Activity Report 2013

Section Contracts and Grants with Industry

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, Pierre Vittet.

Static program analysis, Javacard, Certification, AFSCM

- Partner : FIME
- Period: Starting January 2012; ending June 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 rules specify syntactic constraints but also more semantics properties such as the absence of certain runtime exceptions. FIME aims at automating the process of validating that Javacard applications are conformant to the rules. The outcome of the project is the Jacal (JAvaCard AnaLyser) (4.3 which takes a binary Javacard application; performs static analysis and output statuses for the different rules. Pierre Vittet has recently been recruited by FIME and the operational deployment of Jacal is in progress.

ESPRESSO Project-Team (section vide)

Hycomes Team (section vide)

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.2. Bilateral Grants with Industry

SUMO Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

HiMa. The SUMO team was involved in the common research lab between Alcatel-Lucent Bell Labs France and Inria, through the High-Manageability team, co-headed by Pierre Peloso (Alcatel) and Éric Fabre. This joint team involved other Inria teams: Madynes and Mexico. In the last years of its existence, most of the activity of this joint team was redirected to the UniverSelf FP7 integrated project. Both the joint team and the project ended in 2013 (see the UniverSelf description for more details). This joint team supported two PhD students of SUMO, who defended their thesis in 2013: Aurore Junier (network calculus for early malfunction detection) and Carole Hounkonnou (self-diagnosis for large scale services and networks). Éric Fabre is member of the scientific board of the joint lab ALBLF-Inria, which is now entering in its second round of 5 year common teams.

<div align="center">**TASC Project-Team**</div>

7. Bilateral Contracts and Grants with Industry

7.1. Ligéro(AGIRA)

Participants: Xavier Lorca, Thierry Petit.

> Title: Ligéro.
>
> Duration: 2013.
>
> Type: Regional research group

Teaching optimization project.

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: 2011-2013.
>
> 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). The course will be available on line in spring 2014.

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: 2010-2013.
>
> 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.
>
> 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). In 2013 a filtering algorithm has been devised in the case of objects described by nonlinear inequalities and is now under testing with the Ibex library. This work has been presented in a workshop on interval methods & geometry in ENSTA Bretagne.

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 (continuation of last year 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 CP 2012 model seeker.

7.9. LabCom

Participants: Charles Prud'Homme, Xavier Lorca.

Title: TransOp.

Duration: 2014-2016.

Type: **new project**.

Budget: 300000 Euros.

Others partners: Eurodécision.

The goal of the project is to handle robustness in the context of industrial timetabling problems with constraint programming using CHOCO.

7.10. PHC Ulysses

Participants: Charlotte Truchet, Florian Richoux, Alejandro Reyes.

Title: Development and estimation analysis of massively parallel local search approaches to the k-medoids problem.

Duration: 2014.

Type: **new project**.

Budget: 2500 Euros.

Others partners: 4C (Cork, Ireland).

The goal of this project is to develop parallel local search techniques for solving large instances of the k-medoids problem, a location problem with several applications, in particular in optical fiber networks deployment.

7.11. ECOS Sud

Participant: Eric Monfroy.

Title: Auto-Evol (Autonomous Evolutionary Algorithms).

Duration: 2011-2013.

Budget: 15 KEuros per year for the project.

Others partners: LERIA (Angers, France), Univ. Austral de Chile (Chili), UTFSM (Valparaiso, Chili).

<p align="center" style="color:red;">ASPI Project-Team</p>

6. Bilateral Contracts and Grants with Industry

6.1. Bilateral contracts with industry

6.1.1. DUCATI: Optimization of sensors location and activation — contract with DGA / Techniques navales

Participant: François Le Gland.

See 3.3 and 4.2

Inria contract ALLOC 7326 — April 2013 to December 2016.

This is a collaboration with Christian Musso (ONERA, Palaiseau) and with Sébastien Paris (LSIS, université du Sud Toulon Var), related with the supervision of the PhD thesis of Yannick Kenne.

The objective of this project is to optimize the position and activation times of a few sensors deployed by one or several platforms over a search zone, so as to maximize the probability of detecting a moving target. The difficulty here is that the target can detect an activated sensor before it is detected itself, and it can then modify its own trajectory to escape from the sensor. This makes the optimization problem a spatio–temporal problem. The activity in the beginning of this project has been to study different ways to merge two different solutions to the optimization problem : a fast, though suboptimal, solution developed by ONERA in which sensors are deployed where and when the probability of presence of a target is high enough, and the optimal population–based solution developed by LSIS and Inria in a previous contract (Inria contract ALLOC 4233) with DGA / Techniques navales.

<div align="center" style="color:red">**I4S Project-Team**</div>

6. Bilateral Contracts and Grants with Industry

6.1. Bilateral Contracts with Industry

6.1.1. Contracts with SVS

Participants: Laurent Mevel, Michael Doehler.

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 .

6.2. Bilateral Grants with Industry

6.2.1. PhD CIFRE with Dassault Aviation

Participants: Laurent Mevel, Philippe Mellinger.

contract 7843.

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.

6.3. Bilateral Grants with Industry

6.3.1. Collaboration with Bruel and Kjaer

Participants: Laurent Mevel, Ivan Gueguen.

Collaboration has started on analysis on wind turbines data.

IPSO Project-Team (section vide)

DYLISS Project-Team (section vide)

FLUMINANCE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Contrat CERSAT/IFREMER

This contract aims at studying image based data assimilation strategies for oceanic models incorporating random uncertainty terms. The goal targeted will consist in deriving appropriate stochastic version of oceanic model and on top of them to devise estimation procedures from noisy data to calibrate the associated subgrid models. This contract covers half of the funding of Valentin Resseguier PhD thesis.

<h1 style="text-align:center;color:red">GENSCALE Project-Team</h1>

7. Bilateral Contracts and Grants with Industry

7.1. I-Lab Koriscale

In June 2013, GenScale and the Korilog Company created an Inria common structure research (I-LAB) called KoriScale. This is the outcome of a solid relationship, which has enable the transfer of the PLAST software (bank to bank genomic sequence comparison) from GenScale to Korilog. The resulting commercial product (Klast) is now 5 to 10 times faster than the reference software (Blast). The main research axe of the I-LAB focuses on comparing huge genomic and metagenomic datasets.

7.2. 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).

7.3. Sequence Comparison, Kalray

Parallelization of PLAST on many cores : This collaboration aims to implement he PLAST software on the MPPA chip (256 cores) developed by the Kalray company. PLAST is a BLAST-like parallel implementation of the bank to bank genomic sequence comparison problem. More generally, the purpose, here, is to investigate the performances of the MPPA architecture on scientific life science software. This is a bilateral contract of 4 months, from April to August 2013.

7.4. 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 Susete Alves-Carvalho (engineer).

7.5. 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: October 2010-October 2013
Partner: ANDRA Coordination: J. Erhel, with G. Pépin (ANDRA)

Abstract: It is quite challenging to develop a numerical model for deep storage of nuclear waste. The time interval is very large (several thousands years), models are coupled and simulations must be accurate enough to be used for risk assessment. In most cases, chemistry must be included in models of deep geological storage. We have developed an efficient global method coupling transport and chemistry by a Newton-type algorithm. See sections 6.3.4 , 4.2 , 8.2.7 , 5.1.6 .

<p style="text-align:center; color:red;">**SERPICO Project-Team**</p>

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 Nam-Hoai Nguyen (2013-2016).

VISAGES Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral 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.

<p style="text-align:center;color:red;font-weight:bold;">ACES Project-Team</p>

6. Bilateral Contracts and Grants with Industry

6.1. Bilateral Contracts with Industry

6.1.1. 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 and ended in October 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.

Most existing smart home solutions were designed with a technology-driven approach. That is, the designers explored which services, functionalities, actions and controls could be performed exploiting available technologies. This led to solutions for human activity recognition relying on wearable sensors, microphones or video cameras. Those technologies may be difficult to deploy and get accepted in real-world households, because of convenience and privacy concerns. Many people have concerns on carrying equipments or feeling observed or recorded while living their private life. This could seriously impact the acceptability of the smart home system or reduce its diffusion in real households. To avoid such kind of issues, we designed our system with an acceptability-driven approach. That is, we selected technologies that respond to the constraints of a real-world deployment of the future smart home system, namely, convenience and privacy concerns. We decided to take a very conservative approach, choosing technologies that are as unobtrusive as possible, in order to explore the frontiers of what can be done in a smart home with a very limited instrumentation. Following the same considerations, the adopted technologies and techniques had to guarantee a fast and easy configuration, ultimately allowing a plug-and-play deployment. All these aspects have been studied and experimented using a hardware/software platform maintained by Sylvain Roche. This platform integrated results of two PhDs defended in 2013 (Michele Dominici and Bastien Pietropaoli), and has been used for a demonstration in June 2013 at EDF. A part of software developments is now published under apache licence (see 4.1.1) and used by the team.

The new results in 2013 are presented in section 5.2 .

7. Bilateral Contracts and Grants with Industry

7.1. Technicolor

Participants: Fabien André, Anne-Marie Kermarrec.

We have a contract with Technicolor for collaboration on large-scale infrastructure for recommendation systems . In this context, Anne-Marie Kermarrec is the PhD advisor of Fabien André since November 2013. Fabien André will work on efficient algorithms for heterogeneous data on large-scale platforms.

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.

7.3. Web Alter-Egos Google Focused Award

Participants: George Giakkoupis, Anne-Marie Kermarrec, Nupur Mittal, Javier Olivares.

Duration: Sep. 2013 - Sep. 2015; Coordinator: Inria and EPFL.

This project addresses the problem of extracting the alter-egos of a Web user, namely profiles of like-minded users who share similar interests, across various Internet applications, in real time and in the presence of high dynamics. Beyond their intrinsic social interest, the profiles of alter-egos of a user are crucial to identify a personalized slice of the Internet that can be leveraged to personalize the Web navigation of that user. The expected outcome of the project is a generic architecture of a Web-Alter-Ego service that can run on various devices and use, as well as be used for, various Web applications.

<p align="center" style="color:red">ASCOLA Project-Team</p>

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. In 2013, we presented our first results at ECOCITY, the World Summit on sustainable cities (http://www.ecocity-2013.com/en) and at NEM Summit (http://nem-summit.eu).

ATLANMOD Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. *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 [7].

7.1.2. *IBM*

IBM is funding a PhD Thesis on the topic of reverse engineering of business rules from COBOL systems (see the new results section for more details).

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[7]http://www.ifml.org/

<p style="text-align:center">**CIDRE Project-Team**</p>

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- **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. We first realized a state of the art of the research activities for intrusion detection systems (probes), correlation systems and visualization systems. On a second phase, we defined an assessment methodology of these types of tools. Finally, this methodology was 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.

- **HP contract (2013-2014): "Firmware Security"**

  The work we have conducted on the automatic instrumentation of C programs in order to detect intrusions has led to the implementation of the approach within the Frama-C framework under the form of a plugin called SIDAN (see above). A part of this contract for HP consists in adapting and improving this plugin for a real-word code provided by HP, in order to harden their source code.

  Another aspect of this work consists in developing a knew intrusion detection mechanism at the hardware level to protect the firmware (i.e. BIOS or UEFI) level. This mechanism must take into account industrial constraints provided by HP. Thomas Letan has been hired as an engineer to design and implement a proof-of-concept of such mechanism. In 2013, he focused his work on studying state-of-the-art and comparing existing approaches using metrics adapted to HP constraints.

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/). His work consists in proposing new approaches for protocol reverse-engineering. He developed Netzob, a tool dedicated to this task. The goal is to use this tool to generate realistic traffic during IDS assessment. In 2013, Georges has developed two important improvements of the protocol inference process he previously proposed. First, he improved the message format reverse engineering phase. Unlike previous work, our approach uses contextual information and its semantic definition as a key parameter in both the processes of message clustering and field partitioning. We can also detect complex linear and nonlinear relationships between value, size and offset of message fields using correlation-based filtering. Besides, our multi-step pre-clustering phase reduces the required computation time of the main clustering phase. These results

have been presented in an article that is under review. The second aspect of his work consisted in enhancing the grammar inference phase. He proposed a new approach that combines passive and active algorithms to infer protocol grammars. This approach also relies on grammar decompositions. Thus, he decreased inference time by using an action-based sequential decomposition and we took into account background noise by using a parallel decomposition. G.Bossert is also currently writing his PhD manuscript, with his defense being expected for mid 2014.

- **Orange Labs: "Data Persistence and Consistency in ISP Infrastructures"**

  Pierre Obame is doing his PhD thesis in the context of a cifre contract with Orange Labs at Rennes. Pierre Obame has proposed a distributed storage system called Mistore, dedicated to users who access Internet via a Digital Subscriber Line (DSL) technology. This system aims at guaranteeing data availability, persistence, and low access latency by leveraging millions of home gateways and the hundreds of Points of Presence (POP) of an Internet Service Provider (ISP) infrastructure. Pierre Obame has also proposed a mathematical framework for defining both strong and weak consistency criteria within the same formalism. Both weak and strong consistency criteria are offered by Mistore to its clients when they manipulate their data.

- **DGA-MI: "Security Events Visualization"**

  The PhD of Christopher Humphries on visualization is done in the context of a cooperation with DGA-MI. The objective is to propose new visulization mechnisms dedicated to the analysis of security events, for instance for forensic purposes. The tool ELVis presented earlier in this documents is the most recent contribution to this contract. It should be extended this year to allow the unified manipulation of multiple data sources.

- **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 started in November 2012. The current work consists in the automatic generation of alert correlation rules in the context of deployed distributed systems. The correlation rules aim at being used by our GnG correlation system.

<div align="center" style="color:red">**DIONYSOS Project-Team**</div>

7. Bilateral Contracts and Grants with Industry

7.1. Cifre contract on Small Cell Networks

Participants: Adlen Ksentini, César Viho, Btissam Er-Rahmadi.

This is a Cifre contract (2013-2016) including a PhD thesis supervision, done with Orange Labs, on cooperation and self-* small cell networks. The aim is to define architectures and protocols for deploying small cell networks in AMEA (Africa, Middle East and Asia) countries.

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

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

This is a Cifre contract (2012-2015) including a PhD thesis supervision, done 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 or configuration.

7.3. Data aggregation for large-scale distributed networks

Participants: Bruno Sericola, Romaric Ludinard.

This is 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 the user end, 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 poses the problem of privacy and data aggregation may allow preserving the privacy while collecting data.

7.4. IPChronos

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

We are working in the 3-year (September 2011 – September 2014) 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, based on the IEEE 1588 protocol, the end-to-end delay. IPChronos is leaded by ORALIA SPECTRACOM, and the partners are IPlabel and our team.

7.5. Celtic QuEEN

Participants: Sofiene Jelassi, Pantelis Frangoudis, Gerardo Rubino.

QuEEN (Quality of Experience Estimators in Networks) is a large 3-year Celtic project going from end 2011 to end 2014. Its objectives are to develop automatic QoE measurement modules for Web services and applications, and to organize these measurement modules as a network of cooperative agents in order to allow each agent to take advantage of the measurements done by 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 involves many companies and academic institutions (22 European partners); the project leader is Orange Labs, in Sophia Antipolis.

KERDATA Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

Microsoft: Z-CloudFlow (2013-2016).   In the framework of the Joint Inria-Microsoft Research Center, this project is a follow-up to the A-Brain project (see below). The goal of this new project is to propose a framework for the efficient processing of scientific workflows in clouds. This approach will leverage the cloud infrastructure capabilities for handling and processing large data volumes. In order to support data-intensive workflows, the cloud-based solution will: adapt the workflows to the cloud environment and exploit its capabilities; optimize data transfers to provide reasonable times; manage data and tasks so that they can be efficiently placed and accessed during execution. The validation will be performed using real-life applications, first on the Grid5000 platform, then on the Azure cloud environment, access being granted by Microsoft through a "Azure for Research Award" received by Gabriel Antoniu. The project will also provide funding for a PhD thesis to start in 2014. It is being conducted in collaboration with the Zenith team from Montpellier (led by Patrick Valduriez).

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 provided 2 million computation hours on the Azure platform and 10 TB of storage per year. The project funded a complementary expertise mission for Radu Tudoran (*Mission complémentaire d'expertise*, 3 years, started in October 2011).

<p align="center" style="color:red">MYRIADS Project-Team</p>

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. EDF R&D (2010-2013)

Participants: Stefania Costache, Christine Morin, Nikos Parlavantzas.

The objective of our collaboration with EDF R&D 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 [11] is funded through a CIFRE grant with EDF R&D. In 2013, we have completed the implementation of the Merkat prototype and evaluated it with realistic applications provided by EDF R&D and with task farming and batch scheduling environments such as Condor and Torque [23], [22].

<p align="center">**TRISKELL Project-Team**</p>

7. Bilateral Contracts and Grants with Industry

7.1. VaryMDE

Participants: Benoit Combemale, Olivier Barais, Mathieu Acher, Jean-Marc Jézéquel, João Bosco Ferreira Filho, Suresh Pillay, David Mendez Acuna.

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. 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

7.3. Zenexity

Participants: Julien Richard-Foy, Olivier Barais, Jean-Marc Jézéquel.

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

7.4. Technology transfer

Since mid 2011 the Triskell team is designing and implementing the DAUM platform that integrates a large range of technologies, ranging from wireless low cost sensors to clouds made of rugged field miniservers. Our application use case is a tactical decision system designed in cooperation with a large firefighter department of 3,500 firefighters. This platform is being used as a real life testbed for our results on dynamic, continuous design of distributed pervasive systems. It is also used as a concrete cooperation support within the Marie Curie Initial Training Network *Relate*.

By combining *models@runtime* techniques and component-based techniques, we have shown how we can apply model driven engineering to design large-scale, distributed, heterogeneous and adaptive systems.

Until october 2013 the DAUM platform was funded by an Inria Technology Development activity. In 2013 Triskell was granted for a specific funding (one year of engineer salary) to prepare the transfer of DAUM to the industry and prepare the creation of a startup focused on tools and applications for tactical information and decision systems on the field. The startup planned will involve seven members of the Triskell team.

<p style="text-align:center; color:red;">**DREAM Project-Team**</p>

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts 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 decision trees, the aim being to characterize the faults and consequently update the global knowledge base and its distributed instances. An incremental version of this learning step has been studied in order to get an on-line process [36]. This means being able to learn new faults characterizations and add new preventive rules, and also forget no longer needed ones.

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HYBRID Project-Team

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7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Grants with Industry

7.1.1. *Orange Labs*
Participants: Pierre Gaucher, Anatole Lécuyer.

This grant started in October 2012 and supported Pierre Gaucher's CIFRE PhD program on "Novel 3D interaction techniques based on pseudo-haptic feedback".

7.1.2. *Technicolor*
Participants: Fabien Danieau, Anatole Lécuyer.

This grant started in January 2011 and supported Fabien Danieau's CIFRE PhD program on "Improving audiovisual experience with haptic feedback".

7.2. Bilateral Contracts with Industry

7.2.1. *Mensia Technologies*
Participants: Jozef Legény, Jussi Lindgren, Anatole Lécuyer.

Mensia Technologies is an Inria start-up company created in November 2012 as a spin-off of Hybrid team. Mensia is focused on wellness and healthcare applications emerging from the BCI and Neurofeedback technologies. The Mensia startup should benefit from the team's expertise and of valuable and proprietary BCI research results. Mensia is based in Rennes and Paris. Anatole Lécuyer and Yann Renard (former Inria expert engineer who designed the OpenViBE software architecture and was involved in team projects for 5 years) are co-founders of Mensia Technologies together with CEO Jean-Yves Quentel.

The contract between Hybrid and Mensia started in November 2013 and supported the transfer of several softwares designed by Hybrid team ("OpenViBE", "StateFinder") related to our BCI activity and our OpenViBE software (section 5.1) to Mensia Technologies for 5 years, for future multimedia or medical applications of Mensia.

7.2.2. *MBA Multimedia*
Participants: Ferran Argelaguet Sanz, Maud Marchal, Anatole Lécuyer.

This contract started in June 2013 and supported the transfer of several softwares designed by Hybrid team ("3D Cursors", "Elastic Images") in the frame of the W3D project (section 8.1.2) to MBA Multimédia company for future applications in the field of multimedia and web design based mainly on HTML5 and Word Press software.

7.2.3. *Polymorph Studio*
Participants: Ferran Argelaguet Sanz, Maud Marchal, Anatole Lécuyer.

This contract started in June 2013 and supported the transfer of several softwares designed by Hybrid team ("3D Cursors", "Pseudo-haptik", "Elastic Images") in the frame of the W3D project (section 8.1.2) to Polymorph Studio company for future applications in the field of multimedia and web design based mainly on Unity3D software.

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. Foundation EADS

Participants: Antoine Petit, Eric Marchand.

no. Inria Rennes 5605, duration: 36 months.

This contract ended in December 2013. It supported Antoine Petit's Ph.D. about 3D model-based tracking for applications in space (see Section 6.1.1).

7.1.2. 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. (see Section 6.3.2).

7.1.3. ECA Robotics

Participants: Romain Drouilly, Patrick Rives.

no. Inria Sophia 7030, duration: 36 months.

This project started in May 2012. It 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.

MIMETIC Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Grants with Industry

7.1.1. *Cifre Contract with Faurecia*

Participants: Franck Multon [contact], Pierre Plantard.

This contract aims at developing new ergonomics assessments based on inaccurate Kinect measurements in manufactures on real workers. The main challenges are:

- being able to improve the Microsoft Kinect measurement in order to extract accurate poses from depth images while occlusions may occur,
- developing new inverse dynamics methods based on such inaccurate kinematic data in order to estimate the joint torques required to perform the observed task,
- and proposing a new assessment tool to translate joint torques and poses into potential musculoskeletal disorders risks.

Faurecia has developed its own assessment tool but it requires tedious and subjective tasks for the user, at specific times in the work cycle. By using Kinect information we aim at providing more objective data over the whole cycle not only for specific times. We also wish to make the user focus on the interpretation and understanding of the operator's tasks instead of taking time estimating joint angles in images.

This work is performed in close collaboration with an ergonomist in Faurecia together with the software development service of the company to design the new version of their assessment tool. This tool will be first evaluated on a selection of manufacture sites and will then be spread worldwide among the 270 Faurecia sites in 33 countries.

This contract enabled us to hire Pierre Plantard as a PhD student to carry-out this work in MimeTIC and M2S Lab. He started in January 2013 and will finish in December 2015.

PANAMA 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: Joachim Thiemann, Nancy Bertin, Frédéric Bimbot.

>*Duration: 1.5 years (2012–2013).*
>
>*Research axis: 3.2.2*
>
>*Partner: Canon Research Centre France SAS*

This contract aims at transfering some of the research done within METISS/PANAMA to products developed by Canon Inc. Two patents were filed [50], [51]. Final internal report was delivered in October 2013.

7.1.2. *Contract with Studio MAIA*
Participants: Nancy Bertin, Frédéric Bimbot, Jules Espiau de Lamaestre, Jérémy Paret, Nathan Souviraà-Labastie.

>*Duration: 3 years (2012–2014).*
>
>*Research axis: 3.2.2*
>
>*Partners: Studio MAIA (Musiciens Artistes Interprètes Associés), Imaging Factory*

This contract aims at transfering some of the research done within PANAMA towards new services provided by MAIA Studio.

More specifically, the main objective is to adapt source separations algorithms and some other advanced signal processing techniques elaborated by PANAMA 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. A first version of PANAMA tools were integrated in the software developed by Imaging Factory and delivered to MAIA in December 2013.

7.2. Bilateral Grants with Industry

7.2.1. *CIFRE contract with Technicolor R&I France on Compressive Sensing for the manipulation of large multimedia databases*
Participants: Rémi Gribonval, Anthony Bourrier.

>*Duration: 3 years (2011-2014)*
>
>*Research axis: 3.1.2*
>
>*Partners: Technicolor R&I France, Inria-Rennes*
>
>*Funding: Technicolor R&I France, ANRT*

The objective of this thesis is to explore, both numerically and theoretically, the potential of compressive sensing for the manipulate of large (audiovisual) databases. A particular objective is to propose learning techniques that can work on strongly compressed versions of a large corpus of data while maintaining the ability to infer essential characteristics of the distribution of the items in the corpus.

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SIROCCO Project-Team

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7. Bilateral Contracts and Grants with Industry

7.1. Bilateral 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.
- Research axis : § 6.3.3 .
- 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 which is of very high resolution and characterized by low motion. Different methods for learning tree-structured dictionaries have been studied. The tree-structured dictionaries are 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. Adaptive tree-structures have been developed and the use of such dictionaries in HEVC-based intra coding has been investigated. First tests have also been carried out to known to which extent the learned dictionnaries can allow detecting the modulation transfer function (MTF) used to characterize the quality of electro-optical imaging systems on board remote sensing satellites.

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
- Research axis: 6.2.3
- 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. Single-image super-resolution algorithms have been developed, using different methods (neighbor embedding, local learning with regression), and dictionaries learned from external training images or learned on a multi-resolution pyramid constructed from the input low resolution image. These methods have been extended to video super-resolution, the dictionary being constructed from key frames.

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: Oceanograhic 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. In 2013, the obtained quality versus rate performances has been 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 : § 6.3.5 .
- Partners : Orange Labs, Inria-Rennes, UPC-Barcelona.
- Funding : Orange Labs.
- Period : Apr.2012-Mar.2015.

This contract with Orange labs. (started in April. 2012) concerns the PhD of Bihong Huang and aims at modelling the redundancy which remains in spatial and temporal prediction residues. The analysis carried out in the first year of the PhD has shown that this redundancy (hence the potential rate saving) is high. In 2013, different methods have been investigated to remove this redundancy, such as generalized lifting and different types of predictors. 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 (Prof. Philippe 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 : § 6.1.3 .
- Partners : Orange Labs, Inria-Rennes.
- Funding : Orange Labs.
- Period : Dec.2011-Nov.2014.

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 accuratly 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 High Dynamic Range (HDR) video compression
Participants: Mikael Le Pendu, Christine Guillemot.

- Title : Floating point high dynamic range (HDR) video compression
- Research axis : § 6.3.4 .
- Partners : Technicolor, Inria-Rennes.
- Funding : Technicolor, ANRT.
- Period : Dec.2012-Nov.2015.

High Dynamic Range (HDR) images contain more intensity levels than traditional image formats, leading to higher volumes of data. HDR images can represent more accurately the range of intensity levels found in real scenes, from direct sunlight to faint starlight. The goal of the thesis is to design a visually lossless compression algorithm for HDR floating-point imaging data. The first year of the thesis has been dedicated to the design of a quantization method converting the floating point data into a reduced bit depth representation, with minimal loss. The method leads to a bit rate saving of 50% compared to the existing Adaptive LogLuv transform.

7.2.4. CIFRE contract with Technicolor on sparse modelling of spatio-temporal scenes
Participants: Martin Alain, Christine Guillemot.

- Title : Spatio-temporal analysis and characterization of video scenes
- Research axis : § 6.1.4 .
- Partners : Technicolor, Inria-Rennes.
- Funding : Technicolor, ANRT.
- Period : Oct.2012-Sept.2015.

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 using models based on sparse and data dimensionality reduction techniques, as well as based on epitomes. The objective was then to use these models and methods in different image processing problems focusing in particular on video compression. While, 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 started in Oct. 2012 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 denoising and super-resolution.

7.2.5. 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 pre-analysis approaches.
- Research axis : § 6.3.5 .
- Partners : Thomson Video Networks, Univ. Rennes 1.
- Funding : Thomson Video Networks (TVN).
- Period : Nov.2012-Sept.2015.

This contract with TVN (started 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 thanks to a pre-analysis step. The pre-analysis is expected to provide useful estimates of local video characteristics which will then help selecting the prediction and transform partitions as well as a number of other parameters such as the quantization parameters or the prediction modes.

TEXMEX Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Grants with Industry

- CIFRE Ph. D. thesis of Ludivine Kuznik with Institut National de l'Audiovisuel
- CIFRE Ph. D. thesis of Bingqing Qu with Institut National de l'Audiovisuel
- CIFRE Ph. D. thesis of Mohamed-Haykel Boukadida with Orange Labs
- CIFRE Ph. D. thesis of Cédric Penet with Technicolor