Annual Report '12

Centre of Excellence in Information and Communication Technologies

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ABOUT CETIC

The Centre of Excellence in Information and Communication Technologies (CETIC) is a Belgian centre for applied research serving the ICT industry.

CETIC's mission is to support regional economic development by transferring the results of the most innovative applied research in ICT to Walloon companies, particularly SMEs. On a practical level, CETIC helps companies integrate these technological innovations into their products, processes and services. To achieve this objective, its researchers continually enhance their expertise through collaborative research projects involving regional and European actors in the advanced technology field.

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

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

At a Glance

ICT provides one of the most promising opportunities for addressing key societal challenges in areas like health, energy, mobility, education and culture. Research and innovation in ICT offer new, cutting edge possibilities and solutions, which are developed and promoted by ICT companies.

CETIC continues to develop advanced expertise in core technologies and approaches that support innovative application development in these areas.

Developing and promoting regional ICT expertise by leveraging the research and innovation capacity of industry is crucial for a region that must redeploy its economic initiative. This is the mission of CETIC, a fully accredited Walloon Research Centre.

The year 2012 saw the profile of CETIC's regional ICT expertise raised internationally through the candidacy of the city of Liège for the International Expo of 2017, with its theme of connectivity. CETIC was in charge of managing the scientific aspects of the theme, with the goal of promoting the technological wealth and expertise available in Wallonia on every continent.

The work of CETIC experts stimulates research and provides R&D support to local industries, enabling them to adopt advanced ICT technologies, innovate faster, save time and money, and meet new needs, with a view to strengthening the EU's competitiveness and leadership.

The achievements of CETIC in 2012 were many and varied. Among the most significant outcomes are the following:

- In September, CETIC and UCL jointly embarked on new and promising research in Human Computer Interface (HCI) quality: QualIHM.
- In June, the DEPLOY project presented its results to European Commission experts during its final review process.
- In October, CETIC experts participated in the launch of its new FP7 ICT project, PaaSage, which supports a highly innovative model-based tool to manage the life cycle of cloud applications.

CETIC takes pride in cultivating excellence in order to provide innovative and effective solutions to Wallonia's ICT industry, and the entire team is committed to enhancing this expertise on an on-going basis.

Again, we thank our industrial partners for their active interest and the trust they place in us, and all CETIC employees for their immense creativity and expertise.

Simon ALEXANDRE
CETIC

> CETIC cultivates excellence in order to provide state-of-the-art expertise to industry. The entire team is committed to continuous innovation to help advance Wallonia's Information and Communication Technologies (ICT) industry.

Members and Organisation

CETIC is a non-profit organisation (ASBL under Belgian law) located at B-6041 Charleroi, 29 rue des Frères Wright.

It is composed of the following corporate bodies and individuals:

FIVE CORPORATE BODIES:

- University of Namur (UNAMUR)
- Université catholique de Louvain (UCL)
- University of Mons (UMONS)
- IGRETEC
- Technology Industry Federation AGORIA

THIRTEEN INDIVIDUALS:

- Mr Bernard Bolle, M-team
- Mr Patrick Donnay, Haulogy
- Mr Philippe Fortemps, Professor, UMONS
- Mr Naji Habra, Professor, UNAMUR
- Mr Jean-Luc Hainaut, Professor, UNAMUR
- Mr Benoît Hucq, Océ Software Laboratories Namur
- Mr Roland Keunings, Professor, UCL
- Mr Jean-Didier Legat, Professor, UCL
- Mr Benoît Macq, Professor, UCL
- Mr Pierre Manneback, Professor, UMONS
- Mrs Nicole Moguilevsky, Research Administration, UNAMUR
- Mr Daniel Truyttens, Professor, UMONS
- Mr Christian Verdonck, BizzDev

Members of the organisation meet regularly in a statutory General Assembly, tasked with approving the CETIC budget and appointing administrators.

Board of Administrators

CETIC's Board of Administrators is composed of the following members:

- Mr Bernard Bolle, M-team
- Mr Giacomino Bonsignore, NRB
- Mr Serge Boucher, UMONS
- Mr Patrick Donnay, Haulogy
- **Mr Marc Durvaux, Thales Alenia Space – President**
- Mr Jean-Luc Hainaut, UNAMUR
- **Mr Benoît Hucq, Océ Software Laboratories Namur – Vice-President**
- Mr Jean-Didier Legat, UCL
- Mr Benoît Macq, UCL
- **Mr Pierre Manneback, UMONS – Treasurer and Secretary**
- Mr Lucyan Papiernik, IGRETEC
- **Mr Yves Poullet, UNAMUR – Vice-President**
- Mr Bruno Schroder, Microsoft
- Mr Olivier Verbeke, Idealy
- Mr Christian Verdonck, BizzDev

Mr Pierre Villers, DGO6, is Wallonia's appointed observing member. He sits on the Board of Administrators and also participates 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 embodies the Research Centre's mission, which is to perform general industrial research that can be transferred to industry in response to specific needs.

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 Research Centre's areas of research are determined by the express needs of industry, taking into account a typology of Walloon companies created under the guidance of a Technical Committee composed of corporation and industry representatives.

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 mission and objectives of the Technical Committee, which functions at the request of the Board or the General Manager, are the following:

- Advise the Board and the General Manager on the scientific and technological objectives to develop according to the sector's needs;
- Develop or update CETIC's strategic plan, at the request of the General Manager;
- Evaluate proposals for new research directions, at the request of the Board or the General Manager. If relevant, the Committee proposes new business opportunities or research projects, or both, consistent with CETIC's scientific and technological orientations;
- Support CETIC in its continuing 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 on-going or likely to be initiated;
- Report annually to the CETIC Board of Administrators on its work and scientific achievements.

The CETIC Technical Committee is composed of the following members:

- Mr Simon Alexandre, General Manager, CETIC
- Mr Thierry Bingen, Haulogy
- Mr Jean-Louis Bolsée, Thales Alenia Space ETCA
- Mr Patrick Crasson, BeNovate
- Mr Michaël Demeyere, AGC
- Mr Jean-Christophe Deprez, Scientific Coordinator, CETIC
- Mr Pascal Devincenzo, Open Engineering
- Mr Denis Flandre, UCL
- Mr Naji Habra, UNAMUR
- Mr Jean-Luc Hainaut, UNAMUR
- Mr Patrick Heymans, UNAMUR
- Mr Benoit Hucq, Océ Software Laboratories Namur
- Mr Christian Huvelle, Atos
- Mr Igor Klapka, FN Herstal
- Mr Pierre Leclercq, Microsoft Innovation Centre
- **Mr Jean-Didier Legat, UCL – President**
- Mr Alain Leroy, PENTACLE
- Mr Benoit Macq, UCL
- Mr Pierre Manneback, UMONS
- Mr Philippe Massonet, Scientific Coordinator, CETIC
- Mr Kim Mens, UCL
- Mr Yves Moulart, ST Microelectronics
- Mr Dominique Orban, Rever
- Mr Emmanuel Ottevaere, BizzDev
- Mr Frederic Peters, Thelis
- Mr Frédéric Robert, ULB
- Mr Bruno Schroder, Microsoft
- Mr Daniel Tuyttens, UMONS
- Mr Luc Vandendorpe, UCL
- Mr Christian Vanhuffel, Agoria ICT
- Mr Axel van Lamsweerde, UCL

Key Figures

Sources of revenue

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

Distribution by sector of CETIC technology transfer activities

Human Resources

In 2012, CETIC hired several new researchers to work on innovative technologies, bringing the number of employees to 44.

General Management
Simon Alexandre

Business Development
Michel Van Der Straeten
Olivier van de Werve

Operations Management
Damien Hubaux

Scientific Management
Philippe Massonet
Jean-Christophe Deprez

Admin & Finances
Laurence Lepied
Pierre Romain
Laurie Marciano

Communication
Bérengère Fally

Quality
Frédéric Fleurial Monfils
Nicolas Devos
Michaël Van de Borne

IT
Stéphane Mouton
Etienne Charlier
Dimitri Diakodimitris

Software & System Engineering
Christophe Ponsard

Gautier Dallons
Annick Majchrowski
Sanae Saadaoui
Nicolas Devos
Jacques Flamand
Arnaud Michot
Renaud De Landtsheer
Raphaël Michel
Ravi Ramdoyal
Félix Bregadze
Dimitri Durieux

Software & Services Technologies
Frédéric Fleurial Monfils

Stéphane Mouton
Etienne Charlier
Orlando Cassano
Fabian Steels
Michaël Van de Borne
Robert Viseur
Dimitri Diakodimitris
Joseph Roumier
Fabrice Estiévenart
Nikolaos Matskanis
Louis-Marie Croisez
Mohamed Boukhebouze

Embedded & Communication Systems
Philippe Drugmand

Lotfi Guedria
Valery Ramon
Mathieu Ocaña
Sébastien Dawans
Gérard Florence
Jonas Simon
Jimmy Nsenga
Laurent Deru

Quality Policy

ISO 9001 Certification

CETIC was awarded ISO 9001 certification in September 2010, from SGS, a leading inspection, verification, testing and certification company.

The certified activities support technology transfer missions, as well as the set-up, follow-up and management of R&D projects.

ISO 9001, an internationally recognised quality standard, details the principal compliance requirements for a company's quality management system (QMS). If they are fully met, these requirements ensure that the quality of the processes set up by that company is guaranteed, constituting a proof of trust.

CETIC Quality Policy

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

From this perspective, and to ensure the satisfaction of all its partners (companies, universities and government), 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 through continuous improvement of the technological innovation process;
- Ensuring objectivity and quality results, thanks to its independent position, international recognition, and strict adherence to ethical and scientific protocols;
- Ensuring the quality of its competencies and technical capabilities by conducting on-going training and appropriate recruitment;
- Promoting the development and fulfilment of its employees by promoting a healthy environment, which is conducive to creativity, professional achievement and teamwork.

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

CETIC Values

Customer

CETIC is the trusted third party when partnering with companies, helping them integrate the latest technologies designed to innovate and address new markets.

CETIC employees are approachable and forthright, and regard the quality of their relationship with their partners as a point of honour. They take the time to understand the needs of their clients, and provide them with the solutions that best meet those needs.

Excellence

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

Transfer

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

Innovation

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

Collaboration

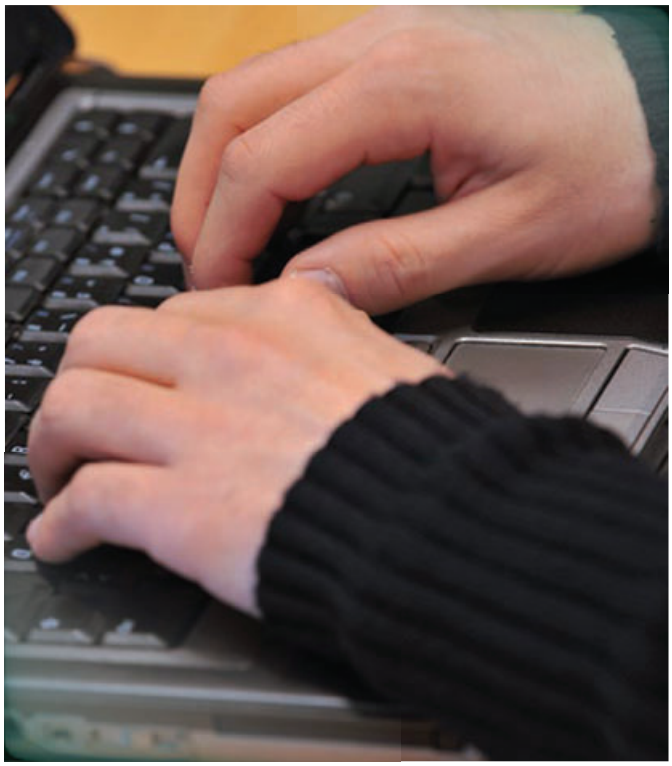
Thanks to its status as a private, non-profit organisation, CETIC is able to collaborate with industry and the public sector in total independence, within a framework of trust and in a spirit of cooperation without competition.

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

EXPERTISE
and Technological Transfer to Industry

CETIC's various knowledge areas - Software Quality, Internet of Things, and Future Internet - are available to industry as advanced services. We can help companies in many aspects of enterprise development, such as collaborative R&D, assistance to IT project owners, technical advice, design and prototyping, IT project quality improvement, and the certification process, among others. These services can be partially financed, by the technology voucher system in Wallonia, for example, or through other sources of public funding.

CETIC's Range of Expertise



CETIC develops expertise in the following areas:

- **Software Quality,** focusing on methodological research, with a view to enhancing the quality, efficiency, security and safety of new and increasingly complex ICT systems. By providing methodological, modelling, tooling, algorithmic design and business decision-making support, CETIC helps IT companies to produce high quality software products and services. It focuses on the use of lightweight approaches specifically adapted to SMEs, while ensuring compliance with international standards.
- **Internet of Things,** helping companies exploit the newest distributed, dynamic and service-oriented architectures to the maximum extent possible. The objectives are to speed up the process of transforming data into knowledge using the semantic technologies, and to provide companies with advanced technological expertise by taking advantage of the valuable opportunities offered by Open Source software. These technologies strongly impact the way software and data are assembled, deployed and managed.
- **Future Internet,** developing exceptional prototyping skills in embedded systems and wireless technologies (Internet of Things) to help industry build new and innovative products.

How to Work with CETIC

Trusted and Skilled Partner in Research and Innovation in the Application of ICT in Various Fields of Expertise

Innovation (R&D&I) Activities

CETIC offers a full range of expertise to companies wishing to externalise a research, development and innovation (R&D&I) activity or needing assistance to integrate breakthrough technologies into their R&D&I process, from feasibility study, design and engineering, to proof-of-concept, prototyping and testing.

Knowledge Transfer and Consulting

With its unique expertise in relevant knowledge areas, CETIC provides specialised and targeted support to partners and customers. Topics include:

- Wireless Sensor Networks (WSN), embedded system design methodology;
- Cloud Computing, Internet of Services, large-scale network-based applications;
- Advanced software engineering, model-based testing, software product lines (SPL);
- Intelligent information management and semantics;
- Combinatorial problem solving;
- Simulation, model-based design.

Trusted Third Party Auditing and Advice

As a research centre and non-profit organisation working in close proximity to academic institutions, CETIC is often asked by public and private organisations to provide neutral, unbiased support, such as:

- Helping with needs identification, choosing technologies and suppliers, contract follow-up, escrow procedure, evaluation of software development costs, etc.
- Conducting technological and methodological audits of software product and development life cycle processes, and providing recommendations on the adoption of best practices, architectural change, code refactoring, etc.

Collaborative R&D Projects

Another means for companies to innovate is to set up collaborative research projects. We offer our comprehensive experience in building projects, large and small, from writing proposals to setting up and coordinating consortia. One of CETIC's goal is to involve companies, especially SMEs, in collaborative R&D programs funded by European and regional authorities, strengthening their market position, and helping them improve their existing products and acquire new expertise. We have an excellent track record in several kinds of competitive calls for proposals, such as FP7, ERANET, Interreg and Marshall Plan 2.Green, for example.

Chèques Technologiques

Financing Innovation

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

For SMEs established in the Walloon Region, the most efficient and lightweight instrument is the technology vouchers provided by the Agence de Stimulation Technologique (AST). When working with an accredited research centre like CETIC, an SME is eligible for reimbursement by Wallonia of up to 75% of the total cost of R&D through the Chèques Technologiques programme. These technology vouchers are available to a maximum amount of €20,000 per SME annually. Further information about these vouchers can be found at www.ct.innovons.be.

The software feasibility studies from the regional research administration (DGO6), also provide up to 75% of required funding.

Brussels-based SMEs can benefit from regional funding for their R&D activities as well. Funding is available from INNOVIRIS, the Brussels Institute for Research and Innovation.

CETIC is also accredited under the Crédit Impôt Recherche programme in France, which is a favourable tax credit scheme that enables any French company to enter into a contractual R&D agreement with CETIC. A significant tax credit is available (cf. http://www.industrie.gouv.fr/enjeux/innovation/cir.html).

For more information, contact CETIC (info@cetic.be)

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

Software Quality

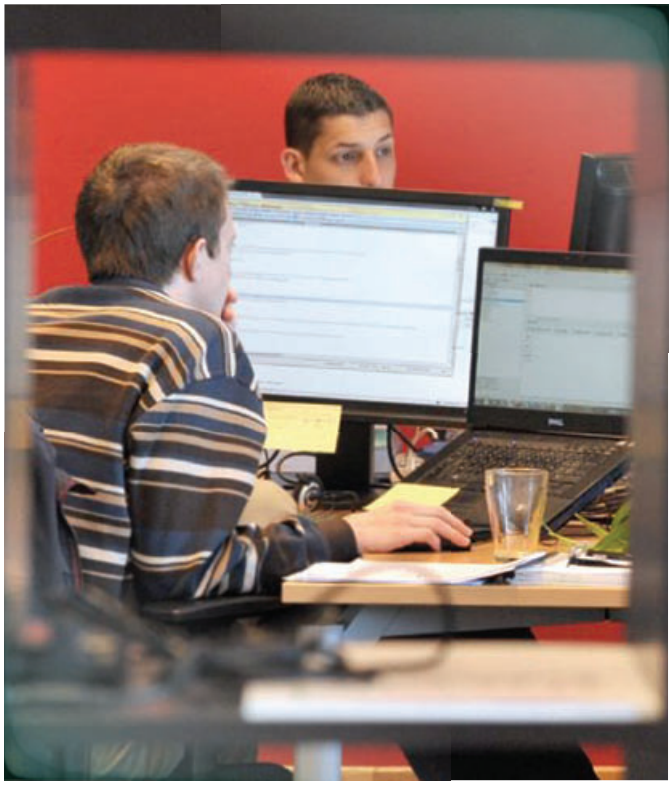
Helping Enterprises Reach Higher Levels of Quality in their Software Development Processes and Products

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

Software Best Practices Assessment

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

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



The direct benefits of compliance with this standard's practices are reductions in the cost and time required for application development, and increased quality of the software delivered. The alignment with ISO 29110 best practices is a quality stamp for software development and services companies, and promotes faster growth of market share and increased profit margins.

Software Development Sizing

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

CETIC's expertise in this area is founded on COSMIC (ISO/IEC 19761), a widely used method for estimating software functional size. The COSMIC function point estimation method is based on objective criteria. It allows measures to be repeated, and it is applicable to requirements documents early in the software life cycle.

Using the ISBSG project cost database, the functional size generated by COSMIC is then converted into development effort. With these estimates, project managers can plan and budget their development projects more accurately.

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

Software Code Quality

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

For the past decade, CETIC has been studying application risk management. Based on ISO 9126 (SQuaRe), CETIC has developed an application quality model that is the foundation of its tooled application code analysis expertise with targeted quality attributes, such as maintainability, security and reliability. Using CETIC's methodology and best-of-breed tooling, the quality of an application is measured in terms of cumulative technical debt, an expression which quantifies the cost of the non-quality of an application and is a figure on which both manager and developer can agree.

This expertise enables companies to monitor and control the structural quality of their applications cost-effectively, without significant impact on the delivery cycle. Direct benefits are: lower cost of delivered projects, better time-to-market

and increased team productivity. The customer is then able to install a quality gate through code quality key performance indicators (KPI), in order to control application delivery at a later stage, as an outsourced service. The advantage for the supplier is the opportunity to set up a long-lasting relationship of trust with their customers.

Requirements Engineering and System Modelling

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

CETIC's expertise in Requirements Engineering covers the whole spectrum of methods and application contexts, from lightweight methods combining structured templates and UML-based notations, to rigorous models that enable early formal reasoning on the system. There is special focus on model-based approaches designed to automate specific development steps. These approaches provide greater design assurance and can manage particular aspects of a project, such as business decision making (especially in the medical and logistics domains: PIPAS on page 22 and BEM on page 14), software product lines (CALiPro on page 15), safety (DEPLOY on page 27), security (ExSec on page 26), and Human-Computer Interfaces (QuallHM on page 24).

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

Certification and Standards

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

Mastering the certification process is not a trivial task, and requires knowledge of the standard concerned and how to integrate it into the software life cycle. CETIC is actively developing expertise and experience in these areas (IEC 62304 for medical devices, EN-50128 for railways, DO-178B for avionics, Common Criteria for security), as well as mastering a number of support tools, providing the organisation with the necessary independent insight on the best standards to integrate and how to achieve certification with minimum overhead in their business context. The SAT project (on page 24), for example, is developing incremental certification support.

Security Engineering and Assessment

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

Future Internet

Exploiting Distributed Resources, Giving Meaning to Data

The **Software and Services Technologies (SST)** department covers key areas relevant to the future of ICT: Service-Oriented Architectures (SOA) – also known as the Programmable Web -, Cloud Computing, the Semantic Web and Open Source software technologies. CETIC helps companies master the expertise required to take advantage of the latest trends and technological advances in these fields, while respecting scalability and deployment constraints.

Programmable Web

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

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

In the PONTE project (on page 29), CETIC defined key Web services that combine the various data sources accessible through the Internet.

Cloud-Ready Software Deployment

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

The ability to make the right choice of architecture, or of the provider of the Cloud Computing infrastructure, is important when validating proofs-of-concept which are vendor-independent and which take advantage of IaaS and PaaS offerings.

In ComodIT (on page 27), CETIC helped automate IT infrastructure provisioning.

Cloud Infrastructure Management

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

CETIC gained valuable experience in OpenStack software and other IaaS solutions from ComodIT (on page 27).

Scalable Distributed Storage

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

Big Data Management

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

Semantic Web Resources

Exploiting Semantic Web resources is about linking together the increasingly large amounts of unstructured data and annotating them with meaningful information. CETIC masters the Semantic Web standards used to model, query and link data, as well as to create ontologies. CETIC also contributes to powerful and interoperable content management solutions, which serve end-users or other software components.

In PONTE (on page 29), CETIC studied and modeled several health-related data sources as ontologies, and published them on a Web platform, making them available for consultation and linking.

Open Source Software

Questions are still being raised about the Open Source movement, in terms of the availability of local support, the quality of the software developed and the compatibility of licenses. Interest in open data and open hardware is also growing. CETIC has expertise in the process of selecting Open Source licenses and an understanding of its impact on business models, all of which enables them to help companies release their applications into the Open Source realm and select the license that aligns best with their own business model.

Security Implementation and Deployment

Threats to IT infrastructure are growing at a time when companies are increasingly required to provide access to their data and resources. To maximise security, CETIC has developed expertise on the PEP-PDP architecture, in which Policy Enforcement Points (PEP) are melded into the infrastructure middleware to intercept user requests and query the Policy Decision Point (PDP) engines that make decisions on accessing and using the requested resources. In ExSec on BonFIRE (on page 26), CETIC studied the scalability of a PEP-PDP security implementation of software service applications, and can now advise customers on how to configure their infrastructure with appropriate PEP integration, and how to distribute their PDP engines for guaranteed scalability.

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

> “CETIC is developing strong expertise in Cloud Computing and in the Semantic Web, with a view to exploiting the resources available today to design efficient architectures and tools for the future.

Internet of Things

Innovative Technologies Enabling Smart Devices for the Internet of Things

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

IPv6 Sensor Networks

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

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

The MidFlex project (on page 21) explores the capabilities of these technologies and experiments with advanced routing algorithms in large scale academic WSN, like INRIA Lille's SensLab and TU Berlin's TWIST. CETIC is collaborating in this area with SICS in Sweden, at the origin of Contiki.

Advanced Architectures

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

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

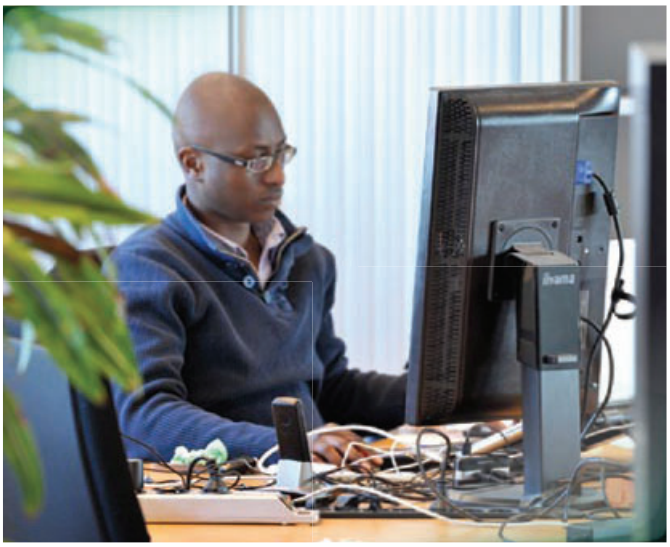
In 2012, CETIC studied pervasive architectures within the scope of the C2A project (on page 26) which allow flexible service deployment of limited resources in an efficient way.

Modelling and Simulation

CETIC has integrated advanced tools for modelling and simulating embedded systems into its Software Engineering Lab and its Wireless Lab (on page 30).

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

In 2012, CETIC provided its expertise in the modelling and simulation of algorithms for efficient signal processing, in order to optimise the performances of a sound processing application for an industrial partner.



Methodologies

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

In the CE-IQS project (on page 18), CETIC studies the all-important teething (test) phase of the life cycle of an embedded system more closely. It is also broadening its expertise in code quality analysis to the specific case of embedded software.

FPGA

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

ECS studies the tools and techniques, like porting C to HDL, that will make it easier to develop HDLs, facilitate the use of FPGAs and shorten development time.

In the PSOPP project (on page 23), CETIC studies and prototypes FPGA-based accelerators based on use cases provided by industrial partners. The systems in these use cases were originally developed in a classical software environment like C. CETIC intends to evaluate advanced generation tools to port existing software to an FPGA and measure the performance improvements. Ultimately, CETIC will focus on the definition of methodologies supporting these tools and guide enterprises in the use of advanced FPGA solutions.

Smart Grids

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

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

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

Security

On the one hand, there is the IoT, which is all about openness and interoperability; on the other, there are embedded systems, which are increasingly important in our lives – like eHealth and Smart Grids, for example – and the correspondingly greater need to pay attention to security issues.

Security is still underestimated in the world of embedded systems, or often at best treated as a function to be added later. Our role is to highlight the need for security at an early stage in a project, and to integrate it into the whole life cycle of the system from a global perspective.

In 2012, CETIC investigated and prototyped advanced security architectures in the eHealth domain (eHealth for Citizens on page 19, SPES on page 29 and AMACS on page 25).

> “As both humans and machines demand increasingly advanced services everywhere and at any time, the ability of embedded systems to adapt to mobility and connectivity will improve. CETIC studies innovative methodologies and technologies for embedded systems and wireless communication.

WALLOON
Research Projects

CETIC is active in several types of regional R&D projects funded by the Regional Ministry of Research and coordinated by the Walloon administration.

Since 2008, CETIC has been working with several research partners (Cenaero, UNAMUR, MULTITEL, UCL, ULB, UMONS) on a new wave of applied R&D projects funded under the Convergence Objective (ERFD 2007-2013).

In addition to these large projects, CETIC is involved in regional collaborative projects (Marshall Plan, WIST projects, Technology Innovation Partnerships and Collaborative Research), designed by Industry, expressly for Industry, to solve specific problem through the innovative use of ICT.

Transport

BEM

Business Event Manager

The BEM solution will help enterprises minimise the fall-out in the transportation and distribution sectors resulting from accidents, thanks to a simplified and affordable, yet optimised, implementation of intelligent workflow management to solve complex problems and deal with unexpected situations.

OBJECTIVES

The goal of the BEM project is to develop and validate a new IT approach to managing events in the transportation and distribution sectors, with a special focus on unexpected events, as these events can deeply affect physical and organisational flows. Process re-alignment and re-optimisation are required to bring the system back into normal operation.

BEM proposes a process management solution built on top of state-of-the-art artificial intelligence engines, giving them temporal coordination capabilities. In short, BEM is designed to minimise the negative consequences of incidents and simplify the implementation of a flow management solution.

RESULTS

CETIC has developed a meta-model for capturing the rules required for supporting efficient reasoning on workflows, both at design-time and at run-time. It combines traditional workflow reasoning with a rich resource management ontology. Tooling support based on the YAWL Open Source platform has also been developed, in order to automate its integration with the intelligent reasoning engine.

ADDED VALUE FOR COMPANIES

With the BEM solution, enterprises will benefit from:

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

Modelling
Logistics
SSE

Partners

NSI IT Software & Services, Orditool Belgium, Smolinfo, Trendy Foods Belgium, UNAMUR

Type of project:	Wallonia – Marshall Plan
CETIC Budget:	€274,850
Duration:	2010-2013
Contact:	ravi.ramdoyal@cetic.be

eHealth

Biomedical Manufacturing

This project has developed an innovative control system for orthotic devices (prostheses designed to compensate for missing articular or muscular functions) which exploits human brain activity, specifically electroencephalographic (EEG) signals.

ECS

OBJECTIVES

The development of an orthotic control system based on the exploitation of EEG signals, either alone or in combination with electromyographic (EMG) signals, was the aim of this project. Creating such a system calls upon expertise in neurophysiology, microelectronics, mechanics and rapid manufacturing. The key steps of the process are the acquisition of EEG signals, and the processing, transmission and control of those signals, to achieve energy management and user comfort.

RESULTS

CETIC has created an embedded platform exploiting EEG signals to control orthotic devices using wireless communication protocols. The focus was to optimise autonomy (low energy consumption) and portability (by the user).

In 2012, with the help of Sirris, CETIC successfully integrated the battery-powered printed circuit board (PCB) it had developed in 2011 into the wireless EEG headset prototyped by the project partners. The PCB uses techniques and components that guarantee very good immunity to the disturbances induced by external and internal noise sources.

ADDED VALUE FOR COMPANIES

The interpretation of brain signals can be applied in road safety applications, and in the remote control of robots and machines. CETIC can exploit the experience acquired in the implementation of neural networks, and in the design of portable and low power wireless communication systems, to offer new services to Walloon SMEs.

Human-Computer Interaction

Partners

Cenaero, Sirris, UMONS

Type of project: Wallonia – ERFD – Convergence Objective
CETIC Budget: €139,307
Duration: 2008-2011
Contact: valery.ramon@cetic.be

CALiPro

Configuration Automatisée de Lignes de Produits logiciels

CALiPro is a PhD project intended to improve and automate the configuration of a software product line through the development of innovative tools, services and methods.

Software

OBJECTIVES

CALiPro targets the improvement and automation of the configuration of a software product line (SPL) by developing a set of innovative tools, services and methods to meet the needs of the collaborating companies.

RESULTS

The project has contributed to major advancements in textual variability languages (TVL) with respect to the key features required for industrial application, i.e. the support of feature cardinalities, multi-valued attributes, and string- and language-related preferences. At the same time, the configuration operations are being formally redefined based on this enhanced TVL version. In terms of tooling, the surface-mount technology (SMT) selected during the CSAIL lab internship at MIT is progressing towards a generic implementation of the various SMT solvers.

ADDED VALUE FOR COMPANIES

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

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

Product Lines

SSE

Partner

UNAMUR

Type of project: Wallonia – First DOC.A
CETIC Budget: €382,500
Duration: 2010-2013
Contact: raphael.michel@cetic.be

Activities

- Applied Research
- Technology Transfer
- Innovation
- Prototyping

Application Domains

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

Thematics

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

Software & System Engineering (SSE)

Software Process Quality
Source Code Quality
Technical Debt Management
Software Development Sizing
Code Analysis

Requirements Engineering

Model-driven Engineering
Software Testing
Software Product Lines
Software Certification
Business Decision Making
Human-Computer Interface

Software & Services Technologies (SST)

Future Internet

Cloud Computing
Service Oriented Architecture
Linked Open Data
Search Engine and Indexing
Semantic Technologies
Web Services
Big Data Management
Programmable Web

Embedded & Communication Systems (ECS)

Electronic Design
FPGA
Ultra Low Power
Embedded Systems

Internet of Things

Networks
Wireless Technologies

Centre of Expertise in Open Source Software

CELLAVI has selected a forge suited to the needs of SMEs, and hosts a platform for SMEs and their partners, who are taking advantage of the best practices emerging from the Open Source communities.

OBJECTIVES

CELLAVI is designed to support the specific needs of companies wishing to use Open Source software. Many companies are interested in this software, from both the technological and economic perspectives, but the path to successful adoption is not straightforward, as the Open Source paradigm involves new licensing schemes and requires that clear economic choices be made.

RESULTS

The PALLAVI portal serves as a proof-of-concept for a software forge sized to the needs of typical SMEs. The operational aspects of PALLAVI are backed by general purpose Open Source expertise, focusing mainly on infrastructure and aligned with local industry needs. This project tackles virtualisation techniques in general, and Open Source Cloud Middleware in particular.

Contributions have been made, in 2012, to local events, such as 'Les Jeudis du Libre' and the 'Rencontres Mondiales du Logiciel Libre'.

ADDED VALUE FOR COMPANIES

In addition to hosting Open Source software, the PALLAVI forge project directly benefits local companies:

- By inspiring them to enhance their development and collaboration processes;
- By providing economic, technical and legal support to help them assess the potential benefits of free software;
- By helping them remain at the leading edge of Open Source software development, as a result of taking into account emerging fields, such as open hardware and automated software analysis.

Partners

MULTITEL, UMONS, UNAMUR

Type of project:	Wallonia – ERFD – Convergence Objective
CETIC Budget:	€3,056,390
Duration:	2008-2013
Contact:	damien.hubaux@cetic.be
Websites:	www.cellavi.be - https://forge.pallavi.be

Centre of Expertise for Engineering and System Quality

CE-IQS proposes advanced expertise for developing software-based systems to Walloon ICT enterprises.

OBJECTIVES

As company performance and competitiveness rely on the mastery of ICT, CE-IQS closely associates ICT enterprises with innovative research carried out by a strong applied research consortium composed of major research centres and universities active in this field and structured around five main themes:

1. **Methodologies for system development and evolution**
   CETIC's role is to develop new methodologies, propose productivity tools and validate them in a company setting, in order to improve the control of systems throughout their lifespan.
2. **Strategies for system verification, validation and quality assessment**
   CETIC's goal here is to improve quality assurance practices, especially those related to code quality and testing.
3. **Certification**
   CE-IQS helps enterprises to adapt their processes and practices for certification in domains such as security, medical software and aeronautics. It also provides specific lightweight support for SMEs based on ISO 29110.
4. **Distributed and embedded systems**
   CETIC studies the software architectures and services that are heavily impacted by new paradigms like the Cloud, Big Data and emerging smart devices.
5. **Intelligent content and semantics**
   In the Information Age, the ability to filter, organise and process content is critical. CETIC develops intelligent content processing technologies, such as search engines, full-text indexers and database search engines.

RESULTS

The applied research conducted by CE-IQS typically involves industrial prototypes or methodological deployment that results in effective transfer to the partnering companies.

ADDED VALUE FOR COMPANIES

CE-IQS represents the needs of Walloon enterprises in standardisation work groups at the national and international (ISO) levels.

Partners

Cenaero, UCL, ULB, UMONS, UNAMUR

Type of project:	Wallonia – ERFD – Convergence Objective
CETIC Budget:	€7,131,576
Duration:	2008-2013
Contact:	christophe.ponsard@cetic.be

DAPCARE

Patient Dosimetry Electronic Pad

The DAPCare project is developing the Patient Dosimetry eBook, a standardised solution for collecting, sharing and archiving the dosimetric data of patients receiving medical ionising radiation delivered at various healthcare institutions.

OBJECTIVES

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

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

RESULTS

The software solution produced by CETIC embodies the following key features: a state-of-the-art dosimetric data exchange to enable access to dosimetry data harvested locally at individual institutions and those stored at other institutions via Web services; and a comparative analysis of the Belgian and French standards, KMEHR-Bis and IHE-REM respectively. The exchange has been complemented by an analysis of the international standard exchange data format DICOM RDSR (Radiation Dose Structured Report). Hospital practices for managing dosimetric data have also been collected and analysed in the light of these standards, to identify shortcomings and obstacles with the aim of improving the interoperability of dosimetric data within and between Belgium and France.

ADDED VALUE FOR COMPANIES

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

Partners

Centre Anti-Cancer Oscar Lambret, Centre Chirurgical Marie-Lannelongue, Centre Hospitalier Belfort-Montbéliard, CIGES, ISLOG

Type of project:	Wallonia – LEAD-ERA
CETIC Budget:	€164,394
Duration:	2011-2014
Contact:	annick.majchrowski@cetic.be

eHealth for Citizens

eHealth for Citizens

This project is developing technological tools designed to offer innovative services to patients in their homes in response to the demographic shift challenge, the increase in chronic illnesses and the shortage of medical specialists.

OBJECTIVES

The project is enabling, enhancing and supporting technological evolution to allow patients to be cared for at home. The focus is on creating a platform of customised services to meet the health care needs of patients, such as monitoring services. The platform will provide an opportunity to achieve better quality medical care, while bringing new, added value services to the eHealth marketplace.

RESULTS

In 2012, the focus was on the demonstration prototype, which is being used by a number of patients in order to verify the adequacy of this platform to meet their care needs. Feedback from these patients is being collected, with a view to defining new objectives and adding new services to the platform.

ADDED VALUE FOR COMPANIES

The technologies developed by this project can be used to build new and innovative medical applications. CETIC has also developed extensive experience in the creation of applications that call for multidisciplinary expertise.

Partners

ImmuneHealth, UCL, UNAMUR

Type of project:	Wallonia – ERFD – Convergence Objective
CETIC Budget:	€1,499,042
Duration:	2009-2014
Contact:	gautier.dallons@cetic.be

Transport

safety

Integrated Management of Supply Chain Risks

The GIR project is working on an ICT solution to enhance the security of hazardous goods transport. An effective software tool to assist safety advisors with regulation compliance will be developed, along with an embedded incident warning system.

ECS

OBJECTIVES

The project will provide safety advisors with a hazardous goods transport management system, which will automate protocol monitoring, check for conformity with regulations, generate reports, verify product compatibility and warn of the occurrence of critical incidents.

Given the very high number of regulations applying to hazardous goods transport by road, rail, sea and waterways, and their various national adaptations and amendments, safety advisors have a challenging and vitally important mission, which is to ensure compliance.

RESULTS

The project was launched in April 2012, with requirements definition and functional analysis. CETIC is mainly responsible for the embedded warning module and its integration into the overall solution, having developed the main functionalities of the module and defined a high level architecture for the hardware, firmware and interfaces.

CETIC has also compared the module's capabilities with those of the eCall European initiative for automatic emergency calling currently being evaluated for lightweight vehicles.

ADDED VALUE FOR COMPANIES

The tool will help safety advisors a great deal of time by automating tedious and human-error-prone tasks, such as checking, monitoring, validating protocol, generating reports, etc. Also, the automatic warning module will allow quicker response and better management of serious events like transport accidents.

Embedded Systems

Partners

DN&T, JOASSIN, OSL, PRAYON, SPRL Luc BEYERS, ULg

Type of project: Wallonia – Marshall Plan
CETIC Budget: €321,572
Duration: 2012-2015
Contact: lotfi.guedria@cetic.be

Low Cost Train Automatic Control

The LOCOTRAC project is developing lower-cost technologies to enable the deployment of state-of-the-art safety mechanisms, such as Automated Train Protection (ATP), on regional and local lines. The project will incorporate these technologies into new products (ground, on-board and telecoms) designed for such lines.

OBJECTIVES

CETIC will develop an automated tool to insert redundancy into the software code, which will continuously deliver reliable evidence that all its computations have been correctly executed.

This tool must itself be reliable, so that it can be used in the development of high-assurance systems. To achieve this objective, CETIC is following a CENELEC-qualified development process.

RESULTS

CETIC has developed a validated set of hardening rules to be implemented in the tool. These rules provide the necessary evidence of the health status of hardware running critical software.

CETIC is developing two tool chains to apply these rules to the same source code, which will ensure that this code has been correctly transformed and that the high quality standards required by the CENELEC standard are met.

ADDED VALUE FOR COMPANIES

CETIC's contribution will make it possible to mass-produce low-cost, high-integrity systems for automated train protection applications, such as TBL1+. These systems are designed to prevent train collisions by ensuring that the train driver obeys the signalling rules and stops at red lights.

The targeted market segments are the regional lines that cannot afford the state-of-the-art technology that relies on costly high integrity hardware.

SSE

Hardware Failure

Partners

ACIC, Alstom, CE+T, Infrabel, Logiplus, MITRA Innovations, Q3S, SEE, STIB, UCL, UMONS

Type of project: Wallonia – Marshall Plan
CETIC Budget: €383,155
Duration: 2011-2014
Contact: renaud.delandtsheer@cetic.be

Ultra Low Power

ECS

MIDFLEX

ECS

SSE

Flexible Middleware for IPv6-based Low Power Embedded Systems

MidFlex is developing middleware to facilitate the design and deployment of IPv6-based sensor network applications.

Internet of Things

OBJECTIVES

This project, which is the subject of a PhD thesis funded by the Walloon First DOC.A program, is designed to provide a simple and coherent network application interface for Wireless Sensor Networks (WSN).

Embedded intelligent systems are gradually becoming commonplace in our everyday lives as a means to measure and control our environment. Coupled with this expansion is the growing diversity of electronic systems, in terms of communication protocols and interconnecting heterogeneous devices is a real challenge.

The interface devised by MidFlex will harness the flexibility and configurability of the underlying technologies and protocols to achieve end goals such as minimal energy consumption and device mobility support on the upcoming Internet of Things (IoT).

RESULTS

CETIC has focused on the deployment of WSNs based on an emerging routing protocol for the IoT, RPL. This routing protocol has the flexibility to support the many different traffic patterns envisioned by the IoT, yet its applicability and configuration in some application domains remain largely unexplored.

In 2012, CETIC initiated the development of a key element for integrating RPL-based WSNs into the IPv6 architecture: a 6LoWPAN Border Router solution, 6LBR.

CETIC has also developed a WSN testbed infrastructure for the validation of research results in a controlled environment mimicking typical indoor channel conditions for smart building and smart home environments.

ADDED VALUE FOR COMPANIES

Through this project, CETIC impacts Walloon companies keen to integrate IoT solutions into their products by guiding them in design choices for WSN hardware and software.

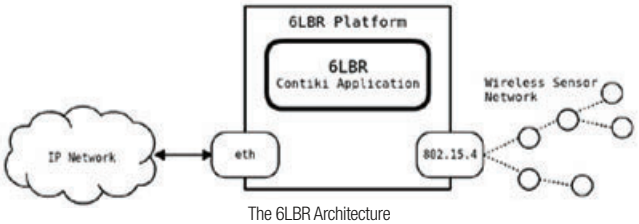
Partner

UCL - IP Networking Lab

Type of project: Wallonia – First DOC.A
CETIC Budget: €425,600
Duration: 2011-2014
Contact: sebastien.dawans@cetic.be

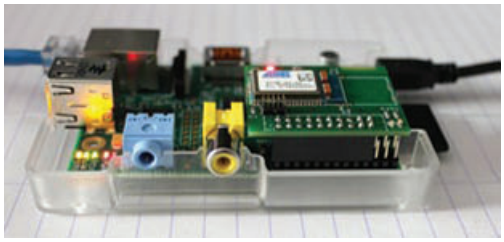
Internet of Things Testbed (6LBR)

The Internet of Things envisions end-to-end connectivity between hosts on the Internet and sensors and actuators embedded in our daily environment, to support applications such as smart homes, smart buildings and environment monitoring. Wireless Sensor Networks (WSN), a designation for low-power, low-throughput and multi-hop networks using IEEE 802.15.4 radio communications, benefit from the standardisation of 6LoWPAN for the adoption an end-to-end IPv6 layer.



The 6LBR Architecture

A 6LoWPAN Border Router connects 6LoWPAN devices to the Internet and is responsible for handling traffic to and from its IPv6 and 802.15.4 interfaces. CETIC has developed 6LBR, a deployment-ready solution for border routers, based on the Contiki OS. 6LBR implements mechanisms which complement existing standards to address the issues surrounding the interconnection of IPv6 (NDP) control protocols with RPL, the routing protocol used for IoT sensor networks.



6LBR running on the RaspberryPi

CETIC's 6LBR project is deployment-ready, and industrial prototypes already exist based on the 6LBR release. It is an out-of-the-box solution that can be run on popular Linux-based embedded platforms, such as RaspberryPi and BeagleBone. The project also serves as a platform for further research in support of complex IoT deployments, with solutions for handling multiple Border Routers and sensor node mobility between WSNs, and for bringing resilience to network and Border Router faults. Tackling these latter challenges is CETIC's objective for the continuation of 6LBR in 2013.

Website: http://cetic.github.com/6lbr
Contact: 6lbr@cetic.be

New Agile Platform for Lifelong Software Engineering

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

OBJECTIVES

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

RESULTS

- Selection and integration of software engineering tools to be integrated for the NAPLES platform;
- Creation of workflow templates based on the ISO 29110 entry profile;
- Implementation of workflow templates that cover all the activities and tasks of the ISO 29110 entry profile, and which may be executed by a workflow engine such as the Bonita Open Solution;
- Implementation of a portal to provide information to different users based on their role in a given project. Summarised information is available via dashboards.

ADDED VALUE FOR COMPANIES

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

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

Partners

Atos, Océ Software Laboratories Namur, UNAMUR

Type of project: Wallonia – Technological Innovation Partnership
CETIC Budget: €606,338.25
Duration: 2010-2013
Contact: christophe.ponsard@cetic.be

Adaptive Piloting of Hospital Processes

The PIPAS project is developing model-driven process support software to help define, pilot and supervise the multiple health care processes that may be involved in patient care, especially in the cancer treatment domain.

OBJECTIVES

The PIPAS project is developing methods and tools to help define clinical pathways, and to model and implement them. Clinical pathways are a means to streamline medical processes, in response to the growing complexity of medical cures that require dedicated machines and expensive drugs, and impose tight time constraints. In addition, the ageing population is beginning to strain the delivery capabilities of health care services.

RESULTS

At this point in the project, CETIC has developed a large-scale scheduler to drive the workflow enactment engine based on the pro-active management of resources (patients, doctors, beds, etc.) and their inter-related constraints. This scheduler is configured by a precise clinical pathway model that is engineered using a set of workflow engineering operators developed by UCL.

ADDED VALUE FOR COMPANIES

The project results will improve the efficiency of medical care delivery units under pressure from complex processes and high load. The deployment of the PIPAS technology will typically be achieved through the collaboration of hospital IT departments and highly specialised IT SMEs active in the medical software field.

Partners

Centre du Cancer, UCL

Type of project: Wallonia - WIST 3.0
CETIC Budget: €274,505
Duration: 2011-2014
Contact: christophe.ponsard@cetic.be

PSOPP

Porting Software on Parallel Processors

Innovative technology has been designed to apply the various optimisation techniques offered by multicore processors, GPUs and FPGA architectures.

OBJECTIVES

This project has developed a methodology for porting existing software to run on multi-core processors, and on GPU or FPGA-based accelerator platforms, so that the computing power of these architectures can be readily exploited. The goal of this methodology is to guide developers in the process of identifying the source code portions potentially prone to acceleration, and of restructuring the application to take advantage of the acceleration technology selected. This methodology, based on experience gleaned from industrial use case studies, will ultimately be promoted among Walloon SMEs.

RESULTS

An analysis of industrial use cases has revealed the need for a comprehensive optimisation methodology to help in the process of source code transformation and of interfacing with the target acceleration module. CETIC has studied acceleration with FPGA-based PCIe modules for bioinformatics and spatial applications. With respect to GPU- and multi-core CPU-based parallelisation, our UMONS partner has achieved promising accelaration - by a factor of 200 - on one of the use cases.

ADDED VALUE FOR COMPANIES

The methodology will be used to help train companies to enable them to optimise their application architectures, in terms of cost, performance and energy consumption. The advantage of this methodology is that it can be applied to multiple configurations (large computing centres, and centres with limited computing capability), and so provide a solution that meets the needs of a large number of companies.

Partners

Cenaero, UMONS

Type of project: Wallonia – Collective Research
CETIC Budget: €438,665
Duration: 2011-2012
Contact: gerard.florence@cetic.be

QDFCA

Quality Design for Competency Assessment

CETIC applied its technological expertise to help raise the DOCIMO platform to the highest possible level of performance and interoperability. Technology quality and high performance were key success factors for the QDFCA project.

OBJECTIVES

The QDFCA project was designed to improve the functionalities of the DOCIMO platform.

This platform provides processes for evaluators, who can construct a structured, sound and standardised assessment, and for those being evaluated, who benefit from high-quality feedback. Since new demands are being expressed all the time, the platform needs to be continually enriched with new functionalities to meet client requirements and to stay competitive in the marketplace. These requirements mainly concern the following two issues: the need for greater interoperability between the platform and the clients' systems, and the need for increasingly complex and specific assessments.

RESULTS

CETIC has carried out a series of innovative actions to raise both the functional and non-functional maturity levels of the platform related, for example, to scalability (private cloud deployment), security (through adequate architecture and configuration) and maintainability (automated source code analysis and deployment). These actions have turned the platform into a real Assessment Management System, covering assessment needs from classical standardised testing to the evaluation of high-level competencies.

ADDED VALUE FOR COMPANIES

Continuous training of staff is a key activity that will ensure the maintenance and renewal of skill levels in companies. The work culture requires great flexibility, and training methods must adapt to changing skill requirements. This platform enables companies to deliver e-learning courses with a competency-based approach, while at the same time facilitating the task of the trainer.

Partners

Assess Group, ULg

Type of project: Wallonia – Marshall Plan
CETIC Budget: €138,747.50
Duration: 2009-2012
Contact: christophe.ponsard@cetic.be

Tool-supported Methodology to Enhance Human-Computer Interface Quality

QualIHM is developing a toolkit for integrating modules to create dynamic and evolving Human-Computer Interface (HCI) prototypes for collecting, discussing and validating user requirements while complying with consistency, ergonomics, usability and accessibility criteria.

OBJECTIVES

QualIHM will integrate domain and task models, scenarios, HCI prototypes and ergonomics rules, and serve as a medium through which companies can discuss and validate user requirements. This will satisfy a real need of ICT enterprises, which is to improve the quality of their requirements specifications and HCIs. In fact, existing tools only focus on particular aspects of requirements specifications, and they aren't integrated into the larger requirements engineering process. HCI quality criteria are ignored altogether.

RESULTS

The toolkit will provide an LGPL3 multi-platform prototyping environment for designing HCIs.

QualIHM will be developed by CETIC and LILab with the support of DefiMedia, industrial sponsor of the project, and will include the following modules:

- HCI prototyper,
- Requirements editor,
- Scenario editor,
- Metrics-based HCI validator,
- Exporter (under reusable formats).

ADDED VALUE FOR COMPANIES

The QualIHM toolkit, with its LGPL3 license will help ICT enterprises increase their efficiency, quality and competitiveness, without the need for expensive and unconvincing combinations of experts and tools that are not interoperable. Given the large number of enterprises active in the ICT sector in general, and in software development in particular, this project will have a significant impact, both on these enterprises and on the end-users of their software.

Partner

UCL

Type of project: Wallonia – Collective Researche
CETIC Budget: €421,590
Duration: 2012-2014
Contact: ravi.ramdoyal@cetic.be

Smarter Airborne Technologies

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

OBJECTIVES

The project's innovative proposal is to develop model-based support for incremental and recertification processes using software product line engineering techniques. Compliance with required software (DO-178B) and hardware (DO-254) standards is extremely expensive to achieve and difficult to deploy, but is required to gain access to any aeronautics market. This model-based support is designed to meet these challenges.

RESULTS

To date, the industrial requirements have been gathered and two cases studies have been defined. In addition, a domain model has been developed to define reusable certification artefacts and processes, as well as operators to enable their instantiation in a recertification or incremental certification context. Tool support is currently being developed and validated using an agile development process that covers increasingly complex industrial scenarios.

ADDED VALUE FOR COMPANIES

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

Partners

Barco Silex, Cissoid, Entreprise Dardenne, Gillam FEI, M3 Systems Belgium, MULTITEL, Thales Alenia Space ETCA, Thales Communications Belgium, UCL, ULg, UNAMUR

Type of project: Wallonia – Marshall Plan – Aeronautical and Space Pole (Skywin)
CETIC Budget: €321,166
Duration: 2010-2013
Contact: christophe.ponsard@cetic.be

EUROPEAN
Research Projects

With the Seventh Framework Programme (FP7) coming to a close at the end of 2013, CETIC is looking back proudly on its track record, which includes participation in five FP7 projects: RESERVOIR, DEPLOY, SCube, PONTE and ExSec on BonFIRE, and a sixth one, PaaSage, launched in 2012. Throughout the FP7 period, CETIC's research effort on the European stage has mostly focused on technologies for the Future Internet. These projects foster closer collaboration with large corporations and research groups, such as Thales, Atos, Telefonica, IBM, INRIA and Fraunhofer, to name a few.

Leveraging the expertise built up through European research projects, CETIC has passed its knowledge on to regional companies via direct training, and to local SMEs via transfer activities, thanks most notably to European Research Area projects like ComodIT, AMACS and DAPCare.

CETIC is currently preparing for Horizon 2020, the new framework programme scheduled to start in 2014, and will further its interactions with other Future Internet research experts and large European companies. The main line of research in Horizon 2020 will be similar to that of FP7, although greater emphasis will be placed on research to generate significant economic impact on the competitiveness of European enterprises and to accelerate recovery from the current economic downturn.

Automatic Monitoring of Activities using Contactless Sensors

AMACS gives the elderly with age-related risks or pathologies (e.g. risk of falling, cognitive decline) the option to stay safely in their home environment for as long as possible.

Wireless Technologies

OBJECTIVES

AMACS is developing and evaluating, in real-life situations, an ICT-based system that can automatically monitor the activities of daily living (ADSLs) of elderly people living alone at home, such as sleeping, cooking, making a phone call, etc.

Monitoring is based on the measurements taken by various contactless sensors installed in the home environment: home security sensors (presence or motion detectors), sensors that measure the usage of public utilities (electricity, water, gas) and video cameras.

RESULTS

CETIC and its Walloon partners are defining, designing and developing the exchange platform that will collect the information about ADLs and changes in seniors' behaviour, and effectively transmit this information to the seniors themselves and their caregivers as well as to their medical records.

The development and evaluation of the prototype is based on measurements recorded in the living quarters of a number of seniors.

ADDED VALUE FOR COMPANIES

The project results are of interest to any company providing ICT services in the health-care sector, and in particular to companies proposing health telemonitoring systems. CETIC and its partners can extend their product portfolio with solutions based on the deployment of video cameras, security sensors and sensors measuring public utilities usage. The results may also be of interest to SMEs active in sectors like energy management, comfort management and home automation.

ECS

Partners

Fontys Paramedische Hogeschool, KULeuven,
MOBILAB of KHKempen University College, Intersysto, PCSol, Smolinfo,
Vlaamse Katholieke Hogeschool voor Wetenschap & Kunst

Type of project:	European Commission/Wallonia – ERANET
CETIC Budget:	€199,733
Duration:	2010-2013
Contact:	valery.ramon@cetic.be
Website:	www.amacs-project.eu

Experimenting with the Scalability of Continuous Security Monitoring on BonFIRE Testbeds

Security is a major concern for Cloud users. The results of the experiment performed by CETIC during the ExSec on BonFIRE project are helping software architects to design secure application architectures that scale in the Cloud environment.

OBJECTIVES

ExSec has been studying the impact of scalability on Web services and Web applications where security policies are continuously monitored. In the Cloud Computing environment, the traditional security model based on access control checks performed only at the time of accessing a resource is no longer sufficient. Advanced mechanisms for continuous security monitoring (also called usage control) are needed, owing to the potential for unrestricted attacks on any cloud resource from anywhere in the world.

RESULTS

After hundreds of experimental runs under dozens of varied Cloud environment set-ups, a security monitoring service was scaled from a fully centralised approach to a completely decentralised approach. CETIC has collected concrete numbers to determine the impact of continuous security monitoring on the scalability of Cloud software applications and Cloud software services.

ADDED VALUE FOR COMPANIES

Depending on the expected customer load, the complexity of security policies to be monitored, the geographical dispersion of application servers and the characteristics of the underlying hardware infrastructure, CETIC can use the numbers and expertise gained in the ExSec project to advise companies on the best architecture for deploying their Web applications and Web services with maximal security.
Summary video: http://www.cetic.be/BonFIRE-ExSec,1253.

Partners

All BonFIRE partners, especially Testbed operators (HLRS, INRIA, EPCC)

Type of project: European Commission – FP7 – Future Internet Research Experimentation
CETIC Budget: €237,622
Duration: 2011-2012
Contact: jean-christophe.deprez@cetic.be

Connect to All

The C2A project was designed to enable, and demonstrate, effective interoperability among the wide variety of embedded devices installed in transport vehicles. Its specific goal is to provide a reference platform implementation.

OBJECTIVES

C2A has developed a generic technology for interoperability (an "intelligent communication tunnel"), which offers a straightforward approach to dynamically interconnecting embedded vehicular devices, sharing resources and activating application services based on the data they provide.

RESULTS

The demonstrator was built and presented during the final year of the project. It consists of embedded units, which run the C2A firmware that automatically handles the hot plug/unplug of peripheral devices and activates the associated services, and a remote server, which monitors the output of the embedded units and configures their parameters. A Web-based C2A user interface is accessible locally via any handheld device, or remotely by connecting to the server.

ADDED VALUE FOR COMPANIES

C2A is an ITS (Intelligent Transport System) consisting of a reference platform that is highly flexible compared to existing commercial products. It enables the creation of embedded solutions that are customised to user requirements and can easily evolve.

The key differentiating features of the C2A system are its capacity to dynamically integrate new equipment and the ease with which it activates related application services.

Partners

Carinna, CReSTIC/URCA, Docledge, Forem, Gunnebo, INFOPOLE Cluster TIC, Monier Borsu Sotrabel, NeXXtep Technologies, Smolinfo

Type of project: European Commission – Interreg IV
CETIC Budget: €327,000
Duration: 2008-2013
Contact: lotfi.guedria@cetic.be
Website: www.c2a-project.eu

SST

ComodIT

The ComodIT project has been developing a new approach to automating the provisioning and management of complete and integrated IT and mobile infrastructures during their entire life cycle. This approach will simplify and secure Cloud Computing technologies.

Private Cloud

OBJECTIVES

The ComodIT project was designed to:

- Formalise: A standardised way to describe all requirements, methods and resources;
- Orchestrate: A single touch point for managing resources, provisioning and configurations;
- Automate: A platform for automating the various IT processes and for reacting to events occurring within the infrastructure.

RESULTS

CETIC has carried out a series of innovative actions to raise both the functional and non-functional maturity levels of the platform; for example, related to scalability (private cloud deployment), security (through adequate architecture and configuration) and maintainability (automated source code analysis and deployment). These actions have turned the platform into a real Assessment Management System, covering assessment needs from classical standardised testing to the evaluation of high-level competencies.

ADDED VALUE FOR COMPANIES

Continuous training of staff is a key activity that will ensure the maintenance and renewal of skill levels in companies. The work culture requires great flexibility, and training methods must adapt to changing skill requirements. This platform enables companies to deliver e-learning courses with a competency-based approach, while at the same time facilitating the task of the trainer.

Service Oriented Architecture

Partners

Aurigae, Guardis, Mobile Interactiva

Type of project: European Commission - ERANET
CETIC Budget: €421,820
Duration: 2011-2013
Contact: michael.vandeborne@cetic.be
Website: www.comodit-project.eu

SSE

Industrial Deployment of Advanced System Engineering Methods for High Productivity and Dependability

DEPLOY was designed to promote the use of formal methods in the industry, and improve the industrial scalability of these methods. It is a technological response to increasing system complexity and to our growing dependence on automated systems for critical tasks.

OBJECTIVES

DEPLOY's goal was to make major advances in the industrial engineering practices required to develop dependable systems through the deployment of formal engineering methods and tools. The project is meeting the challenge of integrating these methods into industrial development life cycles, and of showing evidence of their effectiveness with a view to fostering their adoption.

RESULTS

DEPLOY has designed a validated methodology to introduce formal engineering techniques in a controlled and measurable way, based on large-scale experiments conducted in key industrial sectors. Companies can benefit from a large body of knowledge composed of methodological guides and training plans. Finally, CETIC has contributed an industrial wiki and FAQ to help in the adoption of formal engineering methods.

ADDED VALUE FOR COMPANIES

DEPLOY can benefit companies by providing guidelines for deploying the right engineering methods and tools at the right place and at the right time. In addition, companies can achieve the expected benefits, especially in terms of greater system dependability, while keeping the time-to-market and production costs under control.

Formal Methods

Partners

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

Type of project: European Commission – FP7 – ICT – Integrated Project
CETIC Budget: €829,776
Duration: 2008-2012
Contact: christophe.ponsard@cetic.be

SSE

I2MSteel

Intelligent Integrated Manufacturing for Steel

To remain competitive, the European steel industry needs to improve their processes. This project is developing a new paradigm, where software agents negotiate dynamically optimised production at each step of the steel-making chain.

OBJECTIVES

A completely new paradigm of automation and information technology systems for intelligent and integrated manufacturing in steel production (I2MSteel) is envisioned to overcome the current production challenge, which is to combine the large variety of existing processes and plants into a single, highly interlinked process chain.

The suggested solution is the application of holonic agent technology to build this new paradigm. A holonic agent is an autonomous and flexible computational system operating in a particular environment. Agents have 'social' abilities, allowing them to engage with other components through communication and coordination. Another two technologies are also required: a Service-Oriented Architecture (SOA) to create an underlying framework to provide the agents with all the necessary information; and semantic techniques (ontologies, in this case) to give the agents an 'understanding' of their environment and of the data coming from the SOA.

RESULTS

The requirements for the software platform are currently being defined, and the use cases are being identified and refined.

ADDED VALUE FOR COMPANIES

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

SST

Partners

ArcelorMittal Research (France), Centro Sviluppo Materiali, Siemens, VDEh-Betriebsforschungsinstitut (BFI)

Type of project: European Commission - Research Fund for Coal and Steel
CETIC Budget: €412,886
Duration: 2012-2015
Contact: stephane.mouton@cetic.be

PAASAGE

Model-based Cloud Platform Upperware

PaaSage targets model-based development and the deployment of software applications independently of existing cloud infrastructures.

Cloud Computing

OBJECTIVES

Cloud Computing is a major technological breakthrough for the IT industry; however, taking full advantage of it remains difficult. Cloud platforms are either not fully exploited, or they need significant knowledge and customisation to be fully exploited. There are also issues of cost and risk associated with porting an existing application to the cloud. The solution proposed by the project is to analyse the modules of an application in order to define the deployment model and its execution behaviour.

Overall, the PaaSage project will deliver an integrated development and deployment platform, along with an appropriate methodology, with which developers of enterprise systems can access the services of cloud platforms in a technology-neutral manner that abstracts the technical details, while they are guided through the process of configuring their applications for the best possible performance.

RESULTS

The project will deliver the following results:

- The necessary design time tools, including a speculative profiler and a stochastic reasoning, called Upperware;
- The necessary execution time components, including an adaptation engine, and a metadata database, called Executionware;
- A specific modelling language for the tools, CloudML, produced jointly by several FP7 projects (Artist, Modaclouds and PaaSage).

ADDED VALUE FOR COMPANIES

The project will lower the entry barriers for the adoption of Cloud Computing. The technologies developed will be tested on industrial use cases, and the software developed will be made available as Open Source software.

Partners

ASCS, be.wan, ERCIM, Evry, Flexiant, FORTH, GWDG, HLRS, INRIA, Lufthansa Systems, SINTEF, STFC, Sysfera

Type of project: European Commission - FP7 - ICT - Integrated Project
CETIC Budget: €694,960
Duration: 2012-2016
Contact: damien.hubaux@cetic.be
Website: www.paasage.eu

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

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

OBJECTIVES

PONTE is developing an SOA and a Semantic Web platform for the identification of patients for clinical trials dedicated to drug repositioning that mitigates safety risks and improves clinical trial costs and efficacy. CETIC has contributed to standardisation, Semantic Web research and development, security and the SOA for the project, as well as being the project coordinator.

RESULTS

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

ADDED VALUE FOR COMPANIES

A financial crisis leads industries to search for ways to decrease their costs and increase their profits. There is less room for experimentation, and this is true for the health and pharmaceutical industries as well. Semantic Web concepts, carefully integrated into applications designed in close collaboration with domain experts, help to improve clinical trial design in terms of cost, time and patient safety.

Partners

Addenbrooke's Hospital – Cambridge University Hospitals – NHS Foundation Trust (ADDEN), Gottfried Wilhelm Leibniz Universitaet Hannover (LUH), National Technical University of Athens (ICCS/ NTUA), 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)

Type of project:	European Commission – FP7 – ICT – Specific Targeted REsearch Project
CETIC Budget:	€887,500
Duration:	2010-2013
Contact:	philippe.massonet@cetic.be
Website:	www.ponte-project.eu

Support Patients through eService Solutions

SPES is deploying eServices health solutions specially tailored to manage respiratory problems, dementia, disabilities and social isolation to support patients in at four European locations.

OBJECTIVES

SPES is transferring the approach and results achieved in the OLDES project (www.oldes.eu), in order to implement and evaluate an e-health and entertainment platform in pilot studies in the province of Ferrara (Italy), the city of Vienna (Austria), the city of Brno (Czech Republic) and the city of Kosice (Slovakia), focusing on the following health issues: respiratory problems, dementia, disabilities and social isolation respectively.

RESULTS

Based on the the Software Requirements Specifications (SRS) for the SPES platform agreed to by the various pilots, CETIC has developed a number of services for patients and their caregivers:

- Communication services, to break the isolation of patients by enabling them to stay in touch with family members, friends and medical care providers through technology;
- Telemedicine services with data from medical devices (glucometer, pulse oximeter, blood pressure monitor, etc.) collected and transmitted to a Web portal where they can be accessed by health professionals.;
- Patient geo-location and tracking.

ADDED VALUE FOR COMPANIES

Telemedicine favours the emergence of a completely new market of health care service providers in the future through the provision of health and social care at home.

Partners

ENEA, Province of Ferrara, AUSL – Local Health Authority of Ferrara, CUP2000 SPA, FSW – Vienna Social Fund, University of Vienna,City of Košice, Technical University of Kosice, Czech Technical University in Prague, Pro DEEP

Type of project:	European Commission - ERDF
CETIC Budget:	€275,875
Duration:	2011-2014
Contact:	valery.ramon@cetic.be
Website:	www.spes-project.eu

ICT EQUIPMENT

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

CETIC's ICT Equipment includes:

- a **Software Engineering Laboratory**, equipped with software development tools;
- a **Wireless Laboratory**, equipped with software and hardware tools for the design and test of wireless systems, as well as a **Wireless Sensor Network Testbed**;
- a **Cluster Infrastructure**, for experimenting with large scale distributed systems.

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.

Software Engineering Laboratory

This lab focuses on advanced tools for code analysis, targeting specific properties such as maintainability (quality of architecture, documentation, complexity, e.g. CAST and Sonar), security (absence of vulnerabilities, e.g. Fortify) and reliability (absence of run-time errors, e.g. Polyspace). This lab also features mainstream requirements engineering, business modelling, testing and effort estimation tools. Walloon SMEs active in IT development will have acccess to state-of-the art tools and also benefit from guidance in the adoption process in the form of help in their configuration and deployment.

Wireless Laboratory

This lab addresses the new wireless technologies associated with electronic technologies that make the choice of an appropriate solution so difficult. CETIC selects software and hardware tools encompassing all the emerging technologies, especially those related to new standards introduced to increase throughput and range, reduce power consumption and optimise performance trade-offs.

Wireless Sensor Network Testbed

In 2012, CETIC deployed a Wireless Sensor Network (WSN) testbed in support of research and experimentation for the MidFlex project. The testbed consists of 25 WSN modules deployed over a 500m² office space, connected through a USB backbone for programming, debugging and triggering network faults for reliability tests. In 2013, CETIC will open its testbed to academic institutions and companies, allowing them to prototype WSN applications on the infrastructure. The modules within the testbed are all reachable through IPv6 using instances of CETIC's 6LBR project, which will support companies wanting to design a full scale Internet of Things solution from the Cloud to the sensor.

Distributed Architecture Cluster

Since 2006, CETIC has operated a cluster with a Cloud Computing-oriented architecture. Within the scope of the SINUS project (Convergence Objective), CETIC acquired a new Distributed Architecture Cluster which favours flexibility and virtualisation over raw computing power. The new equipment is the platform on which the tools in the Software Engineering Lab run, and it is also the live testbed for experimentation in Cloud Computing and other distributed system applications, like SOA. The cluster is used internally for CETIC's research projects, but is also available for experimentation conducted by its partners and other enterprises.

Exchanges and Research-Industry Partnerships

Technology Guidance

Technology guidance at CETIC consists of contributing to the efficient technology transfer from this applied research centre to Walloon SMEs.

The WallisTIC II technology guidance project was launched to help Walloon SMEs adopt new technologies and integrate them into their processes, products and services. Six main areas of ICT expertise are covered in this technology transfer: service-oriented technologies, software engineering, Open Source, Internet of Things, wireless networks, IPv6 and applied networks.

To accelerate Wallonia's economic growth, Walloon SMEs in all sectors should integrate the latest ICT into their operations whenever possible, as these technologies are key to competitiveness and productivity. More importantly, these companies can be helped in the adoption process by Wallonia's ICT applied research centres.

Both MULTITEL and CETIC are collaborating on this project.

ACCORD-Wallonie

ACCORD-Wallonie is the organisation that incorporates Wallonia's 22 accredited research centres, including CETIC:

- CEBEDEAU
- CELABOR
- CENAERO
- CENTEXBEL
- CER Groupe
- CERTECH
- CETIC
- CEWAC
- CORI
- CRIBC
- CRIC-OCCN
- CRM Group
- CRR
- CSTC
- CTIB-TCHN
- CTP
- IBS
- IMMUNE
- HEALTH
- INISMa
- MATERIANOVA
- MULTITEL
- SIRRIS

Its role is to drive research to support Walloon SMEs, providing them with easy access to all the competencies of the ACCORD-Wallonie research centres.

ACCORD-Wallonie offers technological guidance for the following sectors covered by the research centres: bio-industry, health, material coating processes, durable construction, transportation, ICT, and environment, recycling and energy. The organisation's mission is to help SMEs address the industrial and economic issues facing these sectors.

For more information: www.accord-wallonie.be

accord-wallonie

Walloon Competitiveness Clusters

The Competitiveness Cluster groups together companies, training centres and public or private research units in a leading sector of the economy covering a particular geographical area of Wallonia. CETIC actively collaborates with Walloon Competitiveness Clusters in order to align R&D directions and objectives with industry needs.

The Cluster members commit to a partnership-based approach intended to generate synergies with respect to common projects of an innovative nature. These partnerships are structured around a market and the related technological and scientific fields, and must achieve the critical mass needed for competitiveness and international visibility that will enable them to develop a virtuous circle of growth.

These are the Competitiveness Clusters:

- Logistics in Wallonia: transportation and logistics
- Skywin: aerospace
- GreenWin: innovation in green chemistry and durable materials
- BioWin: health
- WagrALIM: the food industry
- Mecatech: mechanical engineering

For more information: www.polesdecompetitivite.eu

WALLONIA CLUSTERS

Scientific Publications

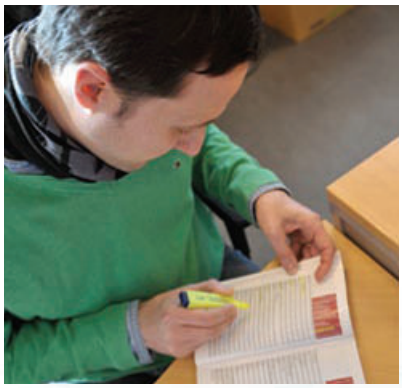
- Jean-Christophe Deprez, Dimitri Durieux, Connect ALM Tools, thanks to the Open Services for Lifecycle Collaboration Specification, DEVOXX 2012, Anvers (Belgium), November 2012
- Sébastien Dawans, Simon Duquennoy, Olivier Bonaventure, On Link Estimation in Dense RPL Deployments, SenseApp 2012, IEEE 37th Conference on Local Computer Networks, Florida (USA), October 2012
- Robert Viseur, From Open Source Software to Open Source Hardware, OSS 2012, Hammamet (Tunisia), September 2012
- G. Tsatsaronis, K. Mourtzoukos, V. Andronikou, T. Tagaris, I. Varlamis, M. Schroeder, T. Varvarigou, D. Koutsouris and N. Matskanis, PONTE: A Context-Aware Approach for Automated Clinical Trial Protocol Design, VLDB PersDB 2012, Istanbul (Turkey), August 2012
- Christophe Ponsard, Ravi Ramdoyal, Daniel Dziamski, An OCR-enabled Digital Comic Book Viewer, ICCHP'12, Linz (Austria), July 2012
- Nikolaj Bjørner, Vijay Ganesh, Raphaël Michel and Margus Veanes, An SMT-LIB Format for Sequences and Regular Expressions, 10th International Workshop on Satisfiability Modulo Theories, Manchester (UK), July 2012
- Raphaël Michel, Vijay Ganesh, Arnaud Hubaux and Patrick Heymans, An SMT-based approach to automated configuration, 10th International Workshop on Satisfiability Modulo Theories, Manchester (UK), July 2012
- Syed Naqvi, Arnaud Michot, Michael Van de Borne, Analysing the Impact of Scalability and Heterogeneity on the Performance of Federated Cloud Security, ISSR 2012 in conjunction with IEEE TrustCom-2012, Liverpool (UK), June 2012
- Mathieu Acher, Raphaël Michel, Patrick Heymans, Next-Generation Model-based Variability Management: Languages and Tools (Tutorial), Journées GDR-GPL-CIEL 2012, Rennes (France), June 2012
- Mathieu ACHER, Raphaël MICHEL, Patrick HEYMANS, Philippe COLLET and Philippe LAHIRE, Languages and Tools for Managing Feature Models, 3rd International Workshop on Product Line Approaches in Software Engineering co-located with ICSE'12, Zurich (Switzerland), June 2012
- Nicolas Devos, Christophe Ponsard, Jean-Christophe Deprez, Renaud Bauvin, Benedicte Moriau and Guy Anckaerts, Efficient Reuse of Domain-Specific Test Knowledge: An Industrial Case in the Smart Card Domain, PLEASE 2012, Zurich (Switzerland), June 2012
- Clément Quinton, Laurence Duchien, Patrick Heymans, Stéphane Mouton, Etienne Charlier, Using Feature Modelling and Automation to Select Among Cloud Solutions, PLEASE 2012, Zurich (Switzerland), June 2012
- Quentin Boucher, Gilles Perrouin, Jean-Christophe Deprez and Patrick Heymans, Towards Configurable ISO/IEC 29110-compliant Software Development Processes for Very Small Entities, 19th EuroSPI, Vienna (Austria), June 2012
- Tassos Tagaris, Efthymios Chondrogiannis, Joseph Roumier, George Tsatsaronis, Vassiliki Andronikou, Nikolaos Matskanis, Konstantinos Mourtzoukos, Michael Schroeder, Philippe Massonet and Theodora Varvarigou, Semantic Interoperability between Clinical Research and Healthcare: the PONTE Approach, (SIMI2012) ESWC2012 Workshop, Heraklion (Crete), May 2012
- Robert Viseur, Le chercheur peut-il se fier aux volumétries indiquées par les moteurs de recherche commerciaux?, 10ème séminaire M@rsouin, Brest (France), May 2012
- Syed Naqvi, Philippe Drugmand and Sébastien Rousseaux, Security Challenges for Remote Patient Care Systems using m-Health Technologies, Med-e-Tel, Luxembourg, April 2012
- Jean-Christophe Deprez, Ravi Ramdoyal and Christophe Ponsard, Integrating Energy and Eco-Aware Requirements Engineering in the Development of Services-Based Applications on Virtual Clouds, REFSQ'12, Essen (Germany), March 2012
- Jean Christophe Deprez and Christophe Ponsard, A Collaborative FAQ Approach for Collecting Evidence on Formal Method Industrial Usage, Deploy Federated Event, Fontainebleau (France), March 2012
- Christophe Ponsard, Jean Christophe Deprez and Jacques Flamand, Assessment of the Evolution of the RODIN Open Source platform, Third RODIN Users and Developer Workshop at Deploy Federeted Event, Fontainebleau (France), February 2012
- Robert Viseur, Forks impacts and motivations in free and open source projects, International Journal of Advanced Computer Science and Applications (IJACSA) Volume 3, Issue 2, February 2012
- Syed Naqvi, Gautier Dallons and Christophe Ponsard, Digital Investigations for Enterprise Information Architectures, ICDS 2012, Valencia (Spain), January 2012
- Syed Naqvi, Digital Investigations and Forensic Analysis – Practices and Technologies, CDS 2012, Valencia (Spain), February 2012
- Massonet P., Michot A., Naqvi S., Villari M. and Latanicki J., Securing the External Interfaces of a Federated Infrastructure Cloud, in Open Source Cloud Computing Systems: Practices and Paradigms, Vaquero L., Hierro J. and Cáceres J. (eds.), 2012

Dissemination

CETIC organised two events and five workshops in 2012 in Belgium.

CETIC's experts also contributed to 42 fairs and events in Belgium and worldwide.

Three newsletters and 15 blog articles were published. CETIC also gave over 15 interviews and was mentioned in more than 35 press clippings.



Collaborations

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

Structured Collaborations

R&D Collaborations

cetic

Your Connection to ICT Research

Aéropole de Charleroi-Gosselies
Bâtiment Éole
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