



RESEARCH CENTER
Rennes - Bretagne-Atlantique

FIELD

Activity Report 2012

Section Contracts and Grants with Industry

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ALF Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Intel Research Grant

Participant: André Seznec.

Intel is supporting the research of the ALF project-team on "Alternative ways for improving uniprocessor performance".

CAIRN Project-Team (section vide)

CELTIQUE Project-Team

6. Bilateral Contracts and Grants with Industry

6.1. Bilateral Project with FIME

Participants: Thomas Jensen, Frédéric Besson, David Pichardie, Delphine Demange, Vincent Monfort, Pierre Vittet.

Static program analysis, Javacard, Certification, AFSCM

- Partner : **FIME**
- Period: Starting January 2012; ending February 2013

The FIME contract consists in an industrial transfer of the Sawja platform 4.2 adapted to analyse Javacard programs according to **AFSCM** (Association Française du Sans Contact Mobile) security guidelines. The outcome of the project is the Jacal (JAvaCard AnaLyser) (4.3).

6.2. The FRAE ASCERT project

Participants: Frédéric Besson, Sandrine Blazy, David Cachera, Thomas Jensen, David Pichardie, Pierre-Emmanuel Cornilleau.

Static program analysis, Certified static analysis

The ASCERT project (2009–2012) is founded by the *Fondation de Recherche pour l'Aéronautique et l'Espace*. It aims at studying the formal certification of static analysis using and comparing various approaches like certified programming of static analysers, checking of static analysis result and deductive verification of analysis results. It is a joint project with the Inria teams ABSTRACTION, GALLIUM and POP-ART.

ESPRESSO Project-Team (section vide)

S4 Project-Team (section vide)

TASC Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Ligéro

Participants: Sophie Demasse, Xavier Lorca.

Title: **Ligéro**.

Duration: 2009-2012.

Type: Regional research group

Budget: PhD funded by the project.

Others partners: **LISA**, **IRCCyN** (team **SLP**), **LERIA** (team **MOA**), **LINA** (team **OPTI**).

The goal of the project is to create an internationally visible regional research group putting together the key actors in the domain of Operations Research in the Pays de la Loire region.

7.2. CPER

Participant: Charles Prud'Homme.

Title: CPER.

Duration: 2010-2014.

Type: Regional research group.

Budget: 250000 Euros.

Others partners: **EMN** (team **ATLANMOD**), **EMN** (team **ASCOLA**), **IRCCyN** (team **SLP**).

Develop, promote and build up an eco-system around free software in the Pays de la Loire region. The **TASC** team is involved in the maintenance and development of the free constraint programming platform **CHOCO**.

7.3. UNIT

Participants: Nicolas Beldiceanu, Eliane Vacheret.

Title: **UNIT**.

Duration: 2011-2012.

Type: Developing teaching material.

Budget: 5000 Euros.

Others partners: **EMN** (**CAPE**).

Pedagogical material and software for learning constraints programming for non experts (integrated within the global constraint catalog).

7.4. FUI SUSTAINS

Participants: Charlotte Truchet, Bruno Belin.

Title: SUSTAINS.

Duration: 2010-2015.

Type: FUI.

Budget: 151400 Euros.

Others partners: **Artefacto**, **Artelys**, **Areva TA**, **EPAMarne**, **LIMSI**.

The **SUSTAINS** project (*Constraint-based Prototyping of Urban Environments*) aims at building decision support system for city development planning with evaluation of energy impacts. The project is focussed on spatial allocation of typical units such as industrial areas, commercial areas and leaving areas with their respective appropriate infrastructure. Its integrates sustainability, transport and energy concerns.

7.5. ANR BOOLE

Participants: Vincent Armant, Jérémie du Boisberranger, Xavier Lorca, Charlotte Truchet.

Title: **BOOLE**.

Duration: 2010-2015.

Type: open research program.

Budget: founding a PhD student and travels.

Others partners: **Univ. de Versailles Saint-Quentin**, **Univ. Caen**, **Univ. Paris 8**, **Univ. Aix-Marseille**, **Univ. Paris Nord**, **Univ. Paris 11**, **ENS Paris**.

Défi: Probabilistic method for combinatorial problems.

The work of **TASC** focuses on the use of probabilistic methods to avoid waking systematically global constraints for nothing. The goal is to provide probabilistic models for the consistency of global constraints such as *alldifferent* or *nvalue*. We compute the probability of a constraint to be still consistent after fixing one of its variables and provide an approximation that can be computed in constant time. The PhD of J. du Boisberranger is co-supervised with **D. Gardy** from **Univ. de Versailles Saint-Quentin**.

7.6. ANR NetWMS2

Participants: Nicolas Beldiceanu, Gilles Chabert.

Title: Networked Warehouse Management Systems 2: packing with complex shapes.

Duration: 2011-2014.

Type: cosinus research program, **new project**.

Budget: 189909 Euros.

Others partners: **KLS Optim** and **CONTRAINTEs** (Inria Rocquencourt).

This project builds on the former European FP6 **Net-WMS** Strep project that has shown that constraint-based optimisation techniques can considerably improve industrial practice for box packing problems, while identifying hard instances that cannot be solved optimally, especially in industrial 3D packing problems with rotations, the needs for dealing with more complex shapes (e.g. wheels, silencers) involving continuous values. This project aims at generalizing the geometric kernel *geost* for handling non-overlapping constraints for complex two and three dimensional curved shapes as well as domain specific heuristics. This will be done within the continuous solver **IBEX**, where discrete variables will be added for handling polymorphism (i.e., the fact that an object can take one shape out of a finite set of given shapes).

7.7. ANR INFRA-JVM

Participants: Xavier Lorca, Charles Prud'Homme.

Title: Towards a Java Virtual Machine for pervasive computing.

Duration: 2011-2013.

Type: **new project**.

Budget: 78000 Euros.

Others partners: Univ. Paris 6 (**REGAL** team), **LaBRI** (**LSR** team), **IRISA** (**TRISKELL**).

The **INFRA-JVM** project will investigate how to enhance the design of Java virtual machines with new functionalities to better manage resources, namely resource reservation, scheduling policies, and resource optimization at the middleware level. **TASC** is concerned with this later aspect. The performance of **CHOCO** will be improved using the memory snapshot mechanism that will be developed.

7.8. EDF

Participants: Nicolas Beldiceanu, Helmut Simonis.

Within the context of the **Gaspard Monge call program for Optimisation and Operation Research** we work with **EDF** on the research initiative on *Optimization and Energy*. The goal of the project is first to extract constraints from daily energy production temporal series issued from the 350 production plants of **EDF**, second to see how to use these constraints in order to reduce the combinatorial aspect of the daily production planning solving process. The work is based on the model seeker [19].

7.9. Google

Participants: Jean-Guillaume Fages, Xavier Lorca, Jean-Charles Régis, Louis Martin Rousseau.

Within the context of a **Google** grant involving **Jean-Charles Régis** from **Nice University**, **Louis-Martin Rousseau** from **Polytechnique Montreal** and **Xavier Lorca** and Jean-Guillaume Fages from **TASC** the following work on graph constraints has been undertaken.

In constraint programming, specific syntax for expressing unweighted circuit constraints in a graph have been proposed already since the first CP systems were developed. Most current CP systems contain a constraint to model unweighted circuits, although the associated filtering algorithm may be quite different for each system. Weighted circuit constraints are less common in CP systems, as the weights and the circuit are typically handled separately. However, several filtering algorithms have been proposed in the literature that can be applied to the weighted circuit constraint. Currently, no professional CP system offers any of these algorithms. Thus, solving problems that contain weighted circuit constraints remains a challenge for constraint programming. One of the main contributions of our work is to expand the reach of constraint programming solvers to complex routing problems. We will propose more effective filtering algorithms for the weighted circuit constraint that are guided by the resolution of real world instances and not only by benchmarking.

VERTECS Project-Team (section vide)

ASPI Project-Team (section vide)

I4S Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. *Contracts with SVS*

Participants: Laurent Mevel, Michael Döhler.

Annual agreement Inria-SVS 2381 + contract 4329

I4S is doing technology transfer towards SVS to implement I4S technologies into ARTEMIS Extractor Pro. This is done under a royalty agreement between Inria and SVS .

7.2. Bilateral Grants with Industry

7.2.1. *PhD CIFRE with Dassault Aviation*

Participants: Laurent Mevel, Philippe Mellinger.

Following the FLiTE2 project, a joint PhD thesis between Inria and Dassault Aviation has been initiated. The thesis will pursue the work achieved in FLiTE2 and started in June 2011 funded by Dassault Aviation and the CIFRE Agency.

IPSO Project-Team (section vide)

DYLISS Team (section vide)

FLUMINANCE Project-Team (section vide)

GENSCALE Team

7. Bilateral Contracts and Grants with Industry

7.1. Sequence Comparison, Korilog

Intensive bank-to-bank comparison with Korilog : this collaborative project between the Korilog company and the GenScale team aims to investigate new research directions in the bank-to-bank sequence comparison problem. Two research axes are followed : constrained exploration of the search space and adaptation of the ORIS algorithm, developed by D. Lavenier for fast DNA comparison, to the protein sequences. It is funded for 3 months (Nov. 2012 - Feb. 2013), including the visit of assistant professor Van-Hoa Nguyen from Vietnam.

KoriPlast: this project is a cooperation between GenScale and the Korilog company, it is funded by Région Bretagne from June 2011 to Nov. 2012. It aims to industrialize the PLAST software prototype, previously developed in GenScale, that performs intensive genomic bank-to-bank comparisons. The commercial version is now called KLAST <http://www.korilog.com/index.php/KLAST-high-performance-sequence-similarity-search-tool.html>

7.2. Peapol

The Peapol project is funded by Sofiproteol company whose mission is to develop the French vegetable oil and protein industry, open up new markets, and ensure an equal distribution of value among its members. The Peapol project counts two collaborators, Biogemma, and INRA, the latter working in collaboration with the Genscale team, in charge of algorithmic research in the context of the project. This collaboration enabled to hire in the Genscale team Raluca Uricaru for 18 months on an INRA post doctoral position, followed by Suzete Alves-Carvalho (engineer).

7.3. Rapsodyn

RAPSODYN is a long term project funded by the IA French program (Investissement d'Avenir) and several field seed companies, such as Biogemma, Limagrain and Euralis. The objective is the optimisation of the rapeseed oil content and yield under low nitrogen input. GenScale is involved in the bioinformatics workpackage, in collaboration with Biogemma's bioinformatics team, to elaborate advanced tools dedicated to polymorphism.

SAGE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. ANDRA: Numerical methods for reactive transport

Participants: Édouard Canot, Jocelyne Erhel, Souhila Sabit.

Title: Numerical methods for reactive transport.

Time: three years from October 2010.

Partner: ANDRA Coordination: J. Erhel, with G. Pépin (ANDRA)

SERPICO Team

7. Bilateral Contracts and Grants with Industry

7.1. Innopsys: Methods and algorithms for tissue microarrays image analysis

In collaboration with Magellium company and Institut Gustave Roussy, Innopsys plans to develop new image analysis software to be included in the INGRID platform developed by Megellium company. New statistical methods and algorithms will be investigated by SERPICO for:

- segmentation and detection of deformable cell contours and cell nuclei in 2D fluorescence tissue microarray images;
- deconvolution and superresolution of fluorescence microarray imaging.

The three-year contract supports the PhD thesis of Alice Bergonzoni (2013-2015).

VISAGES Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Contracts with Industry

7.1.1. Siemens

duration: 5 years from 2011/10/26

In the context of the Neurinfo imaging platform, a partnership between Siemens SAS - Healthcare and University of Rennes 1 was signed in October 2011 for 5 years. This contract defines the terms of the collaboration between Siemens and the Neurinfo platform. The Neurinfo platform has received work in progress (WIP) sequences from Siemens in the form of object code for evaluation in the context of clinical research. The Neurinfo platform has also received source code of selected MRI sequences. This a major advance in the collaboration since it will enable the development of MRI sequences on site.

7.1.1.1. TransIRMf project

Participants: Christian Barillot, Jean-Yves Gauvrit, Jean-Christophe Ferré, Elise Bannier, Camille Maumet, Isabelle Corouge.

duration : 24 months, from 01/10/2010

The objective of this project is to set up and validate acquisition and data processing pipelines for metabolic and functional MRI. Acquisition techniques comprise innovative block design and event related paradigms based on various stimuli (visual, auditive) and use various MRI sequences (BOLD, ASL). Paradigms were selected to cover a large scope of potential applications. The protocol imaging namely includes a BOLD fMRI resting state paradigm, an n-back working memory paradigm for BOLD fMRI, as well as and for the first time, for functional ASL. An emotional prosody recognition task was implemented, also for the first time, in an event related BOLD fMRI context. Data were acquired on 30 healthy subjects. Processing of these data is in progress based on inhouse pipelines (e.g., template construction using DARTEL, PVE correction for ASL data). This grant was awarded in collaboration with Biotrial within the CRITT-Santé Bretagne program.

ACES Project-Team

5. Bilateral Contracts and Grants with Industry

5.1. Bilateral Contracts with Industry

5.1.1. *Energy saving mechanisms in smart homes using ambient computing principles*

- Partner : EDF - R&D
- Starting: 01/06/2010, ending : 01/10/2013

This project is funded by EDF group, leading energy producer in Europe. It started in June 2010. Its ends in June 2013. Its goal is to study the use of ambient computing principles for the management of electricity consumption in residential habitat. It focusses on two main objectives: (1) to define scenarios based on home people activities, and (2) to propose an implementation of these scenarios using ambient computing mechanisms studied in the Aces project. The main results are presented in section [4.3](#) .

ASAP Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Technicolor

Participants: Anne-Marie Kermarrec, Alexandre Van Kempen.

Since 2010, we have had a contract with Technicolor for collaboration on peer-assisted approaches for reliable storage. In this context, Anne-Marie Kermarrec has been the PhD advisor of Alexandre van Kempen since 2010.

7.2. Orange Labs

Participants: Ali Gouta, Anne-Marie Kermarrec.

We have had a contract with Orange Labs for collaboration on peer-assisted approaches for caching and recommendation in streaming applications. In this context, Anne-Marie Kermarrec has been the PhD advisor of Ali Gouta since 2012.

ASCOLA Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Cooperation with SIGMA group

Participants: Thomas Ledoux, Simon Dupont.

In 2012, we have started a two-fold cooperation with Sigma Group (<http://www.sigma.fr>), a software editor and consulting enterprise. The cooperation consists in a joint (a so-called Cifre) PhD on eco-elasticity of software for the Cloud and the sponsorship of several engineering students at the MSc-level.

As a direct consequence of the increasing popularity of cloud computing solutions, data centers are amazingly growing and hence have to urgently face with the energy consumption issue. The aim of Simon Dupont's PhD, started in November 2012, is to explore the *software elasticity* capability in Software-as-a-Service (SaaS) development to promote the management of SaaS applications that are more flexible, more reactive to environment changes and therefore self-adaptive for a wider range of contexts. As a result, SaaS applications become more elastic and by transitivity more susceptible to energy constraints and optimization issues.

ATLANMOD Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

Three technology transfer contracts with software companies were signed this year.

7.1.1. Steria

A first collaboration with Steria Ouest (located in Nantes) is resulting from the presentation of our activities during one of their regular Board of Architects meeting. The identified objective of this initial joint action was to guide and advice them to migrate an internal legacy application to model driven approach and related technologies, relying on our expertise about modeling and the Eclipse ecosystem. This has notably allowed us to get useful feedback on the benefits and drawbacks currently encountered when applying MDE and associated techniques in the context of real applications.

7.1.2. MIA-Software

Since several years, AtlanMod and Mia-Software are actively collaborating around the topic of Model Driven Reverse Engineering (MDRE), i.e.; the combined use of different model-based techniques to solve real reverse engineering problems. This has resulted in the successful creation and development of two open source Eclipse projects, namely Eclipse-MDT MoDisco (providing a generic and extensible MDRE framework) and Eclipse-EMFT EMF Facet (providing a dynamic model extension framework), both reaching today an industrial maturity level.

However, for these technologies to be definitely adopted and deployed in the context of very large systems handling huge data volumes, some remaining scalability issues still have to be addressed. Thus, scalability of model-driven techniques is one of the main challenges MDE is facing right now. In this context, AtlanMod has joined forces with MIA-Software as part of an Inria technology transfer action. This initiative is devoted to the development of new generation MDE techniques, for model creation and general handling, that effectively scale up. Among the different research challenges behind the MDE scalability and performance improvement, the following ones have been explored in the context of this collaborative action:

- **Model random access.** Advanced use of on-demand lazy loading techniques;
- **Model clustering and slicing.** Advanced use of semantic grouping and partial loading techniques;
- **Model virtualization.** Transparent and on-demand access to different views on a same model;
- **Lazy evaluation of model transformation.** On-demand lazy execution of transformations;
- **Incremental model transformation.** Partial model access and transformation execution;
- **Multi-threaded model transformation.** Parallelization of both model accesses and rule executions.

7.1.3. WebRatio

AtlanMod has helped WebRatio and the University of Trento in the definition (to be provided as an answer to the corresponding OMG RFP) of IFML, a modeling language for designing user interaction flows (not limited to the Web). Such a language should be: Extremely compact (no useless overhead), Effective (allows to model exactly what users want), Efficient (grants high reusability of model fragments), Easy to learn (very low learning curve), Comprehensive (covers most of the user interaction needs), Open and extensible (for covering any ad-hoc logic) and Platform independent (addressing any type of user interface device).

For more information about IFML - Interaction Flow Modeling Language see ⁵.

⁵<http://www.ifml.org/>

CIDRE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- **DGA PEA (Exploratory Study Program) contract (2011-2012): « PREVA - Security of the ad hoc routing protocols in the context of future tactical military networks »**

During the DGA-funded PREVA project ending in January 2013, we analyzed secure ad hoc routing in the context of military tactical networks. We first analyzed which routing protocols were the most suited for each type of tactical networks (Joint and Sub-Joint Tactical Groups, vehicular ad hoc networks, Futur Integrated Soldier Technologies (FIST) troopers and sensor networks assisting the troopers). We also considered the various security technologies (both crypto-based proactive mechanisms and intrusion detection-based reactive mechanisms) that could be used to protect each selected ad hoc routing protocols. Finally, we built a demonstrator implementing the various selected protocols and security mechanisms.

This study is led in cooperation with OPEN, an IT service provider located in Rennes.

- **DGA contract (2012-2013): « CAPALID »**

The CAPALID project aims at building a state of the art of off-the-shelf solutions for supervision systems in distributed environments. Our work was at first to make a state of the art of the research activities for Intrusion detection systems, correlation systems and visualization systems. On a second phase, the goal was to define an assessment methodology of these types of tools. Finally, this methodology will be applied by Amossys, our partner in the project, to evaluate the best off-the-shelf tools that have been retained in the context of the project. This study is led in cooperation with Amossys, a SME located in Rennes.

- **Technicolor contract (2011-2014): « Data Aggregation in Large Scale Systems »**

The theme of this contract focuses on the management of massively distributed data sets. Briefly, our goal is to provide a lightweight yet continuous flow of aggregate and relevant data from a very large number of distributed sources to a management system. Collaborative data aggregation are relevant mechanisms that could help in securely providing digests of information. However, an important aspect that we want to preserve is the privacy of the aggregated information. This is of particular interest for Telco operators or software/hardware providers in order to smoothly manage the current state of their deployed platforms, allowing accordingly to develop new applications based on quick reactions/optimizations to identify and handle services inconsistencies.

This study is conducted in cooperation with the Inria project Dionysos.

7.2. Bilateral Grants with Industry

- **Amossys: « Evaluation of intrusion detection mechanisms »**

The PhD of Georges Bossert is done in the context of a Cifre contract with the SME Amossys (<http://www.amossys.fr/>).

- **Orange Labs: « Data persistence and consistency in ISP infrastructures »**

Pierre Obame is doing his PhD thesis in the context of this cooperation with Orange Labs at Rennes. The theme of this project is to propose a distributed storage system dedicated to users who access Internet via a Digital Subscriber Line (DSL) technology. This system aims at guaranteeing data availability, persistency, and low access latency by fully exploiting millions of home gateways and the hundreds of Points of Presence (POP) of an Internet Service Provider (ISP) infrastructure.

- **DGA-MI: « Security events visualization »**

The PhD of Christopher Humphries is done in the context of a cooperation with DGA-MI. Due to the generalization of logging systems, security analysts are now overwhelmed by data when they want to obtain more informations. Manual inspection is clearly not possible anymore, and automated systems such as correlators are showing their limits. Visualization is a promising field. Visualization allows to build concise and often aesthetic representations of systems and events. In this project, we aim at proposing ways to evaluate current visualization solutions and to propose new ones dedicated to security events analysis, for instance for forensic purposes.

- **DGA-MI: « Alerts Correlation Taking the Context Into Account»**

The PhD of Erwan Godefroy is done in the context of a cooperation with DGA-MI. This PhD just started in November 2012.

DIONYSOS Project-Team

6. Bilateral Contracts and Grants with Industry

6.1. ADR Selfnets

Participant: Bruno Tuffin.

We participate to the common lab ALU-Inria within the “Action de Recherche” SELFNETS, on pricing issues in inter-domain. The goal is to produce economic incentives for intermediate autonomous systems to forward the traffic of concurrent providers and to analyze the handover between mobile providers from an economic point of view.

6.2. Cifre contract on QoE-aware network adaptation

Participants: Adlen Ksentini, Gerardo Rubino.

This is a Cifre contract (2009-2012) (PhD thesis supervision) with Viotech Communication, on network adaptation for multimedia traffic by using QoE metrics. This work is done in the context of the FP7 ALICANTE project.

6.3. Cifre contract on LOCARN: Low Opex and Capex Architecture for Resilient Networks

Participants: Adlen Ksentini, Bruno Sericola, Yassine Hadjadj-Aoul.

This is a Cifre contract (2012-2015) (PhD thesis supervision) with Orange labs., on evaluating and developing a new plug-and-play routing protocol (called Low Opex and Capex Architecture for Resilient Networks – LOCARN), which do not require any network management and configuration.

6.4. Data-aggregation for large-scale distributed networks

Participants: Bruno Sericola, Romaric Ludinard.

We started a 3-year (2011 – 2014) bilateral project with Technicolor R & D, France, on data-aggregation for large-scale distributed networks. Along with the ubiquity of data and computing devices, comes the complexity of extracting and gathering relevant information for management purposes. The very distributed nature of sources of data (be they partially local applications at user’s place, or hardware as gateways), as well as their ever increasing number prohibit a systematic and exhaustive gathering on a single (or few) central server for offline analysis. In this context, collaborative data aggregation, where some computing resources collaborate securely to provide digests, appears as an interesting application for both scalability and efficiency. Moreover, collecting information at a large scale pose the problem of privacy and data aggregation may allow preserving the privacy while collecting data.

6.5. IPChronos

Participants: Sofiane Moad, Pantelis Frangoudis, Yassine Hadjadj-Aoul, Adlen Ksentini, Bruno Sericola.

We are working in the 2-years (September 2011 – September 2013) FUI Project IPChronos, where the main focus is in the use of the IEEE 1588 synchronization protocol over IP. Our contribution focuses on developing analytical models to estimate, basing on the IEEE 1588 protocol, the end-to-end delay. IPChronos is led by ORALIA SPECTRACOM, and the partners are IPLabel and our team.

6.6. Celtic QuEEN

Participants: Sofiene Jelassi, Gerardo Rubino.

We started a 3-year Celtic project (end 2011-end 2014) called QuEEN: Quality of Experience Estimators in Networks. The project objectives are: to develop automatic QoE measure modules for Web services and applications, and to organize these measure modules as a network of cooperative agents in order to allow each member to take advantage of the measures of the others. Dionysos is involved in most of the activities of the project, and it is expected that QuEEN will benefit from our experience in developing the PSQA technology. QuEEN is a large project (22 European partners); the project leader is Orange Labs, in Sophia Antipolis.

DISTRIBCOM Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. HIMA

High Manageability (HiMa) is a research team hosted by the virtual joint research lab between Alcatel-Lucent Bell Labs France and Inria. This team is in its last year of existence, and most of its activity is now absorbed by the UniverSelf Eu IP (see below). DistribCom is involved in two topics: joint fault diagnosis in IMS networks and services (Carole Hounkonnou's thesis), and the early detection of anomalies in networks by analyzing the timed behavior of protocols (Aurore Junier's thesis). This work resulted in two publications at CNSM'12, and two joint patents on early fault detection and on the graceful maintenance of OSPF networks.

KERDATA Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

Microsoft: A-Brain (2010–2013). In the framework of the Joint Inria-Microsoft Research Center. See details in Section 4.1 . To support this project, Microsoft provides 2 million computation hours on the Azure platform and 10 TB of storage per year. The project is funding Louis-Claude Canon as a postdoc fellow (18 months since September 2011) and to complete the PhD MESR grant of Radu Tudoran (*Mission complémentaire d'expertise*, 3 years, started in October 2011).

IBM: MapReduce ANR Project (2010–2014). IBM is a partner of the MapReduce ANR Project: see Section 8.1 .

MYRIADS Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Grants with Industry

7.1.1. EDF R&D (2010-2013)

Participants: Stefania Costache, Christine Morin, Nikos Parlavantzas.

In our collaboration with EDF R&D we investigate resource management in virtualized computing platforms in order to efficiently execute distributed applications with stringent time constraints. Our goal is to design a resource management system for private clouds that provides support for different application SLAs while maximizing the resource utilization of the infrastructure. Stefania Costache's PhD work is funded through a CIFRE grant with EDF R&D.

In 2012, we have completed the implementation of Themis prototype and evaluated it with realistic applications provided by EDF R&D and task farming and batch scheduling environments such as Condor and Torque [20], [19].

TRISKELL Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. VaryMDE

Participants: Benoit Combemale, Olivier Barais, Mathieu Acher, Jean-Marc Jézéquel, Joao Ferreira filho, Suresh Pillay.

MDE, Variability Management, Software Language Engineering.

This bilateral collaboration is between the Triskell team and the MDE lab at Thales Research & Technology. This partnership explores variability management both in modeling and metamodeling (i.e., design and implementation of software languages), and enrolls 4 faculty members and 2 PhD students from the Triskell team. This year, we keep working on the CVL usage in the Thales context.

Project duration: 2011-2014

Triskell budget share: 284 keuros

7.2. EDF

Participants: Nicolas Sannier, Benoit Baudry.

model-driven analysis, requirements modelling, evolution

Since October 2010, we have a collaboration with EDF R& D, Chatou. This project aims at investigating the application of metamodeling and model-driven engineering for modeling and analyzing requirement documents of control-command systems. The purpose of this modeling activity is to improve the global understanding of dependencies between requirements and their context and to use this knowledge for impact analysis in case of evolution. In this context, Benoit Baudry acts as Ph.D advisor for Nicolas Sannier.

Project duration: 2010-2013

Triskell budget share: 30 keuros

7.3. Kereval

Participants: Aymeric Hervieu, Benoit Baudry.

test generation, software product lines, test reuse

Since October 2010, we have a collaboration with Kereval, an SME specialized in software testing. In this project we investigate the selection and reuse of test cases for software product lines in the automotive domain. In this context, Benoit Baudry acts as Ph.D advisor for Aymeric Hervieu. Arnaud Gotlieb from the Celtique EPI acts as a co-advisor for the PhD, as well as Olivier Philippot from Kereval.

Project duration: 2010-2013

Triskell budget share: 15 keuros

7.4. Sodifrance

Participants: Emmanuelle Rouillé, Benoit Combemale, Olivier Barais, Jean-Marc Jézéquel.

Software Process, Intentional-Driven Development, Process Execution

Since October 2010, we have a collaboration with Sodifrance, Rennes. In this project we investigate the support (capitalization, definition, execution, and adaptation) of software processes in the context of model driven development (MDD). The purpose of this work is twofold:

- automate the tool configuration and the dynamic adaptation of MDD CASE tools.
- support an automated verification of models, according to the requirements for each activity of the process.

In this context, Jean-Marc Jézéquel acts as Ph.D advisor for Emmanuelle Rouillé, also supervised by Benoit Combemale and Olivier Barais.

Project duration: 2010-2013

Triskell budget share: 25 keuros

7.5. All4Tec

Participants: Hamza Sahmi, Benoit Baudry.

Model-based testing, Software product lines

In this project with the All4Tec company we investigate the support of variability modelling for model-based test generation with Matelo (a tool developed by All4Tec).

In this context, Benoit Baudry acts as Ph.D advisor for Hamza Samih.

Project duration: 2011-2014

Triskell budget share: 20 keuros

7.6. Zenexity

Participants: Julien Richard-FOY, Olivier Barais, Jean-Marc Jezequel.

Web engineering, Domain Specific Languages

In this project with the Zenexity company we investigate the new architecture model for efficient web development on top of the play framework (a web framework developed by Zenexity).

In this context, Jean-Marc Jézéquel and Olivier Barais act as Ph.D advisor for Julien Richard Foy.

Project duration: 2011-2014

Triskell budget share: 20 keuros

DREAM Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Grants with Industry

7.1.1. *ManageYourSelf: diagnosis and monitoring of embedded platforms*

Participants: Marie-Odile Cordier, Sophie Robin, Laurence Rozé.

ManageYourSelf is a project that deals with the diagnosis and monitoring of embedded platforms, in the framework of a collaboration with Telelogos, a French company expert in mobile management and data synchronization. ManageYourSelf aims to perform diagnostic and repair on a fleet of mobile smartphones and PDAs. The idea is to embed on the mobile devices a rule-based expert system and its set of politics, for example "if memory full 'then delete (directory). recognition is performed, using the parameters of the phones as the fact base. Of course, it is impossible to foresee all the rules in advance. Upon detection of a non anticipated problem, a report containing all the system's information prior to the problem is sent to a server. The learning step was first implemented using using decision trees, the aim being to characterize the faults and consequently update the global knowledge base and its distributed instances. This year, we studied an incremental version of this learning step in order to get an on-line process [20]. This means being able to learn new faults characterizations and add new preventive rules, and also forget no longer needed ones.

7.2. National Initiatives

7.2.1. *SACADEAU-APPEAU: Decision-aid to improve streamwater quality*

Participants: Marie-Odile Cordier, Véronique Masson.

The SACADEAU project (Système d'Acquisition de Connaissances pour l'Aide à la Décision pour la qualité de l'EAU - Knowledge Acquisition System for Decision-Aid to Improve Streamwater Quality) was funded by INRA (French institute for agronomy research) from October 2002 to October 2005. The main partners were from INRA (SAS from Rennes and BIA from Toulouse) and from IRISA.

We were then involved in a new project, named APPEAU and funded by ANR/ADD, which started in February 2007 and ended in december 2011. The APPEAU project aimed at studying which politics, for which agronomic systems, are best adapted to improve water management. It includes our previous partners as well as new ones, mainly from INRA(http://www.agir.toulouse.inra.fr/agir/index.php?option=com_content&view=article&id=62&Itemid=134). A synthesis paper has been published in 2012 [5].

7.2.2. *ACASSYA: Supporting the agro ecological evolution of breeding systems in coastal watersheds*

Participants: Marie-Odile Cordier, Véronique Masson, René Quiniou.

The ACASSYA project (ACcompagner l'évolution Agro-écologique deS SYstèmes d'élevage dans les bassins versants côtiers) is funded by ANR/ADD. It started at the beginning of 2009 and will end in june 2013. The main partners are our colleagues from INRA (SAS from Rennes. One of the objectives is to develop modeling tools supporting the management of ecosystems, and more precisely the agro ecological evolution of breeding systems in coastal watersheds. In this context, the challenge is to transform existing simulation tools (as SACADEAU or TNT2 into decision-aid tools, able to answer queries or scenarios about the future evolution of ecosystems. (http://www.rennes.inra.fr/umrsas/programmes/acassya_accompagner_l_evolution_agro_ecologique_des_systemes_d_elevage))

7.2.3. PayOTE-Network: characterizing agricultural landscapes via data mining

Participants: Thomas Guyet, René Quiniou.

The PAYOTE project (Paysage Ou Territoire) was initially funded by AIP INRA/INRIA. It started at the end of 2010 and will end by the end of 2012.. The project is turning into a network mainly funded by INRA. This network still associates Inria Teams (Orpailleur and Dream) with INRA Team (UBIA, MIAJ and SAD-Paysage).

One of the objectives of the PAYOTE network is to provide tools to generate “realistic” agricultural landscapes. This kind of generator are expected by expert to study the impact of the landscape on agro-ecological systems. The main approach of this network is to use data mining to automatically construct a neutral model of a landscape. Then, the model of a landscape may be used to generate new landscapes with same spatial properties.

In this context, the challenge is to develop spatio-temporal data mining algorithms to analyse the spatial organization of agricultural landscapes.

LAGADIC Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Grants with Industry

7.1.1. Dassault Aviation

Participants: Laurent Coutard, François Chaumette.

no. Inria Rennes 5140, duration : 36 months.

This contract that started in 2009 supported Laurent Coutard's Ph.D. about automatic aircraft landing on carrier by visual servoing (see Section 6.2.6).

7.1.2. Fondation EADS

Participants: Antoine Petit, Eric Marchand.

no. Inria Rennes 5605, duration : 36 months.

This contract that started in March 2011 supports Antoine Petit's Ph.D. about 3D model-based tracking for applications in space (see Section 6.1.1).

7.1.3. Orange Labs

Participants: Pierre Martin, Eric Marchand.

no. URI 10CC310-03, duration : 36 months.

This contract started in February 2010. It is devoted to support the Cifre convention between Orange Labs and Université de Rennes 1 regarding Pierre Martin's Ph.D (see Section 6.3.3).

7.1.4. Astrium EADS

Participants: Tawsif Gokhool, Patrick Rives.

no. Inria Sophia 7128, duration : 36 months.

The objective of this project that started in February 2012 is to investigate the general problem of visual mapping of complex 3D environments that evolve over time. This contract supports Tawsif Gokhool's Ph.D.

7.1.5. ECA Robotics

Participants: Romain Drouilly, Patrick Rives.

no. Inria Sophia 7030, duration : 36 months.

This project that started in May 2012 aims at specifying a semantic representation well adapted to the problem of navigation in structured environment (indoors or outdoors). This contract is devoted to support the Cifre Convention between ECA Robotics and Inria Sophia Antipolis regarding Romain Drouilly's Ph.D.

METISS Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. Contract with Canon Research Centre France SAS

Participants: Emmanuel Vincent, Joachim Thiemann, Nancy Bertin, Frédéric Bimbot.

Duration: 1.5 years (2012–2013). Partner: Canon Research Centre France SAS

This contract aims at transferring some of the research done within Metiss to products developed by Canon Inc.

7.1.2. Contract with Studio Maïa

Participants: Nancy Bertin, Frédéric Bimbot, Jules Espiau, Jérémy Paret, Emmanuel Vincent.

Duration: 3 years (2012–2014). Partners: Studio Maïa (Musiciens Artistes Interprètes Associés), Imaging Factory

This contract aims at transferring some of the research done within Metiss towards new services provided by Maïa Studio.

More specifically, the main objective is to adapt source separations algorithms and some other advanced signal processing techniques elaborated by Metiss in a user-informed context.

The objective is twofold:

- partial automation of some tasks which the user previously had to accomplish manually
- improved quality of separation and processing by exploiting user inputs and controls

The resulting semi-automated separation and processing will feed an integrated software used for the professional remastering of audiovisual pieces.

MIMETIC Team (section vide)

SIROCCO Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Contracts with Industry

7.1.1. *Contract with Astrium on compression of satellite images*

Participants: Jeremy Aghaei Mazaheri, Christine Guillemot, Claude Labit.

- Title : Compression of satellite images.
- Partners : Astrium, Inria-Rennes.
- Funding : Astrium.
- Period : Oct.11-Sept.14.

This contract with Astrium addresses the problem of sparse representation and dictionary learning for efficient sparse coding of video signals captured from a geostationary satellite. The goal is to develop a compact spatio-temporal representation taking advantage of the high redundancy present in the video of very high resolution and characterized by low motion. The first year has been dedicated to the study of different methods for learning tree-structured dictionaries, which can be well-tailored to the characteristics of the signals to be processed at each iteration of the greedy matching pursuit algorithms, while allowing efficient encoding of the produced sparse vectors. The performance of the dictionaries both in terms of PSNR versus sparsity and versus actual bit rate has been assessed.

7.1.2. *Collaboration with Alcatel on robust video compression*

Participants: Marco Bevilacqua, Christine Guillemot, Ronan Le Boulch, Aline Roumy.

- Title: Self adaptive video codec
- Funding: Joint research laboratory between Inria and Alcatel
- Period: Oct. 2010 - Dec. 2013.

In the framework of the joint research lab between Alcatel-Lucent and Inria, we participate in the ADR (action de recherche) Selfnets (or Self optimizing wireless networks). The objective is, jointly with the Alcatel Lucent team, to develop video representations and compression tools allowing smooth network adaptation on one hand and loss resilience on the other hand. In that context, the PhD thesis of M. Bevilacqua focuses on the development and study of image and video super-resolution as a tool for constructing scalable representations, hence enabling network adaptation of transmitted video streams. Despite the use of scalable representations and of error correcting codes, the reconstructed video after decoding may still suffer from residual losses. The effect of these residual losses can be mitigated using loss concealment techniques, as developed within the ANR-ARSSO project. However, loss concealment does not allow perfect recovery of the lost data. The reconstructed video after loss concealment is hence still corrupted by noise. Forward error correction using wyner-ziv encoded video is therefore also envisaged as an additional protection means, to cope with the residual noise after loss concealment.

7.1.3. *Contract with EutelSat on video traffic analysis*

Participants: Laurent Guillo, Aline Roumy.

- Title : Bit rate statistical analysis of HEVC encoded video in a broadcast transmission.
- Partners : EutelSat, Inria-Rennes.
- Funding : EutelSat.
- Period : Aug.12-Feb.13.

This contract with Eutelsat (starting in August 2012) is a consulting contract and aims at analyzing the variation of the video traffic, when the video is encoded by HEVC. Indeed, the main characteristic of satellite broadcasting, as proposed by Eutelsat, is to provide a nearly constant video quality, which is obtained by variable video traffic (bit rate). Then, to address this variability issue, statistical multiplexing is used to share the resource among the users. However, statistical multiplexing needs a precise analysis of this variability. In this contract, we therefore analyze this variability, when the video is compressed with the upcoming video compression standard HEVC.

7.1.4. Contract with SHOM (Service Hydrographique et Océanographique de la Marine)

Participants: Alan Bourasseau, Olivier Le Meur.

- Title: Oceanographic data compression
- Partners: SHOM, Alyotech, Univ. Rennes 1
- Funding: SHOM
- Period: 09/2012-02/2013.

The project consists in developing lossless and lossy compression algorithms for oceanographic data in partnership with ALYOTECH. The SIROCCO team contributes on the design and development of compression algorithms for this specific type of data, based on diffusion methods. The main constraint is the limited bandwidth used by the navy to transmit the data, i.e. an emitted message must be smaller than 4 kilo bytes. The obtained quality versus rate performances will be assessed against those given by state of the art solutions (HEVC-Intra and JPEG-2000).

7.2. Grants with Industry

7.2.1. CIFRE contract with Orange on Generalized lifting for video compression

Participants: Christine Guillemot, Bihong Huang.

- Title : Generalized lifting for video compression.
- Research axis : § 6.3.4 .
- Partners : Orange Labs, Inria-Rennes.
- Funding : Orange Labs.
- Period : Apr.12-Mar.15.

This contract with Orange labs. (starting in April. 2012) concerns the PhD of Bihong Huang and aims at investigating various forms of generalized lifting as efficient lossless and lossy coding operators in a video encoder. The generalized lifting is an extension of the lifting scheme of classical wavelet transforms which permits the creation of nonlinear and signal probability density function (pdf) dependent and adaptive transforms. This study is also carried out in collaboration with UPC (Ph. Salembier) in Barcelona.

7.2.2. CIFRE contract with Orange on 3D quality assessment

Participants: Darya Khaustova, Olivier Le Meur.

- Title : Objective Evaluation of 3D Video Quality.
- Research axis : § 6.1.1 .
- Partners : Orange Labs, Inria-Rennes.
- Funding : Orange Labs.
- Period : Dec.11-Nov.14.

This contract with Orange labs. (starting in Dec. 2011) concerns the PhD of Darya Khaustova and aims at developing a video quality metric for 3D content. The usage of 3D video is expected to increase in the next years. In order to ensure a good QoE (Quality of Experience), the 3D video quality must be monitored and accurately measured. The goal of this thesis is to study objective measures suitable for estimating 3D video quality. A comparison with ground truth as well as with the state-of-the-art 2D metrics should be carried out. To be as effective as possible, the feature of the human visual system should be taken into account.

7.2.3. CIFRE contract with Technicolor on sparse modelling of spatio-temporal scenes

Participants: Martin Alain, Safa Cherigui, Christine Guillemot.

- Title : Spatio-temporal analysis and characterization of video scenes
- Research axis : § 6.1.3 .
- Partners : Technicolor, Irista/Inria-Rennes.
- Funding : Technicolor, ANRT.
- Period : Ph.D Of S. Cherigui (Nov.09- Oct.12); Ph.D. of M. Alain (Oct.12-Sept.15).

A first CIFRE contract has concerned the Ph.D of Safa Cherigui from Nov.2009 to Oct.2012, in collaboration with Dominique Thoreau (Technicolor). The objective was to investigate texture and video scene characterization methods and models based on sparse and data dimensionality reduction techniques, as well as on concepts of epitomes. The objective was then to use these models and methods in different image processing problems focusing in particular on video compression. Among the main achievements, one can first cite novel Intra prediction techniques using data dimensionality reduction methods with correspondance map-aided K-NN search. A novel method has also been introduced for constructing epitome representations of an image, with rate-distortion optimization criteria. The epitome coupled with inpainting is used for image compression, showing significant performance gains with respect to H.264 Intra prediction modes. The above results have led to a best student paper award at IEEE-ICASSP 2012 [21], one nominated paper among the 11 finalists for a best student paper award at IEEE-ICIP 2012 [22], one journal publication in the IEEE Trans. on Image Processing [13] and to 6 patents.

The first PhD thesis has focused on spatial analysis, processing, and prediction of image texture. A second CIFRE contract (PhD thesis of Martin Alain) has hence just started to push further the study by addressing issues of spatio-temporal analysis and epitome construction, with applications to temporal prediction, as well as to other video processing problems such as video inpainting.

7.2.4. CIFRE contract with Thomson Video Networks (TVN) on Video analysis for HEVC based video coding

Participants: Nicolas Dhollande, Christine Guillemot, Olivier Le Meur.

- Title : Coding optimization of HEVC by using preanalysis approaches.
- Partners : Thomson Video Networks, Univ. Rennes 1.
- Funding : Thomson Video Networks (TVN).
- Period : Nov.12-Sept.15.

This contract with TVN (starting in Oct. 2012) concerns the PhD of Nicolas Dhollande and aims at performing a coding mode analysis and developing a pre-analysis software. HEVC standard is a new standard of compression including new tools such as advanced prediction modes. Compared to the previous standard H.264, HEVC's complexity is three to four times higher. The goal of this thesis is to infer the best coding decisions (prediction modes...) in order to reduce the computational complexity of HEVC. A pre-analysis or a first coding pass. This latter would provide useful estimates such as rate distortion characteristics of video, the set of quantization parameters (often called just QPs). These estimated characteristics would help to select quantization parameters for the second pass in order to reduce the computational complexity by keeping a good quality.

TEXMEX Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. Consulting agreement with the LTU company

Participant: Hervé Jégou.

Following the interaction in the context of the Quaero Project, LTU and Inria have signed a consulting agreement. In this context, Hervé Jégou has provided some expertise to the company in March 2012.

7.2. Bilateral Grants with Industry

7.2.1. Contract with Orange Labs

Participants: Pascale Sébillot, Khaoula Elagouni.

Duration: 36 months, since October 2009.

K. Elagouni's Ph.D. thesis is supported by a CIFRE grant in the framework of a contract between Orange Labs and TEXMEX. The aim of the work is to investigate a more semantic approach to describe multimedia documents based on textual material found inside the images.

7.2.2. Contract with INA (*Institut national de l'audiovisuel*)

Participants: Guillaume Gravier, Ludivine Kuznik, Pascale Sébillot.

Duration: 36 months, since April 2011.

Ludivine Kuznik's Ph.D. thesis is supported by a CIFRE grant in the framework of a contract between INA and TEXMEX within the OSEO/QUAERO project. The aim of the work is to investigate a more semantic approach to structure and navigate very large collections of TV archives.

7.2.3. Contract with Orange Labs

Participants: Patrick Gros, Mohamed-Haykel Boukadida.

Duration: 36 months, since January 2012.

M.H. Boukadida's Ph.D. thesis is supported by a CIFRE grant in the framework of a contract between Orange Labs and TEXMEX. The aim of the work is to investigate the use of constraint programming to define a general framework for video summarization and repurposing.

7.2.4. Contract with INA

Participants: Guillaume Gravier, Bingjing Qu.

Duration: 36 months, since May 2012.

Bingjing Qu's Ph.D. thesis is supported by a CIFRE grant in the framework of a contract between INA and TEXMEX. The aim of the work is to infer the structure of collections of homogeneous documents.

7.2.5. Contract with Technicolor

Participants: Cédric Penet, Guillaume Gravier, Patrick Gros.

Duration: 36 months, since October 2010.

C. Penet's Ph.D. thesis is supported by a CIFRE grant in the framework of a contract between Technicolor and TEXMEX. The aim of the work is to develop methods to detect audio events and to apply these techniques to violence detection in films.

VR4I Team (section vide)