



RESEARCH CENTER
Lille - Nord Europe

FIELD

Activity Report 2013

Section Contracts and Grants with Industry

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ADAM Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. France Telecom

Participants: Rémi Druilhe, Laurence Duchien [correspondant], Romain Rouvoy, Lionel Seinturier, Amal Tahri.

DigiHome is a contract with France Telecom to study the adaptation of software systems in distributed digital home environments. These environments and their extensions (vehicles, holiday homes, work at home) are now invaded by a multitude of communicating objects dedicated to content management, viewing multiple video streams, or information sharing within a community network. These objects offer services with capacities of configuration and remote administration, and advanced interactions with the end-user or between devices or services. Given the lack of universality of proposals from IT and device companies and the lack of interoperability of these devices and services, it becomes necessary to offer a virtual environment named Extended Digital Home to encompass and unify these proposals and make life easier for the inhabitants. First, we will propose a unified model for integrating devices and services inside and outside the home with a continuum between private and public lives. Second, we will study an energy model to save energy in this extended environment. Overall, the goal of this project will be to propose to design a model for a cloud inside home and to provide some means to reduce the energy using on media devices. First results have been published in [73] and [63]. This contract is complemented by two contracts, which are the CIFRE contract associated to Rémi Druilhe PhD thesis [11] and the CIFRE contract associated to Amal Tahri PhD thesis.

7.2. Kaliterre

Participants: Aurélien Bourdon, Romain Rouvoy [correspondant].

Web Energy Archive (WEA) is a project funded by the French Environment and Energy Management Agency (ADEME) to archive the energy consumption of Web sites that are accessible on the Internet. The objective of this project is to constitute an international referential on the evolution of the Web energy consumption. The adopted methodology focuses on the quality of experience and measures the energy consumed by users when they browse a specific website. The benefit of this approach is that it is representative of Internet usages and takes into account the variety of Web browsers and computer architectures. The software solution developed by this project will build on the [HTTP Archive project](#), initiated by Google, and will extend it with consumption measures that will be collected by our PowerAPI library. The objective of this collaboration is to port our solution to the Windows operating system.

7.3. ip-label

Participants: Nicolas Haderer, Christophe Ribeiro, Romain Rouvoy [correspondant].

This collaboration aims at transferring APISENSE[®] in the industry by investigating the deployment of this platform as a solution to monitor the quality of the GSM signal in the wild. The objective is to provide developers and stakeholders with a feedback on the quality of experience of 3G connection depending on their location.

7.4. dooApp

Participant: Martin Monperrus [correspondant].

The collaboration with dooApp aims at studying a bi-directional automated link between the specifications and standards they work with (from AFNOR, ISO) and their code base in order to facilitate and automate software evolutions.

ATEAMS Project-Team (section vide)

BONSAI Project-Team (section vide)

DOLPHIN Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Grants with Industry

- EDF (2011-2013): Bilevel mathematical programming and pricing problems.
- EDF (2011-2014): Scheduling outages of nuclear plants.
- Tasker (2011-2014) : Scheduling of applications in hybrid cloud computing systems.
- Alicante (2010-2013): PhD of Julie Jacques. Knowledge extraction by optimization methods for improving the process of inclusion in clinical trials.
- Genes Diffusion (2010-2013): PhD of Julie Hamon. Analysis of data from high throughput genotyping: cooperation between statistics and combinatorial optimization.
- Strat&Logic (2012-2015): PhD of Sylvain Dufourny. Optimization of economic decisions in a competitive business management simulator.
- Vekia (2012-2015). The goal of the project is to develop an efficient and generic software for employee scheduling in retail.

DREAMPAL Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

Collaboration contract with Nolam Embedded Systems: In conjunction with the CIFRE grant of Venkatasubramanian Viswanathan, a collaboration contract is established with Nolam ES. The objective is to design an innovative embedded computing platform supporting massively parallel dynamically reconfigurable execution model. The use-cases of this platform cover several application domains such as medical, transportation and aerospace.

7.2. Bilateral Grants with Industry

The FAMOUS project aims at introducing a complete methodology that takes the reconfigurability of the hardware as an essential design concept and proposes the necessary mechanisms to fully exploit those capabilities at runtime. The project covers research in system models, compile time and run time methods, and analysis and verification techniques. These tools will provide high-quality designs with improved designer productivity, while guaranteeing consistency with the initial requirements for adaptability and the final implementation.

Thus FAMOUS is a research project with an immediate industrial impact. Actually, it will make reconfigurable systems design easier and faster. The obtained tool in this project is expected to be used by both companies designers and academic researchers, especially for modern applications system specific design as smart camera, image and video processing, FAMOUS tools will be based on well established standards in design community. In fact, modeling will start from very high abstraction level using an extended version of MARTE. Simulation and synthesizable models will be obtained by automatic model to model transformations, using MDE approach. These techniques will contribute to shorten drastically time-to-market.

FAMOUS ended in December 2013. Its main result is a complete MDE tool for modeling, transforming and generating dynamically reconfigurable systems targeting Xilinx devices. This tool has been validated on a video processing application as a demonstrator.

FUN Project-Team

6. Bilateral Contracts and Grants with Industry

6.1. Etineo Partnership

Participants: Roudy Dagher, Fadila Khadar, Nathalie Mitton [correspondant].

EtiPOPS focuses on portability and flexibility of GOLIATH on several hardwares and in different environments (indoor and outdoor) through the deployment of different applications such as geolocalization. In order to favor the portability, designed solutions in EtiPOPS will respect on-going communication standards which will allow a greater interoperability between heterogeneous hardwares.

6.2. France Telecom partnership

Participants: Nathalie Mitton, Tahiry Razafindralambo [correspondant], Dimitrios Zormpas.

This collaboration aims to investigate rural networks and to deploy efficiently and dynamically such networks.

6.3. Traxens partnership

Participants: Natale Guzzo, Nathalie Mitton [correspondant].

This collaboration aims to set up a full protocol stack for TRAXENS's guideline.

LINKS Team

6. Bilateral Contracts and Grants with Industry

6.1. Bilateral Contracts with Industry

Innovimax, Cifre and Engineer (2010-2014) The PhD thesis of Tom SEBASTIAN within the QUIXPROC project is supervised by J. NIEHREN in cooperation with M. ZERGAOUI the head of the INNOVIMAX company. The software development in this context is supported by D. DEBARBIEUX, a senior engineer co-funded by INNOVIMAX and INRIA.

MAGNET Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

First, we are involved in the HERMES project along a collaboration with the SEQUELINRIA team and with a consortium of companies. In that collaboration, the envisioned applications is the design of recommender systems for commercial data. One objective is to provide social recommendations, that is to take into accounts in the recommendations, social relationships between users and the content of messages posted by users in forums.

Second, we start a one to one cooperation with the CLIC AND WALK company along the PhD thesis of PAULINE WAUQUIER. The company makes marketing surveys by consumers (called clicwalkers). The goal of the company is to understand the community of clicwalkers (40 thousands in one year) and its evolution with two objectives: the first one is to optimize the attribution of surveys to clicwalkers, and the second is to expand company's market to foreign countries. Social data can be obtained from social networks (G+, Facebook, ...) but there is no explicit network to describe the clicwalkers community. But users activity in answering surveys as well as server logs can provide traces of information diffusion, geolocalisation data, temporal data, sponsorship,... We will study the problem of adaptive graph construction from the clicwalkers network. Node (users) classification and clustering algorithms will be applied. For the problem of survey recommendations, the problem of teams constitution in a bipartite graphs of users and surveys will be studied. Random graph modeling and generative models of random graphs will be one step towards the prediction of the evolution of clicwalkers community.

Third, we have started a transfer collaboration with the MUSIC STORY company. In a first phase, we have considered the question of collecting musical metadata from heterogeneous sources. We have proposed machine learning methods and similarity measures for curating metadata. The MUSIC STORY company has close industrial collaborations with the DEEZER company. Current discussions between MAGNET and these two companies are open on social recommender systems for music.

Last, we work with physicians at the Lille hospital (CHRU) on the detection of brain anomalies related to epilepsy. Hence, we will use connectome data which is an approximate map of neural connections at different scales. The connectome can be modeled by a weighted graph. Available data include graphs constructed at different times for a given patient, also graphs for healthy patients and epileptic patients. One objective of the research project is to study how the connectome together with other signals, like functional magnetic resonance imaging (FRMI), MEG and EEG can be efficiently combined in order to detect abnormal brain regions. We will consider diffusion algorithms in graphs to test whether diffusion processes in the brain can be explained with the connectome. We will also consider learning algorithms related to information diffusion in order to enhance graph construction.

7.2. Bilateral Grants with Industry

7.2.1. Cifre SAP (2011-2014)

Participants: Thomas Ricatte, Gemma Casas Garriga, Marc Tommasi, Rémi Gilleron [correspondent].

GEMMA GARRIGA, and MARC TOMMASI supervise the PhD thesis (Cifre) of Thomas Ricatte together with Yannick Cras from SAP.

7.2.2. Cifre Clic and Walk (2013-2016)

Participants: Pauline Wauquier, Marc Tommasi, Mikaela Keller [correspondent].

MIKAELA KELLER and MARC TOMMASI supervise the PhD thesis (Cifre) of PAULINE WAUQUIER on graph-based recommendation together with Guillaume André from Clic and Walk.

MINT Project-Team (section vide)

MODAL Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Arcelor-Mittal

Participants: Christophe Biernacki, Clément Thery.

Subject: Supervised and semi-supervised classification on large data bases mixing qualitative and quantitative variables.

Arcelor Mittal faced some quality problems in the steel production which lead to supervised and semisupervised classification involving (1) a small number of individuals comparing to the numbers of variables, (2) heterogeneous variables, typically categorical and continuous variables and (3) potentially highly correlated variables. A PhD CIFRE grant started on May 2011 on this topic.

7.2. Banque Accord

Christophe Biernacki gave a one-day course on the Rmixmod and BlockCluster packages to statistical members of the Banque Accord company.

7.3. Hi Duty Free

Participants: Christophe Biernacki, Serge Iovleff.

HiDutyFree had to solve a combinatorial optimization problem for optimizing its customer service. For this contract we supervise two internships, giving a mathematical treatment of the problem of HiDutyFree and furnish a beta program based on ruby and java for solving it.

7.4. AGLAE

Participants: Julien Jacques, Cristian Preda, Florence Loingeville.

AGLAE aims to improve analyses, especially chemical and microbiological, of water and other matrices of the environment. In the context of the Ph.D. of Florence Loingeville, we work on ANOVA models for counting data.

7.5. Alicante

Participants: Julien Jacques, Cristian Preda, Florence Loingeville.

Alicante is member of the ANR TecSan ClinMine) we obtained for 2014-2018 to work on the path of patients at the hospital.

NON-A Project-Team (section vide)

RMOD Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Resilience FUI

Participants: Nicolas Petton [Correspondant], Stéphane Ducasse, Damien Cassou.

Contracting parties: Nexedi, Morphom Alcatel-Lucent Bell Labs, Astrium Geo Information, Wallix, XWiki, Alixen, Alterway, Institut Télécom, Université Paris 13, CEA LIST.

Resilience's goal is to protect private data on the cloud, to reduce spying and data loss in case of natural problems. Resilience proposes to develop a decentralized cloud architecture: SafeOS. Safe OS is based on replication of servers. In addition a safe solution for documents should be developed. Sandboxing for Javascript applications should be explored.

There is a plethora of research articles describing the deep semantics of JavaScript. Nevertheless, such articles are often difficult to grasp for readers not familiar with formal semantics. In our first report, we propose a digest of the semantics of JavaScript centered around security concerns. This report proposes an overview of the JavaScript language and the misleading semantic points in its design.

7.2. SafePython FUI

Participants: Damien Cassou [Correspondant], Jean-Baptiste Arnaud, Stéphane Ducasse.

Contracting parties: CEA, Evitech, Inria, Logilab, Opida, Thales, Wallix.

Beyond embedded computing, there is not so much research and development on the verification of software safety. Recently, some tools have been created for languages such as JAVA, SQL, VB or PHP. Nevertheless, nothing exists for Python even though this language is growing fast. SafePython's goal is to provide code analysis tools applicable to Python programs. This project will define a subset of Python that the developers will have to use to have their programs analyzed.

7.3. Generali France

Participants: Nicolas Anquetil [Correspondant], Stéphane Ducasse, Guillaume Larcheveque, Muhammad Bhatti, Camille Teruel.

Contracting parties: Synectique, Generali Assurances <http://www.generalibe>.

RMoD is looking into providing a software solution to Generali France for its software maintenance. The goal is to support decision making by providing quality metrics and software dependance information. The partner needs tools for parsing their legacy code (in a specific, not well-known language) and help in assessing quality and identifying dead code or code duplication. This should serve as an essential element of decision support in the continuing evolution of an important software system of the partner.

7.4. Pharo Consortium

We launched the Pharo Consortium. It has 13 members, 6 academic partners and 3 sponsoring companies. Inria supports the consortium with one full time engineer starting in 2011. More at <http://consortium.pharo.org>.

SequeL Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- **Deezer**, 2013-2014

Participants: Jérémie Mary, Philippe Preux, Romaric Gaudel.

A research project has started on June 2013 in collaboration with the Deezer company. The goal is to build a system which automatically recommends music to users. That goal is an extension of the bandit setting to the Collaborative Filtering problem.

- **Nuukik**, 2013-2014

Participant: Jérémie Mary.

Nuukik is a start-up from Hub Innovation in Lille. It proposes a recommender systems for e-commerce based on matrix factorization. We worked with them specifically on the cold start problem (*i.e* when you have absolutely no data on a product or a customer). This led to promising result and allowed us to close the gap between bandits and matrix factorization. This work led to a patent submission in december 2013.

- **TBS**, 2012-2013

Participants: Jérémie Mary, Philippe Preux.

A research project has started in September 2012 in collaboration with the TBS company. The goal is to understand and predict the audience of news related websites. These websites tend to present an ergodic frequentation with respect to a context. The main goal is to separate the effect of the context (big events, elections, ...) and the impact of the policies of the news websites. This work is based on data originating from major French media websites and also involves research of tendencies on the web (as Google Trends and Google Flu do). Used algorithms mix methods from time series prediction (ARIMA and MARSS models) and machine learning methods (L1 penalization, SVM).

- **Squoring Technologies**, 2011-2014

Participants: Boris Baldassari, Philippe Preux.

Boris Baldassari has been hired by Squoring Technologies (Toulouse) as a PhD student in May 2011. He works on the use of machine learning to improve the quality of the software development process. During his first year as a PhD student, Boris investigated the existing norms and measures of quality of software development process. He also dedicated some time to gather some relevant datasets, which are made of either the sequence of source code releases over a multi-years period, or all the versions stored on an svn repository (svn or alike). Information from mailing-lists (bugs, support, ...) may also be part of these datasets. Tools in machine learning capable of dealing with this sort of data have also been investigated. Goals that may be reached in this endeavor have also been precised.

- **INTEL Corp.**, 2013 - 2014

Participants: Philippe Preux, Michal Valko, Rémi Munos, Adrien Hoarau.

This is a research project on Algorithmic Determination of IoT Edge Analytics Requirements. We are attempting to solve the problem of how to automatically predict the system requirements for edge node analytics in the Internet of Things (IoT). We envision that a flexible extensible system of edge analytics can be created for IoT management; however, edge nodes can be very different in terms of the systems requirements around: processing capability, wireless communication, security/cryptography, guaranteed responsiveness, guaranteed quality of service and on-board memory requirements. One of the challenges of managing a heterogeneous Internet of Things is determining the systems requirements at each edge node in the network.

We suggest exploiting opportunity of being able to automatically customize large scale IoT systems that could comprise heterogeneous edge nodes and allow a flexible and scalable component and firmware SoC systems to be matched to the individual need of enterprise/ government level IoT customers. We propose using large scale sequential decision learning algorithms, particularly contextual bandit modeling to automatically determine the systems requirements for edge analytics. These algorithms have an adaptive property that allows for the addition of new nodes and the re-evaluation of existing nodes under dynamic and potentially adversarial conditions.

SHACRA Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

InSimo is a startup we created in January 2013, after two years of thinking, maturation and incubation. Its founding members are all former or actual team members of SHACRA: Jeremie Allard, Juan Pablo de la Plata Alcalde and Pierre Jean Bensoussan have joined the operation team, while Stephane Cotin and Christian Duriez serve as scientific advisors. The business model of the company is based on the SOFA platform and its community to transfer state-of-the-art simulation technologies into commercially-supported software components that medical simulator vendors can integrate into their products. The goal is to foster the creation of a new generation of medical simulators, highly realistic, faster to develop, allowing a broader commercial offer and novel uses. InSimo participated to the 2012 OSEO / MESR national innovative technology company creation competition (Emergence category) and was selected as the best project in the Alsace region as well as one of the three projects highlighted at the national level. InSimo also won the HelpMeSee contract (in partnership with Moog and SenseGraphics) and entered in February 2013 into a 3-year development phase to build a first batch of 100 MSICS simulators.

7.2. Bilateral Grants with Industry

We have started a collaboration with INSERM - UMR-S 867 (minimal invasive and robotized otological surgery) Faculté de Médecine Paris Diderot Paris 7 and with the company Collin SA (Bagneux, France) which is developing some activities in the domain of the head and neck (surgical robot such as RobOtol, middle ear implants, surgical instruments, surgical navigation, ...). The objective of this project is to obtain a simulation tool applied to the ear surgery for both training and planning of conventional and robotized middle ear surgery. In addition, the aim of this work is to provide a tool able to explore, develop and assess new robotized procedures using a tele-operated device called RobOtol. Guillaume Kazmitcheff is doing his PhD in the context of this collaboration: he is paid by a CIFRE contract with Collin, he is mainly working with the INSERM team but the design of the simulation is done in collaboration with our group and he is enrolled in the university of Lille 1.

SIMPAF Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Study of the EKINOX model of corrosion (CNRS Contract with CEA, Univ Lille1, Univ B. Pascal)

Participants: Claire Chainais-Hillairet, Antoine Gloria.

In collaboration with C.Desgranges and F. Lequien (CEA), F. Bouchon (Univ. B. Pascal), A. Gloria and C. Chainais-Hillairet are considering the model EKINOX developed at CEA for the study of the corrosion of Ni-base alloys in PWR primary water. Starting from this numerical model (leading to an explicit in time scheme), they have established a macroscopic model (a system of coupled partial differential equations). Based on this model, they have proposed a new numerical method based on an implicit discretization of the diffusion terms.

7.2. Numerical methods for the DPCM model (Inria/ANDRA Contract)

Participants: Claire Chainais-Hillairet, Thomas Gallouët, Antoine Gloria.

During his post-doc, Thomas Gallouët is working on the numerical approximation of the DPCM model, see [31]. He has designed a new scheme for the direct computation of a steady-state. This scheme has been implemented in the code CALIPSO developed at ANDRA. Validation is in progress, as the numerical analysis of the scheme. Further work will also be done in order to introduce in the code CALIPSO a second order in time scheme which remain unconditionally stable. This is work in collaboration with C. Bataillon (CEA), F. Bouchon (Univ B. Pascal) and J. Fuhrmann (WIAS Berlin).