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Your connection to ICT research

Centre d'Excellence en Technologies de l'Information et de la Communication

(Center of Excellence in Information and Communication Technologies)

Annual Report 2004

CETIC

2004

www.cetic.be

CETIC asbl is supported by the Walloon Region and the European Union

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1 Message from the Director

The year 2004 has been an exciting time at CETIC, during which the base for long-term development has been successfully set-up.

The key results that we want to stress at the end of the year are :

- CETIC has received the agreement by the Walloon Region as a Collective Research Centre, following the rules of the regional Decret dated from November 13, 2002.
- CETIC has intensified its links with regional ICT enterprises, in particular (but not only) through strong involvement with industry-led organisations, clusters, networks… as well as with local initiatives such as Charleroi 2020.
- CETIC has set up partnerships at European levels, and is now taking part, at a large scale, into the European Research Area, for example through several FP6 research projects. In particular, the participation of CETIC within the CoreGRID Network of Excellence is remarkable, demonstrating the capacity to repeat at a European scale the connecting role between Research labs and Industry.
- CETIC research teams have started a strategic discussion focusing on the research activities to turn these into tools to provide advanced technology-based value added services to the regional ICT industry.

The year ended with the establishment of the 2005-2008 Strategic Plan, paving the way for a long term development of the Centre, beyond the initial phase that will end in 2005-2006.

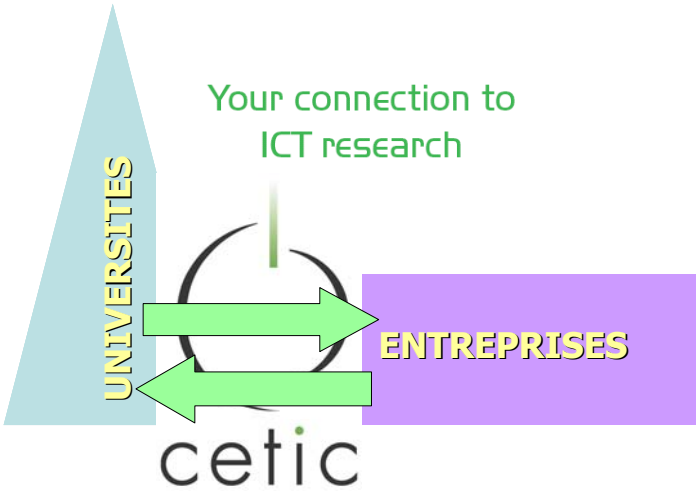
At CETIC, we are particularly proud of the capacity we developed to bridge between top-level European Research activities and regional industrial players, and to have set up the capacity of creating win-win relationships with our industrial partners.

Pierre Guisset
Director

2 Profile of CETIC

CETIC is an *applied research* centre, focused on Information and Communication Technologies (ICT) with a strong orientation towards *technology transfer* to the industry. CETIC, the "Centre of Excellence in Information and Communication Technologies", has been created in 2001 as an initiative of tree Belgian universities: the Polytechnic Faculty of Mons, the University of Namur and the Catholic University of Louvain.

CETIC positions itself as a R&D centre "serving the industry", being a connecting agent between academic research and the enterprises, acting for technology transfer in software engineering and electronic systems. Through its research activities, CETIC strongly relies upon close collaborations with multiple University Labs.



The areas of expertise of CETIC are:

- Software Engineering, with a focus on software processes and products quality, requirements engineering, formal methods, and IT systems reverse engineering;
- Electronic Systems, hardware-software co-design, methodologies related to programming electronic cards (FPGA), wireless technologies, ambient intelligent systems.
- Distributed Systems and GRID computing technologies, targeting high-level availability, efficient distributed data management, mobile and collaborative systems, web technologies.

At the end of 2004, the total headcount of CETIC was 22.5 Full-Time Equivalent.

2.1 The members of CETIC

CETIC is a non-profit association ("Association Sans But Lucratif") set up in 2001. Founding members are:

- The Polytechnic Faculty of Mons (FPMs, "Faculté Polytechnique de Mons"),
- The University of Namur (FUNDP, "Facultés Universitaires Notre-Dame de la Paix"), and
- The University of Louvain (UCL, "Université Catholique de Louvain"), in Louvain-la-Neuve, Belgium.

The other members of the association (on December 31, 2004) are :

- Mr. Gilles Capart,
- Prof. Denis Favart
- Prof. Philippe Fortemps,
- Prof. Jean-Luc Hainaut,
- Prof. Pierre Manneback,
- Mrs. Nicole Moguilevsky.

2.2 The Board of Directors

Composition of the Board of Directors:

- Prof. Serge Boucher, Rector of the FPMs,
- Prof. Marcel Crochet, Rector of UCL, President,
- Mr. Marc Debois, General Manager of Igretec,
- Prof. Jean-Luc Hainaut,
- Prof. Pierre Manneback,
- Prof. Elie Milgrom,
- Prof. Michel Scheuer., Rector of FUNDP.

2.3 The Scientific Advisory Board

Composition of the Scientific Advisory Board:

- Mr. Alain Dangoisse,
- Mr. Pierre Guisset, Director,
- Prof. Naji Habra, President,
- Prof. Jean-Luc Hainaut,
- Prof. Jean-Didier Legat,
- Prof. Pierre Manneback,
- Prof. Elie Milgrom,
- Mr. Alain Renault,
- Prof. Pierre-Yves Schobbens,
- Prof. Axel van Lamsweerde,
- Prof. Peter Van Roy,
- Prof. Luc Vandendorpe,
- Prof. Michel Verleysen.

2.4 The Industrial Advisory Board

Composition of the Industrial Advisory Board:

- Mr. Jean-Michel Adam, Gerling SA,
- Mr. Claude Cambier, UNISYS,
- Mr. Alain Dangoisse, UCL,
- Mr. Marc Durvaux, Alcatel ETCA,
- Mr. Pierre Guisset, CETIC,
- Prof. Naji Habra, FUNDP,
- Mr. Christian Jacques, Siemens Business Services,
- Mr. Igor Klapka, Open Engineering,
- Mr. Bruno Schroder, UNISYS,
- Mr. Jean-Paul Thielemans, ETNIC,
- Mr. Pierre Vandooren, Tradeware,
- Mr. Marc Van Steenwinkel, Business Solution Builders.

3 Research and development activities

3.1 The software quality group

The mission of CETIC is to promote the foundations of software quality improvement into organizations and especially into SME or VSE, by sensitizing these companies to their own strengths and weaknesses in terms of software practices, through the application of methods, services, products or trainings or by coaching these companies during a software process improvement approach.

CETIC possesses competences in several domains:

- The implementation of quality approaches in companies (VSE, SME or large enterprises),
- The evaluation/assessment of the software practices (micro-evaluation or OwPL assessment),
- The use of OwPL model (OwPL stands for Observatoire wallon des Pratiques Logicielles),
- The use of CMM (Capability Maturity Model) and of CBA-IPI (CMM©-Based Appraisal for Internal Process Improvement),
- The definition and implementation of metrics supporting the quality approach.

CETIC is also developing a methodology to evaluate software products in an objective way (use of metrics). The goal of this method is to facilitate the comparison and the exchange of software products. In order to achieve this goal, CETIC is taking part in several working groups at the IBN (Institut Belge de Normalisation), i.e. the Belgian Standard Institute.

CETIC is busy developing a software source quality assessment tool to support this : D-Side Dashboard™.

CETIC is a Walloon reference in terms of software assessment, that is, CETIC is able to identify rigorous assessment criteria that are stable and consistent in order to exchange products or services in the ICT sector. This activity is based on several standards that already exist in the Software Assessment domain (Boehm, McCall, Dromey, ISO/IEC 9126). The use of these standards is particularly interesting in the context of software products specification or certification.

Three main research activities were developed during last year. Firstly, the Software Measures team led strong and rigorous analysis of a lot of software measures widely used, that is, cyclomatic complexity, coupling... Secondly, and in the meantime, the development of software quality predictive models for Java were constructed and implemented in the software product developed by CETIC - D-Side Dashboard™ (a decision-aid tool based on software measure). Thirdly, the tailoring and translation into Spanish of the micro-evaluation tool (a light tool and methodology to assess the software development process capacity of small teams).

Software metrics analysis

Three main software measures have analysed in detail by the Software Metric team, that is, the coupling, the cohesion, and the cyclomatic complexity. These three measures are actually very used in the software industry to forecast the software quality based on the quality of the source code and the software design. It was then a very good reason to study these measures in detail.

Three main conclusions can be drawn from this investigation.

The definition of the software attribute to be measured is often hardly defined in an ambiguous manner. For instance, the coupling is incompletely defined by the state of the art. Some works (Briand) have highlighted the necessity of providing rigorous and non ambiguous definitions of the coupling (the same work has been done for cohesion). Even though this study is the most complete definition available in the literature, most of the measuring instruments of the market do not correctly implement this definition. Moreover, the measurement results given by these instruments is seldom equally the same for the same software. This divergence of results between measuring tools for the same software means that the definition of the coupling (and other software attribute) is not rigorous enough to implement it in a measuring tool.

Another conclusion drawn by this investigation is the serious lack of specification of the use conditions for each software measure. Indeed, it seems that the software measures are not designed with the conditions wherein they can be used. For instance, the cyclomatic complexity was defined 30 years ago without specifying any conditions of use. And, thirty years later, this measure is used in order to assess the complexity of JAVA programs, whereas the JAVA language did not exist in the 70's. Moreover, our investigation enabled us to find out that in an object-oriented context like in JAVA, the cyclomatic complexity does not measure the software complexity, but the degree of object-oriented measurement of the program. Using the cyclomatic complexity within JAVA programs provides the information about the level of object-oriented measurement of such program. Even if this information is very useful for the practitioners, it was never clearly clarified in such a manner. In a more general way, it is important to specify the conditions under which a given measure can be meaningfully applied.

The last conclusion drawn is about the identification and the means to handle the errors that can occur in software measurement. It is widely accepted that the errors do not occur in internal software measurement. However, some sources of errors like the ambiguity of the measures definition have been identified, and their impact on the measurement results have been highlighted. The means to handle errors have been developed coming from the metrology field.

Predictive models

A main goal when using measures is to predict the quality of the software based on its source code. These methods, also called predictive models, are interesting since their execution is automated. Nevertheless, these predictive models are hardly reliable and need a strong improvement.

CETIC wants to implement these predictive models into its D-Side Dashboard tool. So it is necessary to analyse and improve these models.

The first model investigated by the Software Measures team is the maintainability model. The main goal of such model is to forecast the maintainability of a given product based on its source code. The model is made up of several graphs that display correlated measurement like comments density, complexity, coupling... The graphs are organised into dashboards that give insight of the maintainability of the product.

The construction of the maintainability model is based upon the state of the art and an empirical study of the maintainability of 694 JAVA projects made by the Software Measures team.

The refinement of the maintainability model also includes the research results described in the previous paragraph. Indeed, the measures and their thresholds are context-based. Basically, all the frequency distributions of the considered measures have been computed for the JAVA language thanks the JAVA sample. And the thresholds, which are the fundamental base of the means to assess the quality, have been identified in regard with these frequency distributions.

Micro-evaluation

The micro-evaluation is a methodology and a tool to assess the software development capacity of small organisations. This method is very useful to give insight of the capacity of a given company at a given time. This method has been developed for small Walloon companies. A tailoring with a translation of the methods have been done for Instituto Tecnologico de Aragon, a Spanish research centre, which needs the micro-evaluation to make a survey of the software companies of Aragon (a Northern region of Spain).

The tailoring of the micro-evaluation was actually the opportunity to refine the methodology and transform it into an easier method.

3.2 The requirements engineering group

CETIC extended expertise in requirements engineering to develop or reengineer requirements documents in non-critical areas that are still quite complex and where the rich structuring capabilities of our method and tools are very useful.

As an example, in the first quarter of 2004, an extensive documentation has been produced to document the evaluation methodology used for assessing the accessibility of public buildings (Indice Passe-Partout).

The resulting document was build from a complete structure of accessibility goals, elaborated for 6 categories of users (each with a specific profile with respect to some disability: physical, sensorial or cognitive). Measurable metrics were associated with each requirement together with a propagation mechanism taking priorities and relative importance into account in order to yield an index representative of the overall accessibility. This work is now triggering the adoption of the method and the development of automation tool for its support.

Requirements Engineering for Critical Systems

Our world is increasingly relying on complex software-based systems. In a growing number of fields such as transportation, finance, health-care, they now play a critical role as their failure can lead to catastrophic consequences in term of loss of company profit or even human lives. Hence they require high assurance with properties like security, safety, availability…

Achieving assurance requires quality throughout the whole development lifecycle: from requirements to specification, architecture, code and tests. Among those, it is widely recognised that the first cause of project failure still remains in the poor quality of requirements. Our focus is on the requirement problem in relation with the rest of the lifecycle. More precisely, we want to answer the following questions:

- Validation: do we have the right requirements?
- Verification: are the requirements right?
- Acceptance: is the deliverable right?

Our approach is model-based: a **goal model** is created to capture system and environment properties as well as agent capabilities/responsibilities. This model has two levels of description:

- A semi-formal level with graphical notation which integrates with standard UML notations (such as use cases, class, sequence diagrams). It is appropriate to acquire the structure of the model and enough for non-critical properties.
- A formal level using a real-time temporal logic which ensures the formal correctness of the model and is only deployed on critical parts. It is a natural extension of the semi-formal level.

Based on this modelling, the FAUST toolset can perform validation, verification and test generation tasks at the required level of assurance. In particular **formal methods are successfully applied because of their targeted use and the ability to explain them informally** through graphical notations and animations. The underlying formal tools (like model-checkers or constraint solvers) also remain hidden.

Through this approach, CETIC experts are yielding requirements which are unambiguous, robust, conflict-free, validated and testable.

The benefits of the approach are the following:

- Goal and agent based: capturing, refining and reasoning about system properties within this environment, assigning responsibilities, exploring and comparing alternative designs.
- Model-based approach with automatic derivation of a wide variety of artefacts like semi-fomal documents and formal specifications (B), acceptance test cases… enabling an easy integration in your lifecycle (whether test-based or correct-by-construction)
- The power of formal methods while preserving communication as formal notations and underlying tools can be hidden and explained in natural/graphical languages.

At the end, this results in reduced costs thanks to high quality requirements and their tight connection with other lifecycle artefacts.

The toolset is currently composed of the following tools: a refinement checker for verification, a requirement animator for validation and a test case generator (under development). An important feature is that those tools are closely integrated with each other: the refinement checker helps to discover design errors and will generate an example trace which can be animated graphically in the animator and be stored and replayed later as acceptance test-case. Hence the tools has a double purpose. The integration is also present with the underlying semi-formal platform level (Objectiver developed by Cediti SA) which, together with the animator, helps achieving an optimal hiding and explanation of formal notation to the end user/customer/decision maker. In the end, the tool optimally addresses a double purpose at an early stage: model debugging and communication with stakeholders.

The toolset is currently under stabilisation phase and being validated in the context of Europe's 6th Framework Programme projects (such as RODIN in the context of the Industrial Interest Group). Domain-specific adaptations are also being investigated, for example in the field of security, to fit with widely adopted standards such as the Common Criteria.

3.3 The distributed technologies group

In addition to its strong scientific background in distributed peer-to-peer technologies, CETIC has developed strong competences in Grid technologies and has expanded its retro-engineering expertise area with "web mining" and "semantic web" know-how, using distributed technologies. The core competences cover the wide range of data extraction, interpretation, indexation, transfer and storage.

This expertise will be supported by a large scale hardware equipment (Linux Cluster).

Grid and Peer-to-Peer Technologies

CETIC has continued its collaboration with the cluster gathering Walloon graphical industries («grappe technologique des industries graphiques ») to improve the definition of the data transfer application FileStamp. FileStamp answers the needs regarding to the very large size file exchange on a professional network. It focuses on the ease of data exchange, the operations efficiency, the information confidentiality and is user friendly. A first prototype has been implemented and market opportunities have been discussed together with a Wallon industry.

An architecture for services management has been created for the peer-to-peer (P2P) library. This architecture allows to dynamically add or remove some modules to one, several or all applications connected with the P2P network. It defines a programming interface and a user mode that highly decreases the development cost for the writing of peer-to-peer applications with dynamic update. A service management module (Hierarchical Event Based P2P Architecture, HEBP2PA) has been introduced to simplify the use of P2P for software developers and to allow the dynamic update of peer-to-peer applications. The P2P component has been validated on the network Planet Lab.

The CETIC team has developed synergies between the ORAGE project and the new FP6 projects with a focus on distributed grid technologies (EverGrow, CoreGRID et HPC4U). Researchers have participated to a Grid Summer School and several conferences on the subject.

Web Data Mining

RetroWeb is a retro-engineering tool for structuring unstructured complex documents. It facilitates the extraction of interpreted data from documents as web pages.

On basis of the observation that is in the retro-engineering field, the diversity of technologies used for tools development makes their use sometimes difficult and not user-friendly, CETIC has started the integration of all RetroWeb components within a unique platform: Mozilla. The related specific advantages are:

- ease of installation and use of the tools,
- unique view on the treated documents structure,
- integration of the functionalities within a unique menu…

Various improvements have been done to the existing tools and new functionalities have been added, for example the semantic editor. Some processes, as the pages collector, have been automated.

CETIC has established collaboration with a young spin-off (ReVeR SA) from the University of Namur active in database retro-engineering. Together we want to set up the capacity to process the retro-engineering and automated migration to a content management tool of huge web sites, such as these of the European Commission.

CETIC has enlarged its retro-engineering perspectives completing them with « web mining » and «semantic web», using distributed technologies (Grid). A first task has been the detailed analysis of the existing Open Source technologies. In this context, a thematic search engine has been developed as demonstrator, and the benefits of relying on Grid technologies is being studied.

3.4 The Electronic systems group

The CETIC's "Electronic Systems" research group aims to become a key development partner for applied research in the fields of programmable and embedded electronic systems and wireless technologies.

This research group has made a big step in the way of electronic integration combines embedded systems and wireless technologies. Based on its two main core competences, the first one in hardware-software co-design for programmable chip (FPGA) and the second one in telecommunication signal processing, the group had the opportunity to collaborate with several local and European companies on specific leading edge technology projects.

This activity, such as applied research as part of it, has developed several industrial experiences and partnerships with the aim of promoting the use of these new communication and ambient intelligence technologies in Walloon industries.

Intelligent embedded communicating system

In order to integrate both embedded systems and wireless technologies, the "electronic systems" research group has created the first parts of an intelligent embedded communicating system.

Based on its research activities, this group succeed to develop a system enable to communicate with several kind of sensors, such as temperature, moisture, and other industrial ones but also GPS or On Board Diagnostic (OBD) interface available in each common vehicle.

Moreover, on top of its great flexibility, this system has the capability to be completely re-configured. This functionality is now well known for electronic devices such as modem or Wireless LAN devices which have to be upgraded to the last version of the standard protocol they implement. But in this new system the re-configurability is made not only in software but also in hardware and wirelessly.

In addition to this, the research succeeded to make a first proof of feasibility of a remotely re-configurable communicating system both in hardware and in software using embedded technologies such as FPGA and wireless protocols such as Wi-Fi.

Image processing libraries

The aim of this sub-project was to develop image processing libraries able to be integrated in a frame grabber designed by the Seldes SA company. These CETIC libraries enable the frame grabber to make real-time image processing (rotation, convolution, correlation…)

As the last part of its collaboration with the company Seldes SA, the group has made a complete presentation of its several image processing libraries developed for the specific Seldes' architecture on FPGA.

Numerical computing libraries

The CETIC "electronic systems" research group elaborated a "collective research" project in collaboration with several Walloon industrial partners in the field of numerical computing. The CETIC's research in this project is to develop libraries on programmable architecture (FPGA) in order to speed up the computation of specific numerical algorithms.

This project, called CANAPE (standing for "CAlcul Numérique sur Architecture ProgrammablE) has been approved by the Walloon Region and the project will start in 2005.

Specific industrial project

Together with the Technological Advisor cell ("Guidance Technologique"), the team has set up a collaboration with Alcatel ETCA in Charleroi on two technological domains. To successfully accomplish these projects, CETIC involved the Laboratory of Telecommunication of the University of Louvain (Prof. Luc Vandendorpe).

4 2004 highlights

4.1 Quality focus

It is the main priority of CETIC, as a Centre of Excellence, to show evidence of quality in its projects, its communication and its day-to-day activities. The Quality Policy adopted in 2003 has been reinforced through the research teams. This Quality improvement project is driven by a senior research acting as CETIC quality engineer.

Furthermore CETIC has committed itself to respect the requirements defined within the frame of the eTIC label, initiated by SPI+. Additionally, the CETIC quality engineer has been elected as effective member of the eTIC committee.

The eTIC charter defines seven fundamental clauses that TIC providers should respect :

1. Adequacy of the service related to the customer
2. Definition of the scope and exclusions of the project
3. Control and follow up of the costs
4. Supplier responsibility
5. Availability of required resources
6. Solution or service durability and portability
7. Respect of intellectual property rights

More information on the eTIC label can be found on http://www.labeletic.be/.

4.2 New investments

The acquisition process (public call for tender) of the hardware equipment (Linux Cluster) of CETIC has been launched. The specifications have been produced, taking into account the following aspects:

- Focus on information processing and data management research, more than high performance computing;
- Processor comparison, and preference for 64-bits compatible solution;
- Interconnects comparative study, including a flexible architecture allowing an heterogenous set up;
- Storage types comparative study;
- Cluster filesystems comparison.

After a deep screening and analysis of the valid offers, the choice has been made for a Linux cluster SUN featuring 33 nodes (32 nodes biprocessor opteron + 1 node quadriprocessor), 9 Terabytes of storage and equipped with Sun Grid Engine.

The equipment will be intensively used for testing distributed software application developed in the context of the Grid European projects. It will be used for different pilot projects of distributed storage. The cluster will also join the BelGrid and BeGrid cluster networks and will serve as testbed and pilot installation for enterprises.

4.3 Participation in European FP6 projects

In 2004, CETIC started to act as a strategic partner in several large-scale FP6 (6th Framework Program) IST (Information Society Technologies) projects, making real its European ambition.

In January 2004 the EverGrow (Integrated Project, Future and Emerging Technologies) project was launched. In June 2004, the HPC4U Strep was kicked off in Toulouse and in September 2004, the CoreGRID network was launched in Charleroi. In both HPC4U and CoreGRID, CETIC is a strategic partner, playing a key role.

4.3.1 The CoreGRID Network of Excellence

The CoreGRID (http://www.coregrid.net) Network of Excellence (NoE) aims at strengthening and advancing scientific and technological excellence in the area of Grid and Peer-to-Peer technologies.

To achieve this objective, the Network brings together a critical mass of well-established researchers (more than 100 permanent researchers and more than 150 PhD students) from forty-two institutions that have constructed an ambitious joint programme of activities. This join program of activity is structured around six complementary research areas that have been selected on the basis of their strategic importance, their research challenges and the recognised European expertise to develop next generation Grid middleware, namely:

- knowledge & data management;
- programming models;
- system architecture;
- Grid information and monitoring services;
- resource management and scheduling;
- problem solving environments, tools and GRID systems.

The Network is operated as a European Research Laboratory (known as the CoreGRID Research Laboratory) having six virtual institutes mapped to the areas that have been identified in the joint programme of activity. The Network is thus committed to set up this Laboratory and to make it internationally recognised and sustainable.


AVPRESS

The CoreGRID network has been launched in Charleroi in a meeting grouping close to 100 participants.

The main contribution of CETIC has been in the following CoreGRID Institutes :

- Knowledge and Data Management.
- Resource Management and Monitoring Services

Moreover, CETIC is leading the Spreading Excellence activities, with a focus on bridging the Research network with the European ICT Industry.

4.3.1.1 Institute of Knowledge and Data Management

The overall objective of WP2 is to motivate the unification of data management and knowledge discovery with Grid technologies to provide *knowledge-based Grid services* commonly known as the *Semantic Grid*. This Institute has tasks in three main areas Distributed Data Management, Information and Knowledge Management, and Data Mining and Knowledge Discovery.

Distributed data management deals with (1) Storage Infrastructure (replacing existing high-end scalable storage systems with commodity physical storage devices, controllers, interconnect within Grids and examining how current storage systems can migrate to this new architecture), (2) Providing Management Mechanisms (providing techniques to automatically manage storage resources in the Grid and provide "high-quality" storage at low cost to users) and (3) Specifying Management Policies (examining the different classes of storage services that could/should be offered to users and description methods and techniques for specifying service classes and management policies).

Information and Knowledge Data Management focuses on (1) Semantic Modelling (developing metadata for Grid service discovery and information management and the design of knowledge-oriented Grid services), (2) Semantic Representation (exploiting Semantic Web technologies for sharing machine-readable Semantic Grid models and techniques for knowledge of intensive applications), (3) Agent Infrastructure (development and use of agent technologies to exploit semantic representation of users and resources to support workflow and knowledge management across distributed virtual organisations in science and business), and (4) Standardisation and Integration: extending and standardising the existing OGSA middleware for knowledge-based Grid services.

Data Mining and Knowledge Discovery focuses on (1) Semantic Mapping (representation and mining of relationships between different Grid entities and resources), (2) Intelligent queries (query mechanism and intelligent agents for query formation), (3) Distributed Grid Services (design of services and tools for distributed data mining, and knowledge discovery on GRIDs, with Grid-aware highly adaptive data mining algorithms, considering data integrity and privacy), and (4) Monitoring services (services providing accurate estimates of the cost of data mining tasks on Grids.).

CETIC has contributed to the first deliverable (roadmap) based on its GRID related activities. CETIC's contribution is based upon reporting work going on in FP6 project HPC4U, an internal development of a distributed filesystem based on peer-to-peer techniques, and work on reverse-engineering of web sites.

CETIC is also focusing its activities in the area of Grid Trust and Security, which appears to be of the highest interest for the Industry.

4.3.1.2 Institute of Resource Management and Monitoring Services:

The goal of this virtual institute is the development of an efficient, secure and reliable management architecture for Next Generation Grids. This architecture will relieve Grid users and resource providers from the task of dynamically discovering, scheduling and coordinating available resources. It will comprise support for all resource types that may be available in a Grid environment, including computing power, data, software, networks, sensors and visualisation devices. Taking into account the dynamicity and size of Next Generation Grids new, scalable and on-demand scheduling, strategies are required to consider the individual policies of Grid participants. The availability of such a solution is essential for the implementation of business models for Grids.

CETIC and the University of Mons (FPMs) are contributing to the activities of this Institute.

4.3.1.3 WP8 : Spreading Excellence

CETIC is leader of CoreGRID Institute 8. It aims at Spreading Excellence outside the network by implementing a set of activities to disseminate the results of the Network and the knowledge acquired by the Network's members.

These activities are mainly aiming at facilitating the adoption of CoreGRID research results by the European ICT Industry. This covers in particular:

- Setting up the public website
- Organiwing the network publications
- Organising workshops
- Setting-up and animating the Industrial Advisory Board
- Publishing the network newsletter
- Organising the CoreGRID conferences
- Designing and publishing the CoreGRID brochure

- Setting-up and organising training and education activities

CETIC repeats at European level its experience in technology transfer between universities and the Industry.

4.3.2 The HPC4U project

The objective of the HPC4U (Highly Predictable Cluster for Unix) FP6 Strep project (http://www.hpc4u.org) is to expand the potential of the Grid approach to Complex Problems Solving through the development of software components for a dependable and reliable Grid environments and combining this with Service Level Agreements (SLA) and commodity-based clusters providing Quality of Service (QoS).

Development of HPC4U are taking place in a Grid context following standards of the Global Grid Forum (GGF).

The HPC4U results will provide Next Generation Grids with the possibility to guarantee the completion of Grid jobs and leverage the larger uptake of Grid environments. The HPC4U software will be customisable and interoperable with other Grids and will open new perspectives to the usage of Grids for additional services as they are today strongly required by the industry. HPC4U will extend well accepted technologies and integrate them with very innovative features (such as Grid embedded Fault Tolerance), for all the components required for a dependable Grid (storage, communication, resource management, application environment).

CETIC has mainly been involved in WP1 Specification and has been in charge of the task on End users' requirement analysis, and has started to contribute to the task related to System architecture definition.

The objective of WP1 was to capture the objectives and requirements for HPC4U from an end user perspective. This required meeting potential end users of HPC4U, explaining how fault tolerance could work to provide them with service level agreements, and how this could benefit to their way of working and their organisation. These meetings helped with building a requirements model, and defines desired system scenarios.

The HPC4U project partners validated the requirements model. The model was built from a series of end user interviews, and meetings with project partners between 06/2004 and 11/2004. The objectives and requirements were described using a goal-oriented requirements engineering methodology and the scenarios were described using UML sequence diagrams.

The global methodology followed to create the requirements model involving the following steps:

- Identifying end user requirements: this involved meeting potential end users of HPC4U, explaining the main benefits that HPC4U could provide them, and examining how they could use it within their organisation.
- Identifying the high-level services that HPC4U could deliver to end users: this involved meeting project partners to gather a precise enough understanding of HPC4U to define the scenarios of the next step.

- Building a sufficiently rich set of scenarios to provide a sufficiently precise description of the main functionalities. The scenarios were described using UML sequence diagrams.
- Building a goal-oriented requirements model of the objectives: a goal oriented methodology (KAOS) was used to capture the goal structure in the form of goal refinement trees. This involved examining the results of the previous steps to acquire sufficient understanding of the objectives of HPC4U to be able to build a requirements model of them.
- Deriving the requirements document from the model.

CETIC has also been involved in Monitoring and Deployment (WP5). CETIC has contributed to the project monitoring plan.

Thanks to HPC4U, CETIC is developing at the same time a specific expertise in Grid technologies, and applying its software engineering know-how in the field of distributed technologies.

4.3.3 Participation in European CELTIC projects

Based on its experience of European FP6 projects, CETIC elaborated a proposal to the CELTIC Initiative.

The CELTIC Initiative (http://www.celtic-initiative.org) is a five years EUREKA cluster program, supported by most of the major European players in communication technologies. The main goal of CELTIC is to maintain European competitiveness in telecommunications through collaborative R&D.

The project proposal submitted to the CELTIC Office, coordinated by CETIC, was called Wi-Phone standing for Wi-fi enabled mobile phones : a technical, applicative and social platform and laboratory to deliver future applications and business models.

This proposal successfully passed through the Project Outline evaluation process thanks to its very relevant research topics, but unfortunately this project did not pass through the Full Proposal evaluation mainly because of the lack of big players in the consortium and the large number of ambitious objectives.

Anyway, this preparation work was, for CETIC, a very interesting way of networking with European companies and a very efficient way to ease further EU project participations.

4.4 Visit of Commissioner Busquin

On April 20, 2004, CETIC was honoured by the visit of Philippe Busquin, European Commissioner in charge of Research. During an afternoon, CETIC executives and representatives of CETIC industrial partners presented to the Commissioner their activities, stressing the action of CETIC to support the adoption of new technologies and innovative processes by CETIC partners.

Commissioner Busquin was particularly impressed by the active participation of CETIC within the 6th Framework Programme, and specifically by the HPC4U Strep, that results from the initiative of mostly SMEs.

4.5 Moz'2004 Conference

On October 7-8, 2004, CETIC organised the Second International Conference on Mozart/OzMOZ'2004, in Charleroi. The conference was a real success, regrouping researchers from Academies and Industries from all over the world. CETIC researchers have coordinated the review process of the scientific papers and the practical organisation. Proceedings have been published by Springer in the Lecture Notes in Computer Science Series (LNCS 3389).

5 Dissemination

5.1 List of scientific publications

- T. Van Hung, A. van Lamsweerde, P. Massonet, C. Ponsard, "Goal-Oriented Requirements Animation", 12th International Requirements Engineering Conference, Kyoto (Japan), September 2004.
- C. Ponsard, P. Massonet, A. Rifaut, J.F. Molderez, A. van Lamsweerde and H. Tran Van, Early Verification and Validation of Mission Critical Systems, 9th Formal Methods for Industrial Critical Systems, Linz (Austria), September 2004.
- J.F. Molderez, C. Ponsard, Deriving Acceptance Tests from Goal Requirements, 2nd International Mozart/Oz Conference, Charleroi (Belgium), September 2004.
- CETIC, Clarification of an evaluation method for the accessibility of public infrastructures, study for "Ministere des affaires sociales et de la santé de la région wallonne", March 2004 (in french).
- Abran, M. Lopez, N. Habra, "An Analysis of the McCabe Cyclomatic Complexity Number", 14th International Workshop on Software Measurement (IWSM2004) Berlin, Germany, Shaker Verlag, 2004.
- M. Lopez, S. Alexandre, V. Paulus, G. Seront, "On the Application of some Metrology Concepts to Internal Software Measurement", 8th ECOOP Workshop on Quantitative Approaches in Object-Oriented Software Engineering (QAOOSEÕ2004) Oslo, Norway, 2004.
- Alexandre S., Paulus, V., Lopez, M., Renault, A., Seront, G., and Habra, N., "What Can Be Learnt About the Software Process from the Internal Product Qualities?", in Proceeding of the Second Workshop on Software Quality, ICSE 2004, Edinburgh, 2004.
- Lopez, M., Alexandre, S., Paulus, V., "Validation report: Coupling, Cohesion and Stability", LQL-2004-TR-01, CETIC-FUNDP, Gosselies-Namur, 2004.
- Lopez, M., Paulus, V., "Validity Conditions Impact of a Software Measure", in Proceedings of Software Measurement European Forum 2004, Roma, Italy, p.120-130.
- Thiran Ph., Estiévenart F., Hainaut J.-L., Houben G.-J., "Exporting Databases in XML – A conceptual and Generic Approach", WISM 2004
- Grolaux D., Van Roy P., Vanderdonckt J., “Migratable User Interfaces: Beyond Migratory Interfaces”

- Sameh El-Ansary, Grolaux D., Van Roy P., Mahmoud Rafea"Overcoming the Multiplicity of Languages and Technologies for Web-based Development Using a Multiparadigm Approach"
- Grolaux D., Glynn K. , Van Roy P., "A Fault Tolerant Abstraction for Transparent Distributed Programming"
- Mesaros V., Carton B., Van Roy P., "P2PS: Peer-to-Peer Development Platform for Mozart"
- Mesaros V., Carton B., "Improving the Scalability of Logarithmic-Degree DHT-based Peer-to-Peer Networks*". In Proc. of the Euro-Par International Conference on Parallel Processing, August-Septembre 2004 LNCS © Springer-Verlag

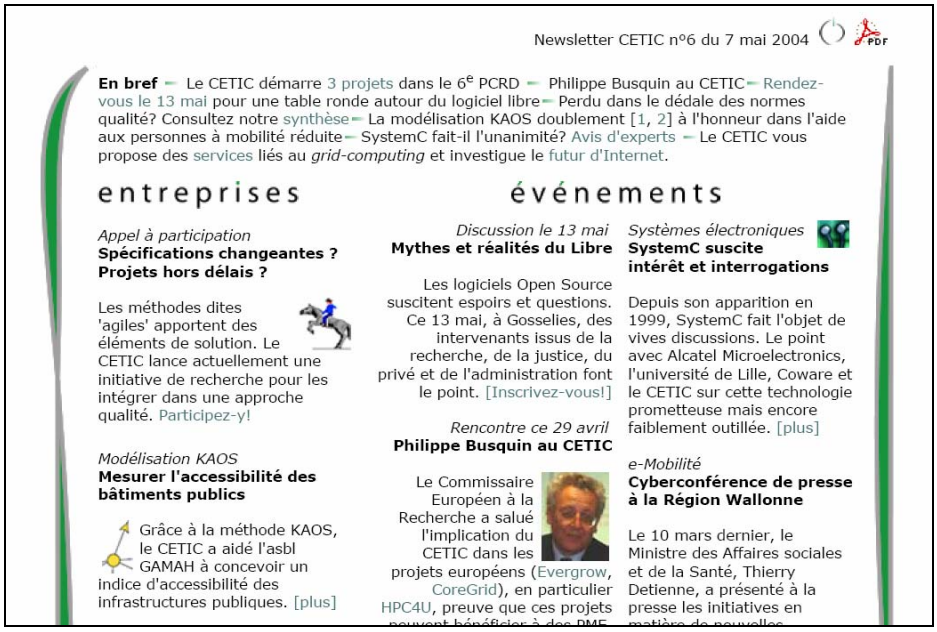
5.2 Discussion groups

CETIC is organising on a regular basis "Discussion Groups", where researchers and industries meet to debate and discuss specific technological or scientific topic.

- SystemC, an alternative for the modelling and the synthesis: February 12, 2004
- The Agile methods : April 21, 2004
- Myths and realities of the Open Source: May 13, 2004
- Modelling, Verification and Validation of critical systems: June 17, 2004
- The advanced uses of the Open Source softwares: November 18, 2004

5.3 Newsletter

In 2004, 3 issues of the CETIC newsletter have been published electronically.



Newsletter CETIC n°6 du 7 mai 2004

En bref – Le CETIC démarre 3 projets dans le 6e PCRD – Philippe Busquin au CETIC – Rendez-vous le 13 mai pour une table ronde autour du logiciel libre – Perdu dans le dédale des normes qualité? Consultez notre synthèse – La modélisation KAOS doublement [1, 2] à l'honneur dans l'aide aux personnes à mobilité réduite – SystemC fait-il l'unanimité? Avis d'experts – Le CETIC vous propose des services liés au *grid-computing* et investigue le futur d'Internet.

entreprises

Appel à participation
Spécifications changeantes ? Projets hors délais ?

Les méthodes dites 'agiles' apportent des éléments de solution. Le CETIC lance actuellement une initiative de recherche pour les intégrer dans une approche qualité. Participez-y!

Modélisation KAOS
Mesurer l'accessibilité des bâtiments publics

Grâce à la méthode KAOS, le CETIC a aidé l'asbl GAMAH à concevoir un indice d'accessibilité des infrastructures publiques. [plus]

événements

Discussion le 13 mai
Mythes et réalités du Libre

Les logiciels Open Source suscitent espoirs et questions. Ce 13 mai, à Gosselies, des intervenants issus de la recherche, de la justice, du privé et de l'administration font le point. [Inscrivez-vous!]

Rencontre ce 29 avril
Philippe Busquin au CETIC

Le Commissaire Européen à la Recherche a salué l'implication du CETIC dans les projets européens (Evergrow, CoreGrid), en particulier HPC4U, preuve que ces projets

Systèmes électroniques
SystemC suscite intérêt et interrogations

Depuis son apparition en 1999, SystemC fait l'objet de vives discussions. Le point avec Alcatel Microelectronics, l'université de Lille, Coware et le CETIC sur cette technologie prometteuse mais encore faiblement outillée. [plus]

e-Mobilité
Cyberconférence de presse à la Région Wallonne

Le 10 mars dernier, le Ministre des Affaires sociales et de la Santé, Thierry Detienne, a présenté à la presse les initiatives en

5.4 Other dissemination activities

Acting as technology transfer platform between the academic and the industry worlds, CETIC is actively participating in several forums and sector company associations.

ECSI

The ECSI, European Electronic Chips & Systems Design Initiative, is an association of industrial companies and research institutes active in the design of electronic systems or provider of Electronic Design Automation tools. The mission of ECSI is to identify, develop and promote efficient methods for electronic systems design, with particular regards to the needs of the system-on-chip and to provide ECSI members with a competitive advantage in this domain for the benefit of the European industry.

Thanks to its renowned expertise in electronic system development technologies, CETIC was invited to join the ECSI. This invitation is another mark of recognition to the activity of CETIC for the applied research world. CETIC took part in activities such as seminaries about the use of SystemC and UML for electronic system design.

Walloon Automotive Cluster

With its activity in electronic system and especially for its last development in the field of "automobility" improvement, CETIC was invited to join the Belgian Cluster Automobilité (www.clusterautomobilite.be).

Intelligent Transport System Forum New Mobility

With its active participation in the Cluster Automobilité mentioned here above, CETIC has been elected as the academic representative in the Belgian ITS Forum new mobility (Intelligent Transport system Forum for new mobility), www.itsnewmobility.be. This forum gathers companies from the three Belgian clusters in the automotive, the transport & logistics and the aerospatial sectors.

5.5 Grid Press Conference

Together with the launch of the CoreGRID Network of Excellence in Charleroi (September 13, 2004), CETIC organised a press conference in order to communicate about its research activities in Grid technologies and the role of CETIC in the network.

AVPRESS


Recherches

Le Grid européen inauguré à Charleroi

L'aéropole de Charleroi a été, à la mi-septembre, la capitale européenne du Grid. Le Grid - appelé aussi la Grille dans le monde francophone - est l'étage supérieur de l'Internet, construit par la mise en collaboration massive d'énormes ressources informatiques. «Le Grid, c'est l'Internet au carré. Demain, on s'y connectera aussi facilement que l'on se branche sur le réseau électrique ou que l'on ouvre le robinet», prédit Pierre Guisset, l'un des acteurs wallons de cette ambitieuse initiative

Dans l'optique de la Commission européenne, les technologies pour la société de l'information représentent un champ d'action majeur puisqu'elles sont dotées du plus gros budget des sept priorités thématiques définies par le 6e programme-cadre de recherche et développement 2002-2006. Ce budget est de 3,625 milliards d'euros, dont 52 millions sont d'ores et déjà réservés à la première vague de

Mais qu'est-ce que le *Grid* ? Pierre Guisset précise d'emblée qu'il préfère ce vocable anglais à l'appellation francophone de *Grille*. Il eût pourtant été plaisant d'évoquer, à l'instar des Québécois, le passage de la *Toile* à la *Grille*. «*Le* Grid, résume-t-il, *c'est un immense réseau informatique permettant le traitement, le stockage et le partage d'énormes masses de données. En bref, c'est l'Internet au carré. On*

This press conference resulted in many articles in the international, national and regional press, as well as TV appearance.