CETIC was awarded this certification by SGS.

The certified activities cover business support for the realisation of service missions, as well as the set-up, follow-up and management of R&D projects.



ISO 9001 is a standard recognised worldwide, which details the basic requirements with which a company's quality management system (QMS) must be compliant. If these requirements are met in full, the quality of the processes set by this company is guaranteed, constituting a proof of trust.

### CETIC QUALITY POLICY

CETIC's mission is to make companies in the Walloon Region more efficient and more competitive by helping them integrate ICT into their products and services quickly and effectively.

To ensure the satisfaction of all its partners (companies, universities and public organisations), CETIC aspires to practice 'operational excellence'.

CETIC is committed to:

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

This commitment applies to all the research projects that CETIC leads with and for companies, as well as to the management of these research projects and the organisation of CETIC's long-term development.

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## CETIC VALUES

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Prompted by its commitment to operational excellence, CETIC maintains a set of values that enables it to achieve a high level of partner and customer satisfaction.

### RESPECT FOR THE CUSTOMER

CETIC employees make the quality of partner reception a point of honour. They understand client needs, providing the solutions best tailored to meet those needs, and offering clients an honest and user-friendly relationship. Thanks to its status as a private, non-profit SME, 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.

### TECHNOLOGICAL 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 CETIC chooses.

### A HIGH LEVEL OF QUALITY

CETIC applies its expertise to achieve the highest level of software quality to yield maximum benefit. Thanks to the close ties between research teams, CETIC maintains control of all phases of a project.

### REGIONAL COMMITMENT

CETIC actively contributes to the development of the Walloon Region by supporting and stimulating innovation in the local economy, especially in SMEs. CETIC's research orientations are validated by the Technical Committee, which, because it is made up primarily of businesses, ensures that the required competencies are in place to meet the needs of regional industries.

### NATIONAL AND INTERNATIONAL VISIBILITY

Thanks to its scientific and technological expertise, its ability to forge collaborations and its excellent results, CETIC serves as a reference, both nationally and internationally. This is evident in the many projects to which CETIC contributes, as well as in the numerous scientific reports it publishes about its projects.

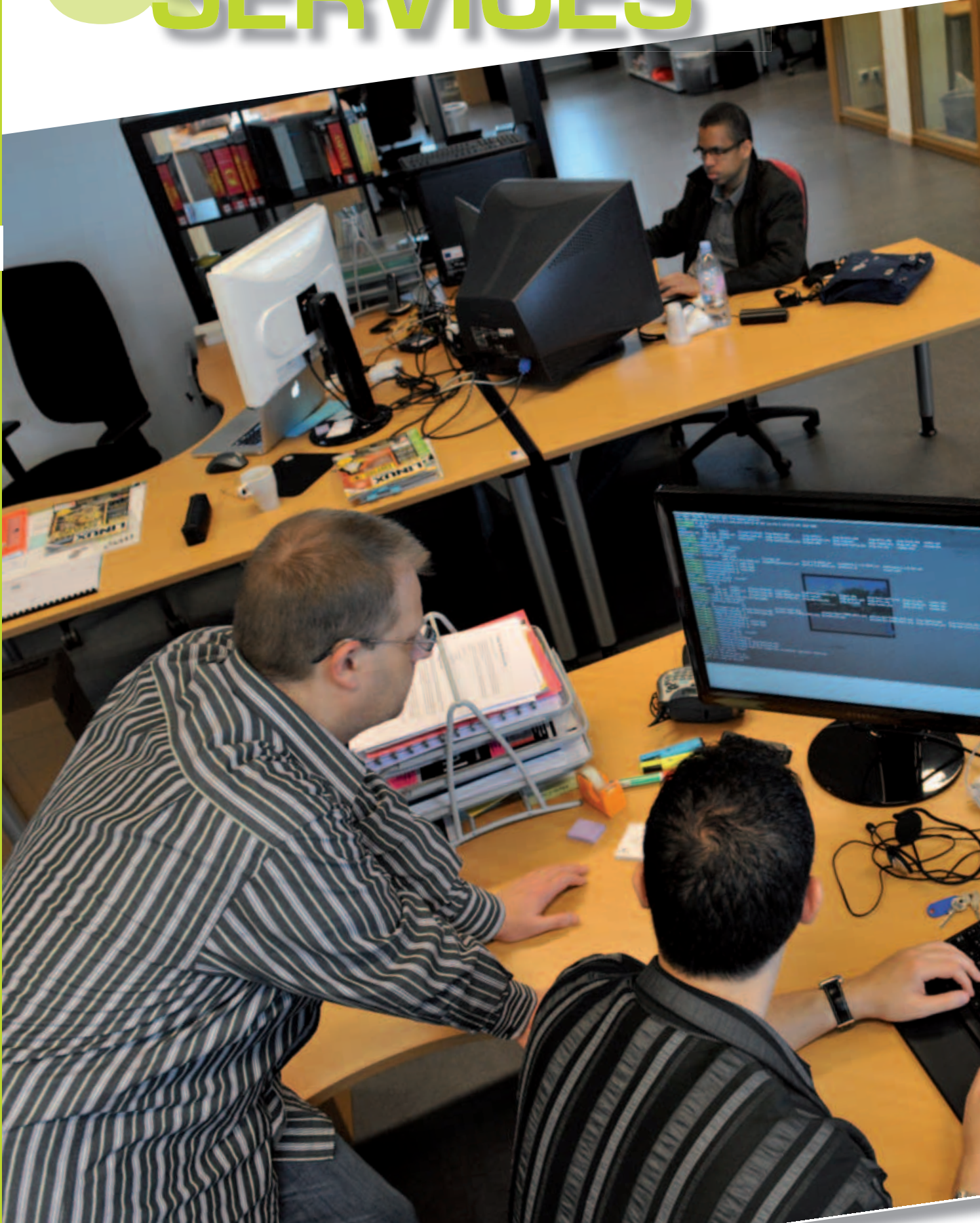
### TEAM SPIRIT

CETIC personnel work collaboratively, both within and among teams. This team spirit is one of CETIC's major strengths, enabling it to provide services and products of very high quality.

### RESPECT FOR CO-WORKERS

CETIC offers its employees a challenging work environment that combines friendliness, flexibility and autonomy. Personal development opportunities are offered to staff members and freedom of speech is encouraged, to help inspire creativity and innovation. In addition, they all have the opportunity to continually improve their skills, thanks in particular to the diversity of expertise represented within CETIC and the close collaboration among the teams.

# EXPERTISE & SERVICES







CETIC research teams are continually reinforcing and developing their expertise in the key ICT domains that match industry needs.

CETIC develops its company-oriented activities around three complementary and interdependent research directions.

The **Software and System Engineering** team focuses on methodological research, with a view to enhancing the quality and security of new ICT systems, which are becoming increasingly complex. By providing methodological support, they help businesses design products and services, and improve their quality, reliability and security, while enforcing internal standards.

The **Software and Services Technologies** team helps businesses exploit to the utmost the newest distributed, dynamic and service-oriented architectures, with the aim of speeding up the process of transformation from knowledge to semantic technologies, as well as taking advantage of the valuable opportunities offered by open source software and providing them with advanced technological expertise. These technologies strongly impact the way software and data are built, deployed and managed.

Finally, the **Embedded and Communication Systems** team develops exceptional prototyping skills in the electronic component and wireless technologies to help industry build new and innovative products.

These various knowledge areas are available as advanced services for business. We can help companies in the following: collaborative R&D, assistance to IT project owners, technical advice, design & prototyping, IT project quality improvement, certification process... These services can be partially financed, e.g. by technology vouchers in Walloon Region or by other public fundings.



# ■ ■ Software and System Engineering (SSE)

As software becomes even more pervasive and business-critical, the mission of the Software and System Engineering (SSE) department is to actively help enterprises master their software development activities and IT processes. The department's expertise covers the whole span of technical activities involved in the software development life-cycle: requirements engineering, architecture design, model-driven development, code quality and test design/coverage. The department also looks after the deployment of larger software systems, using its expertise in IT organisational audits, safety/security analysis and certification.

## IT DEVELOPMENT PROCESS QUALITY

### Expertise

SSE has developed strong expertise in process quality and in related standards, such as CMMI and ISO/IEC 15504. However, because these standards target large organisations and are complex and expensive to implement, they cannot be easily adopted by small structures. To address this problem, the department has developed a software improvement approach for use by very small development structures, staged as follows:

- The first stage involves a basic evaluation called a **micro-assessment**, which is used to collect information about current software practices and to make people aware of the importance of software quality.
- The second stage involves the software process improvement model, **OWPL (Observatoire Wallon des Pratiques Logicielles)**, which is directly inspired by CMM and SPICE and covers 10 processes, broken down into discrete practices.

Complementary expertise concerns knowledge management, as a lack of consolidation of IT experience across projects is a well-known problem in small structures that results in a substantial loss of performance. Through the EXTRA project (see page 42), CETIC acquired practical expertise in assessing SMEs and advising them on the best way to manage their IT experience.

Finally, IT process quality can also be part of more general quality standards, such as ISO 9001. Based on its own ISO 9001 compliance, CETIC has the experience to wrap the IT processes within such standards.

### Success story

Micro-assessment has been applied in several SMEs throughout the Walloon Region, and OWPL has been applied in a number of companies that produce commercial software, in order to improve specific software processes. For example, a large OWPL evaluation was carried out at Gillam-FEI. Based on the audit, improved procedures have been defined and integrated in the ISO9001 Quality Management System of the company. In parallel, supporting tools have also been proposed.

## SOFTWARE PRODUCT QUALITY

### Expertise

It is critically important to assess process quality, as it is a driver of product quality; however, it is also important to measure the quality of the resulting product. Drawing on its expertise in software metrics, CETIC has adopted a static analysis approach to performing precise code-level measurements of maintainability, security and reliability. This expertise is supported by state-of-the-art tools, maintained by the "Software Engineering Lab", which originated in the open source domain (e.g. PMD,

FindBugs) or have been developed by leading tool vendors (e.g. CAST, Kalistick, Fortify, Polyspace).

This aspect of CETIC expertise is based on a deep knowledge of the tool landscape as a whole, and rests on its ability to select the right tool for each development context (level of criticality, language, coding practices). These tools can then be tuned, if required, for optimal performance prior to deployment. CETIC has the ability to interpret the resulting outputs and produce a high quality code analysis report, to assist project managers in the decision-making process and developers in the code improvement process.

CETIC performs typical quality-related tasks, such as:

- Continuous **code assessment**, as required for internal quality control or within the scope of a client-provider relationship. An attractive solution is a secure SaaS platform, which enables both local monitoring and in-depth remote analysis by CETIC experts. Locally deployed solutions can also be used.
- **One-shot analysis**. Examples would be: a decision on legacy code, or the inclusion of external software (possibly open source, see also page 15). Such analysis may be related to specific issues, like security or safety, for which very specific tools (like Fortify or Polyspace) would be used.
- **Deployment of a user-operated platform**. Support can be provided for the selection, deployment, configuration, adaptation and use of a quality assessment platform; for example, open source solutions that are gaining in popularity, like Sonar.

### Success story

Numerous source code audits have been carried out by CETIC, especially for the public sector (for example, evaluation of open source components and assessment of newly developed components for the French Community Parliament) and for IT companies active in the medico-social and the real estate domains.

## REQUIREMENTS ENGINEERING AND SYSTEM MODELLING

### Expertise

Requirements Engineering (RE) is the process of defining the purpose of a software system by identifying stakeholders and their needs and documenting them in a form that can be analysed, communicated and subsequently implemented. RE plays a fundamental role in the software development process, and several studies have shown that it is one of the most critical success factors for the on-schedule and within-budget delivery of software projects.

CETIC has developed extensive expertise in RE, covering the whole spectrum of methods, from lightweight methods combining structured templates and UML-based notations to rigorous models enabling early formal reasoning (see also the DEPLOY project on page 41). RE-related expertise relies on the use of goal-oriented methodologies (e.g. KAOS, developed at UCL), for which CETIC is actively maintaining and developing tool support.

### Success Story

In 2010, CETIC performed a complimentary organisational audit of the Brussels Regional Parliament to support the evolution of its IT support

CETIC expertise rests on its ability to select the right tool for each development context and its capacity to produce a high quality code analysis report to assist project managers in the decision-making process and developers in the code improvement process.

function. CETIC also assessed the RE practices of Deutsche Bank, and helped the company to introduce methodological improvements to enhance adherence to corporate project guidelines and to the enterprise architecture perspective.

## DEVELOPMENT EFFORT ESTIMATION

### Expertise

Accurately estimating a software development effort is a challenge that has a major impact on the project's organisation and schedule. Up to now, the estimate often relied mainly on past experience. CETIC has developed expertise in this area based 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. The functional size generated by COSMIC is then converted into development effort based on the ISBSG project database. CETIC can also help companies implement their own internal reference effort database.

### Success Story

CETIC initiated new transfers of the COSMIC software functional size estimation methodology in companies from the medico-social and financial sectors. CETIC continued to support Siemens IT Solutions and

Services, Belgium, to increase its expertise with this method and to apply it to specific projects.

## CERTIFICATION AND STANDARDS

### Expertise

Certification is required in a number of industrial domains as a condition for accessing a particular market or to comply with domain-related regulations. Security-critical products, like smart cards or firewalls, can be subject to the Common Criteria for Information Technology Security Evaluation (ISO/IEC 15408). A number of safety standards – such as DO-178B (aeronautics), Cenelec 50126/8/9 (railways) and ECSS (space) – must also be met in safety-critical domains. Mastering the certification process is not trivial and requires knowledge of the standard and how to implement it in the software life-cycle. CETIC is actively developing expertise and experience in these areas, and has also mastered a number of leading software tools that help assess the security and safety of code, and assist in the writing of specific certification documents.

### Success Story

CETIC is leading a long-term effort to develop the ISO29110 standard defining development processes for VSEs. This work has resulted in the approval of the standard, and its official publication is scheduled for the first quarter of 2011.

CETIC's Software and System Engineering department is actively helping enterprises and organisations to improve the quality of their IT- or IS-related processes and software products, throughout the software life-cycle process. We also help our customers reduce safety and security risks in simple to critical production environments.

### Development Process Assessment

We provide the following organisational-level audit:

- IT software development process improvement model (OWPL) evaluation, to identify weaknesses and correct them using micro- and full assessments (see OWPL on page 12)

### IT Project Quality Improvement:

We provide ad hoc support and project assistance in specific life-cycle stages, such as:

- Requirements analysis: production of precise requirements documents; for example, for an invitation-to-tender process.
- Software development effort estimation: functional size, effort and cost estimation services based on requirements, for end-customers and software factories (COSMIC).
- Software analysis and design: reverse engineering activities, software architecture review and advice.
- Code quality: punctual/continuous code quality assessment and improvement advice, as part of internal quality procedures or for

the acceptance of code developed externally, using a large set of static analysis tools (CQC, CAST, etc., see "Software Engineering Lab" on page 48).

CETIC also offers global project guidance: retro-documentation, knowledge management, OWPL assessment and the Agile development methodologies.

### Security & Safety Standards Readiness and Certification

Security-related services:

- Code analysis for security (vulnerability detection) using advanced tools (Fortify see page 12).
- ISO 27002-based light security micro-assessment to evaluate security maturity related to security practices and to prioritize security investments from a risk management perspective.
- Common Criteria for Information Technology Security Evaluation (ISO/IEC 15408): helping companies prepare their protection profiles or security targets prior to a Common Criteria evaluation.

Safety-related services:

- Code analysis for reliability (run-time errors, exceptions) using advanced tools (Polyspace see page 12).
- Safety assessment/coaching based on generic IEC 61508 or domain-specific standards, such as DO-178B for the aeronautics domain or Gamp for biotech/clinical research.



# ■ ■ ■ Software and Services Technologies (SST)

The Software and Services Technologies (SST) department covers key areas in the context of ICT: Service Oriented Architecture, Cloud Computing, Intelligent Content and Semantics, and Open Source Software Technologies.

SST provides companies with the skills and approaches required to develop the new capabilities they need to acquire in order to take advantage of the latest trends and significant technological advances in the ICT industry. SST also helps them select and implement the technologies that are appropriate for them.

## SERVICE ORIENTED ARCHITECTURE

### Expertise

Service Oriented Architecture (SOA) supports the development of complex and distributed software applications. It also supports modularity, and hence the reuse of software components. The quick adoption of Web-enabled mobile devices is creating a demand for more applications available via the Internet, which requires that significant architectural changes be made to software. SOA is also key to combining services to create more advanced service offerings.

CETIC has built up significant expertise in defining the architecture of Service Oriented Applications, and the re-architecting of existing applications. With a specific focus on the needs of SMEs, in terms of simplicity, flexibility and innovation, CETIC can design and build solutions using the REST/stateless approach in Web services, workflow engines, enterprise service buses (ESB) and service composition using the semantic technologies (OWL-WS or WSMO).

CETIC is also involved as an expert on the Belgian mirror committee of ISO/IEC JTC1/SC38: "Distributed Application Platforms and Services" (DAPS).

### Success story

CETIC has supported SMEs like Uniwan and Great Circle in the definition of the optimal architecture of their solution, in line with their business model. The team was able to provide technical recommendations with regard to standards, technologies and architecture.

## CLOUD COMPUTING

### Expertise

Cloud computing is a concept that covers three distinct categories of Internet-based computing service delivery: Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS).

Now that users and customers are increasingly accessing Web-based on-demand IT resources, significant variation is developing in the way the underlying infrastructure is used. The IaaS paradigm enables the flexibility necessary to accommodate this variation. By taking advantage of virtualisation, the computing infrastructure is now becoming part of the IT network. As new technologies and IaaS providers appear in the marketplace, CETIC keeps track of their technical capabilities and the associated emerging standards. CETIC has mastered OpenNebula, the open source infrastructure stack toolkit for cloud computing, and the related open standards, like the open virtualisation format (OVF) and the open cloud computing interface (OCCI), as well as de facto standards, such as Amazon Machine Image (AMI).

The PaaS is a way to provide custom applications via the Internet, making it possible for users to avoid much of the burden of owning, running

and developing their own internal IT infrastructure. However, building the architecture of the application and selecting a PaaS provider are very sensitive tasks, and CETIC can provide valuable advice on performing them. CETIC can build proofs-of-concept, using a representative PaaS framework, such as the Hadoop or NoSQL database.

Because of intrinsic advantages and market trends, many software vendors are planning to adopt the SaaS business model. In doing so, they will need to make significant changes, and it will be especially challenging for them to manage the transition from a traditional software vendor approach. CETIC can help with the porting of applications, changing their underlying architecture to support scalability, flexibility and resiliency, by using SOA, PaaS or IaaS technologies.

All the technologies mentioned above are evolving rapidly, and CETIC tracks them continuously through numerous research projects in which its expertise is recognised.

### Success story

By participating in the RESERVOIR project (see page 45), CETIC acquired a great deal of knowledge about the OpenNebula IaaS solution and the related open standards, and deployed a proof-of-concept test bed to demonstrate this technology to local SMEs. CETIC can demonstrate an IaaS solution that is vendor-independent, allowing its partners to evaluate the solution without bias.

CETIC has also demonstrated a cloud-based solution for a fully distributed data management infrastructure for Haulogy and Tagexpert, with technologies such as Hadoop-HBase, Voldemort, Riak and TokyoCabinet.

## INTELLIGENT CONTENT AND SEMANTICS

### Expertise

Companies today must maintain control of the increasing amount of data they handle. The Intelligent Content and Semantics (ICS) team at CETIC develops methods and tools for information management in business, targeting unstructured information on the Internet, private networks or specific domains, like media and health.

Some intrinsic features of information make it difficult to manage. CETIC designs and builds solutions, and provides advice that helps SMEs cope with the advent of the Internet and integrated enterprise information systems, as well as constantly changing digital content, which is becoming overwhelmingly abundant, but remains poorly structured.

Beyond indexing and classification, CETIC's expertise in semantic technologies enables the team to offer much more powerful solutions to these issues. Following the semantic Web standards (RDF, OWL, SKOS, SPARQL), the team contributes to powerful and interoperable content management solutions aimed both at users and at further software processing. In alignment with this approach, CETIC recognizes the importance of the Linked Data paradigm as an example of the capabilities of these technologies, and actively supports its increased use in the field of health care.

### Success story

CETIC has intervened at various levels in the eHealth sector using semantic Web concepts and tools. In connection with its work with various inter-linked medical terminologies and classifications, the Jamoulle Medical Office wanted to develop a prototype of an ontology-based system to demonstrate the modelling and interoperability benefits it offers. CETIC

In an environment where software and services are evolving rapidly, CETIC tracks new technologies through numerous research projects in which its expertise is recognised and makes them accessible to its local partners.

studied and modelled several health-related data sources (LOCAS2, ICPC2 and ICD10) as ontologies, and then published them on a Web platform, permitting consultation using semantic links both from the user's browser and from software queries. This has paved the way for future innovative uses. CETIC prepared and conducted a set of presentations and seminars for the project on the concepts and technologies of ontologies, the semantic Web and Linked Data. These presentations ensured that the proposed tools and objectives met the needs of the Jamouille Medical Office, and that the underlying elements were understood by all the stakeholders.

## OPEN SOURCE SOFTWARE TECHNOLOGIES

### Expertise

For years, CETIC has been involved in the open source movement, covering aspects like business models, development models, software quality measurement, open source community analysis, and so on.

Specifically, CETIC has developed recognised expertise regarding:

- Support for releasing software into the open source domain, auditing existing code and managing open source projects, as well as helping to set up collaborative development infrastructures. Releasing source code to an open community requires preparation, in order to maximise the chances that it will operate successfully.

- Architecture analysis and selection of software components. To avoid disappointment, the integration of open source blocks into an application cannot be overlooked.

- Choice of a license and its impact on business models. The open source model has already been embraced by many providers; however, license and business model selection are of crucial importance, and vary with the context and objectives.

## COMPUTING CENTRE

### Expertise

Thanks to its computing infrastructure and its experience with tools and middleware, CETIC can test cluster, grid and cloud computing solutions. This infrastructure was developed for flexibility, as it can be partitioned to run multiple groups of operating systems and different applications. Virtualisation technologies can be used as well.

### Success Story

Many of our partners, like Haulogy, PHD Consulting and Tagexpert, among others, have used the computing centre as a test bed.

The CETIC Software and Services Technologies department focuses on helping companies take advantage of the new "service" orientation of IT, which is Web-centred, and assists them in the selection and implementation of the associated technologies. SST offers consulting services, feasibility studies, training and technical support.

### Service Oriented Architecture (SOA)

#### Cloud Computing and SOA Technologies

1. The state of the art and definition of strategic choices and technology (evaluation and selection of cloud middleware or framework, for example);
2. Technology assessment on CETIC infrastructure;
3. Drafting of architecture or infrastructure design;
4. Development of a proof-of-concept (PoC), including know-how transfer;
5. Workload performance measurement of the target infrastructure (cloud only).

#### Web Services

SaaS feasibility audit for software vendors: CETIC helps companies by validating the technical and economical feasibility of their offerings, providing advice on the technological aspects (changes to applications,

architecture reengineering, etc.) and business model exploration.

### Open Source

CETIC can help by:

- Studying the impact of releasing sources of existing software,
- Participating in the selection of open source providers (calls for tender),
- Independently selecting and integrating open source components.

### Intelligent Content and Semantics

#### Semantics

- Support in applying semantic Web concepts and in tool selection,
- Elaboration of ontologies, thesaurus,
- Design and implementation of solutions based on semantic Web technologies (integrating Linked Data).

#### Content Indexing & Knowledge Extraction

- From structured and unstructured content,
- Web sites: intelligent, customised data crawling,
- Structured data sources : like RSS, documents (.doc, .pdf, etc.), social networks,
- Study and development of tailored search tools/engines, including crawling, indexing, defining and implementing user interfaces.

# ■ ■ ■ Embedded and Communication Systems (ECS)

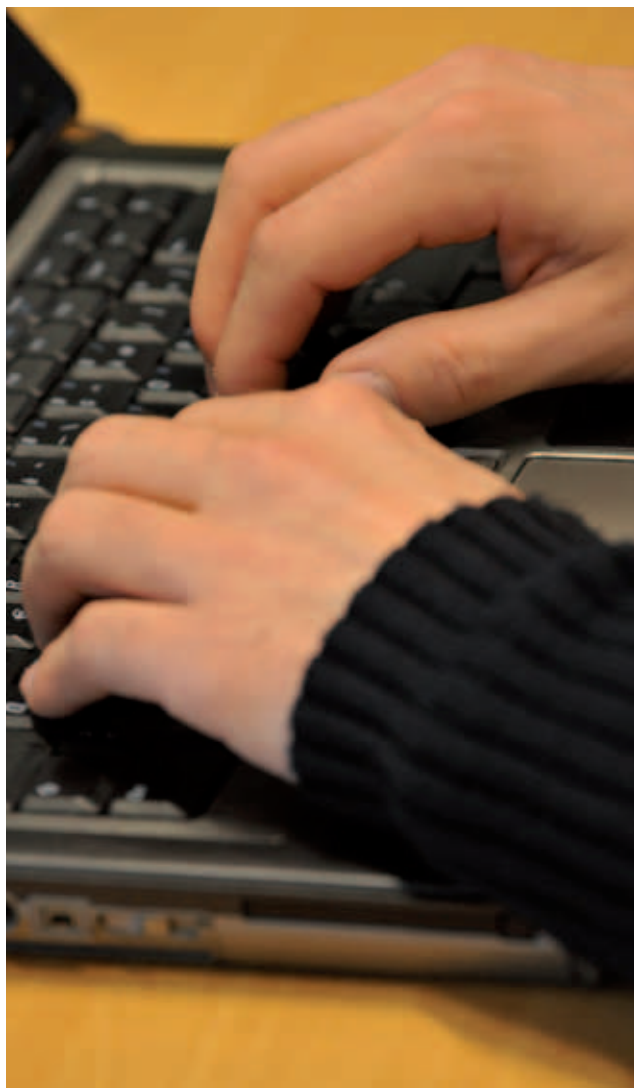
The Embedded and Communication Systems (ECS) department develops innovative solutions in the integration of embedded systems based on wireless technologies and programmable logic. ECS studies new technologies and processes in the world of embedded systems and sets up proofs-of-concept to demonstrate efficient solutions to industrial problems.

## EMBEDDED SYSTEM PROTOTYPING

### Expertise

The design of embedded systems requires a variety of skills: knowledge of electronic components, electronic design, embedded operating system and software development, and system integration. Today's rapidly evolving technologies offer new solutions, but at the same time growing competition in this field calls for increased efficiency and reduced costs.

Companies – and especially SMEs – are finding it more and more difficult to monitor all the latest technological developments and smoothly integrate them into an optimised solution. The ECS department has developed extensive expertise in emerging technologies for embedded and communication systems in a wide range of applications. It has studied several development platforms for accelerating the creation of prototypes, based on different types of microprocessors or microcontrollers. In the embedded world, many interfaces exist, in terms of communication standards and industrial busses. The department has also studied the interfaces involved in road transportation, thanks to several research projects: CAN/



FMS, interfaces with tachygraphs, GPS, etc. This expertise has made it possible to build a research platform for evaluating the capabilities of the applications embedded in lorries, for example.

User interfaces in embedded systems have very specific requirements. They must be simple and there are constraints in their design that must be respected – small LCDs or screens, a limited number of buttons, the basic packaging for industrial applications, etc. CETIC explores ergonomic end-user interfaces for industrial systems, as well as interfaces for specific uses, like eHealth systems for use by the elderly.

CETIC also sets up demonstrations to show that these efficient solutions are applicable to industrial problems. In specific cases, configurable electronic circuits (FPGA, PSoC) can greatly improve the flexibility and the time-to-design for advanced proofs-of-concept. CETIC has mastered the full range of expertise (electronic design, including VHDL, the use of softcores and the development of embedded software) and transfers it to SMEs.

### Success Story

CETIC recently demonstrated its ability to achieve efficient and rapid technological results in a complex environment by helping Thales Alenia Space to solve a problem in the integration of a Galileo satellite. Owing to discrepancies in the interface specifications of two hardware building blocks developed by different partners, Thales Alenia Space asked CETIC to develop a stop-gap solution to get round the issue. A bypass was developed to correct the problem and to allow the integration process to continue. The solution took the form of a dedicated box that translated the protocol between the two building blocks. This translation box was designed and developed in VHDL on an FPGA in less than 3 weeks, with the result that it was not necessary to stop the integration process. Thales Alenia Space, and other industrial partners of Galileo, like Astrium, were impressed with how quickly CETIC found a solution to the problem.

## WIRELESS COMMUNICATION AND LOW-POWER SOLUTIONS

### Expertise

CETIC has developed extensive expertise in wireless standards and protocols, and in low-power technologies. These fast-growing technologies offer a multitude of possibilities that could not have been envisioned until recently. Many types of equipment can benefit from a suitable connection, regardless of their particular constraints. The multiplicity of technologies available is magnified by the explosion in electronic architectures and modules on the market. In the real world, the new embedded systems have to integrate various wireless technologies, such as WiFi, Bluetooth, Zigbee, GSM, GPRS, 3G, etc. They must also be designed efficiently and rapidly, using commercially available components, to provide the best performance/cost ratio. In addition to the transmission technologies, these systems often require advanced network capabilities, like network auto-discovery, dynamic routing, node mobility, etc. Power consumption is an essential parameter in the performance of embedded systems. In industrial use, the deployment of these systems may be hampered by installation and maintenance costs, owing to poor battery autonomy. The market requires energy-efficient and energy-aware systems, in order to improve system performance, lifetime and reliability, and to reduce service interruptions and maintenance costs.

When their location prevents easy maintenance or battery replacement, purely autonomic system and sensor network solutions can be applied, thanks to embedded renewable energy devices like photovoltaic cells.

CETIC also sets up demonstrations to show that these efficient solutions are applicable to industrial problems. In specific cases, configurable electronic circuits (FPGA, PSOC) can greatly improve the flexibility and the time-to-design for advanced proofs-of-concept.

The modelling and simulation of embedded systems is also important in accelerating the design phase, in anticipating their behaviour and performance and in achieving optimal results. The ECS department is very active in this area, thanks to its expertise in classical tools and languages.

### Success Story

Intersysto is a leading producer of ICT equipment for nursing homes in Belgium and France. For the brand new generation of its complete solution, called Care Integrated Systems, Intersysto has called on CETIC to study

the integration into its platform of a specific input/output board, support for new identification devices and a Voice-Over-IP software suite. CETIC evaluated the commercially available and open source solutions, prototyped the selected solution and transferred the technology to Intersysto for its industrialisation in their product suite. The first deployments of this new system began in early 2011.

CETIC has mastered leading edge technologies for modelling and implementing embedded systems (hardware/software). CETIC is a reliable R&D partner, supporting companies developing innovative proof-of-concept prototypes that meet the requirements of its industrial partners. Our working objective is to transfer the know-how and the technologies at hand to businesses, so that they can achieve their industrial goals. CETIC has gained significant expertise in developing solutions for issues arising in eHealth applications (see page 18) and also in transportation and logistics applications (see page 16).

### Development of Embedded Systems (hardware/software/wireless communications)

- **Requirements engineering.** We offer support in defining requirements and specifications for embedded systems, including user interfaces.
- **System design.** We offer support on the following aspects of the design of innovative systems:
  1. Hardware: analysis and selection of components and architectures (e.g. selection of microcontrollers/FPGAs/DSPs, evaluation and selection of IP blocks), simulation (e.g. VHDL);
  2. Software: selection of libraries, modelling and simulation;
  3. Wireless communications, including wireless sensor networks: selection of components and technologies.
- **Prototyping.** We build prototypes of embedded systems, including:
  1. Hardware: VHDL design and development, PCB design;
  2. Software, including real-time aspects;
  3. Human-machine interfaces (HMI/GUI): development of interfaces adapted to specific user needs.
- **Test and validation.** We offer support (methodologies and tools) for test automation and test completeness.
- **Transfer** of the know-how involved, including source code and hardware description files.

### Technical Advice

- **Consultancy in innovative technologies for embedded systems.** We offer expertise and technical know-how related to:
  - ▶ Wireless communications;
  - ▶ Development on embedded OS for PDA/Smart phone (Android);
  - ▶ State-of-the-art wireless sensor technologies;
  - ▶ A selection of low-power components.
- **Audits of methods, products and tools for embedded systems.**
  - ▶ Internal: We carry out audits on a company's methods, products and tools, including quality audits (e.g. quality of source code), certification support (e.g. DO 178B).
  - ▶ External: We analyse solutions available on the market and help select those that meet a company's needs (e.g. test tools, design methodologies, etc.).
- **Third-party status.** We take the role of independent and trustworthy partner in a customer-supplier relationship in:
  - ▶ Analysing calls for tender;
  - ▶ Assisting IT project owners;
  - ▶ Auditing technical content of Escrow (protection of IT project sources).

### Services Related to the CETIC Wireless Lab

We provide:

- Access to specific equipment, such as development kits (e.g. ZigBee modules), electronic measuring devices.
- Access to design and test software, e.g. Matlab/Simulink, Labview, Polyspace.
- Guidance and support in the use of in-house equipment and software.



# Focus on eHealth

## Context

The health sector is faced with challenges related to the ageing of the population and to the increased incidence of chronic illnesses, both of which entail high costs for social security systems. These changes, and the decrease in the number of health specialists, underline the need for adequate solutions and innovative processes. Experts have demonstrated that ICT have an important role to play. Among the strategies that could help overcome the challenges are: reducing the duration of hospital stays, and enabling patients to take an active part in the management of their health.

## CETIC EXPERTISE IN EHEALTH

For several years, CETIC has been developing strong expertise in eHealth through research projects and technology transfer to industry. CETIC is involved in several research projects focused on eHealth. This work increases the knowledge of the eHealth domain on the part of CETIC researchers, and, in turn, enables them to maintain their high level of expertise.

CETIC participated in the FP6 OLDES European project (see page 43) and now coordinates a regional project, eHealth for Citizens (see page 32), which evaluates and develops technological solutions to assist with home care and provide a platform for delivering specialised patient care services, as well as to monitor illness from the patient's home.

In addition, CETIC is the coordinator of the PONTE FP7 European project (see page 44), and is responsible for the data representation and organisational elements of the project. Medical trials are a means for validating new drugs for treating new illnesses and disorders, and this project will lead to the establishment of a service-oriented platform to make possible the intelligent and automatic identification of individuals who will be participating in clinical trials.

In 2010, CETIC was awarded two new European projects: the AMACS project, dedicated to the monitoring of the elderly who are suffering from dementia, and the SPES project that focuses on adding new functionalities to the OLDES platform to cover more illnesses (respiratory problems and dementia, for example) and address accessibility issues ("e-inclusion"). Both projects will start early in 2011.

## Services

With its three domains of expertise, CETIC is able to study, design and develop solutions to meet the needs of various stakeholders in a highly multi-disciplinary environment like eHealth.

## REQUIREMENTS ENGINEERING

### Expertise

The design and integration of ICT-based solutions in health care processes require specific competencies in order to gain an understanding of eHealth issues and meet the challenges they pose. ICT-based systems for the health sector have to deal with important and constraining quality and security standards that guarantee patient safety and ensure the confidentiality of their data.

CETIC can help companies better understand and identify the needs and challenges associated with eHealth, and integrate them into their activities. CETIC can help companies evaluate the possibility of integrating emerging ICT technologies into their eHealth services portfolio by conducting requirement studies, elaborating technical specifications, performing strategic analysis and designing business models.

## SOA – SERVICE COMPOSITION

### Expertise

It is becoming increasingly important to integrate IT solutions into health care processes to make the communication between the various stakeholders more efficient and automate recurring tasks. However, the growing number of services developed and integrated into IT systems leads to challenges related to the integration and composition of these services, and to the standardisation of the data exchanged between them and the health care stakeholders.

To optimise the costs related to the management and maintenance of their IT systems, hospitals and health care service providers need flexible, scalable and secure IT infrastructures that can adapt to the demand.

CETIC has the expertise to help companies meet these challenges by integrating intelligent service composition engines to create high value composite services, and can also support companies while integrating the health care IT standards related to the interoperability of data exchanges (e.g. HL7, IHE, Kmehr).

## INTELLIGENT CONTENT AND SEMANTICS

### Expertise

The generalised use of ICT among health care professionals in hospitals and the introduction of ICT in clinical research processes result in more and more electronic content being produced and stored. These data are available in various, mainly unstructured formats, which makes it very challenging to exploit them intelligently.

With its expertise in semantic technologies, as well as in intelligent content indexing and data processing, CETIC is able to help companies and public organizations take advantage of the power of these technologies to improve the integration and intelligent processing of medical data. CETIC also provides support services for the integration of semantic Linked Data and its publication. In addition, CETIC can use the expertise developed in the PONTE project to help companies develop and integrate semantic interoperability layers, with the objective of intelligently integrating data from various heterogeneous sources. Those semantic interoperability layers are used by CETIC to build intelligent custom search engines to interrogate data sources in a unified way.

## DEVELOPMENT OF ICT-BASED SYSTEMS FOR PATIENTS

### Expertise

For several years now, the ECS department of CETIC has developed strong expertise in the design and development of electronic embedded systems and embedded software for various application domains, taking advantage of emerging innovative technologies. In the field of eHealth, ECS has studied electronic communication modules for medical appliances. These modules enable patients to transparently collect and send out their medical data using wireless technologies. These technologies make it possible for patient data to be transmitted in real time to centralised repositories through secure and reliable communication channels.

ECS also has the capability of designing and developing embedded user applications equipped with the latest user interface technologies, like touch screens.



# How to Work with CETIC

Backed by the outstanding expertise they have gained over many years in European and Walloon research projects, our professional teams are available to help companies at every step of their innovation projects, as they turn their ideas into mature products ready for the marketplace.

CETIC is a trusted and skilled partner, on hand to help companies address a wide array of issues:

- **Collaborative R&D:** We support companies in their R&D activities by strengthening or complementing the expertise of their teams, and help them integrate breakthrough technologies into their R&D.
- **Assistance to IT project owners** (third-party partners): We help manage internal and external IT development projects, with the objective of ensuring that projects are completed within the timeframe set and with the expected quality standards. We act as the technical “architect” of a project, performing quality checks of the work of IT suppliers and of the overall project follow-up.
- **Technical advice:** We carry out technology assessments and audits of methods, products and tools, and give advice on innovative technologies (Rfid, Android, Cloud/SOA, Semantic Web concepts, etc.).
- **Design & prototyping:** We help in the design and building of prototypes, in the case of SOA/cloud solutions or embedded systems, for example, including software, hardware and communication, and even Graphical User Interfaces (GUIs).
- **IT project quality improvement:** We help improve the quality of software development processes and products to better fit a company’s initial requirements and expectations, using sets of methodologies and tools, like Cosmic, for example.
- **Certification process** (D0178B/Common Criteria, GAMP, etc.): We provide support and assistance to companies to help them meet their security and safety standards objectives.

Use us as a guide on the path to innovation!

Our services, which are designed for SMEs, as well as larger companies and institutions, enable us to respond:

- with high-level advice or purely technical assistance,
- to issues arising in normal or safety-critical environments,
- with global insights or deep operational or organizational audits,
- with generic to custom-made studies or work-outs.

## FINANCING AN INNOVATION PROJECT WITH TECHNOLOGY VOUCHERS

An SME ready to innovate can quickly obtain simple, flexible financial support from the Walloon Region.

When working with an accredited research centre like CETIC, an SME is eligible for re-imbusement by the Walloon Region of 75% of the total cost of R&D through the Chèques Technologiques programme. These technology vouchers are available to a maximum yearly payment of €20,000 per SME.

Further information about these vouchers can be found on the CETIC website and at [www.ct.innovons.be](http://www.ct.innovons.be).

CETIC is also certified 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. A significant tax credit is available (cfr. <http://www.industrie.gouv.fr/enjeux/innovation/cir.html>). Brussels-based companies can also benefit from regional funding for their R&D activities.

Please contact CETIC for more information ([www.info@cetic.be](mailto:www.info@cetic.be)).



# SUPPORTING INDUSTRY THROUGH ICT RESEARCH AND INNOVATION

RESEARCH

BUSINESS

TECHNOLOGY TRANSFER

Embedded Systems

eHealth

Internet of Things

Low Power

Standards

Ambient Assisted Living

Cloud Computing

Certification

Open Source

Semantic Open Data

Security





INNOVATION

PROTOTYPING

Smart Grids

Wireless Technologies

Prototyping

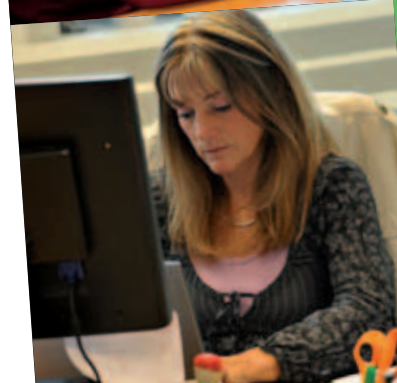
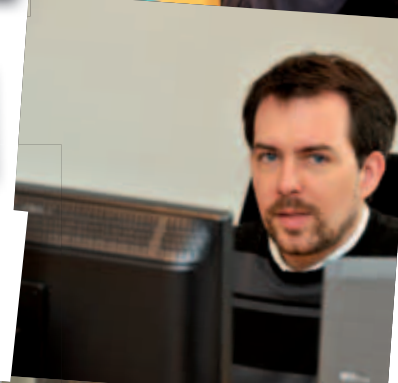
Software Quality

Service Oriented Architecture

Energy Efficiency

Trust

Requirements Engineering



# WALLOON RESEARCH PROJECTS

CETIC is active in several regional R&D projects funded by the Regional Ministry of Research and supervised by the Walloon administration (SPW-DG06).

Since 2008, CETIC has been working on a new series of applied R&D projects funded under the terms of the Convergence Objective (FEDER 2007-2013) with several research partners (Cenaero, FUNDP, MULTITEL, UCL, ULB, UMONS):

The objective of **CE-IQS** is to provide Walloon ICT enterprises with high-level expertise in Quality for developing IT applications.

**CELLaVi** is an initiative for stimulating the adoption of open source software in the Walloon Region.

**Biomufacturing** is developing a neural interface and a system to exploit data (human bio-signals) for controlling articulated prostheses.

In addition, CETIC is working on Marshall Plan projects in two fields:

**Logistics:** Within the **eCMR** project, CETIC is in charge of implementing an intelligent embedded system dedicated to the acquisition and transmission of transport data.

**Aeronautics:** Through **3WSA**, CETIC is investigating combining state-of-the-art ICT and existing technologies and future infrastructures for space applications, like Galileo.

The focus of the **S@T** project is to develop a new generation of embedded electronic systems, a new digital platform and multi-modal interfaces, including obtaining certification and addressing security aspects.

The **HM+** project aims to increase reliability and safety inside aircraft through the use of monitoring techniques.

Finally, **QDFCA** is enhancing existing tools to develop a real Assessment Management System.









# BEM

## Business Event Manager

**Type of project:** Walloon Region – Marshall Plan

**CETIC budget:** €274,850

**Duration:** 2010-2013

**CETIC department:** Software and System Engineering

**CETIC contact:** Renaud De Landtsheer – renaud.delandtsheer@cetic.be

### BACKGROUND

The goal of the BEM project is to develop and validate a new IT approach to manage events in the transport and distribution sectors. The focus is on managing unexpected events, as they can sometimes deeply affect physical and organisational flows, and a re-optimisation is required to bring the system back to normal operation.

Flux management software is among the solutions commonly found on the IT market, and includes process management engines, graphical editors, and the like. These engines all have their limitations:

- They are unable to coordinate, activate and synchronize processes.
- They are unable to manage situations that do not match the defined flux model they are processing, which leaves the engine without a solution in the event that normal operation is no longer possible.
- They are incapable of bringing the engine back to normal operation after an unexpected event. Ideally, doing so would follow an optimal path towards that state.

The goal of BEM is to propose a process management solution built on top of state-of-the-art artificial intelligence engines, and give them temporal coordination capabilities. With this innovation, we hope to minimize the negative consequences of incidents, and perhaps even simplify the implementation of a flux management solution.

The BEM industrial case study involves Trendy Foods, a leader in food distribution that targets shops in close proximity.

*BEM aims to produce a smart event manager capable of adapting to unanticipated and exceptional situations, and bring the system back to normal operation in an optimal way.*

### KEY RESULTS

CETIC produced an initial analysis of the Trendy Foods logistics platform, including a set of concrete exceptional situations. A KAOS analysis of the project has begun, using the Objectiver tool for requirements engineering.

CETIC also contributed to the specification of the logistical chain management tool. Its key part is an engine incorporating:

- An event-based process management solution, with temporal coordination capabilities,
- A description of its logistical process, written in the form of business-specific logical rules,
- A classification of states designed to automate the management of exceptional events, and the elaboration of an optimal path to achieve stability in those states.

### PARTNERS

Facultés Universitaires Notre-Dame de la Paix de Namur (FUNDP), NSI IT Software & Services SA, Orditoool Belgium SA, Smolinfo SPRL, Trendy Foods Belgium SA

# BIOMANUFACTURING

**Type of project:** Walloon Region – FEDER – Convergence Objective

**CETIC budget:** €139,307

**Duration:** 2008-2011

**CETIC department:** Embedded and Communication Systems

**CETIC contact:** Valéry Ramon – valery.ramon@cetic.be



## BACKGROUND

The Biomanufacturing project targets the processing and exploitation of human bio-signals to control orthotic devices, a sub-class of articulated prostheses. The main goal of this project is to develop a neural interface and a system to exploit measured brain activity. Extracting representative information from EEG (electroencephalogram) and EMG (electromyogram) signals and processing these data through an artificial neural network will enable pattern matching to activate orthotic devices.

Orthotic devices are prostheses designed to compensate for absent articular or muscular functions. Performing this body assistance requires intelligent guidance, which is a major challenge in the field of human-machine interfaces. The Biomanufacturing project aims to develop intuitive control for orthotic devices by means of the state-of-the-art processing of EEG and EMG bio-signals, which measure brain and muscle activity respectively.

This multidisciplinary project is being carried out by several research teams working together to develop a functional orthotic prototype. The bio-signals must be processed in order to extract useful information related to the control of the orthotic devices using a Dynamic Recurrent Neural Network (DRNN), following encephalographic signal sampling and processing. The DRNN is a critical part of the decision-making process, as its output governs the design of control signals and the manufacturing of orthotic devices that can incorporate the associated actuators and regulation systems.

## KEY RESULTS

In this project, CETIC's Embedded and Communication Systems department is in charge of the design of the overall system architecture, and of the technical integration of system components. During 2010, CETIC established design specifications for the wireless communication systems of the EEG signals and the integration of DRNNs into embedded systems.

In 2011, CETIC will participate in the design of a functional prototype of the Biomanufacturing platform, through the implementation of the EEG signal processing system and wireless transmission system.

*During 2010, CETIC established design specifications for the wireless communication systems of the EEG signals and the integration of DRNNs into embedded systems.*

## PARTNERS

Cenaero, Sirris, Université de Mons (UMONS)

# CALiPro

## Configuration Automatisée de Lignes de Produits Logiciels

**Type of project:** Walloon Region – First DOC.A  
**CETIC budget:** €210,000  
**Duration:** 2010-2012, 2012-2014  
**CETIC department:** Software and System Engineering  
**CETIC contact:** Raphaël Michel – raphael.michel@cetic.be

### BACKGROUND

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 mass customisation required to meet the needs of an ever more demanding market.

SPLs are common nowadays. Examples are ERPs; telecommunication services; office suites; e-business, e-learning and e-government services; Web services and open source software; among many others.

During the last decade, SPL development methods have progressed enormously, and success stories are becoming more and more common. The advantage of these approaches is the ability to massively reuse components across the products of an SPL in a planned and systematic way. This makes it possible to:

1. Reduce costs thanks to economies of scale;
2. Reduce time-to-market;
3. Improve the global quality of the software.

In our opinion, however, there is still a lack of tool support in the Application Engineering phase, which is the phase during which a product is assembled and configured from intermediary reusable components. Several companies that plan to adopt (or have already adopted) an SPL approach have confirmed the need for tools and services during the configuration

phase. Our CALiPro project targets the improvement and automation of the configuration of an SPL by developing a set of innovative tools, services and methods to meet the needs of the collaborating companies.

### KEY RESULTS

During the first year of the project, the focus has been on developing the theoretical aspects of SPL configuration and modelling.

A prototype was developed on the basis of the existing formal semantics of feature diagrams, in order to demonstrate the use of the text-based feature modelling language TVL and its associated reasoning tools. The formal semantics was then extended with support for feature cardinalities and cloning, which allows the creation of the richer models needed by our industrial partners.

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

### PARTNERS

Facultés Universitaires Notre-Dame de la Paix de Namur (FUNDP)



**Type of project:** Walloon Region – FEDER – Convergence Objective  
**CETIC budget:** €7,131,576  
**Duration:** 2008-2013  
**CETIC departments:** Embedded and Communication Systems, Software and Services Technologies, Software and System Engineering  
**Project website:** [www.cetic.be/rubrique306.html](http://www.cetic.be/rubrique306.html)  
**CETIC contact:** Christophe Ponsard – [christophe.ponsard@cetic.be](mailto:christophe.ponsard@cetic.be)



### BACKGROUND

CE-IQS is the centre of expertise for engineering and system quality. Its objective is to provide Walloon ICT enterprises with advanced expertise for developing software-based systems. More than ever, the performance and competitiveness of companies relies on mastering ICT. CE-IQS responds to this need by closely associating ICT enterprises with innovative research carried out by a strong applied research consortium composed of major research centres and universities active in this field.

Any enterprise in Wallonia can join the project throughout its lifespan by contacting CETIC. The needs of the enterprise will be discussed and matched with one or more research tasks structured around five main themes:

#### Theme 1: Methodologies for system development and evolution.

Here, state-of-the-art methodologies for system development are investigated, with the aim of facilitating their evolution. Specific activities are devoted to model-driven development at an earlier stage than code (architecture, requirements), the Agile methodologies, software product lines and measuring the evolution of software systems. Within this theme, CETIC works on new methodologies and productivity tools designed to maintain and improve the control of systems throughout their lifespan. The study of embedded and open source systems is also addressed.

#### Theme 2: Strategies for system verification, validation and quality assessment.

The objective is to improve quality assurance practices, especially those related to testing, in order to allow cost reduction, better quality and quicker time-to-market. Specifically, techniques for identifying optimal test coverage related to code quality are investigated, with a view to precisely assessing that coverage, testing plan design and automating the test process based on a number of techniques, including model-based testing. A complementary task is investigating formal techniques for design time verification.

#### Theme 3: Certification.

Certification is required in a growing number of applications with critical aspects, such as security and dependability. Also, quality assurance levels are continually on the rise, owing to the ubiquitous presence of software in the systems we all use. A number of standards define the

certification rules to be respected, such as the Common Criteria (IEC/ISO 15408) for security IT and DO-178B in aeronautics. CE-IQS helps companies prepare for certification through all phases of the project, and, in particular, improves the required practices. This theme also focuses on specific constraints (e.g. adapting the process to SMEs) and on specific domains (e.g. the Belgian electronics identity). In addition, CE-IQS actively represents the needs of Walloon enterprises in standardisation work groups at the national and international (ISO) levels.

#### Theme 4: Distributed and embedded systems.

Software systems are increasingly interconnected through a variety of networks. This results in richer systems, but also more complex systems from the design point of view. A variety of such systems are being investigated, including:

- Service-oriented applications implemented in highly dynamic business chains, especially stimulating SME ecosystems.
- Grid and cloud applications that enable on-demand access to resources and scaled performance.
- Embedded systems, and the related new technologies emerging in the area of wireless communication and computing devices. One of the main drivers of innovation in the embedded world today is the need to extend the autonomy of these systems by lowering their electrical consumption. "Low power" is the new motto, and new, more stringent wireless standards are appearing in response to the need for improved throughput, range and power consumption. Similarly, new microcontrollers are introducing complex execution models that meet the most recent consumption levels. Thanks to this intensive survey of the state of the art, CE-IQS can provide accurate, up-to-date advice and propose advanced designs to Walloon enterprises.

#### Theme 5: Intelligent content and semantics.

In the Information Age, the ability to filter, organise and process content is critical for many companies that rely on this information for their business. The aim here is to identify, adapt and further develop content processing technologies, such as search engines, indexers or full-text database searches, to meet the needs of these companies. Emerging search tools, such as semantics-based search engines and semantic Web technologies, are also evaluated on industrial cases.



### PARTNERS

Cenaero, Facultés Universitaires Notre-Dame de la Paix de Namur (FUNDP), Université catholique de Louvain (UCL), Université de Mons (UMONS), Université Libre de Bruxelles (ULB)

## ICT EQUIPMENT

To be effective, the above methodological research must be supported by state-of-the-art tools. Also, the systemic barriers that prevent Walloon companies – especially SMEs – from benefitting from the high-quality return on such tools, like missing information about existing tools, acquisition and maintenance costs, casual use, installation complexity, learning curves, etc., must be removed. The aim of the ICT equipment support project is to break through these barriers by providing easy access to today's tools and to the associated consulting and support services. This equipment (described on page 42) consists of advanced software engineering tools and software/hardware tools for designing and testing embedded and communication systems.

## CETIC'S ROLE

CETIC is coordinating this project and actively involving SMEs in project activities. CETIC is also contributing to the main research themes and triggering specific dissemination activities directed towards the enterprises.

## KEY RESULTS

The applied research conducted by the CE-IQS typically involves an industrial prototype or methodological deployment that results in an effective transfer to the partnering companies. These are the main achievements of the CE-IQS in 2010, including examples of results transfer to the industrial partners:

- The research conducted on the **development and evolution methodologies** theme addressed the topic of Agile software development processes. Unlike the heavyweight, monolithic methods, the Agile methods favour team interaction over a strict process, and on reactivity over a locked-in plan. Therefore, they are of value for small IT software development structures.
- The **verification and validation** theme focused on test design activities, with the aim of easing the production of high-quality tests, taking domain-specific knowledge into account. It is based on the

elaboration of a structured library of test patterns which helps to capture, manage and transfer the know-how about testing in a test team. A toolset was also developed to help in the instantiation of this pattern library on a specific project in order to produce high quality test design and test plan documents.

- The **certification activities** theme covered a wide range of problems. The OWPL method, related to the **assessment of IT development practices**, is being deployed more and more, as it closely matches the level of granularity required by Walloon SMEs and can help them improve. The COSMIC function point evaluation method, related to **development effort estimation**, is increasingly being transferred to SMEs based on training and coaching needs. Some organisations have even achieved autonomy in this area. In terms of **security**, specific risk analysis techniques have been circulated several times now, across the whole of Wallonia (SPI+, ASE, BEP, CCI, etc.). In terms of **safety**, training to the DO-178B aeronautics standard was organised. Finally, CETIC remained very active in representing SME needs on standardisation committees, such as the national SC27 security group, the BISI initiative and the international committee, ISO/IEC-SC7 (specifically, WG6 on quality and WG24 on SME software processes).
- Within the **distributed systems** application theme, the area of Service Oriented Knowledge Utilities (SOKU) was investigated, with a specific focus on server virtualisation, which was subsequently extended to cloud computing.
- Within the **embedded systems** application theme, heterogeneous wireless systems were investigated, with the focus on lowering power consumption. Several computing architectures were studied to compare their efficiency. An industrial case study was conducted to optimise the performances of a telecom board: various computing architectures were compared and combined to achieve the best performance/consumption ratio.
- Finally, within the **intelligent content and semantics** application theme, many pilots were demonstrated, using a wide variety of content management technologies. Semantic technologies were used successfully for the first time on industrial cases, drawing a great deal of interest from project partners.

CE-IQS applied research typically involves an industrial prototype or methodological deployment, resulting in effective transfer to our partner companies.





# CELLaVI

## Centre d'Expertise en Logiciel Libre à Vocation Industrielle

**Type of project:** Walloon Region – FEDER – Convergence Objective

**CETIC budget:** €3,056,390

**Duration:** 2008-2013

**CETIC departments:** Embedded and Communication Systems, Software and Services Technologies, Software and System Engineering

**Project websites:** [www.cellavi.be](http://www.cellavi.be) – <https://forge.pallavi.be>

**CETIC contact:** Damien Hubaux – [damien.hubaux@cetic.be](mailto:damien.hubaux@cetic.be)



### BACKGROUND

Many companies are interested in open source software, both technologically and economically, but the path to successful adoption is not an easy one. The open source paradigm brings with it new licensing schemes, requires that clear economic choices be made and encourages the development of new models. So-called hybrid licensing, which incorporates the features of full open source and classic software licenses, makes the choice even more complicated.

Open source software is an attractive option, as little infrastructure exists that can be shared among user businesses. Mutualisation structures, by contrast, support networking among industrial actors from both the private and public sectors (the public sector plays a role in adopting open source software and can act as a stimulus). To be efficient, the collaborative environment must remain independent with respect to business actors, licensing, business models and the technologies used.

Through its various research tasks, the project will support three categories of companies:

- **Software editors:** Open source involves specific business models, as free software creates a distinction between primary development activities and value-added activities, such as support and advanced functionalities. Software companies can take advantage of free software to turn these two characteristics into assets for exporting their skills. Open source allows very small companies to become worldwide references, while the availability of the code provides a strong guarantee for the customer. At the same time, open access can oblige the publisher to remain the expert on its reference product. With open source, traditional independent software vendors face the risk of competition from new entrants into the marketplace distributing free software.
- **Software services companies:** Free software can be incorporated into specific solutions. Integrating free software based on the reuse of proven components and avoiding licensing costs can provide a strong competitive advantage. Still, help is needed in selecting the appropriate software components, and, where appropriate, taking into account trust issues, traceability of licenses and possible legal risks. There is also the opportunity to provide a knowledge base of existing free software in some areas, as well as knowledge of outstanding contributions from research projects and innovative initiatives.

- **End-users:** Free software is important for companies and administrators for various strategic tasks. As new applications emerge, their functionality and quality catch up with, and even out-perform, classic commercial applications. Users face the difficulty of selecting open source software tailored to their needs, with the required quality and support.

In order to support all these actors, CELLaVI provides several answers in different areas:

1. By setting up a forge and a collaborative environment, CELLaVI meets the needs of companies looking for an online service to host their applications. While this service is a means for promoting the software, it is also a tool to support co-development between a company and its partners.
2. CELLaVI helps companies questioning the potential benefits of free software by providing services in these areas:
  - ▶ Legal: choice and combination of licenses,
  - ▶ Economic: choice of business model, management support for open source projects,
  - ▶ Technical: choice of software components, application architecture, etc.,
  - ▶ Training: knowledge of open source platforms, training certificates, etc.
3. By taking into account emerging fields, such as open hardware or automated software analysis, CELLaVI provides a decisive advantage for companies associated with the initiative: it helps them remain at the leading edge of development in the area of open source software.

CETIC coordinates this Centre of Expertise, and is responsible for the active involvement of SMEs in project activities. CETIC also leads the main research themes and triggers specific dissemination activities that target enterprises.



### PARTNERS

Facultés Universitaires Notre-Dame de la Paix de Namur (FUNDP), MULTITEL, Université de Mons (UMONS)

CETIC is specifically responsible for:

- Deploying the project portal (called PALLAVI), based on a forge, and supporting dissemination of the project outcomes: <https://forge.pallavi.be/wiki/cellavi>.
- Quality assurance of open source software, in particular the analysis of metrics, software life-cycle and software product lines.
- Specific expertise on the use of open source software for embedded devices, specifically open hardware.
- Dissemination and exploitation of project results.

## KEY RESULTS

The PALLAVI portal has served as a proof-of-concept of a forge sized to the needs of typical SMEs. The study conducted for the selection of the forge, in which a methodology was defined for comparing several open source alternatives, has aroused significant interest. Several partners have decided to implement a forge on their premises, taking advantage of the collaborative tools and methods developed by the open source communities. The CELLaVI website is now hosted on the forge wiki.

The operational aspects of PALLAVI are backed by general purpose open source expertise, focused mainly on infrastructures and aligned with local industry needs, tackling virtualisation techniques and open source cloud middleware in particular.

The quality of open source software is crucial, if it is to be adopted and used in a business context. The project benefits from the results of the QualOSS project, that are in turn further developed via the CELLaVI project.

The project activities also include progress on training aspects and on legal expertise, managed by MULTITEL and FUNDP/CRID respectively. With regard to exploitation of the research results, specific advice has been provided to several partners and local companies.

A second edition of the Open the Source event ([www.openthesource.be](http://www.openthesource.be)) is planned for 2011. Well-known speakers have already agreed to participate. This second edition will be organised in collaboration with INFOPOLE Cluster TIC, the LIEU network (Interfaces Entreprises Universités) and the Cluster TIC from Brussels.

Many other activities have been organised to strengthen the network of actors in the open source domain, notably several presentations made at the Rencontres Mondiales du Logiciel Libre. As well, information about open source software and about the project has been widely disseminated via both generic and specific media.



*The experience gained from selecting and operating a forge suited to the needs of SMEs has drawn significant interest from partners who are taking advantage of the good practices emerging from open source communities.*



**Type of project:** Walloon Region – Marshall Plan  
**CETIC budget:** €147,861  
**Duration:** 2007-2010  
**CETIC department:** Embedded and Communication Systems  
**CETIC contact:** Gérard Florence – gerard.florence@cetic.be

## BACKGROUND

The CMR form (a legal instrument defined and regulated by the Convention on the International Carriage of Goods by Road) is a required document for goods transport and transportation logistics. However, this paper form is tedious to fill out and process, particularly for small and medium-sized fleets that provide services to third parties. The introduction of an electronic CMR, or eCMR, with handwriting recognition, would simplify and speed up commercial and administrative procedures, while preserving current practices associated with the use of paper forms. There is a real opportunity here to ensure the traceability of goods, and obtain a precise cost evaluation for operations purposes. A significant amount of time would be saved, compared to the current procedures for encoding and managing data, especially for high volumes of goods transported.

The eCMR project targets efficient electronic handling and exploitation of CMR forms. Through the development of an embedded system for seamless acquisition and transmission of a CMR form's information, the eCMR project aims to skilfully cross-reference and combine CMR data with available in-vehicle information from various other sources (tachograph, GPS, sensors, etc.).

The information sources used to enhance the CMR form's information can be extracted from various devices embedded in trucks. These include:

- CAN/FMS
- Sensors
- Positioning system (GPS)
- Digital tachograph (recording the driver's activities, distances travelled, the vehicle's speed and identification data, etc.)

Thanks to its expertise in embedded equipment, communication protocols and interfaces, CETIC is able to design an embedded system dedicated to the acquisition, local processing and transmission to a remote server of information from a number of different devices.

The remote information management system requires an adequate level of abstraction to allow the end-operator to focus on the data, and not be distracted by the specific constraints and details related to the heterogeneity of the equipment.

## KEY RESULTS

Development began in 2008 with:

- The Bluetooth Dongle, which is a smart wireless communication device that transfers the digitised CMR forms from a digital note recorder to any Bluetooth-enabled device.
- A centralised information management system, which implements the abstraction layer required for position data collection from vehicle devices.

The second step was to enhance the embedded system by the addition of an embedded PC. This PC is permanently connected to devices such as the tachograph data broadcast interface, the CAN/FMS interface and the AVL (Automatic Vehicle Location) device that provides GPS and various sensor data.

In 2010, the project was extended for 6 months to improve the system with the addition of new features to optimize the use of the TCP/GPRS connection for data transmission, and to run real-world tests. As a result of the improvements, the transmission of GPS, CAN and tachograph data is configurable remotely from the management station. Similarly, recognition of events from tachographic data (e.g. exceeding the speed limit) logged in a file by the onboard equipment allows the transmission of only relevant information. In June, 2010, tests were conducted, and then the embedded equipment was mounted in a truck operated by the transport company Paquet, and the server (remote information management system) was deployed on a PC in Smolinfo's offices.

*Thanks to its expertise in embedded equipment, communication protocols and interfaces, CETIC can design an embedded system dedicated to the acquisition, local processing and transmission of data from various different devices to a remote server.*

## PARTNERS

Connector, Docledge, Facultés Universitaires Notre-Dame de la Paix de Namur (FUNDP), Orditool Belgium SA, Paquet, Smolinfo SPRL



# eHEALTH FOR CITIZENS

**Type of project:** Walloon Region – FEDER – Convergence Objective

**CETIC budget:** €1,205,509

**Duration:** 2009-2014

**CETIC departments:** Embedded and Communication Systems, Software and System Engineering, Software and Services Technologies

**CETIC contacts:** Gautier Dallons – gautier.dallons@cetic.be and Sébastien Rousseaux – sebastien.rousseau@cetic.be

## BACKGROUND

This project constitutes a technological response to the challenges posed by the evolution of health care, as the sector faces a major demographic shift. An ageing population combined with an increase in chronic illnesses is changing the way health care is provided. Add to this a shortage of medical specialists, and the need to find new solutions to address health care issues becomes even more pressing. Our eHealth for Citizens project is mainly aimed at designing and implementing a technological service-oriented platform capable of devising and supporting innovative eHealth services.

An important project objective is to enable, enhance and support technological evolution to allow patients to be cared for in their homes. The focus is on creating customized services to meet the health care needs of patients, such as monitoring services. The platform will offer a wonderful opportunity for achieving better quality medical care, while bringing new added value services to the eHealth marketplace.

The project addresses various research topics:

- Development of a multi-modal Graphical User Interface (GUI) adapted to meet the patient's needs and designed in accordance with his capacities.
- Service composition, which examines what specialized services to provide to the patient and the mechanisms for delivering those services in an automated and transparent way.
- Communication protocol design, which focuses on the design of an interoperable protocol to share information between medical devices and the platform.
- Security and certification, which involves selecting the various mechanisms that must be implemented in order to secure the platform and ensure confidence in its services.

*An important project objective is to enable, enhance and support technological evolution to allow patients to be cared for in their homes.*

## PARTNERS

Facultés Universitaires Notre-Dame de la Paix de Namur (FUNDP), ImmuneHealth, Université catholique de Louvain (UCL)

- Data integration, where the consolidation of medical data is key to providing specialized services to the patient, in the case of a fall, for example, and for detecting emergencies.
- Legal constraints, which concerns the legal requirements that must be met by the platform because of the sensitivity of the data contained in medical records.

Based on the results of these research activities, validation scenarios will be implemented to demonstrate what has been achieved. These demonstrations will focus on three main health care cases:

- Diabetic patients,
- Epileptic patients,
- Patients suffering from multiple pathologies.

The medical devices collecting patient data will be included in the demonstrations. Based on those data, an assortment of services will be packaged and presented to the patient to help him establish his health care management plan. In the case of diabetic patients, this could be a home food delivery service set up in accordance with his prescribed diet, which would provide added value to the patient.

CETIC is in charge of coordinating the project and the research items related to service composition and security, and to the design of the communication protocol. CETIC is also responsible for the global integration of the platform and for conducting the demonstrations.

## KEY RESULTS

In 2009, CETIC put together the requirements for the earliest versions of the demonstrations, and conducted state-of-the-art studies on service composition techniques and eHealth platforms. The first validation scenario that was identified in consultation with physicians and patients' associations is related to the follow-up of diabetic patients at home.

In 2010, CETIC began developing demonstration scenarios related to home care for diabetic patients. An in-depth study was undertaken with Walloon hospitals and diabetologists to itemise their specific needs and create the scenarios. On the basis of these scenarios, CETIC designed the architecture of the platform and the services that would be implemented. A strong focus was placed on improving communication among the actors participating in the care of these patients, which will be based on a communication link between this eHealth platform and the public sector Walloon Health Network.

CETIC has begun to implement the first of these services, which will be tested through a pilot project in the Walloon Region in 2011.

## Health Monitoring in Aeronautics

**Type of project:** Walloon Region – Marshall Plan – Aeronautical and Space Pole (Skywin)

**CETIC budget:** €51,900

**Duration:** 2008-2011

**CETIC department:** Embedded and Communication Systems

**Project website:** <https://www.skywin-hmplus.be>

**CETIC contact:** Mathieu Delehayé – [mathieu.delehayé@cetic.be](mailto:mathieu.delehayé@cetic.be)



### BACKGROUND

Health monitoring is a broad, multi-disciplinary domain made up of specialised skills that are already available in the Walloon Region. However, prior to 2008, these skills had never been brought together within a coordinated project, and practical experience applying them in the aeronautics market was lacking.

Since January, 2008, CETIC has been collaborating in the HM+ (Health Monitoring +) project to remedy this situation. HM+ aims to reduce health monitoring (maintenance) costs in aeronautics by using embedded devices and information technologies in aircraft. This is a Marshall Plan-funded project that meets the requirements of the Walloon competitiveness cluster for aeronautics and space: Skywin ([www.skywin.be](http://www.skywin.be)).

The HM+ project is divided into two 2-year phases. The first phase (2008-2009) consisted of the specification and design of a complete health monitoring system for three specific applications. The second phase (2010-2011) involves the development and validation of a functional prototype. At the beginning of 2010, the HM+ project entered its second phase.

The overall aim of the project is to increase reliability and safety inside aircraft through the use of health monitoring techniques. Three specific applications have been envisioned to achieve this:

- Actuator systems and damage simulation inside aircraft (this application is managed by Sonaca).
- Engine and equipment monitoring inside aircraft, a cryogenic actuator (managed by Techspace Aero).
- Electrical distribution systems and arc fault detection inside aircraft (managed by Thales Alenia Space ETCA).

*The aim of the project is to increase reliability and safety inside aircraft through the use of health monitoring techniques.*

The research topics are: design, integration and validation of new sensors and actuators, electronics and interfaces inside aircraft, damage assessment, critical embedded system certification methodologies, algorithms for default detection and error recognition, and signal processing from sensors inside aircraft.

CETIC is contributing to HM+ by monitoring engine oil system status in terms of temperature, pressure, rejection rate, coking phenomenon (obstruction caused by carbon deposits), etc. With its extensive expertise in embedded systems design, CETIC is assisting with the migration of the detection algorithms developed by the Automatic Control and Systems Analysis Department (SAAS) of the Université Libre de Bruxelles onto the platform prototype designed by the industrial partners. This task takes into account the embedded platform's physical constraints (like processor and memory limitations) at the engines' working temperatures. More specific aspects, such as advice on certification for critical embedded systems, following RTCA DO-178B (software standard) and RTCA DO-254 (hardware standard), are also provided by CETIC.

### KEY RESULTS

During 2010, CETIC began the development of a platform prototype to monitor engine oil system status. Among other things, CETIC helped port the detection algorithms from Matlab Simulink onto the embedded system designed in the project. CETIC has also studied the certification potential of the platform's software and hardware. The collaboration initiated with the partners will be pursued in the follow-up to the HM+ project, for which critical embedded systems certification will still be considered.

### PARTNERS

Cissoïd, CRIBC, Deltatec, GDTech, Open Engineering, SONACA, Samtech, Thales Alenia Space ETCA, Techspace Aero, Université catholique de Louvain (UCL), Université Libre de Bruxelles (ULB), University of Liège (ULg) and Université de Mons (UMONS)

# NAPLES

## New Agile Platform for a Lifelong Engineering of Software

**Type of project:** Walloon Region – Partenariat d'Innovation Technologique  
**CETIC budget:** €606,338.25  
**Duration:** 2010-2013  
**CETIC department:** Software and System Engineering  
**CETIC contact:** Jean-Christophe Deprez – jean-christophe.deprez@cetic.be



### BACKGROUND

Increased market pressure is forcing software development firms to improve the productivity of their development teams and the dependability of the software solutions delivered to their customers. The chief means for achieving a positive impact on productivity and dependability is through reuse at the various stages of a software development project. Next in importance is improved communication among stakeholders throughout the project life-cycle.

Although advocated by many, well-orchestrated reuse in software development projects is not yet a reality. To enable reuse, several roadblocks must be removed. First, existing software reuse techniques, which are not always well known by software engineers in industry, must be better publicized. Second, the application of reuse techniques, which often requires too much of an initial effort, in re-engineering existing software solutions, for example, must become easier. Third, reuse techniques must be included in the software development process of many organisations, which has not always been the case up to now.

With regard to communication among the stakeholders of a project, the major roadblock is the lack of visibility that each project participant has of the work and needs of others. Although all reference models of software development practices attempt to organize everyone's work and interactions, practitioners find these models either too high-level, and therefore do not provide enough practical guidance (CMMI, ISO 12207), or too intrusive, in that too many fine-grained tasks are imposed that not everyone in an organisation will be prepared to perform (RUP).

The NAPLES project aims to improve this situation by developing its platform to:

- Facilitate the reuse of material (artefacts) from a large NAPLES knowledge base built from past projects.
- Encourage and ease the production of new reusable material to add to the NAPLES knowledge base.
- Promote workflow-oriented software development; that is, each stakeholder will be able to select and customize the workflows of recognized practices to perform many tasks throughout the software development life-cycle. Tedious workflow tasks will be automated, particularly those requiring interaction between software engineering tools and the project's IT environment.

- Make the production and consumption of reusable artefacts a reality through the streamlining of reuse activities in workflow templates of every discipline of the software development life-cycle.
- Provide a portal where the various stakeholders in a software project, including the customer, will obtain an accurate project status at a selected level of detail. The portal will also enable common software engineering operations, such as reporting bugs, without interacting directly with software engineering tools.

To build a successful NAPLES platform, a partnership was initiated with two Industry partners, Siemens IT Solutions and Services (SIS) and Océ Software Laboratories (OSL), and two academic partners, the PRECISE department of FUNDP and CETIC. To guarantee industrial applicability of the NAPLES platform, its main requirements are developed by the two industrial partners. Then, all the partners are involved in designing the architecture of the NAPLES platform and take part in its development. The final result will be validated through several industrial case studies.

### KEY RESULTS

The NAPLES project has enabled CETIC to achieve the following:

- Development of an audit questionnaire to capture the reuse practices already in place in an organisation, and the reuse practices that an organisation wishes to promote.
- Development of a selection method for identifying software engineering tools to include in the NAPLES platform, and application of the selection methods for building three different NAPLES platform instances, one each for SIS, OSL and CETIC.
- Implementation of initial workflow templates for requirements management in the Bonita workflow solution, and automated interactions between workflow tasks and requirements engineering tools via the protocol defined by the Open Services for Life-cycle Collaboration (OSLC).

*The NAPLES platform improves reuse in software development projects and streamlines the application of recognised software engineering practices.*

### PARTNERS

Facultés Universitaires Notre-Dame de la Paix de Namur (FUNDP) – PRECISE, Océ Software Laboratories, Siemens IT Solutions and Services

# QDFCA

## Quality Design For Competency Assessment

**Project type:** Walloon Region – Marshall Plan  
**CETIC budget:** €138,747.50  
**Duration:** 2009-2012  
**CETIC department:** Software and System Engineering  
**CETIC contact:** Sanae Saadaoui – sanae.saadaoui@cetic.be

### BACKGROUND

The aim of the QDFCA project is to improve the functionalities of the ExAMS platform. This is an open source platform ([www.exams.be](http://www.exams.be)) based on a structured approach and innovative scientific concepts. It was developed jointly by SMART and the Assess group (a spin-off of the University of Liège).

The ExAMS platform objectives are the following:

- Help evaluators implement procedures for constructing and managing standardised quality evaluations,
- Offer precise monitoring to those whose system is being evaluated and provide personalised diagnostic feedback,
- Guarantee the best quality improvement (validity, reliability, equity, etc.).

The platform is a great success and is continuously expanding in the European market. Nevertheless, clients keep voicing new demands. As a result, the platform needs to be enriched by new functionalities to meet client requirements and stay competitive in this market. These requirements mainly concern the following two issues: (1) the need for greater interoperability between the platform and the clients' systems; and (2) the need for more complex and specific evaluations.

The objective of the QDFCA project is to transform the platform into a real Assessment Management System, covering assessment needs from the classical standardised testing to the evaluation of high-level competencies.

CETIC applies its technological expertise to help the platform reach its highest level of performance and interoperability. Technology quality and high performance are key success factors for the project.

### KEY RESULTS

During the first year of the project, efforts were mainly devoted to mastering the platform environment and analysing the existing functionalities and the technologies used. Based on this initial analysis, some recommendations were made:

- Improve the quality of the code and of the classes,
- Include project management and open source,
- Select tools and technologies to enhance the security of the platform.

During the second year, 2010, several of the recommendations were implemented. CETIC helped analyse, choose and develop the best technological solutions, methods and tools that will guarantee the highest reliability and efficiency of the platform.

The main tasks achieved during this year were:

- Deployment of a new server,
- Security of data on the various instances of the platform: dependencies between instances, isolation of instances,
- Security of communication methods,
- Security of the server: Analysis of Web technologies and their vulnerabilities, availability, mirroring, IP fail-over, etc.,
- Database migration and evolution,
- Stress-testing the application using existing workload testing tools.

To ensure the best collaboration among the proponents of the ExAMS platform, special attention has been given to the open source aspects of project management. A scientific study on intellectual property and open source licenses was performed.

*CETIC applies its technological expertise to help the platform reach its highest level of performance and interoperability. Technology quality and high performance are key success factors for the project.*

### PARTNERS

Assess Group sa, SMART – University of Liège



**Type of project:** Walloon Region – Marshall Plan – Aeronautical and Space Pole (Skywin)

**CETIC budget:** €321,166

**Duration:** 2010-2013

**CETIC department:** Software and System Engineering

**CETIC contact:** Mathieu Delehay – mathieu.delehay@cetic.be

## BACKGROUND

The objective of the SAT project is to develop new technologies for aircraft and smarter airborne systems. Five projects are included in the SAT project: two competency centres and three technologies and their associated applications.

- **Ceces\_2:** This is a centre for the study of electronic components subjected to radiation and extreme temperature environments (Communauté d'Expertise pour Composants en Environnements Sévères). The behaviour of sensitive components, like MEMS (microelectromechanical systems) sensors or FPGA (field-programmable gate arrays), will be studied in this project. The partners involved are: Thales Alenia Space ETCA (project leader), Cissoïd and UCL.
- **Certif\_2:** This is a centre for the certification of critical and aeronautical embedded systems, following the embedded software (RTCA DO-178B) and hardware (RTCA DO-254) standards from the US FAA (Federal Aviation Administration) and EUROCAE (European Organisation for Civil Aviation Equipment). The modelling of the certification process, including variations in design, and the management of software and hardware product lines will be considered in this project. The partners involved are: CETIC (project leader), Thales Communications Belgium, Barco Silex and FUNDP.
- **PHM Compact:** The objective of this project is to develop a compact hydrogen maser (atomic clock), based on the cavity magnetron, for use in space and civil applications. The partners involved are: Gillam FEI (project leader), Entreprise Dardenne, UCL and ULg.
- **HMIs Aveugle:** The objective of this project is to develop new human-machine interfaces (HMIs) for blind interactions between pilot and cockpit instruments or commands. A multi-modal approach, using voice, video, touch screens, etc., will be favoured. The partners involved are: MULTITEL (project leader), Thales Communications Belgium and Gillam FEI.

- **Simulation Radio/Aéroport:** The objective of this project is to study the radio system congestion problem at airports, specifically considering the problems of air traffic control and communication through airport speakers. A virtual reality-based approach, combined with real equipment prototypes, will be followed in this study. This project will involve the two Walloon civil airports (Charleroi and Liege). The partners involved are: Thales Communications Systems (leader), M3 Systems and UCL.

The overall SAT project is coordinated by Thales Communications Belgium. CETIC is the leader of the Certif\_2 sub-project, which will first conduct a study of industrial needs, based on the experience of two project partner companies: Thales Communications Belgium and Barco Silex. Following the preliminary study, CETIC and FUNDP will model the generic certification process, including the variations in embedded systems design that may potentially impact the certification process. Critical embedded system certification is a very costly process, which can amount to an overhead of 3 to 5 times the design cost of the embedded system. Reuse and adaptation of previously produced documentation and minimization of the change impact on the overall certification process will be considered. As the safety certification of critical systems will constitute a condition for market access in the future, this kind of expertise will provide a competitive advantage to Walloon aeronautics companies.

## KEY RESULTS

The S@T project, which began on September 1, 2010, has produced a preliminary study of industrial needs which led to the identification of two industrial study cases, one by Thales Communications Belgium and the other by Barco Silex. At the end of the Certif\_2 project, Thales Communications Belgium will validate the industrial application of the methodologies and tools developed by CETIC and FUNDP.

S@T is developing new technologies for aircraft and smarter airborne systems.

## PARTNERS

Barco Silex, Cissoïd, Entreprise Dardenne, Facultés Universitaires Notre-Dame de la Paix de Namur (FUNDP), Gillam FEI, MULTITEL, M3 Systems Belgium, Thales Alenia Space ETCA, Thales Communications Belgium, Université catholique de Louvain (UCL), University of Liège (ULg)

# 3WSA

## Wallonia Worldwide Space Applications

**Type of project:** Walloon Region – Marshall Plan – Aeronautical and Space Pole (Skywin)  
**CETIC budget:** €126,700  
**Duration:** 2007-2010  
**CETIC departments:** Software and Services Technologies, Software and System Engineering  
**Project website:** <http://3wsa.accessible-it.org/>  
**CETIC contact:** Fabian Steels – [fabian.steels@cetic.be](mailto:fabian.steels@cetic.be)



### BACKGROUND

The 3WSA project addresses the development of technical tools, and experimentation with these tools, merging state-of-the-art ICT with existing and future infrastructures for space applications, especially GALILEO and GEMS. The purpose of the project is to provide decision tools to security agencies and citizens in the areas of public security, environmental issues, mobility and natural resources management.

The 3WSA project is intended to initiate a centre of geomatic services in the Walloon Region, addressing European and even global markets, built on existing infrastructures and leading to a number of industrial and commercial initiatives:

- A reference platform (technical infrastructure and operational structure) for service orchestration in security, the environment, mobility, natural resources and disaster management.
- A European centre for the transmission of secured and broadband messaging between fixed and mobile entities.
- A European reference centre for the management of industrial risks, particularly addressing hazardous sites like the SEVESO plants and the transportation of hazardous substances.
- A start-up incubator, WSLux, to support Walloon initiatives in space infrastructure.

An example of an application of service orchestration is the selection of satellite photography from a limited zone – e.g. a SEVESO plant – from which a specific service provider will identify the storage tanks and their contents. Then, it should be possible to launch a new service to determine the required security zones and dispersion areas around the tanks, taking into account the risk posed by the substances of concern.

CETIC is participating in the development of the billing platform (based on SOA – Service Oriented Architecture) and in the development of the security module for each registered service (based on an Access Control technology). CETIC is providing 3WSA with its expertise in conception and prototyping to upgrade a service platform and add new services to it. CETIC will transfer the corresponding technologies to its partner, Spacebel.

Thanks to its federative character, the 3WSA project makes it possible for Walloon companies to take a more competitive position with respect to the technological tools necessary to build secured geomatic service platforms.

### PARTNERS

Agence Prévention et Sécurité (ULg), AMOS, Aquapole, Centre Spatial de Liège (CSL), CREACTION, IONIC Software, SPACEBEL, Vitrociset-EPB, WALPHOT, WSLux

### KEY RESULTS

CETIC's role is to provide its expertise in the areas of security, certification and billing. In each of these three domains, CETIC has designed a state-of-the-art service platform and developed a prototype to demonstrate the technology.

- Concerning security, various standards were investigated, and GEO-XACML, which enables the association of access rights with geographical areas, was studied in more detail. An Access Control prototype was built based on the PEP technologies using an SAML token and GEO-XACML standards with SOAP requests.
- Concerning invoicing, a prototype was produced for a service that would manage the establishment of the offer, the recording of the necessary information and the creation of the invoices between customers and service providers (and also between suppliers, in the case of composed services).
- Concerning certification, CETIC ensured that only the services that respected the minimum requirements, as defined in the Service Level Agreement (SLA), were allowed to be integrated into the platform.

*The 3WSA project enables Walloon companies to take a more competitive position with respect to the technological tools necessary to build secured geomatic service platforms.*

# EUROPEAN RESEARCH PROJECTS

With the move from the Sixth to the Seventh Framework Programme (FP7), the European Commission further promoted innovation; specifically, the conversion of research knowledge into new products and services to create a thriving European economy that requires highly skilled jobs. To achieve this, the European Commission has defined a very ambitious Digital Agenda<sup>1</sup> and a new vision for the EU, which is to become an Innovation Union<sup>2</sup>. ICT is critically important in this vision; in particular, cloud computing and the Internet, where billions of devices and services will seamlessly assist European individuals in their daily lives and support European organisations in their businesses. In this ICT-controlled world, guaranteeing the proper functioning of software systems has never been more important. Consequently, the Seventh Framework Programme also supports the development of formal, i.e. mathematical, techniques for developing highly dependable systems.

CETIC is contributing to this European vision. Under FP7, CETIC is involved in two projects, one related to cloud computing (RESERVOIR) and the other to formal methods (DEPLOY), with a third project starting in 2011 (COMMODIT - <http://comodit.com/> - on cloud infrastructure management and cloud application management).

**RESERVOIR** is a European Strategic Project developing the concept of Infrastructure as a Service, where an application will transparently scale up and down on demand using virtual machines, and where these machines will be able to migrate from hardware machines at execution time to optimise performance and reduce energy consumption. CETIC was invited to join the RESERVOIR project because of its expertise in security and distributed computing acquired in FP6 research projects, such as GridTrust, BEinGRID, AssessGrid and HPC4U.

<sup>1</sup> [http://ec.europa.eu/information\\_society/digital-agenda/index\\_en.htm](http://ec.europa.eu/information_society/digital-agenda/index_en.htm)

<sup>2</sup> [http://ec.europa.eu/research/innovation-union/index\\_en.cfm](http://ec.europa.eu/research/innovation-union/index_en.cfm)



**DEPLOY** improves and transfers formal engineering methods for the development of highly dependable systems. Industrial transfers are conducted in the automotive, mass transport, space, business, aeronautics and computer chip design sectors.

Besides pure ICT research, FP7 funds projects in various sectors to accelerate the take-up of new technologies in industry, one of the most promising for ICT innovation being eHealth. CETIC has been active in this sector for a few years now and is recognized as Wallonia's leader in eHealth innovation. Leveraging the expertise acquired in the **OLDES** project (FP6), CETIC is currently leading two European projects in the health sector: **PONTE** and **AMACS**.

**PONTE** builds software technologies to integrate heterogeneous health databases to facilitate clinical trial planning, in particular for efficient patient selection.

**AMACS**, which is to be launched in 2011, will develop a fall detection system and monitoring systems to detect early dementia based on video cameras positioned to supervise patients at risk in their home.

The greatest indicator of CETIC's success is its ability to speed the transfer of European project results to businesses in Wallonia, to be applied and used to improve the Wallonia economy on an ongoing basis. CETIC will maintain its involvement in FP7 R&D activities and continue to invite Wallonia businesses to join their research consortium.



# C2A

## Connect to All

**Type of project:** European Commission – Interreg IV  
**CETIC budget:** €327,000  
**Duration:** 2008-2012  
**CETIC department:** Embedded and Communication Systems  
**Project website:** <http://www.c2a-project.eu>  
**CETIC contact:** Lotfi Guedria – [lotfi.guedria@cetic.be](mailto:lotfi.guedria@cetic.be)



### BACKGROUND

C2A is a cross-border cooperation project between the Walloon Region and France, targeting the transport and logistics sectors. The idea for the project grew from a general observation about ICT usage in transport vehicles. The number of embedded communication devices has significantly increased over time. Systems include mandatory devices, such as the digital tachograph, as well as radio communication systems (GSM/GPRS), localisation devices (GPS), data loggers, PC tablets, cameras, mobile phones, on-board computers, etc.

Although these devices are intended to automate processes and to offer significant added value and economic return, their exploitation remains sub-optimal in practice, and communication and resource sharing among them are usually very limited. This results in feature redundancy, service duplication and sub-optimal utilisation of deployed hardware and software resources.

To address this issue, the C2A project aims to offer a generic and intelligent interconnection system for embedded hybrid equipment, enabling greater interoperability and more efficient resource sharing. A flexible and open architecture is a key feature of such systems, in order to enable efficient data handling from a wide range of devices, sensors and communication interfaces.

The project is structured around two main actions:

- R&D action focusing on the design of the innovative embedded system (hardware and software),
- A dissemination and communication action, aiming at fostering interaction between ICT service providers and transport and logistics operators through various activities, such as the organization of discussion groups on specific issues.

CETIC's involvement is mainly focused on the project's R&D action. This entails developing specifications, defining relevant use cases and implementation scenarios, and designing and prototyping a flexible, open and upgradeable architecture.

### KEY RESULTS

In 2010, our work addressed the proof-of-concept of the specified architecture through the implementation of two system prototypes. The objective of this prototyping activity was to illustrate the ability to dynamically support the insertion and removal of new peripherals, to activate the devices' recognition mechanisms effectively, to integrate them into the system's functionalities and to trigger the appropriate application services. We chose to develop two demonstrators based on different hardware platforms in order to identify their constraints and limitations, as well as the complexity that may arise, and to research their impact on development. Our goal was to clearly identify the hardware-dependent and hardware-independent parts of the software, the latter constituting the reusable part of the design. One demonstrator was based on an embedded PC-like platform implementing a standard Linux operating system. The other was based on an SoC (System on Chip) platform with a proprietary operating system and tools.

We chose to use different peripherals on the prototypes in order to gather wider feedback on their integration. For the same reason, the prototypes were fitted with two different monitoring and configuration interfaces.

The prototypes were presented to the industrial partners of the project consortium, who were pleased with the results and recommended enhancements to the third and final demonstrator, to be developed in 2011.

*The C2A project aims to supply a smart platform to interconnect embedded equipment in transport, enabling interoperability, efficient resource sharing and easy ICT service deployment.*

### PARTNERS

Carinna, CReSTIC/URCA, Docledge, Forem, Gunnebo, INFOPOLE Cluster TIC, Monnier Borsu Sotradel, NeXXtep Technologies, Smolinfo SPRL



**Type of project:** European Commission – FP7 – ICT – Integrated Project  
**CETIC budget:** €829,776  
**Duration:** 2008-2012  
**CETIC department:** Software and System Engineering  
**Project website:** [www.deploy-project.eu](http://www.deploy-project.eu)  
**CETIC contact:** Christophe Ponsard – [christophe.ponsard@cetic.be](mailto:christophe.ponsard@cetic.be)



## BACKGROUND

DEPLOY is a European Commission (FP7) research project that will promote the use of formal methodology in European industry and develop industrially scalable formal methods. DEPLOY is a technological response to the increasing complexity of engineering systems and to our increasing dependence on automated systems for critical tasks, notably in safety-critical contexts.

The overall aim of DEPLOY is to make major advances in industrial practices for engineering dependable systems through the deployment of formal engineering methods and tools.

Industries are facing the challenge of mastering the development of ever more complex systems with ever higher levels of assurance. Formal engineering methods respond to this challenge through precise system modelling, powerful reasoning support for models (using automated analysis tools, such as theorem provers and model checkers) and exploitation in domain-specific models, and code generation.

More and more, industries are considering formal engineering methods, and DEPLOY aims to overcome problems of integrating these methods into existing industrial development life-cycles, and to present evidence of their overall efficiency and benefits in order to facilitate their adoption.

Throughout the lifetime of the project, DEPLOY methods and tools are intensively deployed in real industrial settings by the industrial partners, in order to test them against the industrial imperatives of cost-effectiveness, scaling and the ability to cope with the evolution of requirements. Industrial deployment takes place in five sectors, each of which is key to the future of European industry and society: automotive, rail transportation, space systems, telecommunications and business information. Each deployment sector is led by a partner who is a major player in that sector.

The rich and complementary mix of expertise to tackle the engineering challenges of the industrial deployment partners, along with the extensive technology base of the academic partners and service providers, constitute a combination that is unique in Europe, and indeed internationally, and one that is ideally suited to addressing the aims of DEPLOY.

CETIC's responsibility in the project is to quantify the benefits gained by the deployment of formal methods in industry. This assessment is particularly critical, as it will serve as the main

motivation for other industrial players to deploy formal methods as well. To achieve this, CETIC has put together evidence that is relevant to industry which supports the claim that formal methods provide substantial benefits when deployed in industrial settings.

## KEY RESULTS

In 2010, CETIC gathered the evidence that shows the value of deploying formal methods in industrial settings through a literature review and interviews of the industrial partners involved in the project.

CETIC published the gathered evidence material under the practical form of an online industrial FAQ (Frequently Asked Questions) which is easily browsable and understandable by industrial managers considering the adoption of formal engineering methods.

Aside from any quality improvement or positive return on investment they may deliver, formal methods train engineers to think in a more precise and systematic way, and so have a positive impact beyond their usefulness in engineering.

We have also observed that formal methods are difficult to tweak out of their original scope, so they need to be carefully selected according to the technical context and business objective concerned.

*Aside from any quality improvement or positive return on investment they may deliver, formal methods train engineers to think in a more precise and systematic way, and so have a positive impact beyond their use in engineering.*

## PARTNERS

Bosch, Clearsy, ETH Zurich, Newcastle University, SAP, Siemens Mobility, Space System Finland, Systerel, University of Southampton, University of Düsseldorf

# EXTRA

## Experience Transfer and Knowledge Management in SMEs Developing and Delivering Software Products

**Type of project:** European Commission/Walloon Region – CORNET

**CETIC budget:** €300,000

**Duration:** 2008-2010

**CETIC department:** Software and System Engineering

**Project website:** [www.cornet-extra.eu](http://www.cornet-extra.eu)

**CETIC contact:** Sanae Saadaoui – [sanae.saadaoui@cetic.be](mailto:sanae.saadaoui@cetic.be) and Frédéric Fleurial Monfils – [frederic.fleurialmonfils@cetic.be](mailto:frederic.fleurialmonfils@cetic.be)

# EXTRA

### BACKGROUND

Capitalising on knowledge and learning from past experience are software production activities that are crucial to SMEs. Unfortunately, they are too often ignored. At the same time, existing approaches to knowledge management focus primarily on solutions developed for large companies. EXTRA aims to offer solutions to SMEs that are better adapted to their context and their size.

The EXTRA project's main goal is to help European SMEs and VSEs active in the development and delivery of software to improve their process of developing and delivering the product by improving their knowledge management process. This in turn improves their competitiveness, both nationally and internationally.

There are different approaches to knowledge management. The EXTRA project focuses on four "technocratic" management schools:

1. System school: focuses on information systems and knowledge-based systems (repositories, databases, etc.), the main idea being to codify explicit knowledge;
2. Engineering school: focuses on processes and how to make their descriptions explicit;
3. Organisational school: focuses on the use of organised structures (practice communities, networks);
4. Spatial school: focuses on how to design work spaces to foster knowledge sharing.

Nine practical knowledge management techniques belonging to these four knowledge management schools are described and compiled in a practical handbook. The technique descriptions are the result of iterations based on validations and feedback from European SMEs participating in the project.

To guide SMEs on the optimal use of the techniques described, a self-assessment tool has been developed, which is designed to assist SMEs in: (1) evaluating the level of maturity of their knowledge management practices; and (2) improving this maturity level using the techniques described in the handbook.

The techniques and assessment tools developed are suitable for both traditional and Agile software development methodologies. Increasingly, the Agile methodologies are being adopted by small organisations. They relate to knowledge management, and they encourage knowledge sharing.

Many of the techniques described were inspired by the Agile concept. Based on their strong expertise in software process improvement, CETIC developed this EXTRA self-assessment tool.

CETIC was responsible for describing four from the nine techniques:

- A simple way to collect and manage key project information using a memory card,
- How to investigate a client scene and extract useful information for improving a product,
- How to foster knowledge brokers (a knowledge broker is a key individual who is aware of who knows what),
- How to organise technical information meetings to foster experience and information sharing among employees.

CETIC also participated in enhancing other techniques developed by the partners.

### KEY RESULTS

Launched in April, 2008, the project ended in June, 2010.

The main deliverables of the EXTRA project are:

- The production of the EXTRA handbook, entitled "Practical Knowledge Management – Techniques for Small and Medium Sized Software Companies". It was presented during the Agile XP2011 conference, where the project was well received. A copy can be ordered/downloaded from <http://extra.cetic.be>.
- The EXTRA tool for helping companies self-assess their knowledge management practices.
- A workshop was held in Charleroi on January 27, 2011. The deliverables of the project were presented to Belgian SMEs. The handbook was appreciated for being practical, as well as easy to read and use.

*EXTRA aims to offer solutions to SMEs that are better adapted to their context and their size.*

### PARTNERS

CITEA, ICT Norway, Intelliscape, SINTEF, Virtual IT

# OLDES

## e-Services at Home for the Elderly

**Type of project:** European Commission – FP6 – ICT – Specific Targeted Research Project

**CETIC Budget:** €555,360

**Duration:** 2007-2009

**CETIC department:** Embedded and Communication Systems

**Project website:** [www.oldes.eu](http://www.oldes.eu)

**CETIC contact:** Sébastien Rousseaux – [sebastien.rousseau@cetic.be](mailto:sebastien.rousseau@cetic.be)



### BACKGROUND

In the next few years, owing to the ageing of the population, Europe and the rest of the world will have to cope with significant challenges in supporting the elderly and providing them with good quality health care services. Many of the elderly live alone at home and have lost many of their social contacts. The majority suffer from chronic illnesses, like diabetes or heart failure, and cannot visit hospitals or doctors regularly. This complex situation generates expenses which will significantly increase in the near future.

The OLDES project was initiated in January, 2007, with two main objectives related to improving the quality of life of the elderly living at home.

The first objective is to develop a low-cost home health telemonitoring platform using wireless medical devices (glucometer, pulse oxymeter, sphygmomanometer, weight scale and electrocardiogram) and providing interactive online entertainment. Participants can access online news, videos and audio content, and are able to communicate easily using modern Internet-based Voice Over IP (VOIP). The OLDES system includes an online platform for a discussion group led by moderators who encourage interest among participants and reactions from them.

The second objective is to ensure the optimal exploitation of the project results. It focuses on engaging all the stakeholders in the co-construction of the system, in order to guarantee that all the needs of this demographic are taken into account, and to ensure that the final project results are accepted.

OLDES deployment began in October, 2009. Two 12-month pilots were established, one in Bologna and one in Prague. The objectives were to evaluate the OLDES technical solution and assess its final acceptance level, to monitor its impact on the quality of life of the elderly and to measure the economic impact of such systems in the two cities. The Bologna pilot focuses on evaluating the tele-accompany and entertainment systems. The Prague pilot focuses on the validation of the health telemonitoring system with 20 diabetic patients. The main objective of the pilot is to demonstrate that more cost-effective diabetes care is possible using telemonitoring and remote diet management.

The OLDES project has great potential for exploitation and growth. The system helps the elderly live longer at home and helps reduce the length of hospital stays. It also significantly reduces travel costs for medical and paramedical staff, who are able to remotely follow the health of seniors. All these results contribute to the reduction in health care costs for the society. The development of eHealth solutions for the elderly is of interest to many companies and public institutions in the field of home care services, hospitals (public or private) and doctors, medical device

### PARTNERS

Agentscape, Bologna Health Authority, Bologna University, CUP2000, ENEA, INK Media, Municipality of Bologna, Newcastle University, Prague Technical University

developers, health information science, health insurance, etc. All these stakeholders could take advantage of the innovative platform and the expertise developed through the OLDES project.

In the Belgian Walloon Region in July, 2009, CETIC began a 5-year regional research project, called "eHealth for Citizens", to evaluate, implement and deploy an eHealth service-oriented infrastructure based on the expertise built up through the OLDES project (for more information see page 32). CETIC is also in contact with companies and universities with a view to exploiting the results of the project with the creation of new start-up companies and spin-offs.

CETIC was a key partner of the OLDES project. CETIC was the leader of the work package dedicated to the development of the OLDES platform. CETIC also participated in the collection and analysis of the user requirements and elaborated the technical specifications.

### KEY RESULTS

In its early years, the work of the OLDES project consortium focused on collecting users needs and elaborating the main models of the platform. A significant effort was devoted to the involvement of all the stakeholders participating in the care of the elderly. Based on the information collected, CETIC drew up the technical specifications of the OLDES platform and started the implementation work.

During the third year of the project (2009), the work mainly focused on improving the functionalities of the platform and adding new services. As a result of these developments, a stable OLDES system, ready to be deployed in homes for the elderly, was produced. That summer, the first pilots were organised: 140 elderly people were enrolled in the Bologna pilot.

During the final year of the project, the work focused on the execution of the Bologna and Prague pilots. A detailed exploitation report was produced, assessing the economic aspects of the OLDES system. The final review of the project was successfully organised in Bologna in October, 2010. The European Commission's Project Officer was impressed with the work done by the OLDES consortium members.

*Stakeholders can take advantage of the innovative platform and the expertise developed through the OLDES project.*



# PONTE

## Efficient Patient Recruitment for Innovative Clinical Trials of Existing Drugs for Other Conditions

**Type of project:** European Commission – FP7 – ICT – Specific Targeted Research Project

**CETIC budget:** €694,875

**Duration:** 2010-2013

**CETIC departments:** Software and Services Technologies, Software and System Engineering

**Project website:** [www.ponte-project.eu](http://www.ponte-project.eu)

**CETIC contacts:** Philippe Massonet (Project Coordinator) – [philippe.massonet@cetic.be](mailto:philippe.massonet@cetic.be) and Joseph Roumier – [joseph.roumier@cetic.be](mailto:joseph.roumier@cetic.be)



### BACKGROUND

Owing to the global economic crisis, which is impacting pharmaceutical research, new research funding is being reduced and existing medications are being re-positioned for new uses and applied to new illnesses and disorders.

However, the expected benefits may be limited by the occurrence of side-effects, and new efficacies may be missed in the trials. Translation into clinical therapies must also overcome barriers at the pre-clinical and clinical levels. Bridging the gap between basic science and clinical practice will require a new relationship to be created between the scientific challenges, so that successful clinical applications can be developed at a low cost.

PONTE aims to provide a platform based on a Service Oriented Architecture (SOA) and a semantic approach that will offer semi-automatic, intelligent identification of patients eligible to participate in well-specified clinical trials for drug re-positioning, with particular focus on mitigating patient risk, reducing clinical trial costs and improving clinical trial efficacy. Such work involves decision support mechanisms fed with information retrieved using a semantic search engine operating on top of a data representation, and linking data in drug and illness knowledge databases, as well as in clinical care and clinical research information systems.

CETIC has three key responsibilities in the PONTE project:

- As coordinator of the project, overall management with a focus on quality assurance tasks.
- Standardisation activities: continuous interaction between the activities of eHealth-related international standards.
- Data representation and organisation: semantic data and metadata representation for clinical trials, to support the interoperability of clinical care information system data, enabling search, data mining and advanced machine learning across clinical care information systems based on an SOA approach.

### KEY RESULTS

PONTE will generate four main outcomes:

- Consistent semi-automated linking of clinical research information systems with clinical care information from Electronic Health Records (EHRs), through the development of a Semantic Specification Language. An innovative ontology-based search engine capable of mining information based on this semantic data representation will be used. Then, combining ontology-driven data integration and text mining techniques will enable the mining of the information required from the various heterogeneous data sources involved.
- Integration of a wide spectrum of existing clinical data standards into an innovative core, ontology-driven scheme that encompasses all the clinical research and clinical care processes within the PONTE objectives. As scalability is considered to be of major importance, the proposed platform will be implemented following SOA concepts.
- Incorporation of advanced authentication and data confidentiality techniques, and exploration of usage control techniques for providing access control services and privacy protection services.
- Study of current legislation related to access to, and use of, patient health data for the purposes of the PONTE platform (among other legal issues) and to guide the PONTE architecture throughout the duration of the project.

As the first year of the project comes to an end, PONTE has already produced a report on Clinical Trials Protocol design requirements, covering privacy requirements, the strengthening of the state of the art and the practices in the field, and careful design of the architecture and the main components of the platform. As expected, novel ideas stemmed from this work, both medical – a new methodology for designing the Clinical Trials

Protocol is being defined – and technical – the Linked Data paradigm is now a core element of the platform. The year 2011 will see the first implementation of the platform, along with a dedicated semantic search engine and the inclusion of the Medical Partners Information System.

*PONTE aims to provide an SOA and semantic platform for the automatic, intelligent identification of patients for clinical trials dedicated to drug re-positioning while mitigating patient risk and improving clinical trial cost and efficacy.*

### PARTNERS

Addenbrooke's Hospital – Cambridge University Hospitals – NHS Foundation Trust (ADDEN), Gottfried Wilhelm Leibniz Universitaet Hannover (LUH), Institute of Communications and Computer Systems / National Technical University of Athens (ICCS / NTUA), Institute of Psychophysiology & Rehabilitation of the Kaunas University of Medicine (IoPR), National Research Council – Institute of Clinical Physiology (CNR), Strategic Medicine Inc (SMI), Technische Universität Dresden (TUD), University of Athens (UoA)



# RESERVOIR

## REsource and SERvice Virtualisation withOut barrleRs

**Type of project:** European Commission – FP7 – ICT – Integrated Project

**CETIC budget:** €494,827

**Duration:** 2008-2011

**CETIC departments:** Software and Services Technologies, Software and System Engineering

**Project website:** [www.reservoir-fp7.eu](http://www.reservoir-fp7.eu)

**CETIC contact:** Philippe Massonet – [philippe.massonet@cetic.be](mailto:philippe.massonet@cetic.be)



### BACKGROUND

The RESERVOIR project (REsource and SERvice Virtualisation withOut BarrleRs) is providing the foundation for a service-based online economy, in which – using virtualisation technologies – resources and services are transparently provided and managed on an on-demand basis at competitive prices and at a high level of quality. The project consortium is coordinated by IBM's Haifa Research Lab, with balanced representation on the part of industry and academia.

Cloud computing has emerged as a very popular paradigm for delivering on-demand services over the Web. This paradigm lowers software complexity and costs, reduces time-to-market, improves reliability and enhances customer accessibility to government and business services. Cloud computing constitutes a true manifestation of the visionary promise of Service Oriented Computing (SOC).

With RESERVOIR, we are developing breakthrough systems and service technologies that will serve as the infrastructure for cloud computing. However, SOC's wide-scale penetration of the economic landscape is contingent on the ICT industry solving several well-recognised technical challenges. A key one is the development of a scalable and effective service-oriented infrastructure. RESERVOIR is focusing on scalability of the infrastructure cloud.

The vision of RESERVOIR is to enable the delivery of services on an on-demand basis, at competitive prices and without requiring a large capital investment in infrastructure.

#### The Service Oriented Infrastructure (SOI) Equation

To achieve this vision, our work extends, combines and integrates three technologies: virtualisation, grid computing and Business Service Management (BSM). We believe this approach can deliver ubiquitous utility computing by harnessing the complementary strengths of these technologies. The virtualisation technology has been shown to be useful in overcoming some of the barriers to the commercial adoption of grid technology. At the same time, RESERVOIR will add virtualisation awareness to the federation of sites, by using low-level monitoring information for metering and billing.

To benefit fully from the dynamic nature of the RESERVOIR computing cloud, the project is developing a uniform policy-driven management layer that will automatically allocate resources to services, and monitor execution and utilisation to ensure compliance with Service Level

Agreements (SLA), by adjusting the level and location of the allocation. The new capability of the infrastructure is enabling us to explore new allocation policies, optimising them over a range of parameters (e.g. a reduction in power consumption) that is more comprehensive than what is commonly considered today.

CETIC is the dissemination activity leader and is in charge of analysing threats, defining the security architecture and implementing security solutions for the RESERVOIR infrastructure.

### KEY RESULTS

The main outcome of the project is an architecture for a flexible, secure and scalable service-oriented infrastructure, along with a reference implementation. This implementation is based on open standards and new technologies for the provision of on-demand infrastructure services. These scenarios illustrate the significant and measurable improvements achieved in productivity, quality, availability, reliability and cost of service delivery.

During the third year of the project, the whole RESERVOIR stack, from top to bottom, was integrated, and the RESERVOIR framework was created to make it easier for the European Community to take advantage of its artefacts. Provisioning and migration of virtual machines across data centres was demonstrated in various case studies.

The project's dissemination, led by CETIC, was highly successful:

- RESERVOIR promotion at 116 project presentations, keynote lectures, workshops and demonstrations;
- 12 RESERVOIR/OpenNebula training sessions;
- 64 RESERVOIR scientific publications;
- 10 RESERVOIR press releases;
- More than 130 RESERVOIR clips and articles;
- 4 RESERVOIR newsletters published.

*The RESERVOIR vision is to enable service delivery on an on-demand basis, at competitive prices and with guaranteed quality.*

### PARTNERS

Elsag Datamat, IBM Haifa Research Lab, SAP Research, Sun Microsystems, Telefónica Investigación y Desarrollo, Thales, The Open Grid Forum E.E.I.G. Standards Organisation, Universidad Complutense de Madrid, University College London, University of Lugano, University of Messina, University of Umeå

# S-CUBE

## The European Network of Excellence in Software Services and Systems

**Type of project:** European Commission – FP7 – ICT – Network of Excellence

**CETIC budget:** N/A

**Duration:** 2009-2012

**CETIC departments:** Software and Services Technologies, Software and System Engineering

**Project website:** [www.s-cube-network.eu](http://www.s-cube-network.eu)

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### BACKGROUND

S-CUBE, the Software Services and Systems Network, will establish an integrated, multidisciplinary and vibrant research community, which will help enable Europe to lead the software services revolution, in turn helping to shape the software services-based Internet that will form the backbone of our future interactive society.

The project is motivated by the need to integrate research expertise, and a strong collaboration of researchers in the field of software services and systems is required to address the following key problems:

- Research fragmentation: Every research community (e.g. grid computing, software engineering) concentrates mostly on its own specific techniques, mechanisms and methodologies. As a result, the solutions proposed are not aligned with, or influenced by, activities in related research fields.
- Future challenges: One example is to build service-based systems in such a way that they can self-adapt, while guaranteeing the desired level of service quality. Such an adaptation may be required as a result of changes in a system's environment or in response to predicted and unpredicted problems.

The S-CUBE project, which is expected to have a long-lasting impact on European research, will pursue the following objectives:

- Re-align, re-shape and integrate the research agendas of key European players from diverse research areas. By synthesizing and integrating diversified knowledge, an enduring foundation for steering research and for achieving innovation at the highest level will be established.
- Inaugurate a Europe-wide common programme of education and training for researchers and industry. This will create a common culture that will have a profound impact on the future of the field.
- Establish a proactive mobility plan to enable cross-fertilisation, which will foster the integration of research communities and the establishment of a common software services research culture.
- Establish trust relationships with industry. European Technology Platforms (specifically NESS) will have a catalytic effect on shaping

European research, strengthening industrial competitiveness and addressing the main societal challenges.

- Define a broader research vision and perspective. This will shape the software service-based Internet of the future, as well as accelerate economic growth and improving the living standards of European citizens.

### KEY RESULTS

The main outcomes of the project are the following:

- S-CUBE Publications, which is a browsable repository of S-CUBE publications and deliverables.
- Public deliverables, published by the S-CUBE consortium (including abstract and full text), and are grouped according to the work packages that released them.
- S-CUBE Case Studies, which is a collection of S-CUBE case studies in service engineering.

CETIC is contributing to the area of quality-driven and adaptable service composition and service composition models. The aim is to integrate security and service monitoring research challenges into S-CUBE activities.

*S-CUBE will enable Europe to lead the software services revolution, thereby helping shape the software services-based Internet that will form the backbone of our future interactive society.*

### PARTNERS

Center for Scientific and Technological Research, City University London, Consiglio Nazionale delle Ricerche, The French National Institute for Research in Computer Science and Control, Lero – the Irish Software Engineering Research Centre, MTA SZTAKI – Computer and Automation Research Institute, Tilburg University, Universidad Politécnica de Madrid, Université Claude Bernard Lyon, University of Crete, University of Duisburg-Essen, University of Stuttgart, University of Hamburg, Vienna University of Technology, Vrije University (Amsterdam)



## RESEARCH IN THE WALLOON REGION

CETIC research teams are actively collaborating with the following academic laboratories:

- The Communications and Remote Sensing Laboratory (TELE), the Microelectronics Laboratory (DICE) and the Department of Computer Science and Engineering (INGI) at the Université catholique de Louvain (UCL – [www.uclouvain.be](http://www.uclouvain.be)).
- The Faculty of Computer Science at the Facultés Universitaires Notre-Dame de la Paix de Namur (FUNDP – [www.fundp.ac.be](http://www.fundp.ac.be)).
- The Computer Science and Management Group at the Université de Mons (UMONS – [www.umons.ac.be](http://www.umons.ac.be)).
- The Embedded Electronics research unit at the Université Libre de Bruxelles (ULB – [www.ulb.ac.be](http://www.ulb.ac.be)).

CETIC is a founding member of Accord Wallonie ([www.accord-wallonie.be](http://www.accord-wallonie.be)), the association of Walloon research centres, and actively participates in the work and events coordinated by this organisation. Through this association, CETIC takes part in many bilateral exchanges and cooperative projects with other research centres and universities active in the Walloon Region.

With Cenaero ([www.cenaero.be](http://www.cenaero.be)), the Centre for Aerospace Research, CETIC established a High Performance Computing centre that is unique, in that both organisations contribute equipment to it. Cenaero and CETIC together constitute an outstanding team at the European level, which serves research and businesses alike.

## ENTERPRISE NETWORKS

CETIC is an active member of the INFOPOLE Cluster TIC association ([www.infopole.be](http://www.infopole.be)), and is represented on its Board of Administrators. This association is a network of partners in information systems in the Walloon Region, and has more than 150 members. In 2008, CETIC and INFOPOLE Cluster TIC signed a partnership agreement to structure collaboration between the two organisations.

Since 2009, CETIC has been collaborating closely with the new Microsoft Innovation Center (MIC – [www.mic-belgique.be](http://www.mic-belgique.be)), located in Mons, as a key R&D partner, particularly in the eHealth area. CETIC is also a member of the MIC's Scientific Advisory Board.

CETIC has reinforced its involvement in the Marshall Plan ([www.polesdecompetitivite.eu](http://www.polesdecompetitivite.eu)) through strong participation in R&D calls launched by the competitiveness clusters by the end of 2008.

## INTERNATIONAL COLLABORATIONS

CETIC and CITI – the Innovation Centre for Information Technology, Department of Public Research, Centre Henri Tudor, based in Luxembourg ([www.tudor.lu](http://www.tudor.lu)) –

have developed a strategic collaboration to establish a European centre of excellence in quality services and software products to serve companies in the Benelux region.

# STRUCTURED COLLABORATIONS

CETIC and the Ecole de Technologie Supérieure ([www.etsmtl.ca](http://www.etsmtl.ca) – Montréal, Canada) have established a network of international experts in software engineering to help very small enterprises (0 to 25 employees) which are active in software development. The two institutions – participants in the International Organisation for Standardisation (ISO) on system and software engineering – are collaborating to help SMEs by providing training materials, including guides for improving software practices.

CETIC is a member of the European Technology Platform, NESSI (Networked European Software and Services Initiative, [www.nessi-europe.com](http://www.nessi-europe.com)), and participates in four working groups: software engineering, trust and security, service engineering and service-oriented infrastructure. CETIC also works with ARTEMIS (<https://www.artemis-ju.eu>), the technological platform on embedded systems.

In the field of software quality, CETIC has entered into a partnership with Océ Software Laboratories Namur, Kalistick, Respect-IT, REVER sa and Idéo Technologies.

## OTHER PARTNERS

CETIC is partnered with Innovatech ([www.innovatech.be](http://www.innovatech.be)), which promotes innovation in the Walloon Region. With the support of universities and research centres, Innovatech offers technological and legal advice to companies, informing, educating and supporting them with a view to facilitating the process of technological innovation. CETIC works in collaboration with IGRETEC ([www.igretec.com](http://www.igretec.com)), the economic development agency of Charleroi that is responsible for finding global solutions for large and small companies, and for new and established investors in the region. In addition, CETIC works with the Heracles ([www.heracles.be](http://www.heracles.be)) and NamurlInvest ([www.namurlinvest.be](http://www.namurlinvest.be)) business centres.



# ICT EQUIPMENT

To be effective, methodological research must be supported by state-of-the-art tools. Also, the barriers that exist, which prevent Walloon companies, and especially SMEs, from benefitting from the high-quality return such tools generate, need to be removed: ignorance of the existence of tools, acquisition costs, infrequency of use, complexity of installation and learning curve, for example.

The aim of the support project, ICT Equipment, is to break down those barriers by providing access to state-of-the-art tools and the associated consulting and support services.

Two main categories of tools are supported: software engineering tools, and software and hardware tools for the design and test of wireless systems. They are

managed, respectively, by the Software Engineering Lab and the Wireless Lab, each with its specific focus (subject to constant evolution):

- The **Software Engineering Lab** concentrates its attention on advanced tools for code analysis, targeting specific properties such as security (absence of vulnerabilities), reliability (absence of run-time errors) and maintainability (quality of architecture, documentation, complexity). These tools rely on advanced analysis techniques, such as static analysis and abstract interpretation.
- The **Wireless Lab** focuses on the new wireless technologies associated with multiple electronic technologies that make the choice of a correct solution difficult. CETIC selects software and hardware tools encompassing all emerging technologies for its wireless lab, especially those related to new protocols and standards introduced

to increase throughput, improve range, lower power consumption and optimise performance trade-offs.

In addition, CETIC is making significant improvements to its cluster through the Sinus project (Convergence Objective). While this cluster is not intended to yield gross performances for applications with high resource demands, it does serve as a live test bed for experimentation in grid computing, cloud computing and other distributed system applications, like SOA, SaaS, etc. The cluster is heavily used internally for CETIC's research projects, but is also available for experimentation by its partners and enterprises.

## ACHIEVEMENTS

The two labs were opened in 2009. The tools and equipment for the labs were selected based on their importance industrially, and the choice was verified by the CE-IQS project partners prior to acquisition.

Several tools were acquired in 2009 for the Wireless Lab for the modelling, simulation, design and test of embedded systems (hardware and software); in particular, an advanced software environment, high-bandwidth oscilloscopes, an advanced signal generator and several protocol sniffers. The CAN bus simulator and the telecommunication systems complemented these in 2010.

The first batch of tools for the Software Engineering Lab included advanced code analysis tools with the ability to detect security vulnerabilities, runtime errors and architecture problems, and covered a wide spectrum of languages. An SaaS commercial analysis platform was also acquired, and made available to Walloon SMEs.

Public calls for tender were issued for this set of equipment and tools. The tools were deployed in the labs and the teams concerned acquired the training necessary for their use through the implementation of specific prototypes related to real industrial cases. These studies allowed them to check their mastery of the tool sets and to produce documentation to facilitate their implementation by our industrial partners. Several preliminary studies were undertaken in collaboration with Walloon enterprises to define the standard services to be offered in association with this equipment.



- Cassano, O., Mouton S., **Addressing Aggregation of Utility Metering by Using Cloud – The Power Grid Case Study**, ERCIM News 83, Special Theme: Cloud Computing – Platform, Software and Applications, October, 2010
- De Landtsheer, R., Ponsard, C., Massonet, P., **Deriving Event-Based Usage Control Policies from Declarative Security Requirements Models**, Second International Workshop on Security in Model Driven Architecture, University of Pierre & Marie Curie, Paris, France, June 16, 2010
- Fally, B., **Le CETIC accroît son expertise eHealth**, Newsletter INFOPOLE Cluster TIC, July 8, 2010
- Extra Consortium, **Practical Knowledge Management Techniques for Small and Medium Sized Software Companies**, Project Handbook, November 2010
- Hubaux, A., Classen, A., Boucher Q., Michel, R., Heymans, P., **Evaluating a Textual Feature Modelling Language: Four Industrial Case Studies**, SLE 2010, 3rd International Conference on Software Language Engineering, Eindhoven, The Netherlands, October 12-13, 2010



- Latanicki, J., Massonet P., Rochwerger, B., Villari, M., Naqvi, S., **A Monitoring Service for Compliance in a Cloud Architecture**, Cracow Grid Workshop 2010 (CGW'10), Krakow, Poland, October 11-13, 2010

- Latanicki, J., Massonet, P., Naqvi, S., Rochwerger, B., Villari M., **Scalable Cloud Defences for Detection, Analysis and Mitigation of DDoS Attacks**, in Towards the Future Internet: Emerging Trends from European Research, G. Tselentis et al. (eds.), pp. 127-137, IOS Press Inc, The Netherlands. ISBN 978-1-60750-538-9 (Hardback) ISBN 978-1-60750-539-6 (eBook), 2010
- Monfils, F. F., Saadaoui, S., **Le CETIC propose d'améliorer les développements logiciels via une meilleure gestion de la connaissance au sein des PME**, Newsletter INFOPOLE Cluster TIC, August 24, 2010
- Naqvi, S., Massonet, P., **RESERVOIR – A European Cloud Computing Project**, ERCIM News, number 83, Special Theme: Cloud Computing – Platform, Software and Applications, October 2010
- Naqvi, S., Massonet, P., **Scalable Service and Resource Virtualisation Infrastructure for Business Applications**, IEEE/ACM International Conference on Grid Computing 2010 (Grid2010), Brussels, Belgium, October 24-27, 2010
- Naqvi, S., Dallons, G., Ponsard, C., **Protecting Corporate ICT Infrastructures by Using Digital Forensics**, IEEE International Conference on Computer Information Systems and Industrial Management Applications 2010 (IEEE-CISIM'2010), Krakow, Poland, October 8-10, 2010
- Naqvi, S., Chaparadza, R., Nunzi, G., **Technological Challenges for Assuring Business Benefits of Future Internet**, Journal of Economy Informatics, vol. 10, no. 1, eds. Tomai, N., G.C. Silaghi (eds.) ISSN: 1453-1305, 2010
- Naqvi, S., Dallons, G., Ponsard, C., Massonet, P., **Ensuring Security of the Future Internet-based Virtualization Infrastructures** (Position Paper), IEEE Symposium on Security and Privacy 2010, Oakland, CA, USA, May 16-20, 2010
- Naqvi, S., Dallons, G., Ponsard C., **Applying Digital Forensics in the Future Internet Enterprise Systems – European SMEs' Perspective**, Fifth International Workshop on Systematic Approaches to Digital Forensic Engineering (SADFE), In conjunction with

the IEEE Security and Privacy Symposium, Oakland, CA, USA, May 16-20, 2010

- Naqvi, S., Dallons, G., Michot, A., Ponsard,

## SCIENTIFIC PUBLICATIONS

C., **Assuring Privacy of Medical Records in an Open Collaborative Environment – A Case Study of Walloon Region's eHealth Platform**, LNCS Privacy and Identity Management for Life, Bezzi et al. (eds.), pp. 146-159, Springer Publisher, ISBN 978-3-642-14281-9, 2010

- Nsenga, J., Bourdoux, A., Horlin, F., **Mixed Analog/digital Beamforming for 60 GHz MIMO Frequency Selective Channels**, IEEE ICC 2010 – Signal Processing for Communications Symposium, Capetown, South Africa, May 23-27, 2010
- Ponsard, C., De Landtsheer, R., **Comparison of the AADL and Event-B Model-Based Tool Chains for Designing Embedded Systems**, First Workshop on Hands-on Platforms and Tools for Model-based Engineering of Embedded Systems, Paris, France, June 15, 2010
- Saadaoui, S., Monfils, F. F., **EXTRA Helps SMEs Assess Their Knowledge Management Practices**, ERCIM News 81, April, 2010
- Sutura, J., Le Maire, B., Ponsard, C., Hanteau, J., Verstraete, J., **Précision relative à la visiophonie**, Sournal 108, October, 2010

## FAIR AND EVENTS

CETIC participated in the following fairs and events in 2010:

- January 20, 2010 – Maastricht (NL): CETIC participated in the CORNET/EraSME Partnering event
- January 26, 2010 – Brussels (BE): CETIC participated in The Future of Cloud Computing
- February 22-23, 2010 – Brussels (BE): CETIC presented RESERVOIR and ENISA at CloudScope II
- March 12, 2010 – Brussels (BE): CETIC led a plenary session at the Symposium on Open Source Software
- March 12, 2010 – Nice (FR): CETIC participated in The Future Internet Public-Private-Partnership
- March 15-17, 2010 – Grenada (ES): CETIC participated in the Wire 2010 conference
- March 16-17, 2010 – Barcelona (ES): CETIC participated in World of Health IT
- March 16-17, 2010 – Barcelona (ES): CETIC participated in SecureCloud 2010
- March 30, 2010 – Brussels (BE): CETIC presented its eHealth research projects at the High-Level eHealth event organised by Agoria
- April 12-16, 2010 – Valencia (ES): CETIC participated in the 4th EU Conference on FP7
- April 22, 2010 – Charleroi (BE): CETIC presented EXTRA at the TIC Forum
- May 6, 2010 – Charleroi (BE): With INFOPOLE Cluster TIC, CETIC co-organised a workshop on Business Intelligence Open Source Tools
- May 16-20, 2010 – Oakland, California (USA): CETIC participated in IEEE Symposium on Security & Privacy
- May 23-27, 2010 – Cape Town (South Africa): CETIC presented its research results at the IEEE International Conference on Communications
- June 1-4, 2010 – Trondheim (NO): CETIC presented EXTRA at XP2010
- June 28-July 2, 2010 – Heraklion (GR): CETIC organised a RESERVOIR training session during the SSAIE Summer School
- June 30-July 1, 2010 – Barcelona (ES): CETIC participated in the FIREWeek conference
- July 6-11, 2010 – Bordeaux (FR): CETIC participated in the Libre Software meeting
- July 12, 2010 – Brussels (BE): CETIC presented its European research projects at the European Young Innovators Forum (EYIF) Innovation Axess 2010 at the European Parliament
- September 10, 2010 – Cluj-Napoca (R): CETIC participated in the Romanian Workshop on Mobile Business 2010 (RWMB2010)
- September 16, 2010 – Charleroi (BE): With INFOPOLE Cluster TIC, CETIC co-organised a workshop about security of applications handling sensitive data
- September 20-23, 2010 – Düsseldorf (DE): CETIC participated in AVOCs conference
- September 25, 2010 – Brussels (BE): CETIC participated in the International Day of the Deaf
- September 27-29, 2010 – Brussels (BE): CETIC demonstrated its latest ICT achievements at ICT2010
- September 30 to October 1, 2010 – Paris (FR): CETIC participated in the Open World Forum
- October 5-6, 2010 – Berlin (DE): CETIC organised a RESERVOIR training at the SOA Cloud Symposium
- October 8-10, 2010 – Cracow (PL): CETIC participated in the International IEEE Conference
- October 11-13, 2010 – Cracow (PL): CETIC presented RESERVOIR at The Cracow Grid Workshop
- October 19-20, 2010 – Brussels (BE): CETIC presented DEPLOY and RESERVOIR at the Internet of Services conference
- October 22, 2010 – Meux (BE): CETIC participated in the Skywin Technologic Forum
- October 26-30, 2010 – Brussels (BE): CETIC organised a RESERVOIR training session at OGF30
- October 27-29, 2010 – Liège (BE): CETIC presented its activities at Europe INNOVA
- October 28-29, 2010 – Frankfurt (DE): CETIC presented its activities at ISC Cloud'10
- October 28, 2010 – Charleroi (BE): With INFOPOLE Cluster TIC, CETIC co-organised a workshop on information management and semantics
- November 9, 2010 – Mons (BE): CETIC presented its activities at GPU Day, organised by UMons
- November 16, 2010 – Lille (FR): With INFOPOLE Cluster TIC and INRIA CETIC co-organised a workshop on traceability and health at CITC-EuraRFID
- November 30, 2010 – Charleroi (BE): With INFOPOLE Cluster TIC and INRIA, CETIC co-organised a workshop on ICT solutions for maintaining the autonomy of the elderly
- December 6, 2010 – Leuven (BE): CETIC participated in the Wireless Community working group
- December 8, 2010 – Louvain-la-Neuve (BE): CETIC presented PONTE at BIOWin Day
- December 13-17, 2010 – Gand (BE): CETIC presented its research projects at the Future Internet Conference and Service Wave

## CETIC NEWSLETTER

The CETIC electronic newsletter is a key communication and dissemination tool targeting all the regional actors impacted by the research and technology transfer activities conducted at our research centre. It also reports on the major events in which CETIC has been involved and on future events (especially events organised or co-organised by us), where it is possible to meet our researchers. The newsletter – issued in French every four months – contains four main sections: services for companies, innovation, publications and an interview with a CETIC employee. In 2010, three issues were produced, on the following topics: SOA and cloud computing, eHealth and Software Quality.

To subscribe to the CETIC newsletter, click on the 'Newsletter' tag on the CETIC website's homepage ([www.cetic.be](http://www.cetic.be)).



**AMI:** Amazon Machine Image  
**ASBL:** Association Sans But Lucratif – Non-profit organisation  
**API:** Application Programming Interface  
**AVL:** Automatic Vehicle Location  
**BE:** Business Experiment  
**BSM:** Business Service Management  
**CAN/FMS:** Control Area Network/Fleet Management System  
**CED:** Cloud Encryption Device  
**CETIC:** Centre d'Excellence en Technologies de l'Information et de la Communication – Centre of Excellence in Information and Communication Technologies  
**CE-IQS:** Centre d'Expertise en Ingénierie et Qualité des Systèmes – Centre of Expertise in Engineering and Quality Systems  
**CELLaVI:** Centre d'Expertise en Logiciel Libre à Vocation Industrielle – Centre of Expertise in Open Source Software  
**CMM:** Capability Maturity Model  
**CMMI:** Capability Maturity Model Integrated  
**CMR:** Contrat Marchand Routier  
**CNR:** Consiglio Nazionale delle Ricerche  
**CoE:** Centre of Expertise  
**CReSTIC:** Centre de Recherche en Sciences et Technologies de l'Information et de la Communication  
**CRM:** Customer Relationship Management  
**CRID:** Research Centre on IT and Law - FUNDP  
**CUH:** Cambridge University Hospitals  
**DAPS:** Distributed Application Platforms and Services  
**DSP:** Digital Signal Processor  
**DRNN:** Dynamic Recurrent Neutral Network  
**EC:** European Commission  
**ECS:** Embedded and Communication Systems  
**EEG:** Electroencephalogram  
**EMG:** Electromyogram  
**ERP:** Enterprises Resource Planning  
**ESB:** Enterprise Service Buses  
**EU:** European Union  
**FEDER:** Fonds Européen de Développement Régional – European Regional Development Fund  
**F/OSS:** Free and Open Source Software  
**FP6:** Sixth Framework Programme  
**FP7:** Seventh Framework Programme  
**FPGA:** Field Programmable Gate Array  
**FUNDP:** Facultés Universitaires Notre-Dame de la Paix de Namur

**GAMP:** Good Automated Manufacturing Practice  
**GPRS:** General Packet Radio Service  
**GSM:** Global System for Mobile Communication  
**GUI:** Graphical User Interface  
**HDL:** Hardware Description Language  
**HMI:** Human-Machine Interfaces  
**IaaS:** Infrastructure as a Service  
**ICS:** Intelligent Content and Semantics  
**ICT:** Information and Communication Technologies  
**IGRETEC:** Intercommunale pour la Gestion et la Réalisation d'Etudes Techniques et Economiques  
**IoPR:** Institute of Psychophysiology and Rehabilitation of the Kaunas University of Medicine  
**IP:** Internet Protocol  
**IP:** Integrated Project  
**IS:** Information Services  
**ISO:** International Organisation for Standardisation  
**ISO/IEC 15408:** Common Criteria for Information Technology Security Evaluation  
**IST:** Information Society Technology  
**ISV:** Independent Software Vendor  
**IT:** Information Technology  
**KM:** Knowledge Management  
**LCD:** Liquid Crystal Display  
**LUH:** Gottfried Wilhelm Leibniz Universität Hannover  
**NGG:** Next Generation Grids  
**NKUA:** National Kapodistrian University of Athens  
**NTUA:** National Technical University of Athens  
**OCCL:** Open Cloud Computing Interface  
**OCR:** Optical Character Recognition  
**OGF:** Open Grid Forum  
**OGSA:** Open Grid Services Architecture  
**OSLC:** Open Services for Life-cycle Collaboration  
**OVF:** Open Virtualisation Format  
**OWPL:** Observatoire Wallon des Pratiques Logicielles  
**PaaS:** Platform as a Service  
**PALLAVI:** Plate-forme d'Accueil pour le Logiciel Libre à Vocation Industrielle  
**PCB:** Printed Circuit Board  
**PHP:** Personal Home Page  
**PoC:** Proof-of-concept  
**PSoC:** Programmable System on Chip  
**QMS:** Quality Management System  
**R&D:** Research and Development

**RE:** Requirements Engineering  
**Rfid:** Radio-frequency identification  
**SaaS:** Software as a Service  
**SLA:** Service Level Agreement

# ACRONYMS

**SME:** Small and Medium-sized Enterprise  
**SMI:** Strategic Medicine Inc  
**SOA:** Service Oriented Architecture  
**SoC:** System on Chip  
**SOC:** Service Oriented Computing  
**SOI:** Service Oriented Infrastructure  
**SOKU:** Service Oriented Knowledge Utility  
**SPICE:** Software Process Improvement and Capability Determination  
**SPL:** Software Product Line  
**SPW:** Service Public de Wallonie  
**SSE:** Software and System Engineering  
**SST:** Software and Services Technologies  
**STREP:** Specific Targeted REsearch Projects  
**TSP:** Trust, Security and Privacy  
**UCL:** Université catholique de Louvain  
**ULB:** Université Libre de Bruxelles  
**ULg:** University of Liège  
**UML:** Unified Modelling Language  
**UMONS:** Université de Mons  
**VHDL:** Very High Speed Hardware Description Language  
**VO:** Virtual Organisation  
**VOIP:** Voice Over Internet Protocol  
**WPAN:** Wireless Personal Area Network  
**VSE:** Very Small Enterprise



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