Activity Report 2016

Section Contracts and Grants with Industry

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

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral contracts with industry

In this section, we describe the collaboration between ABS and MS Vision (http://msvision.eu/), and company based in the Netherlands. MSVision was created in 2004 and currently involves 20 employees; it is a worldwide leader in delivering tailored hardware solutions to the mass spectrometry community. As detailed below, the collaboration aims at strengthening the offer of the company on the algorithmic and software sides.

This collaboration is funded by the Instituts Carnots (http://www.instituts-carnot.eu/en).

7.1.1. *Context*

Protein complexes underlie most biological functions, so that studying such complexes in native conditions (intact molecular species taken in solution) is of paramount importance in biology and medicine. Unfortunately, the two leading experimental techniques to date, X ray crystallography and cryo electron microscopy, involve aggressive sample reparation (sample crystallization and sample freezing in amorphous ice, respectively) which may damage the structures and/or create artifacts. These experimental constraints legitimate the use of mass spectrometry (MS) to study biomolecules and their complexes under native conditions, using electrospray ionization (ESI), a soft ionization technique developed by John Fenn (Nobel prize in chemistry, 2002). MS actually delivers information on the masses of the molecular species studied, from which further information on the stoichiometry, topology and contacts between subunits can be inferred. Thanks to ESI, MS is expected to play a pivotal role in biology to unravel the structure of macromolecular complexes underlying all major biological processes, in medicine and biotechnology to understand the complex patterns of molecules involved in pathways, and also in biotechnologies for quality checks.

7.1.2. *Specific goals*

A mass spectrometer delivers a mass spectrum, i.e. an histogram representing the relative abundance of the ions (ionized proteins or protein complexes in our case), as a function of their mass-to-charge (m/z) ratio. Deconvoluting a mass spectrum means transforming it into a human readable mass histogram. Due to the nature of the ESI process (i.e. the inclusion of solvent and various other molecules) and the intrinsic variability of the studied biomolecules in native conditions, the interpretation of such spectra is delicate. Methods currently used are of heuristic nature, failing to satisfactorily handle the aforementioned difficulties. The goal of this collaboration is to develop optimal algorithms and the associated software to fill the critical gap of mass spectra deconvolution. The benefits for the analyst will be twofold, namely time savings, and the identification of previously undetected components. Upon making progress on the deconvolution problem, the collaboration will be expanded on the geometric and topological modeling of large macro-molecular assemblies, a topic to which ABS recently made significant contributions [2], [3].

ACUMES Project-Team (section vide)

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

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

A 3-year contract with ARTELIA Group: funding for the PhD thesis of M.P. Daou (CIFRE)

A 3-year contract named ALBATROS with Mercator-Ocean on the topic « Interaction océan, vagues, atmosphère à haute résolution ».

A 1-year contract with NOVELTIS on the thematic "Développement de démonstrateurs avec AGRIF": see 6.1

A 1-year contract with IFREMER on the thematic "Evolution de la librairie de raffinement de maillage en Fortran (AGRIF) : amélioration de la prise en compte du trait de côte et des frontiéres ouvertes en contexte paralléle MPI/OpenMP" : see 6.1

The Chair OQUAIDO – for "Optimisation et QUAntification d'Incertitudes pour les Données Onéreuses" in French – is the chair in applied mathematics held at Mines Saint-Étienne (France). It aims at gathering academical and technological partners to work on problems involving costly-to-evaluate numerical simulators for uncertainty quantification, optimization and inverse problems. This Chair, created in January 2016, is the continuation of the projects DICE and ReDICE which respectively covered the periods 2006-2009 and 2011-2015.

ALICE Project-Team (section vide)

ALPAGE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Contracts with Industry

Alpage has developed several collaborations with industrial partners. Apart from grants described in the next section and informal discussions, specific collaboration agreements have been set up with the following companies:

- Verbatim Analysis (license agreement, transfer agreement, "CIFRE" PhD (contract ended in Dec 2014), see section 5.20),

- Yseop ("CIFRE" PhD of Raphael Salmon started in 2012 about automatic text generation)

- Agence France-Presse (on-going discussions aimed at a renewal of a long-lasting collaborations, involving several joint projects and a CIFRE PhD)

ALPINES Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- Contract with Total, February 2015 - February 2018, that funds the PhD thesis of Hussam Al Daas on enlarged Krylov subspace methods for oil reservoir and seismic imaging applications. Supervisor L. Grigori.

- Contract with IFPen, February 2016 - February 2019, that funds the Phd thesis of Zakariae Jorti on adaptive preconditioners using a posteriori error estimators. Supervisor L. Grigori.

- Contract with IFPen, October 2016 - October 2019, that funds the Phd thesis of Julien Coulet on the virtual element method (VEM). Supervisor F. Nataf and V. Girault.

- Contract with MentorGraphics, March 2016, that funds the internship of T. Freiman on circuit simulations. Supervisor F. Nataf.

AMIB Project-Team (section vide)

ANGE Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

A contract has been made (120.000 euros) with SAUR, IAV (Institut d'Aménagement de la Vilaine) and Agence de l'eau Loire-Bretagne in collaboration with SciWorks Technologies. It deals with the modelling and the simulation of chlorides entry in the Vilaine reservoir.

The ANR project Hyflo-Eflu relies on a collaboration with the company "HydroTube Energie". It comprises the recruitment of a young engineer and regular meetings with industrial (Bordeaux) and academic partners (Nantes).

8.2. Bilateral Grants with Industry

P. Quémar's PhD thesis is funded by EDF ("thèse CIFRE"). His PhD is entitled "3D numerical simulations of environmental hydrolics: application to Telemac".

ANJA Team (section vide)

ANTIQUE Project-Team (section vide)

AOSTE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

Airbus CIFRE grant   This contract, started on March 2014, provides full support for the PhD thesis of Cristian Maxim. The thesis concerns the statistical timing analysis while different variability factors are taken into account. The proposed methods are built on top of existing statistical approaches while proving appropriate programs for training these methods and thus learning from the history of the execution.

6. Bilateral Contracts and Grants with Industry

6.1. Contract CNES-Inria-XLIM

This contract (reference Inria: 7066, CNES: 127 197/00) involving CNES, XLIM and Inria, focuses on the development of synthesis algorithms for N-ports microwave devices. The objective is to derive analytical procedures for the design of multiplexers and routers, as opposed to "black box optimization" which is usually employed in this field (for $N \geq 3$). Emphasis at the moment bears on so-called "star-topologies".

6.2. Contract CNES-Inria-UPV/EHU

This contract (reference CNES: RS14/TG-0001-019) involving CNES, University of Bilbao (UPV/EHU) and Inria aims at setting up a methodology for testing the stability of amplifying devices. The work at Inria is concerned with the design of frequency optimization techniques to identify the unstable part of the linearized response and analyze the linear periodic components.

6.3. Contract BESA GmbH-Inria

This is a research agreement between Inria (Apics and Athena teams) and the German company BESA [0], which deals with head conductivity estimation and co-advising of the doctoral work of C. Papageorgakis, see Section 5.1.5 . BESA is funding half of the corresponding research grant, the other half is supported by Region PACA (BDO), see Section 1 .

6.4. Flextronics

Flextronics, active in the manufacturing of communication devices all over the world, bought two sets of licenses for Presto-HF and Dedale-HF. Deployment of our tools in their production facilities for wireless communication units is being studied.

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[0]http://www.besa.de/

ARAMIS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. *Air-Liquide Medical Systems*

Participants: Mario Chavez [Correspondant], Xavier Navarro.

Project title: Real-time characterisation of respiratory states from EEG

Funded in 2014

Amount: 370 K€

Coordinator: Thomas Similowski

Other partners: UPMC, Inserm UMR 1158

Abstract: The project aims at developing a real-time brain computer interface (BCI) for the monitoring of respiratory states from scalp EEG data of healthy volunteers and patients, recorded at the laboratory, hospital ward, operating room or intensive care units..

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

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

Bosch (Germany) ordered us some support for implementing complex numerical algorithms.

7.2. Bilateral Grants with Industry

- Marie Paindavoine is supported by an Orange Labs PhD Grant (from October 2013 to November 2016). She works on privacy-preserving encryption mechanisms.

- Miruna Rosca and Radu Titiu are employees of BitDefender. Their research internships (from October to December 2016) are supervised by Damien Stehlé and Benoît Libert, respectively. Miruna Rosca works on the foundations of lattice-based cryptography, and Radu Titiu works on functional encryption.

- Within the program Nano 2017, we collaborate with the Compilation Expertise Center of STMicro-electronics on the theme of floating-point arithmetic for embedded processors.

AROMATH Project-Team (section vide)

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

7. Bilateral Contracts and Grants with Industry

7.1. Contract with Technicolor

Participants: Fabien Andre, Anne-Marie Kermarrec.

We had a contract with Technicolor for collaboration on large-scale infrastructure for recommendation systems. In this context, Anne-Marie Kermarrec was the PhD advisor of Fabien Andre until Nov 2016. In his Phd, Fabien Andre worked on efficient algorithms for heterogeneous data on large-scale platforms.

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

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. CIFRE PhD Fellowships

7.1.1.1. Neurelec/Oticon Medical

Participants: Thomas Demarcy [correspondent], Hervé Delingette, Nicholas Ayache, Dan Gnansia [Oticon Medical].

The work of Thomas Demarcy, *Segmentation and anatomic variability of the cochlea and other temporal bone structures from medical images*, is supported by a PhD fellowship from the Neurelec/Oticon Medical company.

7.1.2. Inria - Mauna Kea Technologies I-Lab SIWA

Participants: Nicholas Ayache [correspondent], Xavier Pennec, Marzieh Kohandani Tafreshi, Rémi Cuingnet.

This I-lab involves the Mauna Kea Technologies company.

The first focus of this I-lab is to develop efficient and friendly content-based image retrieval (CBIR) tools to help users make a diagnosis. The second focus is on image registration to provide near real-time and robust image registration tools built on GPU implementations for image stabilization and super-resolution since it is a critical method for the smart atlas.

For more information, see this link[0]. The I-lab SIWA ended in March 2016.

7.1.3. Microsoft Research

Microsoft Research is funding through the Inria-Microsoft joint lab the projects "4D Cardiac MR Images"[0] and "Medilearn"[0] which aim at analyzing large databases of cardiac images to help the diagnosis of cardiac diseases and planning of therapy. This project involves A. Crimisi from MSR and partially funds the PhDs of Loic Le Folgoc, Pawel Mlynarski as well as the post doctoral stay of Hervé Lombaert.

7.1.4. Spin-off company Therapixel

Therapixel[0] is a spin-off of the Asclepios (Inria Sophia Antipolis) and Parietal (Inria Saclay) project teams founded in 2013. Therapixel makes surgical information systems. It relies on depth sensing, advanced software processing and innovative user interfaces to provide touchless control of the computer. This technology allows for a direct control of the computer, which sterility constraints made impractical in the past. In 2015, Therapixel obtained the CE marking of its product on touchless visualization of medical images.

7.1.5. Siemens HealthCare

Siemens Healthcare, Medical Imaging Technologies, Princeton, NJ (U.S.A). is funding the Phd work of Julian Krebs which aims at developping robust medical image registration methods

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[0]https://lisa.sophia.inria.fr/siwa-loasis-numerique-dinria-et-de-mauna-kea-706.html
[0]http://www.msr-inria.fr/projects/4d-cardiac-mr-images
[0]http://www.msr-inria.fr/projects/medilearn
[0]http://www.therapixel.com/

8. Bilateral Contracts and Grants with Industry

8.1. Cooperation with SIGMA group

Participants: Thomas Ledoux [correspondent], Simon Dupont.

In 2012, we have started a 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 rapidly growing in number and size and have to urgently face with energy consumption issues. 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 2016, Simon Dupont defended his PhD on "Cross-layer elasticity management for Cloud: towards an efficient usage of Cloud resources and services" [12]. Besides, we focused on ElaScript, a domain-specific language that offers Cloud administrators a simple and concise way to define complex elasticity-based reconfiguration plans [23].

ASPI Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral grants with industry

See 4.1 .

7.1.1. Hybrid indoor navigation — PhD project at CEA LETI
Participants: François Le Gland, Kersane Zoubert–Ousseni.

This is a collaboration with Christophe Villien (CEA LETI, Grenoble).

The issue here is user localization, and more generally localization–based services (LBS). This problem is addressed by GPS for outdoor applications, but no such general solution has been provided so far for indoor applications. The desired solution should rely on sensors that are already available on smartphones and other tablet computers. Inertial solutions that use MEMS (microelectromechanical system, such as accelerometer, magnetometer, gyroscope and barometer) are already studied at CEA. An increase in performance should be possible, provided these data are combined with other available data: map of the building, WiFi signal, modeling of perturbations of the magnetic field, etc. To be successful, advanced data fusion techniques should be used, such as particle filtering and the like, to take into account displacement constraints due to walls in the building, to manage several possible trajectories, and to deal with rather heterogeneous information (map, radio signals, sensor signals).

The main objective of this thesis is to design and tune localization algorithms that will be tested on platforms already available at CEA. Special attention is paid to particle smoothing and particle MCMC algorithms, to exploit some very precise information available at special time instants, e.g. when the user is clearly localized near a landmark point.

In some applications, real time estimation of the trajectory is not needed, and a post processing framework may provide a better estimation of this trajectory. In [23], we present and compare three different algorithms to improve a real time trajectory estimation. Actually, two different smoothing algorithms and the Viterbi algorithm are implemented and evaluated. These methods improve the regularity of the estimated trajectory by reducing switches between hypotheses.

7.1.2. Bayesian tracking from raw data — CIFRE grant with DCNS Nantes
Participants: François Le Gland, Audrey Cuillery.

This is a collaboration with Dann Laneuville (DCNS Nantes).

After the introduction of MHT (multi–hypothesis tracking) techniques in the nineties, multitarget tracking has recently seen promising developpments with the introduction of new algorithms such as the PHD (probability hypothesis density) filter [55], [62] or the HISP (hypothesised filter for independent stochastic populations) filter [47]. These techniques provide a unified multitarget model in a Bayesian framework [59], which makes it possible to design recursive estimators of a *multitarget probability density*. Two main approaches can be used here: sequential Monte Carlo (SMC, also kown as particle filtering), and Gaussian mixture (GM). A third approach, based on discretizing the state–space in a possibly adaptive way, could also be considered despite its larger computational load. These methods are well studied and provide quite good results for *contact output* data, which correspond to regularly spaced measurements of targets with a large SNR (signal–to–noise ratio). Here, the data is processed (compared with a detection threshold) in each resolution cell of the sensor, so as to provide a list of detections at a given time instant. Among these methods, the HISP filter has the best performance/computational cost ratio.

However, these classical methods are unefficient for targets with a low SNR, e.g. targets in far range or small targets with a small detection probability. For such targets, preprocessing (thresholding) the data is not a good idea, and a much better idea is to feed a tracking algorithm with the raw *sensor output* data directly. These new methods [30] require a precise modeling of the sensor physics and a direct access to the radar (or the sonar) raw data, i.e. to the signal intensity level in each azimuth/range cell. Note that these new methods seem well suited to new types of sensors such as lidar, since manufacturers do not integrate a detection module and do provide raw images of the signal intensity level in each azimuth/range cell.

The objective of the thesis is to study and design a tracking algorithm using raw data, and to implement it on radar (or sonar, or lidar) real data.

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

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

- The Olea Medical company from La Ciotat (FR) funds 50% of the PhD of Marco Pizzolato, supervised by Rachid Deriche, which is funded by the PACA Region for the remaining 50%.

- The dMRI Library has been transfered to the Olea Medical company.

- The BESA company (Brain Electrical Source Analysis) from Germany funds 50% of the PhD of Christos Papageorgakis, co-supervised by Maureen Clerc (Athena) and Juliette Leblond (Apics), which is funded by the PACA Region for the remaining 50%.

- The Neurelec company (Cochlear Implants) has obtained a CIFRE PhD funding for Kai Dang, supervised by Maureen Clerc.

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

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Grants with Industry

7.1.1. *NewGeneration-SR*

We have a collaboration with the company NewGeneration-SR (http://newgeneration-sr.com/). The aim of this company is to reduce the energy impact through solutions at each layer of the energy consumption (from datacenter design and the production to usage). NewGeneration-SR improves the life cycle (design, production, recycling) in order to reduce the environmental impact of it. NewGeneration-SR was member of the Nu@ge consortium: one of five national Cloud Computing projects with "emprunts d'avenir" funding. With a CIFRE PhD student (Daniel Balouek-Thomert), we are developing models to reduce the energy consumption for the benefit of data-center.

7.1.2. *IFPEN*

We also have a collaboration with IFPEN (http://ifpenergiesnouvelles.com/). IFPEN develops numerical codes to solve PDE with specific adaption of the preconditioning step to fit the requirement of their problems. With a PhD student (Adrien Roussel) we are studying the parallel implementation of multi-level decomposition domains on many-core architecture and GPGPU.

AVIZ Project-Team   (section vide)

AYIN Team (section vide)

BEAGLE Project-Team (section vide)

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

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Bilateral Contracts with Industry

8.1.1.1. Transgene 1. (2016-2017)

> Participants: A. Gégout-Petit, A. Muller-Gueudin, Y. Shi
>
> Transgene (Euronext: TNG), part of Institut Mérieux, is a publicly traded French biopharmaceutical company focused on discovering and developing targeted immunotherapies for the treatment of cancer and infectious diseases. B. Bastien, head of the biostatistics team appeals to BIGS to select covariates among genomics, proteomics expressions linked to the success of a treatment of the lung cancer. This subject was the purpose of the master thesis of Y. Shi and a paper on the subject is in preparation.

8.1.1.2. Transgene 2. (2016-2017)

> Participants: T. Bastogne, L. Batista, P. Vallois
>
> Transgene (Euronext: TNG), part of Institut Mérieux, is a publicly traded French biopharmaceutical company focused on discovering and developing targeted immunotherapies for the treatment of cancer and infectious diseases. B. Bastien, head of the biostatistics team appeals to BIGS to model data collected in vivo for growth tumor and to measure the effect of the treatment on the dynamics of the tumor.

8.1.1.3. SAFRAN Aircraft Engines (2016-2019)

> Participants: R. Azaïs, A. Gégout-Petit, F. Greciet
>
> SAFRAN Aircraft Engines designs and products Aircraft Engines. For the design of pieces, they have to understand mechanism of crack propagation under different conditions. It appeals to BIGS for modeling crack propagation with Piecewise Deterministic Markov Processes (PDMP). It is the subject of F. Greciet PhD, granted by ANRT. F. Greciet presented her work during a Fédération Charles Hermite Journey on November the 23th. She was laureat of "Mathématiques, oxygene du monde numérique" poster challenge [33].

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

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

BioEnTech: the collaboration with the BioEnTech start-up is aiming at developing new functionalities for ODIN in order to improve the advanced monitoring and control of industrial anaerobic digesters.

Inalve: with the Inalve start-up we develop a breakthrough process that we patented, in which microalgae grow within a moving biofilm. The objective of the collaboration is to optimize the process by enhancing productivity, while reducing environmental footprint.

BIOVISION Team (section vide)

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- CIFRE PhD thesis (N. Akhadkar) with Schneider Electric.

BONSAI Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

The PhD thesis of Léa Siegwald is funded by a CIFRE contract with the biotechnology company Gènes Diffusion.

CAGIRE Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- Collaborative research contract with EDF (UPPA): "Nouveau modèle de turbulence Haut-Bas Reynolds avec prise en compte de la thermique active ou passive. (New high-low Reynolds number turbulence model accounting for active or passive heat transfer)" associated with the PhD thesis of J.-F. Wald.
- Collaboration contract "OpenLab Fluidics" with PSA (CNRS-UPPA): "Simulation numérique d'écoulements de convection naturelle typique des situations rencontrées dans l'espace sous-capot des véhicules automobiles".

8.2. Bilateral Grants with Industry

- PhD grant (CIFRE) of J.-F. Wald, EDF, defended in May 2016.
- Internship grant of S. Jameel, PSA, defended in September 2016.

CAIRN Project-Team (section vide)

CAMIN Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

FUI MMCD (Multifunctions Modular Cockpit Display) [2014-2017] Labels : Pegase, ASTech
The MMCD project (Multi Functions Modular Cockpit Display) aims at designing a mechatronic architecture that is modular, certifiable and evolutive in terms of embedded GPU. This project will contribue to Avionics 2020 by developing a mock-up of new cockpit display system, allowing easy to manage GPU evolution.
Our contribution concerns formal design and prototyping of embedded supervisory functions, using the HILECOP methodology and tool.

8.2. Bilateral Grants with Industry

CIFRE phd financial support with Axonic (PhD grant), Wafa Tigra, 2013-2016, restoration of grasping using FES and selective stimulation

8. Bilateral Contracts and Grants with Industry

8.1. Caldera

Vincent Loechner and Cédric Bastoul are involved in a collaboration with the French company Caldera (http://www.caldera.com), specialized in software development for wide image processing. The goal of this collaboration is the development of parallel and scalable image processing pipeline for industrial printing. The project started in September 2016 and involves a contract established between the ICube laboratory and the Caldera company. This contract includes the funding of the industrial thesis (CIFRE) of Paul Godard (started in September 2016) on the topic of the collaboration, under the supervision of Vincent Loechner and Cédric Bastoul.

8.2. NANO 2017/PSAIC

The CAMUS team is taking part of the NANO 2017 national research program and its sub-project PSAIC (Performance and Size Auto-tuning thru Iterative Compilation) with the company STMicroelectronics, starting January 2015. Since the release of our automatic speculative parallelization framework Apollo, we have been working on an extension making Apollo usable as a advanced program profiling tool. We are also currently working in extending advanced loop optimization techniques to nonlinear loops using a linear virtual data layout remapping.

CAPSID Project-Team (section vide)

8. Bilateral Contracts and Grants with Industry

8.1. Training and Consulting with HTCS

The training and consulting activities begun in 2012 with the HTCS company have been pursued, and the existing contract has been renewed in identical form.

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

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

Several contracts have been realized:

- SAFRAN-HERAKLES, 20Keuros for the development of a code for computing low-probability.
- CNES, 10 KEuros, for the technological transfer of Sparse-PDD code.
- CEA 2015 10237, 60 Keuro for the supervision of the post-doc of Maxence Clayes by P.M. Congedo
- CEA 16-CIFRE PELUCHON, 20 Keuro for the supervision by L. Mieussens of the PhD of Simon Peluchon at the CEA-CESTA (1/1/15 - 31/12/17)
- BGS IT&E (2016-2018), 20 Keuro for a consulting by M. Ricchiuto on the implantation of some of the technology in the code SLOWS in their in-house model.

CARMEN Project-Team (section vide)

CARTE Team (section vide)

CASCADE Project-Team (section vide)

CASTOR Project-Team (section vide)

CEDAR Team (section vide)

CELTIQUE Project-Team (section vide)

<div align="center">

CHROMA Team

</div>

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. *Toyota Motors Europe*

[2006 - 2017]

The contract with Toyota Motors Europe is a joint collaboration involving Toyota Motors Europe, Inria and ProBayes. It follows a first successful short term collaboration with Toyota in 2005.

This contract aims at developing innovative technologies in the context of automotive safety. The idea is to improve road safety in driving situations by equipping vehicles with the technology to model on the fly the dynamic environment, to sense and identify potentially dangerous traffic participants or road obstacles, and to evaluate the collision risk. The sensing is performed using sensors commonly used in automotive applications such as cameras and lidar.

This collaboration has been extended for 4 years and Toyota provides us with an experimental vehicle Lexus equipped with various sensing and control capabilities. Several additional connected technical contracts have been signed also.

8.1.2. *Renault*

[2010 - 2017]

This contract was linked to the PhD Thesis of Stephanie Lefèvre. The objective is to develop technologies for collaborative driving as part of a Driving Assistance Systems for improving car safety. Both vehicle perception and communications are considered in the scope of this study. An additional short-term contract (3 months) has also been signed in november 2012.

8.1.3. *IRT-Nano Perfect (2012-2014, and 2015-2017)*

Perfect is a project supported by ANR in the scope of the IRT (Technological Research Institute) Nano-electronic driven by the CEA (Nuclear Energy Agency). The partners of the project are the CEA-LETI LIALP laboratory, ST-Microelectronics and Inria. The goal of this project is to propose integrated solutions for "Embeeded Bayesian Perception for dynamic environments" and to develop integrated open platforms. During the first phase of the project (2012-2014), the focus is on the domain of transportation (both vehicle and infrastructure); health and smart home sectors will also be considered in the second phase (2015-2017).

8.2. Bilateral Grants with Industry

8.2.1. *INSA-VOLVO Chair PhD grant*

[Oct 2016 - Oct 2019]

This grant is linked to the PhD Thesis of Guillaume Bono, funded by the INSA-VOLVO Chair. The objective is to deal with Global-local Optimization Under Uncertainty for Goods Distribution Using a Fleet of Autonomous Vehicles.

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

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- **HP (2013-2016): Embedded Systems Security**

  We aim at researching and prototyping low-level intrusion detection mechanisms in embedded system software. This involves mechanisms in continuation of previous work realized by our team as well as investigating new techniques more directly tied to specific HP device architectures. Our main objective is to monitor low-level software (firmware, OS kernels, hypervisors) thanks to a dedicated external co-processor. Being under NDA, details about this research program cannot be provided.

8.2. Bilateral Grants with Industry

- **Orange Labs: Privacy-preserving location-based services**

  Solenn Brunet has started her PhD thesis in September 2014 within the context of a CIFRE contract with Orange Labs Caen. Her PhD subject concerns the development of privacy-preserving location-based services that are able to personalize the service provided to the user according to his current position while preserving his location privacy. In particular, Solenn Brunet adapts existing cryptographic primitives (private information retrieval, secure multiparty computation, secure set intersection, ...) or design novel ones to use them as building blocks for the construction of these privacy-preserving location-based services.

- **DGA: BGP-like Inter Domain routing protocol for tactical mobile ad hoc networks: feasibility, performances and quality of service**

  Florian Grandhomme has started his PhD thesis in October 2014 in cooperation with DGA-MI. The subject of the PhD is to propose new secure and efficient algorithms and protocols to provide inter-domain routing in the context of tactical mobile ad hoc network. The protocol proposed will have to handle context modification due to the mobility of MANET, that is to say split of a MANET, merge of two or more MANET, and also handle heterogeneity of technology and infrastructure. The solution will have to be independent from the underlying intra-domain routing protocol and from the infrastructure: wired or wireles, fixed or mobile.

- **DGA: Visualization for security events monitoring**

  Damien Crémilleux has started his PhD thesis in October 2015 in the context of a cooperation with DGA-MI. The subject of the PhD is to define relevant representations to allow front-line security operators to monitors systems from a security perspective. A first proposal was made that led to a tool, VEGAS, that allows to monitor large quantities of alerts in real time and to dispatch these alerts in a relevant way to security analysts.

- **DGA: Intrusion Detection in Distributed Applications**

  David Lanoé has started his PhD thesis in October 2016 in the context of a cooperation with DGA-MI. His work will focus on the construction of behavioral models (during a learning phase) and their use to detect intrusions during an execution of the modelled distributed application.

- **Nokia: Risk-aware security policies adaptation in modern communication infrastructures**

  Pernelle Mensah was hired in January 2016 on this CIFRE funding in order to work on unexplored aspects of information security, and in particular response strategies to complex attacks, in the context of cloud computing architectures. The use case proposed by our industrial partner is a multi-tenant cloud computing platform involving software-defined networking in order to provide further flexibility and responsiveness in architecture management. The topic of the thesis is to adapt and

improve the current risk-aware reactive response tools, based on attack graphs and adaptive security policies, to this specific environment, taking into account the heterogeneity of actors, platforms, policies and remediation options.

- **B-Com: Privacy Protection for JPEG Content on Image-Sharing Platforms**

  Kun He was hired as a PhD in September 2013 by the IRT B-Com. The subject of the PhD was the protection of users' privacy while publishing images on image-sharing platforms. The proposed solution is an image encryption algorithm that preserve the image format after encryption, and the experimentation have shown that the proposed encryption algorithm can be used on several widely used image-sharing platforms such as Flickr, Pinterest, Google+, Facebook and Twitter.

- **Thalès: Privacy and Secure Multi-party Computation**

  Aurélien Dupin has started his PhD thesis in January 2016 within the context of a CIFRE contract with Thalès. His PhD subject concerns the development of privacy-preserving location-based services based on secure multi-party computation. As part of his Master of Science from the ETS (Ecole de Technologie Supérieure) in Montreal, co-supervised by Prof. Jean-Marc ROBERT (ETS) and Prof. Christophe BIDAN (CentraleSupélec), Mr Aurélien DUPIN has already addressed the issue and proposed multi-party computation protocols to provide evidence of geolocations while ensuring the secrecy of the geographical location of participants protocols. The thesis is an opportunity to continue the work initiated during the Master of Science.

- **Thalès: Combining Attack Specification and Dynamic Learning from traces for correlation rule generation**

  Charles Xosanavongsa has started his PhD thesis in December 2016 in the context of a CIFRE with Thales. His work will focus on the construction of correlation rules. In previous work on correlation rule generation, the usual approach is static. It always relies on the description of the supervised system using a knowledge base of the system. The use of correlation trees is an appealing solution because it allows to have a precise description of the attacks and can handle any kind of IDS. But in practice, the behavior of each IDS is quite difficult to predict, in particular for anomaly based IDS. To manage automatically the correlation rules (and adapt them if necessary), we plan to analyze synthetic traces containing both anomaly based and misused based IDS alerts resulting from an attack.

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

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

A new Iilab, Rain_Water, has been accepted in 2016. It concerns joint research with the company Weather Measures. Rain_Water aims to define a platform of local meteorology. Users are mainly farmers that will use the platform for monitoring the agricultural practices at the parcel level.

<p align="center">COAST Project-Team</p>

6. Bilateral Contracts and Grants with Industry

6.1. Bilateral Contracts with Industry

6.1.1. Industrial funding Groupe Open (2016–2019)

Groupe Open is a leading french company specialised in digital services and operations. The goal of the project is to propose an industrial composition model for APIs that takes into account the new constraints imposed by this new way to distribute and operate software. It will be based on a formal API contract along with trust and reputation attributes in order to allow consumers to anticipate risks regarding the quality and the safety of services. A PhD student is under recruitment for this project. Coast funding : 237,000 €

6.2. Bilateral Grants with Industry

6.2.1. CIFRE Grant with Bonitasoft

Participants: François Charoy, Samir Youcef, Guillaume Rosinosky.

Bonitasoft is a leading software company in the domain of open source Business Process Management Systems. The objective of this grant is to help Bonitasoft to support effective elastic BPM operation in the Cloud by leveraging the business knowledge, the process models and the execution history of process instances and correlate them with cloud resource consumption. Guillaume Rosinosky has been recruited as a PhD Student to work on this project. We will define models that will be validated based on a detailed analysis of existing use cases that we have started to collect from Bonitasoft and its clients.

COATI Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

8.1.1. Allocation Carnot Inria / Instant System

Participants: David Coudert, Idriss Hassine.

The Instant System startup company develop a platform in the area of Intelligent transportation systems (ITS). The partnership with COATI aims at designing algorithms for itinerary planning in multimodal transportation networks. The main objective is to combine public transport system and dynamic car-pooling.

COFFEE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Grants with Industry

The project has industrial collaborations with Total, GDFSuez EP and Storengy on oil and gas recovery and gas storage.

The collaboration with Andra is concerned with the modelling and the simulation of mass and heat exchanges between porous media and ventilation channels. It leads to consider porous medium equations and hydrodynamic systems, coupled through intricate boundary conditions. Clearly one of the difficulties relies on the multiphase nature of the flows (at least water and air are present). We identify relevant physical scales, typical of the flows under consideration in nuclear waste engineering. We start by dealing with quite simple geometries, in order to discuss properly the order of magnitude of the different phenomena, and to design suitable schemes.

COFFEE has also a collaboration with BRGM, funded through the program "Carnot Institutes", devoted to the setting of a parallel computing platform for the simulation of geothermal reservoirs. We aim at contributing to the design of a new generation of parallel tools of simulations, addressing the stiffness issues of actual reservoirs, a large variety of mesh geometries, able to handle faulted media.

A large part of these works is based on the development of the software COMPASS.

COMETE Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Contract with Renault

Project title: Protection techniques for location data

Duration: July 2016 - December 2016

Budget: 38K euros, financed by Renault

Coordinator: Catuscia Palamidessi, Inria Saclay, EPI Comète

Abstract: The goal of this project is to produce a survey of the state of the art methods for protecting location data, as well as a prototype showing the application of some of these methods in the context of a "connected car".

Stage: A six month intern (Anna Pazii) was funded by this project.

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

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Ifpen

In the framework of the PhD thesis of Arthur Le Rhun, we study the energy management of hybrid (parallel) vehicles, and more specifically the optimal use of the thermal engine. Before the PhD, a 4-month internship was focused on the eco-routing problem for hybrid vehicles, ie computing the optimal path. We proposed a method based on graphs: the road network is defined by a graph, and to take into account the hybrid aspect of the vehicle, we dicretized the State of Charge on each node. Then a simple shortest path algorithm (A*) applied to this extended graph is able to solve the routing problem. Numerical simulations indicate that the solution of our discrete eco-routing problem converges to the correct solution when a sufficiently fine discretization of SoC is used. We illustrate the method on the Ille-et-Vilaine department, see Fig. 1 and Table 1 . The main disadvantage of the method is the increasingly large computation time when the size of the extended graph grows.
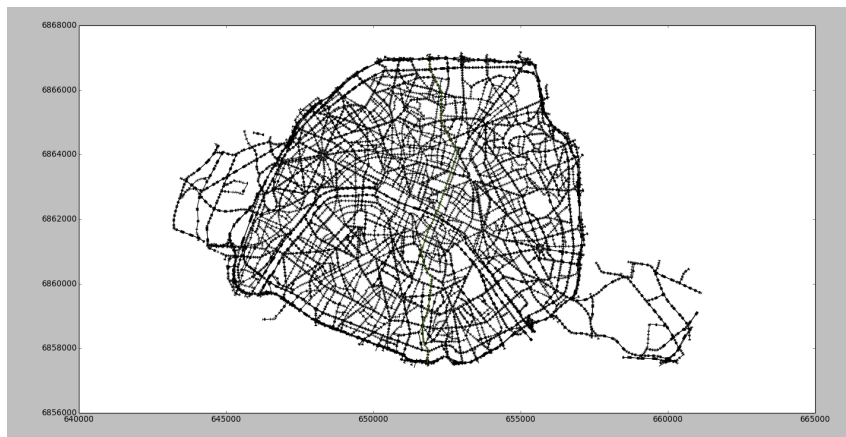
Figure 1.

Table 1. Results on the Ille-et-Vilaine department over 100 simulations

SoC disc.	improved cases	Fuel savings	CPU time (s)
3	19%	0.9753	6.03
5	65%	0.8531	14.64
10	88%	0.5831	52.80
20	88%	0.4222	283.43

8.1.2. Safety Line

In the framework of an Ilab with Safety Line (a startup in aeronautics), we design tools for the optimization of fuel consumption for civil planes. A first part is devoted to the identification of the aerodynamic and thrust characteristics of the plane, using recorded data from hundreds of flights. Fig. 2 shows the drag and lift coefficients for a Boeing 737, as functions of Mach and angle of attack. A second part is optimizing the fuel consumption during the climb and cruise phases. Fig. 3 shows a simulated climb phase, along with recorded data from the actual flight. This collaboration relies significantly on the toolboxes BOCOP and BOCOPHJB developed by Commands since 2010.
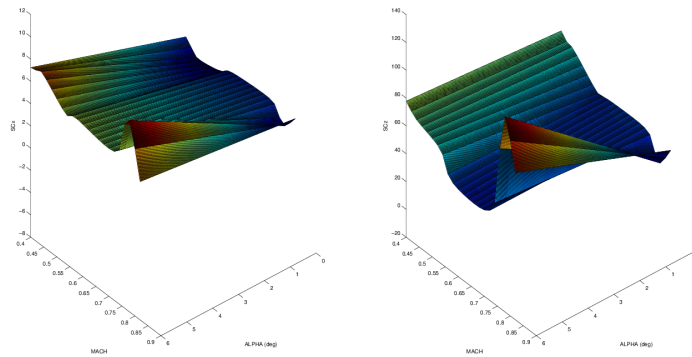
Figure 2.
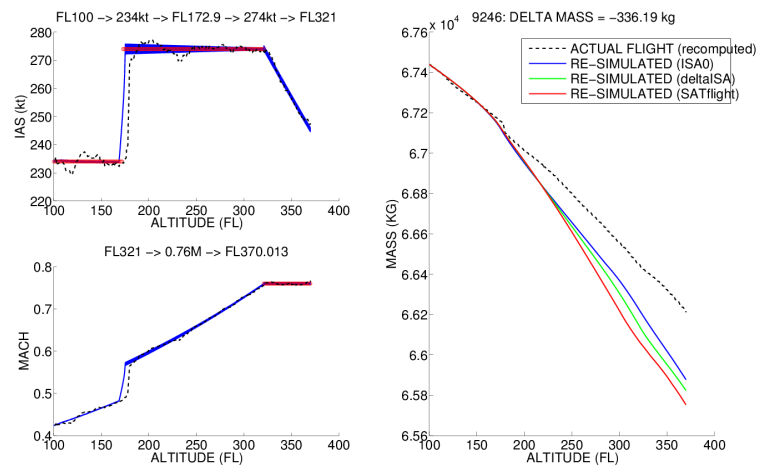
Figure 3.

COMPSYS Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

Since the team was going to be stopped, Compsys did not try to establish any long-term contract with industry.

8.2. Bilateral Grants with Industry

Same situation.

CONVECS Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Grants with Industry

Participants: Umar Ozeer, Gwen Salaün.

Umar Ozeer is supported by a PhD grant (from November 2016 to November 2019) from Orange Labs (Grenoble) on detecting and repairing failures of data-centric applications distributed in the cloud and the Internet of Things (see § 6.5.1), under the supervision of Xavier Etchevers (Orange Labs), Gwen Salaün (CONVECS), François Gaël Ottogalli (Orange Labs), and Jean-Marc Vincent (POLARIS project-team).

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

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Grants with Industry

- PSAIC Nano2017 is a bilateral Grant with STMicroelectronics. CORSE is involved in the development of trace analysis and hybrid compilation.
- DEMA Nano2017 is a bilateral Grant with STMicroelectronics. CORSE is involved in the development of debugging of multithreaded applications.

7.2. CIFRE contracts

- CORSE is involved in a contract with Kalray associated with the CIFRE PhD of Duco van Amstel who defended in Spring 2016. The subject of the collaboration is related to fine grain scheduling.
- CORSE is involved in a contract with Aselta for the CIFRE thesis of Nassim Halli. Nassim Halli was advised by Henri-Pierre Charles (CEA LIST, Grenoble and Jean-François Méhaut. The subject of this thesis is the code optimization of Java Applications. The thesis was defended in October 2016.
- CORSE is also involved in a contract with STMicroelectronics for the CIFRE thesis of Oleg Iegorov. The subject of this thesis is a Data Mining Approach to Temporal Debugging of Embedded Streaming Applications. Oleg Iegorov was advised by the SLIDE LIG team and the CORSE Inria team. The thesis was defended in April 2016.

CQFD Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. *Airbus*

Participants: Benoîte de Saporta, François Dufour, Christophe Nivot.

We are interested in the optimization of a launcher integration process. It comprises several steps from the production of the subassemblies to the final launch. The four subassemblies go through various types of operations such as preparation, integration, control and storage. These operations are split up into three workshops. Due to possible breakdowns or staff issues, the time spent in each workshop is supposed random. So is the time needed to deliver the subassemblies, for similar reasons including e.g. shipping delays. We also have to deal with constraints related to the architecture of the assembly process itself. Indeed, we have to take into account waiting policies between workshops. The workshops may work in parallel but can be blocked if their output is not transferred to the next workshop in line. Storage capacity of output products is limited.

Our goal is finding the best rates of delivery of the subassemblies, the best choice of architecture (regarding stock capacities) and the best times when to stop and restart the workshops to be able to carry out twelve launches a year according to a predetermined schedule at minimal cost. To solve this problem, we choose a mathematical model particularly suitable for optimization with randomness: Markov decision processes (MDPs).

We have implemented a numerical simulator of the process based on the MDP model. It provides the fullest information possible on the process at any time. The simulator has first been validated with deterministic histories. Random histories have then been run with exponentially distributed delivery times for the subassemblies and several families of random laws for the time spent in each workshop. Using Monte Carlo simulations, we obtain the distribution of the launch times. Preliminary optimization results allow choosing stock capacities and delivery rates that satisfy the launch schedule.

In this context, the PhD Thesis of Christophe Nivot (2013-2016) is funded by Chaire Inria-Astrium-EADS IW-Conseil régional d'Aquitaine.

8.1.2. *Thales Optronique*

Participants: Benoîte de Saporta, François Dufour, Alizée Geeraert.

Integrated maintenance, failure intensity, optimisation.

As part of optimizing the reliability, Thales Optronics includes systems that examine the state of their equipment. This function is performed by HUMS (Health Unit Monitoring Systems). The collaboration is the subject of the PhD of Alize Geeraert (CIFRE). The aim of this thesis is to implement in the HUMS a program based on observations that can determine the state of the system, optimize maintenance operations and evaluate the failure risk of a mission.

8.1.3. *DCNS*

Participants: Huilong Zhang, Jonatha Anselmi, François Dufour, Dann Laneuville.

This contract is with DCNS, a French industrial group specialized in naval defense and energy. In particular, DCNS designs and builds submarines and surface combatants, develops associated systems and infrastructure, and offers a full range of services to naval bases and shipyards, together with a focus into marine renewable energy. The main objective is to have robust algorithms able to build an accurate picture of the objects that are around a submarine by only using "passive sonar" information. This means that no information is transmitted by the submarine, which just listens to acustic waves coming in, to the target. We estimate the position and the velocity of moving targets through noisy observations and a Kalman-type filter. Estimates become accurate depending on the type and the number of maneuvers done by the submarine. Our goal is to combine the filter that is currently used in DCNS with a Markov decision process. This provides a systematic framework to compute the best sequence of submarine maneuvers that allows the system to determine, as soon as possible, accurate target position and velocity. The current technological transfer to DCNS stands in a stochastic optimization framework developed in Matlab that operates under the hypothesis that the target follows a uniform linear motion with constant velocity or zero acceleration. The case where targets move in a more complex manner gives concrete perspectives for further transfers to DCNS.

<div align="center">**CTRL-A Team**</div>

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

Our cooperation with CEA LETI/LIST DACLE at Grenoble Minatec is bilateral, involving the CEA PhD grant of Adja Sylla, to work with F. Pacull and M. Louvel on high-level programming on top of a rule-based middleware.

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

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

The CIFRE scholarship of David Montoya started in 2014, with Sinovia, Cofely Ineo (group GDF Suez). The topic is on analysis of multimodal itineraries and the integration of itinerary data with other personal data.

DANTE Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. *GranDATA*

Participants: Márton Karsai [correspondant], Éric Fleury.

Founded in 2012, Grandata is a Palo Alto-based company that leverages advanced research in Human Dynamics (the application of âbig dataâ to social relationships and human behaviour) to identify market trends and predict customer actions. Leading telecom and financial services firms are using Grandataâs Social Universe product to transform âbig dataâ into impressive business results.

The DANTE team and Grandata started to collaborate in 2014 on the analysis of large datasets provided by the company. The aim of the collaboration is to gain better understanding about the dynamical patterns of human interactions, mobility, and the socio-economic structure of the society.

8.1.2. *STACC, Skype/Microsoft Labs*

Participant: Márton Karsai [correspondant].

The Software Technology and Applications Competence Centre (STACC) is a research and development centre conducting high-priority applied research in the field of data mining and software and services engineering. Together with Skype/Microsoft Labs, STACC maintains a long lasting research collaboration with Márton Karsai (DANTE) on the modelling the adoption dynamics of online services.

8.2. Inria Alcatel-Lucent Bell Labs joint laboratory

Participants: Isabelle Guérin Lassous, Paulo Gonçalves Andrade, Thomas Begin, Éric Fleury [correspondant].

The main scientific objectives of the collaboration within the framework Inria Alcatel-Lucent Bell Labs joint laboratory is focused on network science:

- to design efficient tools for measuring specific properties of large scale complex networks and their dynamics;
- to propose accurate graph and dynamics models (*e.g.*, generators of random graph fulfilling measured properties);
- to use this knowledge with an algorithmic perspectives, for instance, for improving the QoS of routing schemes, the speed of information spreading, the selection of a target audience for advertisements, etc.

8.3. Bilateral Grants with Industry

8.3.1. *Orange R&D*

Participant: Isabelle Guérin Lassous.

A contract has been signed between Inria and France Télécom for the PhD supervision of Laurent Reynaud. The PhD thesis subject concerns mobility strategies for fault resilience and energy conservation in wireless networks.

DATAMOVE Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

BULL-ATOS SE (2015-2018). Two PhD grants (David Glesser and Michael Mercier). Job and resource management algorithms.

7.2. Bilateral Grants with Industry

CEA DAM (2016-2018). PhD grant support contract (PhD of Estelle Dirand, funded by CEA). In situ analysis for Molecular Simulations.

<div align="center">**DATASHAPE Team**</div>

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

Research contract with GeometryFactory in the context of Mael Rouxel-Labbé's Ph.D. thesis on anisotropic mesh generation [12].

DEDUCTEAM Team (section vide)

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

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- Grant with ART-FI (June 2016- June 2017) on quantification of electromagnetic radiations inside the brain from partial measurements

- A CIFRE PhD thesis started in January 2015 with Dassault Aviations. The student is M. Aloïs Bissuel who is working on "linearized Navier-Stokes equations for optimization, fluttering and aeroacoustic".

- A CIFRE PhD thesis started in December 2015 with Safran Tech. The student is Mrs Perle Geoffroy who is working on "topology optimization by the homogenization method in the context of additive manufacturing".

8.2. Bilateral Grants with Industry

- The SOFIA project (SOlutions pour la Fabrication Industrielle Additive métallique) started in the summer of 2016. Its purpose is to make research in the field of metallic additive manufacturing. The industrial partners include Michelin, FMAS, ESI, Safran and others. The academic partners are different laboratories of CNRS, including CMAP at Ecole Polytechnique. The project is funded for 6 years by BPI (Banque Publique d'Investissement).

- FUI project Tandem. This three years project started in December 2012 and has been extended to September 2017 involves Bull-Amesys (coordinator), BOWEN (ERTE+SART), Ecole Polytechnique (CMAP), Inria, LEAT et VSM. It aims at constructing a radar system on a flying device capable of real-time imaging mines embedded in dry soils (up to 40 cm deep). We are in charge of numerical validation of the inverse simulator.

- FUI project Saxsize. This three years project started in October 2015 and involves Xenocs (coordinator), Inria (DEFI), Pyxalis, LNE, Cordouan and CEA. It is a followup of Nanolytix where a focus is put on SAXS quantifications of dense nanoparticle solutions.

<p align="center" style="color:red">DEFROST Team</p>

8. Bilateral Contracts and Grants with Industry

8.1. A.I. Mergence

A.I. Mergence is a startup company based in Paris. The transfer contract was about building a soft robot prototype. The aim of the demonstration was to show that we can improve the appearance and user interaction. They have a usage of our license for 12 months. Amount of the contract: 1500 euros.
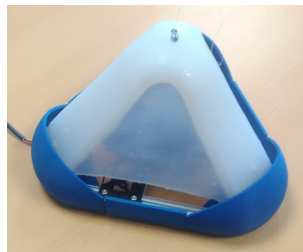
Figure 5. Prototype for A.I. Mergence

8.2. TruPhysics

TruPhysics is a german startup, using SOFA for the simulation of industrial robots. We did an expertise and research contract on modeling grasping tasks in SOFA with a deformable gripper. Amount of the contract: 7940 euros.

8.3. InSimo

InSimo is a French startup, based in Strasbourg, that was created by members of the team in 2013. The goal of InSimo is to create a new generation of surgical simulators with high quality biomechanics. We have signed a contract to work on the simulation of suture during the years 2016-2017. Amount of the contract: 33000 euros.

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

7. Bilateral Contracts and Grants with Industry

7.1. Enabling network function composition with Click middleboxes

In the context of the common Inria - Nokia Bell-Labs laboratory on Communication networks of the future, we participate to the Content Centric Networking ADR (Action de Recherche). In the context of this ADR, a post-doctoral researcher, Anandatirtha Nandugudi Sathyaraja, is working on enabling network function composition with Click middleboxes. In fact, the Click modular router has significant advantages for middlebox development, including modularity, extensibility, and reprogrammability. Despite these features, Click still has no native TCP support and only uses nonblocking I/O, preventing its applicability to middleboxes that require access to application data and blocking I/O. In this paper, we attempt to bridge this gap by introducing Click middleboxes (CliMB). CliMB provides a full-fledged modular TCP layer supporting TCP options, congestion control, both blocking and nonblocking I/O, as well as socket and zero-copy APIs to applications. As a result, any TCP network function may now be realized in Click using a modular L2-L7 design. As proof of concept, we develop a zero-copy SOCKS proxy using CliMB that shows up to 4 times gains compared to an equivalent implementation using the Linux in-kernel network stack.

DICE Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

Worldline Wordline is a leader in B2B applications development, and is in the front line to provide new technical solution in the Web 2.0 era. We have a CIFRE partnership contract on the study of flow based architectures both at the data centers and at the Web browser level.

DIONYSOS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contract with Industry: ALSTOM-Inria Common Lab

Participants: Bruno Tuffin, Gerardo Rubino.

Bruno Tuffin is the co-director of ALSTOM-Inria common Lab.

Dionysos manages a project with ALSTOM on system availability simulation taking into account logistic constraints. Current ALSTOM Transport and Power contracts, especially service-level agreements, impose stringent system availability objectives. Non-adherence to the required performance levels often leads to penalties, and it is therefore critical to assess the corresponding risk already at a tender stage. The challenge is to achieve accurate results in a reasonable amount of time. Monte Carlo simulation provides estimates of the quantities it is desired to predict (e.g., availability). Since we deal with rare events, variance reduction techniques, specifically Importance Sampling (IS) here, is used. The goal of the project is to establish the feasibility of IS for solving problems relevant to ALSTOM and to develop the corresponding mathematical tools.

8.2. Bilateral Contract with Industry: Participation in a CRE with Orange

Participant: Bruno Tuffin.

We are participating to a CRE (managed by Telecom Bretagne) with Orange on the strategies of Content Delivery Networks (CDNs) and their impact on the overall Internet economy and regulation. In this study, we focus on the CDN as an economic actor. The goals are 1) to analyze CDNs' caching strategies from an economic point of view, 2) to study the strategies of an integrated CDN actor, and 3) to study the impact of CDNs in the net neutrality debate.

8.3. Cifre contract on Device-Assisted Distributed Machine-Learning on Many Cores

Participants: Corentin Hardy, Bruno Sericola.

This is a Cifre contract including a PhD thesis supervision (PhD of Corentin Hardy), done with Technicolor. The starting point of this thesis is to consider the possibility to deploy machine-learning algorithms over many cores, but out of the datacenter: on the devices (home-gateways) deployed by Technicolor in users' homes. In this device-assisted view, an initial processing step in the device may significantly reduce the burden on the datacenter back-end. Problems are numerous (power consumption, CPU power, network bandwidth and latency), but costs for the operator can be lowered and scale may bring some new level in data processing.

8.4. Cifre contract on SDN for 5G mobile networks

Participants: César Viho, Yassine Hadjadj-Aoul, Adlen Ksentini.

This is a Cifre contract (2015-2018) including a PhD thesis supervision (PhD of Imad Alawe), done with TDF, on cooperation in SDN use for the 5th generation of mobile networks. The objective of the thesis is to study and devise appropriate solutions to introduce SDN in the current LTE architecture.

8.5. Camion

Participants: Yassine Hadjadj-Aoul, César Viho, Raymond Marie.

We are working in the 2-year (October 2014 to October 2016) Eurostars European Project Camion, which aims at offering cost-efficient, QoE-optimized content delivery, allowing for faster content access, as well as offline operation, while improving wireless network capacity and coverage. Camion is leaded by JCP-Connect, and the partners are a SME (FON) and our team. The project is extended until June 2017.

8.6. DVD2C

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

We are working in the 3-year (September 2014 – September 2017) FUI Project DVD2C, which aims to virtualize CDN through the Cloud and Network Function Virtualization concept. DVD2C is leaded by Orange labs., and the partners are two SMEs (Viotech and Resonate) and two academics (our team and Télécom Paris Sud).

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

6. Bilateral Contracts and Grants with Industry

6.1. Bilateral Contracts with Industry

A collaboration with SAGEM Défense Sécurité on the stabilization of the lines of sight for pointing systems from optronic criterion using Bayesian optimization ended in December 2016 (CIFRE).

A collaboration with Renault on the observability study of AC machines ended in May 2016 (CIFRE).

A collaboration with SNCF on the supervision and rescheduling of a mixed CBTC traffic on a suburban railway line is currently undergoing (CIFRE).

A collaboration with EDF on the control of renewable energy parks is undergoing (financial support of a PhD student).

A collaboration with CEA and ADEME on the modelling anc control of district heating networks is undergoing (financial support of a PhD student).

DIVERSE Project-Team (section vide)

DOLPHIN Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- Beckman (2015-2018): the goal of this contract concerns the strategic and operational planning for medical laboratories (Phd of Sohrab Faramarzi).
- Strat&Logic (2012-2016): the objective of this CIFRE contract is the optimization of economic decisions in a competitive business management simulator (Phd of S. Dufourny).
- PIXEO (2014-2018): the objective of this bilateral project is the predictive models and knowledge extraction for insurance web comparator (Phd of A-L. Bedenel).
- Alicante (2014-2017): the objective of this CIFRE contract is the design of new optimization methods to extract knowledge from hospital data (Phd of M. Vandromme)
- Intel (2015-2016) Bilateral academic and research partnarship between Université Lille 1 and Intel. In this context, Intel provides Lille 1 with training and technical support for the dissemination of its activities related to High Performance Computing.
- Nvidia (2016) Nvidia GPU Research Center, (see: https://developer.nvidia.com/academia/centers/universit%C3%A9-lille-1).

8.2. Bilateral Grants with Industry

- Intel 2015-2016 Intel has supported with a budget equivalent to 22Keuros the acquisition of a cluster of 2 multi-core servers and 8 Intel Xeon Phi coprocessors. The objective is to develop research and teaching on multi and many-core computing on coprocessors. The hybrid cluster has been deployed in 2016.

DRACULA Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

The industrial connections of the Dracula team have been made through the "Modeling of the immune response" project. Contacts have been established with both large pharmaceutical companies (Sanofi-Pasteur and Merial) and SMEs (AltraBio and The Cosmo Company). The now finished ANR PrediVac project included the two aforementioned SMEs and therefore strengthened the ties between Dracula and its industrial local ecosystem. The same consortium applied to ANR grants on close research topics in 2016. Furthermore, the ties with The Cosmo Company have been strenghened through a joint CIFRE PhD (see below).

7.2. Bilateral Grants with Industry

A recent cooperation has been initiated with the start up "Neolys Diagnostics" about radiotherapy effects on healthy cells and tumor cells. A PhD student, Aurélien Canet, has started his doctorate studies in January 2016 paid for one half by the start up and for the other half by the labex Milyon. Aurélien Canet is co-supervized by Larry Bodgi (from Neolys), Nicolas Foray (from Inserm) and Laurent Pujo-Menjouet.

7.3. Bilateral Grants with Industry

Celine Vial is scientific responsible of a contract with the European Consortium Eurokin and in collaboration with IFP "Energies nouvelles" on the topic: "Design experiments, sensibility and uncertainty analysis and kriging". The delivrable: "How accurate is my model?" Report by Celine Vial (80 pages).

DREAMPAL Project-Team (section vide)

DYLISS Project-Team (section vide)

DYOGENE Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. CRE with Orange

One year CRE contract titled "Mise au point d'une méthode d'évaluation de la qualité de service pour le sens montant d'un réseau cellulaire LTE validée avec les mesures terrain" between Inria and Orange Labs have been signed in 2015 end realized in 2016. It is a part of the long-term collaboration between TREC/DYOGENE and Orange Labs, represented by M. K. Karray, for the development of analytic tools for the QoS evaluation and dimensioning of operator cellular networks. Arpan Chattopadhyay was hired by Inria as a post-doctoral fellow thanks to this contract.

8.1.2. Joint Research Lab with Nokia Bell Labs

Arpan Mukhopadhyay was hired by Inria as a post-doctoral fellow within this lab dedicated to the research on communication networks of the future; https://www.inria.fr/en/institute/partnerships/industrial-partnerships2/ alcatel-lucent-bell-labs-france.

8.2. Bilateral Grants with Industry

8.2.1. CIFRE Nokia

PhD: Dalia-Georgiana Herculea, co-advised by B. Blaszczyszyn, E. Altman and Ph. Jacquet

ECUADOR Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- Ecuador and Lemma share the results of Gautier Brèthes' thesis, which is partly supported by Lemma, the other part being supported by a PACA region fellowship.
- Ecuador and Lemma have a bilateral contract to share the results of Stephen Wornom, Lemma engineer provided to Inria and hosted by Inria under a Inria-Lemma contract.

ERABLE Project-Team (section vide)

EVA Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. CNES

Participants: Ines Khoufi, Pascale Minet, Erwan Livolant.

Partners: CNES, Inria.

Following the SAHARA project that ended in 2015, CNES decided to fund a study about the use of wireless sensor networks in space environment. This new project started in November 2015 and will end in November 2016.

For CNES we studied how to use a IEEE 802.15.4e TSCH (Time Slotted Channel Hopping) network in the space launch vehicles. We proposed new solutions and evaluated their performances with the NS3 simulation tool.

8.1.2. OpenMote

Participant: Thomas Watteyne.

Inria-EVA has signed an long-standing Memorandum of Understanding with OpenMote Technology.

8.2. Bilateral Grants with Industry

8.2.1. Gridbee CIFRE

Participants: Jonathan Muñoz, Thomas Watteyne.

- Title: km-scale Industrial Networking
- Type: CIFRE agreement
- Period: Nov 2015 - Oct 2018
- Coordinator: **Thomas Watteyne**
- Goal: CIFRE agreement with Gridbee (http://www.gridbeecom.com/) to apply 6TiSCH-style scheduling on top of long-range IEEE802.15.4g radios. Implementation of those solutions on OpenWSN.

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

MultiHub (Microsoft donation, 2015-2016) – ExSitu was one of the ten academic institutions world wide awarded a hardware and monetary grant by Microsoft Research as part of its request for proposal to expand the potential applications of the Surface Hub across all aspects of society (http://research.microsoft.com/en-us/projects/surface-hub/). The goal of the MultiHub project is to enable interaction in the large, where groups of experts can interact with rich content and complex data while collaborating both locally and remotely in interactive, multi-surface environments. ExSitu was awarded two 55" Surface Hubs and $19,000 in cash.

EXMO Project-Team (section vide)

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

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. *Autonomous Driving Commuter Car*

Participants: David Filliat [correspondant], Emmanuel Battesti.

We further developed a planning algorithm for a autonomous electric car for Renault SAS in the continuation of the previous PAMU project. We improved our planning algorithm in order to go toward navigation on open roads, in particular with the ability to reach higher speed than previously possible, deal with more road intersection case, and with multiple lane roads (overtake, insertion...).

8.2. Bilateral Grants with Industry

8.2.1. *Curiosity and visual attention*

Participants: David Filliat [correspondant], Celine Craye.

Financing of the CIFRE PhD grant of Celine Craye by Thales S.A. with the goal of developing a mechanism of visual attention guiding the exploration of a robot.

8.2.1.1. Adaptive device for disease awareness and treatment adherence of asthma in children

Participants: Manuel Lopes [correspondant], Alexandra Delmas, Pierre-Yves Oudeyer.

Financing of the CIFRE PhD grant of Alexandra Delmas by Itwell with the goal of developing a tool for self-learning for patients to improve their compliance to treatment.

<div align="center">

FLUMINANCE Project-Team

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7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. *Contract CERSAT/IFREMER*

Participants: Etienne Mémin, Valentin Resseguier.

duration 36 months. This partnership between Inria and Ifremer funds the PhD of Valentin Resseguier, which 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.

7.1.2. *Contract inter Carno IFREMER Inria*

Participants: Etienne Mémin, Thibaut Tronchin.

duration 36 months. This contract aims at proposing image-based tools for the analysis of the hydraulic load of an immerged body. This project takes place within an inter Carnot cooperation between Ifremer and Inria.

7.1.3. *Contract ITGA*

Participants: Dominique Heitz, Etienne Mémin.

duration 36 months. This partnership between Inria, Irstea and ITGA funds the PhD of Romain Schuster. The goal of this CIFRE PhD is to design new image-based flow measurement methods for the study of industrial fluid flows. Those techniques will used in particular to calibrate industrial fume hood.

7.1.4. *ANDRA project*

Participants: Yvan Crenner, Benjamin Delfino, Jean-Raynald de Dreuzy, Jocelyne Erhel.

Contract with ANDRA (National Agency for Nuclear Waste)
Duration: three years from November 2015.
Title: reactive transport in fractured porous media
Coordination: Jocelyne Erhel.
Partners: Geosciences Rennes.
Abstract: Even in small numbers, fractures must be carefully considered for the geological disposal of radioactive waste. They critically enhance diffusivity, speed up solute transport, extend mixing fronts and, in turn, modify the physicochemical conditions of reactivity around possible storage sites. Numerous studies in various fields have shown that fractures cannot be simply integrated within an equivalent porous medium with a simple enhancement of its petro-physical properties (porosity and permeability). We propose a combined numerical and experimental approach to determine the influence on reactivity of typical fracture patterns found in some radioactive waste applications.

7.1.5. *IFPEN project*

Participants: Bastien Hamlat, Jocelyne Erhel.

Contract with IFPEN (Institut Français du Pétrole et Energies Nouvelles)
Duration: three years from October 2016.
Title: Fully implicit Formulations for the Simulation of Multiphase Flow and Reactive Transport
Coordination: Jocelyne Erhel.

Abstract: Modeling multiphase flow in porous media coupled with fluid-rock chemical reactions is essential in order to understand the origin of sub-surface natural resources and optimize their extraction. This project aims to determine optimal strategies to solve the coupled transport and chemical reaction equations describing the physical processes at work in reactive multiphase flow in porous media. Three different formulations show great potential to accurately solve these equations. Two are fully implicit ("Reactive Coats" and "Semi-smooth Newton)" and one is an operator splitting approach. These formulations are still incomplete at the moment. The work will focus on extending the existing formulations to more complex physical phenomena, study their stability, convergence and theoretical equivalence. Another objective is to provide practical solutions to efficiently solve the resulting non-linear systems.

FOCUS Project-Team (section vide)

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

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- Evolution
  Participants: Gabriele Sabatino, Nathalie Mitton [correspondant].

  This collaboration aims to set up a full RFID system on the basis of AspireRFID middleware and pre-existing RFID modules issued from FUN research in the Evolution company facility and to integrate them with their IS.

GALEN Project-Team (section vide)

GALLIUM Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. *The Caml Consortium*

Participants: Xavier Leroy [**contact**], Damien Doligez, Didier Rémy.

The Caml Consortium is a formal structure where industrial and academic users of OCaml can support the development of the language and associated tools, express their specific needs, and contribute to the long-term stability of Caml. Membership fees are used to fund specific developments targeted towards industrial users. Members of the Consortium automatically benefit from very liberal licensing conditions on the OCaml system, allowing for instance the OCaml compiler to be embedded within proprietary applications.

The Consortium currently has 14 member companies:

- Aesthetic Integration
- Ahrefs
- Bloomberg
- CEA
- Citrix
- Dassault Aviation
- Esterel Technologies
- Facebook
- Jane Street
- Kernelyze
- LexiFi
- Microsoft
- OCamlPro
- SimCorp

For a complete description of this structure, refer to http://caml.inria.fr/consortium/. Xavier Leroy chairs the scientific committee of the Consortium.

8.1.2. *Scientific Advisory for OCamlPro*

Participant: Fabrice Le Fessant.

OCamlPro is a startup company founded in 2011 by Fabrice Le Fessant to promote the use of OCaml in the industry, by providing support, services and tools for OCaml to software companies. OCamlPro performs a lot of research and development, in close partnership with academic institutions such as IRILL, Inria and Univ. Paris Sud, and is involved in several collaborative projects with Gallium, such as the Bware ANR, the Vocal ANR and the Secur-OCaml FUI.

Since 2011, Fabrice Le Fessant is a scientific advisor at OCamlPro, as part of a collaboration contract for Inria, to transfer his knowledge on the internals of the OCaml runtime and the OCaml compilers.

GAMMA3 Project-Team

5. Bilateral Contracts and Grants with Industry

5.1. Bilateral Contracts with Industry

- The Boeing Company,
- Safran-Tech,
- Projet Rapid (DGA) avec Lemma.

GANG Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Collaboration with Nokia Bell Labs

Gang has a strong collaboration with Bell Labs (Nokia). We notably collaborate with Fabien Mathieu who is a former member of GANG and Nidhi Hegde. An ADR (joint research action) is dedicated to content centric networks and forwarding information verification. The PhD thesis of Leonardo Linguaglossa was funded by this contract.

This collaboration is developed inside the Alcatel-Lucent and Inria joint research lab.

GECO Project-Team (section vide)

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

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Empowerd memory

Participants: Charles Deltel, Dominique Lavenier.

The UPMEM company is currently developing new memory devices with embedded computing power (http://www.upmem.com/). GenScale investigates how bioinformatics algorithms can benefit from these new types of memory (see section New Results).

8.2. Bilateral Grants with Industry

8.2.1. EnginesOn start-up project

Participant: Jennifer Del Giudice.

EnginesOn is a start-up project based on life science digital data analysis (http://engineson.fr/). The origin of the project comes from a simple field observation: NGS technology is involved in numerous scientific studies. Deciphering the heterogeneous and voluminous data generated is a real challenge. People with the skills to analyze this type of data are scarce. EnginesOn focuses its first effort on health market with cancer diagnosis and personalized medecine. The start-up provides to physicians a virtual research laboratory with analysis workflows, compute infrastructure and data management that will lead to a simple, fast, reproducible diagnosis in a transparent fashion. EnginesOn also addresses the issue of big data management and storage. The project is entitled to the Fasttrack program since october 2016. Inria funds a 6-month technology transfer engineer in order to study the valorization and promote the GATB toolbox.

8.2.2. Rapsodyn project

Participants: Dominique Lavenier, Claire Lemaitre, Sebastien Letort, Pierre Peterlongo.

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 (http://www.rapsodyn.fr/). The objective is the optimization of the rapeseed oil content and yield under low nitrogen input. GenScale is involved in the bioinformatics work package, in collaboration with Biogemma's bioinformatics team, to elaborate advanced tools dedicated to polymorphism.

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

7. Bilateral Contracts and Grants with Industry

7.1. Carnot-Inria

GeoStat has been granted in 2015 a Carnot-Inria project to fund a 1 year engineer to develop a prototype of a speech emotion detection system. This contact, led by K. Daoudi, is in collaboration with the start-up BatVoice which targets the commercialization of affect-interactive digital systems. The prototype was developed and transferred to BatVoice for 48000 euros. The phase 2 of the collaboration is under discussion. Engineer: N. Brodu.

7.2. Bilateral Grants with Industry

- With Batvoice company: *Détection des émotions à partir de la voix*. Startup Batvoice: M. Sendorek & G. Maluréanu.
- With CARDIOLOGS company, headed by Y. Fleureau. Contacts and first collaborations started in 2016.

Patent in the process of being first deposited in January 2017 *Dispositif analyseur de rythme cardiaque*, Inria-185.

GRACE Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

8.1.1. *Nokia (ex Alcatel-Lucent)*

Within the framework of the joint lab Inria-ALU, Grace and Alcatel-Lucent collaborate on the topic of Private Information Retrieval: that is, enabling a user to retrieve data from a remote database while revealing neither the query nor the retrieved data. (This is not the same as data confidentiality, which refers to the need for users to ensure secrecy of their data; this is classically obtained through encryption, which prevents access to data in the clear.)

A typical application would be a centralized database of medical records, which can be accessed by doctors, nurses, and so on. A desirable privacy goal would be that the central system does not know which patient is queried for when a query is made, and this goal is precisely achieved by a Private Information Retrieval protocol. Note also that in this scenario the database is not encrypted, since many users are allowed to access it.

We are exploring applications of Locally Decodable Codes to Private Information Retrieval in the multi-cloud (multi-host) setting, to ensure both secure, reliable storage, and privacy of database queries.

N. Coxon made the first implementation of these codes, who are indeed very practical. On a laptop, we can encode an ADN of a drosophilia in two seconds, and a 10^9 bit data base in 30 seconds. We have a few real-life scenario in mind (DNA, geolocalisation, streaming), and we will check how realistic they are.

8.1.2. *Safran Identity and Security (ex-Morpho)*

A contract has been signed in November 2016 between Safran Identity and Security and École polytechnique, for one year post-doc position. A candidate has been found, and will arrive early 2017 (January).

The topic is the research is to use bitcoin's blockchain to issue and manipulate certification of identities, which is very close to the (trendy) topic of diplomation with blockchains.

Safran had a preliminary construction for doing that, and a preliminary version has been submitted to the IEEE Security and Privacy on the Blockchain Workshop.

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

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. Optis

Participants: Valentin Deschaintre, Adrien Bousseau, George Drettakis.

Valentin Deschaintre is starting a CIFRE PhD in collaboration with Optis, a company specialized in material acquisition and rendering.

7.2. Bilateral Grants with Industry

7.2.1. Technicolor

Participants: George Drettakis, Adrien Bousseau.

We have initiated a collaboration with Technicolor on the use of deep learning for computational photography and video tasks. This will involve the use of our synthetic ground truth data generation platform (see Sec. 5.4) to tasks such as color grading and white balance. This is a collaboration with P. Pérez and E. Reinhard of Technicolor.

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

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. UMR IATE / UMR STLO / Régilait

Participants: Patrice Buche, Jérôme Fortin, Alain Gutierrez.

In the framework of a contract between INRA IATE and STLO (Rennes) research units and Régilait, two master students have been recruited in 2016. Marine Damblon, food engineer from Polytech Montpellier, has created a knowledge base which represents the causal links between a food descriptor (mouillabilité des poudres de lait) and actions which can be undertaken by operators to control food quality on the line. Justine Flore Tchouanguem participated to the development of the new CoGui-Capex version presented in section 5.4 . CoGui-Capex prototype has been successfully evaluated by Régilait and is considered to be used in production conditions in its milk powder factory in Macon. Marine Damblon has been recruited by Régilait for that. This collaboration will be extended in 2017 and a new master student should be recruited.

HEPHAISTOS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Airbus

8.1.1. Airbus

Participant: Yves Papegay.

Research activities on MOSELA environment, section 7.3.2 , have been covered by a contract with Airbus company.

8.1.2. GénérationRobot

Participant: Jean-Pierre Merlet.

- we have got a grant from the company GénérationRobot to develop a pedagogical cable-driven parallel robot as a direct consequence from our research work, see section 7.1.1 .

8.1.3. Ellcie-Healthy

Participants: Alain Coulbois, Jean-Pierre Merlet.

- we have got a grant from the company Ellcie-Healthy to evaluate connect objects that are developed by this company.

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

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

Airbus Safran Launchers research and development contract:

- Design of a parallel version of the FLUSEPA software (Jean-Marie Couteyen (PhD); Pierre Brenner, Jean Roman).

Airbus Group Innovations research and development contract:

- Design and implementation of linear algebra kernel for FEM-BEM coupling (A. Falco (PhD); Emmanuel Agullo, Luc Giraud, Guillaume Sylvand).

- Design and implementation of FMM and block Krylov solver for BEM applications. The HIBOX project is led by the SME IMACS and funded by the DGA Rapid programme (C. Piacibello (Engineer), Olivier Coulaud, Luc Giraud).

HYBRID Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. *Mensia Technologies*

Participants: Anatole Lécuyer, Jussi Tapio Lindgren.

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 on-going contract between Hybrid and Mensia started in November 2013 and supports the transfer of several softwares designed by Hybrid team ("OpenViBE", "StateFinder") related to our BCI activity to Mensia Technologies for multimedia or medical applications of Mensia.

8.2. Bilateral Grants with Industry

8.2.1. *Technicolor*

Participants: Antoine Costes, Anatole Lécuyer, Ferran Argelaguet.

This grant started in December 2015. It supports Antoine Costes's CIFRE PhD program with Technicolor company on "Haptic Texturing".

8.2.2. *Realyz*

Participants: Guillaume Cortes, Anatole Lécuyer.

This grant started in December 2015. It supports Guillaume Cortes's CIFRE PhD program with Realyz company on "Improving tracking in VR".

8.2.3. *VINCI Construction*

Participants: Anne-Solène Dris-Kerdreux, Bruno Arnaldi, Valérie Gouranton.

This grant started in November 2015. It supports Anne-Solene Dris-Kerdreux's CIFRE PhD program with Vinci company on "Training in VR for construction applications".

HYCOMES Project-Team (section vide)

I4S Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. PhD project with EDF – Electrical device ageing monitoring

Participants: Nassif Berrabah, Qinghua Zhang.

A joint PhD project between Inria and EDF (ElectricitÈ de France) has been started since December 2014. The purpose of this study is to develop methods for the monitoring of electrical instruments in power stations, in order to prevent failures caused by ageing or accidental events. This project is funded by EDF and by the ANRT agency for three years.

8.1.2. Contracts with SVS

Participants: Laurent Mevel, Michael Doehler.

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 .

In 2014, the damage detection toolbox has been launched http://www.svibs.com/products/ARTeMIS_Modal_Features/Damage_Detection.aspx.

In 2015, SVS and Inria have earned an Innobooster grant to help transfer algorithms in 2016 Artemis Extractor Pro.

In 2016, uncertainty quantification for modal analysis has been launched http://www.svibs.com/newsletter/newsletter_2016_09.aspx.

8.1.3. Contracts with A3IP

Participant: Vincent Le Cam.

Since 2008, IFSTTAR has licensed the company A3IP to sell licenses of the PEGASE 1 platform (previous version of PEGASE 2 as mentioned above). A3IP sells them to to companies, laboratories or any third-party partner interested in in-situ monitoring (SHM) with smart and wireless sensors. Since 2008, about 1000 of PEGASE 1 units have been sold, plus hundreds of the following items:

- daughter boards: 3G / Ethernet communications, Analog to Digital data acquisition...
- sensors: accelerometer, strain gauges, temperature...
- specific packaging to make the PEGASE 1 solution ready to use in waterproof conditioning

For example, in 2016, A3IP has provided a complete panoply of PEGASE-1 Vibration Monitoring system with more than 30 PEGASE1 units to ensure the monitoring of the new High Speed Train line in west of France (Bretagne Pays de la Loire high speed railway).

This non exclusive license is clearly a success in terms of dissemination.

8.1.4. Contract with SNCF: DEMETER

Participant: Vincent Le Cam.

DEMETER is one of the major projects for I4S in terms of strategy, scientific and technological impact.

DEMETER is a meta project whose global objective is the validation of the contribution of the Internet of Things (IOT) applied to the Health Monitoring of Railways Items. SNCF and IFSTTAR have signed a roadmap for safety relevant items, where wireless monitoring and smart algorithms could bring strong improvements to SNCF in terms of real-time maintenance or predictive maintenance. Those items are, amongst others:

- Crossing engine motor monitoring
- Needle motor monitoring
- Axel counter monitoring
- Train detection pedal monitoring

In each case, a prototype of a specific PEGASE 2 sensor is designed, installed along in-situ railways lines under exploitation and data are transmitted wireless to the cloud supervisor at IFSTTAR for evaluation in SHM algorithms. IFSTTAR's engineers Arthur Bouche, Laurent Lemarchand and David Pallier are contributing to this project.

In particular, SNCF and IFSTTAR are able to perform the entire validation process quickly in few months: from the algorithm to the electronic design and installation. In 2016, the consortium reached 2 milestones: the PEDAL-LORA monitoring sensor has been awarded the European Railway Cluster Price in railway innovation; this system is now becoming an industrial product, directly designed by a third-party company for SNCF. In 2017, the roadmap will be extended with a specific focus on SHM algorithms implementation to help SNCF moving from big data to smart data.

8.1.5. Contracts with SDEL-CC (VINCI Group)
Participant: Vincent Le Cam.

In 2016, a contract has been signed with the company SDEL-CC, 100% daughter of the VINCI Group, Energy department. The project exploits the unique time stamp capacity of PEGASE 2 up to 50 nanosecond, independently of distances in the network of PEGASE2 nodes. The synchronization capacity is employed to design a sensor prototype based on PEGASE2 to time-stamp the current wave after a lightning impact on a high-voltage line. By knowing the exact time, the wave can be seen at each extremity of the electrical line to localize accurately the lightning impact point. IFSTTAR's engineers Arthur Bouche and Laurent Lemarchand have contributed to this project.

During 2016, we have improved its embedded algorithms on PEGASE 2 platform to:

- take into account some specific GPS frames that output from its GPS receiver and give practical information on time drift
- take into account the temperature effect
- auto compute the real quartz period on each specific PEGASE 2 board

Two PEGASE 2 platforms are now able to time stamp an event with an accuracy of less that 10 nanoseconds. This leads to a precision of around 3 m for Lightning localization.

In 2017 in situ validation will be achieved on a real operated electric line.

8.1.6. Collaboration with SIEMENS : CityVal Rennes
Participant: Jean Dumoulin.

A first Winter season measurements campaign on the 100m metro structure mock-up built at IFSTTAR test track facilities in Nantes was carried out in 2016. It was completed by in situ instrumentation including coupling of infrared thermography with other measurements techniques for long term monitoring during several months. A new campaign is under preparation and will be launched in 2017. This collaboration is also connected with the new automated metro line B under construction in Rennes.

IBIS Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. BGene

Participants: Johannes Geiselmann, Hidde de Jong, Corinne Pinel.

BGene is a start-up company of Université Grenoble Alpes in the field of DNA engineering. BGene proposes efficient and custom-made modifications of bacterial genomes, leaving no scars or antibiotics resistance genes. The company has know-how and expertise at all stages of the development process, including the *in-silico* design of a desired construction, the choice of the appropriate genetic tools, and the delivery of the finished product. Former IBIS-member Caroline Ranquet and Johannes Geiselmann are co-founders of BGene, together with Marie-Gabrielle Jouan (Floralis, Université Grenoble Alpes). Johannes Geiselmann and Hidde de Jong are members of its scientific advisory board. For more information on BGene, see http://www.bgene-genetics.com/.

7.2. Genostar

Participants: Hidde de Jong, Michel Page, François Rechenmann.

Genostar, an Inria start-up created in 2004, provides bioinformatics solutions for the comparative analysis of bacterial genomes, proteomes and metabolomes. Genostar's software suite performs the annotation of sets of genomic sequences, *i.e.*, the identification of the coding sequences and other features, followed by the prediction of the functions of the gene products. The modules which make up the software suite were originally developed within the Genostar consortium and the HELIX project team at Inria Grenoble - Rhône-Alpes. The software suite also includes the modeling and simulation tool GNA developed by members of IBIS (Section 5.1). Genostar offers a comprehensive service line-up that spans genome sequencing, read assembly, annotation, and comparison. Genostar thus works with trusted subcontractors, each specialized in state-of-the-art sequencing technologies. François Rechenmann is CEO of the company. For more information, see http://www.genostar.com.

ILDA Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- Tecknowmetrix (TKM): ANRT/CIFRE PhD (Hugo Romat), 3 years, starting June 2016.

IMAGINE Project-Team (section vide)

INDES Project-Team (section vide)

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

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- Participation to Microsoft Research – Inria Joint Centre, which funds two PhD students (Lennart Gulikers and Remi Varloot).
- During 2016, Cisco and Nordic Semiconductors have funded further development of RIOT and sponsored the RIOT Summit.

7.2. GranData

Participants: Aline Carneiro Viana, Eduardo Mucelli.

Since June 2014, we have a collaboration with GranData (http://grandata.com/), Buenos Aires, Argentina on traffic vs mobility modeling of smartphone users. GranData is a small company that integrates first-party and telco partner data to understand key market trends, to predict customer behavior, and to deliver business results. Its products integrates and analyzes diverse data traces (e.g., telco, social media, or mobile data) to generate behavioral insights and deliver targeted mobile marketing. Part of the thesis of Eduardo Mucelli analysis data traffic using telco traces provided by GranDatas. While this collaboration allow us collaborating with machine learning experts, GranData has the opportunity to get our expertise in mobility analysis.

<div align="center">

INOCS Team

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7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- Fluxys (2016-2018). Study of optimization problems arising in the management of gas networks.
- Colisweb (2015-2016). Study of optimization problems arising in courier scheduling. This bilateral contract leads to the creation of an Inria Innovation Lab at the end of 2016.

7.2. Bilateral Grants with Industry

- PARROT (Planning Adapter performing ReRouting and Optimization of Timing), part of BEWARE Fellowships Academia funded by the COFUND program of the European Union (FP7 - Marie Curie Actions). INFRABEL is the industrial partner of this project.(2014-2018)

- Design and Pricing of Electricity Services in a Competitive Environment within the Gaspard Monge Research Progam (PGMO) funded by the Fondation Mathématiques Jacques Hadamard. EDF is the industrial partner (2015-2018).

- BENMIP: A generic bender decomposition-based (mixed) integer programming solver within the Gaspard Monge Research Progam (PGMO) funded by the Fondation Mathématiques Jacques Hadamard.(2015-2017)

IPSO Project-Team (section vide)

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

8. Bilateral Contracts and Grants with Industry

8.1. 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. 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 G. Antoniu. The project also provides funding for the PhD thesis of Luis Pineda-Morales, started in 2014.

Collaboration.   *The project is being conducted in collaboration with the Zenith team from Montpellier, led by Patrick Valduriez.*

Huawei: HIRP Low-Latency Storage for Stream Data (2016–2017).   The goal of this project is to explore the plausible paths towards a dedicated storage solution for low-latency stream storage. Such a solution should provide on the one hand traditional storage functionality and on the other hand stream-like performance (i.e., low-latency I/O access to items and ranges of items).

We plan to investigate the main requirements and challenges, evaluate the different design choices (e.g., a standalone component vs. an extension of an existing Big Data solution like HDFS) and then propose an architectural overview.

LACODAM Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. *SocTrace: analysis of SOC traces*
Participant: Alexandre Termier.

SoCTrace is a FUI project led by STMicroelectronics, with the companies ProbaYes and Magilem, University Grenoble Alps and Inria Rhône-Alpes. Its goal is to provide an integrated environment for storing and analyzing execution traces. In this project, we are working on data mining techniques for analyzing the traces, and on the use of ontologies to enable querying traces with a higher level of abstraction.

8.1.2. *ITRAMI: Interactive Trace Mining*
Participant: Alexandre Termier.

ITRAMI is a Nano2017 project. Such projects are designed to support joint research efforts between STMicrolectronics and academic partners in the domain of embedded systems. Alexandre Termier is the PI of this project whose goal is to design novel data mining methods for interactive analysis of execution traces. Such methods aim at considerably reducing the time that STMicroelectronics developers spend at understanding, debugging and profiling applications running on STMicrolectronics chips. The project work is done at University Grenoble Alps, in collaboration with Lacodam researchers. Two contractual staff are working on the project in Grenoble: Willy Ugarte as a postdoc, and Soumaya Ben Alouane as an engineer.

8.2. Bilateral Grants with Industry

Maël Guillemé has obtained a CIFRE PhD grant with the Energiency startup, supervised by V. Masson and L. Rozé. The goal of Maël Guillemé's thesis is to propose new approaches for improving industrial energy performance and aims at integrating both numerical and symbolic attributes. A master 2 internship explored in 2016 a first approach based on an algorithm proposed by Shokoohi and al, but with several improvements: avoid data normalisation, detect patterns as fast as possible, enhance functions like distance and score.

Another CIFRE PhD has started, this time with the Amossys company, specialized in cyber-security. This is the PhD of Alban Siffer, located in the EMSec team of IRISA and co-supervised between EMSec (P.A. Fouque) and Lacodam (A. Termier, C. Largouët). The goal of this PhD is to propose new methods for intrusion detection in networks. The originality is to only consider IP flow as input (metadata of packets and not packet contents), requiring to detect intrusion via unusual traffic patterns.

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

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

8.1.1. *Technicolor*

Participants: Salma Jiddi, Eric Marchand.

no Univ. Rennes 1 15CC310-02D, duration: 36 months.

This project funded by Technicolor started in October 2015. It supports Salma Jiddi's Ph.D. about augmented reality (see Section 7.1.7).

8.1.2. *Realyz*

Participant: Eric Marchand.

no Inria Rennes 10822, duration: 36 months.

This project funded by Realiz started in October 2015. It is realized in cooperation with Anatole Lecuyer, Hybrid group at Irisa and Inria Rennes-Bretagne Atlantique to support Guillaume Cortes Ph.D. about motion capture.

8.1.3. *Pôle Saint Hélier*

Participants: Louise Devigne, Marie Babel.

no. Insa Rennes 2015/0890, duration: 36 months.

This project started in November 2015. It addresses the following two issues. First, the idea is to design a low-cost indoor / outdoor efficient obstacle avoidance system that respects the user intention, and does not alter user perception. This involves embedding innovative sensors to tackle the outdoor wheelchair navigation problem. The second objective is to take advantage of the proposed assistive tool to enhance the user Quality of Experience by means of biofeedback as well as the understanding of the evolution of the pathology.

8.1.4. *Axyn*

Participants: Dayana Hassan, Paolo Salaris, Patrick Rives.

no Inria Sophia 10874-1, duration: 36 months.

The objective of this project that started in November 2016 is to explore new methodologies for the interaction between humans and robots, autonomous navigation and mapping and to transfer the results obtained on the robotic platform developed by AXYN for assisting disabled/elderly people at home or in hospital structures. Cost limits, good accessibility to aged people, robustness and safety related to the applications are at the heart of the project. This contract (ANRT-CIFRE) support Dayana Hassan's Ph.D.

LARSEN Team (section vide)

LEMON Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Free surface hydraulics

The finite volume-based, SW2D computational code (see Software section) is used by Cereg Ingénierie and Enveo (Montpellier Lavérune location) on a regular basis to carry out flood risk assessment studies. The code is constantly being developed on a work-for-hire basis depending on the company needs. The developments mostly concern pre- and post-processing functionalities, as well as specific hydraulic modules.

8.1.2. Hydrodynamics of coastal lagoons with porosity models

A two-dimensional shallow water with depth-variable porosity has been developed. The depth-variable porosity allows the subgrid-scale variations of the topography and hydraulic connectivity to be accounted for. The governing equations are written in conservation form and solved using a finite volume scheme. This allows the CPU time of the computational code to be divided by 2 to 3 orders of magnitude. The model is currently being tested against in situ measurements in the Vaccarès system in collaboration with Tour du Valat.

8.2. Bilateral Grants with Industry

Antoine ROUSSEAU collaborates with ARTELIA in the framework of M-P Daou's PhD thesis (CIFRE).

LFANT Project-Team (section vide)

LIFEWARE Project-Team (section vide)

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

Teddy Furon spent 20 % of his time during 6 months to transfer research result to IRT B-com

Ph. D. contract with Alcatel-Lucent Bell Labs (Raghavendran Balu) in the framework of the joint Inria-Alcatel Lucent lab.

LINKS Project-Team (section vide)

M3DISIM Project-Team (section vide)

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

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- Xilopix (Epinal, France):
    - Pay-per-use contract for the use of Grid'5000
    - Support contract for their use of Grid'5000 (define experimental requirements and plans)

7.2. Bilateral Grants with Industry

- CIFRE, Thales TRT (Paris, France):
    - CIFRE PhD (Florian Greff, supervised by Ye-Qiong Song and Laurent Ciarletta)
    - Dynamic reconfiguration and graceful degradation of distributed real-time applications over mesh networks
- CIFRE, Orange Labs (Issy-Les-Moulineaux, France)
    - CIFRE PhD (Maxime Compastie, supervised by Olivier Festor and Rémi Badonnel)
    - Software-Defined Security for Distributed Cloud Infrastructures
- CIFRE, Orange Labs (Issy-Les-Moulineaux, France)
    - CIFRE PhD (Paul Chaignon, supervised by Olivier Festor and Jérôme François)
    - Monitoring of Software-Define Networks
- CIFRE, Xilopix (Epinal, France):
    - CIFRE PhD (Abdulqawi Saif, supervised by Ye-Qiong Song and Lucas Nussbaum)
    - Open Science for the scalability of a new generation search technology
- CIFRE, Thales (Elancourt, France)
    - CIFRE PhD (Pierre-Olivier Brissaud, supervised by Isabelle Chrisment and Jérôme François)
    - Anomaly detection in encrypted traffic

MAESTRO Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

MAESTRO members are involved in the

- Inria Nokia Bell Labs joint laboratory: the joint laboratory consists of six ADRs (Action de Recherche/Research Action) in its second phase (starting October 2012). MAESTRO members participate in two ADRs (see §8.1.1 and §8.1.2).

- Inria ALSTOM joint laboratory: the joint laboratory consists of four projects. MAESTRO members participate in project P11 (see §8.1.3).

8.1.1. ADR "Self-Organized Networks in Wireless" (July 2008 – September 2016)
Participant: Eitan Altman.

- Contractor: Nokia Bell Labs (http://www.bell-labs.com)
- Collaborator: Laurent Roullet (coordinator).

Coordinator for Inria: Eric Fleury (team DANTE).

8.1.2. ADR "Network Science" (June 2013 – March 2017)
Participants: Konstantin Avrachenkov [coordinator], Guillaume Huard, Jithin Kazhuthuveettil Sreedharan, Giovanni Neglia.

- Contractor: Nokia Bell Labs (http://www.bell-labs.com)
- Collaborators: Philippe Jacquet (coordinator), Alonso Silva.

"Network Science" aims at understanding the structural properties and the dynamics of various kind of large scale, possibly dynamic, networks in telecommunication (e.g., the Internet, the web graph, peer-to-peer networks), social science (e.g., community of interest, advertisement, recommendation systems), bibliometrics (e.g., citations, co-authors), biology (e.g., spread of an epidemic, protein-protein interactions), and physics. The complex networks encountered in these areas share common properties such as power law degree distribution, small average distances, community structure, etc. Many general questions/applications (e.g., community detection, epidemic spreading, search, anomaly detection) are common in various disciplines and are being analyzed in this ADR "Network Science". In particular, in the framework of this ADR we are interested in efficient network sampling.

8.1.3. Project P11 "Data Communication Network Performance" (December 2013 – May 2016)
Participants: Sara Alouf [coordinator], Konstantin Avrachenkov, Philippe Nain, Giovanni Neglia, Alina Tuholukova.

- Contractor: ALSTOM Transport (http://www.alstom.com/transport/)
- Collaborators: Pierre Cotelle, Pascal Derouet (coordinator from November 2015), Pierre Dersin, Sébastien Simoens (coordinator until October 2015).

The objective of this study is to build a simulation platform (see §6.2) and develop an evaluation methodology for predicting Quality of Service and availability of the various applications supported by the data communication system of train networks.

8.1.4. *"Hybrid GPS-free Localization Algorithms" (May 2016 – October 2016)*

Participants: Giovanni Neglia [coordinator], Dimitra Politaki.

- Contractor: Lucie Labs (http://www.lucielabs.com/)
- Collaborators: François Mazard.

G. Neglia and D. Tsigkari, together with F. Mazard (Lucie Labs) did a literature survey of localization algorithms that could be deployed in Lucie Labs entertainment wristbands. They proposed a localization algorithm that combines information from Bluetooth and WiFi connectivity in a centralized way. This activity was partially funded by AMIES (Agence pour les Mathématiques en Interaction avec l'Entreprise et la Société).

8.2. Bilateral Grants with Industry

8.2.1. *Huawei CIFRE on the topic "Scalable Online Algorithms for SDN controllers" (June 2016 – May 2019)*

Participants: Zaid Allybokus, Konstantin Avrachenkov.

- Contractor: Huawei   Technologies   (http://www.huawei.com/en/about-huawei/research-development)
- Collaborators: Jérémie Leguay et Lorenzo Maggi

Software-Defined Networking (SDN) technologies have radically transformed network architectures. They provide programmable data planes that can be configured from a remote controller platform.

The objective of this CIFRE thesis is to provide fundamental answers on how powerful SDN controller platforms could solve large online flow problems to optimize networks in real-time and in a distributed or semi-distributed fashion. We plan to use methods from both optimization and dynamic programming.

MAGIQUE-3D Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Contracts with TOTAL

- Depth Imaging Partnership (DIP)

  Period: 2014 May - 2019 April , Management: Inria Bordeaux Sud-Ouest, Amount: 120000 euros/year.

- Méthodes d'inversion sismique dans le domaine fréquentiel

  Period: 2014 October - 2017 December , Management: Inria Bordeaux Sud-Ouest, Amount: 180000 euros.

- Portage de méthodes numériques de simulation de phénomènes complexes sur des architectures exascales

  Period: 2016 January - 2017 December , Management: Inria Bordeaux Sud-Ouest, Amount: 150000 euros.

- Approximations hybrides par éléments finis discontinus pour l'élasto-acoustique

  Period: 2016 November - 2018 October, Management: Inria Bordeaux Sud-Ouest, Amount: 165000 euros.

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

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Cifre Clic and Walk (2013-2016)

Participants: MIKAELA KELLER [correspondent], PAULINE WAUQUIER, MARC TOMMASI.

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

8.1.2. ADEME

ADEME project MUST: Méthodologie d'exploitation des donnees d'usage des vehicules et d'identification de nouveaux Services pour les usagers et les territoires. JAN RAMON is the local PI at Inria of this project.

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Grants with Industry

The partnership with GE Healthcare started in 1993. In the past few years, it bore on the supervision of CIFRE PhD fellows on the topic of using a multi-modal framework and augmented reality in interventional neuroradiology. A new PhD thesis -Charlotte Delmas- started in April 2013 with the aim to perform 3D reconstruction of tools in interventional neuroradiology. Our goal is to help clinical gesture by providing the physician with a better understanding of the relative positions of the tools and of the pathology.

MAMBA Project-Team (section vide)

MANAO Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- CIFRE PhD contract with Technicolor (2014-2018)
  Participants: A. Dufay, X. Granier, and R. Pacanowski
  For this project, we aim at providing interactive previsualization of complex lighting with a smooth transition to the final solution.
- CIFRE PhD contract with FEI (2014-2018)
  Participants: D. Murray, and X. Granier
  For this project, we aim at providing expressive rendering techniques for volumes.

MARELLE Project-Team (section vide)

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

7. Bilateral Contracts and Grants with Industry

7.1. Contracts and grants with Industry

Many research activities of the project-team are conducted in close collaboration with private or public companies: CEA, SANOFI, IRDEP, EDF, IFPEN. The project-team is also supported by the Office of Naval Research and the European Office of Aerospace Research and Development, for multiscale simulations of random materials. All these contracts are operated at and administrated by the École des Ponts.

MATHNEURO Team (section vide)

MATHRISK Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- Consortium PREMIA, Natixis - Inria
- Consortium PREMIA, Crédit Agricole CIB - Inria

8.2. Bilateral Grants with Industry

Chair Ecole Polytechnique-ENPC-UPMC-Société Générale "Financial Risks" of the Risk fondation : A. Alfonsi, B. Jourdain, B. Lapeyre

MAVERICK Project-Team (section vide)

MCTAO Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. CNES - Inria - UB Contract

Contract number: 130777/00. Call Number: R-S13/BS-005-012

"Perturbations and averaging for low thrust" (Poussée faible et moyennation).
Research contract between CNES and McTAO (both the Inria and the Université de Bourgogne parts). It runs for the period 2014-2017. It concerns averaging techniques in orbit transfers around the earth while taking into account many perturbations of the main force (gravity for the earth considered as circular). The objective is to validate numerically and theoretically the approximations made by using averaging, and to propose methods that refine the approximation. It has co-funded the PhD thesis of Jeremy Rouot [2] (also co-funded by Région PACA) and fully funded the postdoc of Florentina Nicolau [32], [31].

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

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

We intend to pursue our partnership with Valeol, a wind turbine contractor in Aquitaine. Valeol poses simulation problems that cannot be addressed with standard tools. We have developed for them simplified PDE models for design in the frame of an industry funded PhD (CIFRE). We are currently adapting octree and Chimera approaches to the design of aerodynamic appendices to improve performance of existing installations. This is done in the frame of yet another CIFRE PhD thesis and the corresponding research contract. Moreover, thanks to this technology readiness, Valeol could join for the first time an H2020 research project, AEROGUST, that we are promoting with several academic and industrial institutions across Europe.

This year, we have also developed an new collaboration with the CorWave (http://www.corwave.fr). CorWave develops blood pumps based on a unique and patented wave membrane pumping technology. This collaboration has begun with an industry funded PhD (CIFRE), officially for the early 2017. Antoine Fondaneche, the PhD candidate, is now employed by CorWave on a basis of a two-month CDD contract.

We continue to deploy our effort in flow control and drag reduction for ground vehicles. After a fruitful collaboration with Renault, we are in the phase of negotiating a new collaboration. A new collaboration is starting with Valeo to optimize car cooling devices. DNS simulations are performed and compared to the industrial results obtained with URANS and LES methods and an EU network about this subject is going to be proposed.

MEPHYSTO Project-Team (section vide)

MEXICO Project-Team (section vide)

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

6. Bilateral Contracts and Grants with Industry

6.1. Bilateral Contracts with Industry

The team is in close collaborations with:

InSimo is a startup we created in January 2013, after two years of thinking, maturation and incubation. Its founding members were all former team members of the SHACRA team (our previous team). The business model of the company is based on the SOFA platform and its community to transfer state-of-the-art simulation technologies into commercially-supported software components that medical simulator vendors can integrate into their products. The goal is to foster the creation of a new generation of medical simulators, highly realistic, faster to develop, allowing a broader commercial offer and novel uses. We collaborate with InSimo through the RESET ANR project.

In the context of the SOFA Consortium, the team is in close collaborations with:

Altran is a global leader in innovation and high-tech engineering consulting, Altran accompanies supports its clients in the creation and development of their new products and services. At the occasion of Altran internal scientific workshop, several members of the team (Rosalie Plantefève, Bruno Marques Jaime Guevara and Christoph Paulus) presented their work. We collaborate with Altran through the PhD thesis of Rosalie Plantefeve.

Anatoscope is a young start-up company created in 2015 by researchers, engineers and one surgeon. It develops a software solution to automatically build 3D digital avatars based on medical images of patients. The avatars allow biomechanical simulations of the real person.

TruPhysics develops Industry 4.0 software solutions to support manufacturing companies in development and sales processes by using a real-time and high-resolution physics simulation. We provide software that enables developers and engineers to simulate control programs, physical properties, kinematics and behavior of industrial robots, machines and assemblies. We collaborate with TruPhysics through the RASimAs FP7 project.

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

8. Bilateral Contracts and Grants with Industry

8.1. Cifre Faurecia

Participants: Franck Multon [contact], Pierre Plantard.

This contract aims at developing new ergonomics assessments based on inaccurate Kinect measurements in real manufacturing conditions. 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 manufacturing sites and will then be spread worldwide among the 300 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, finished at the beginning of 2016, and defended his PhD in July 2016. This contract was the opportunity to demonstrate the impact of MimeTIC's work about in-site motion capture on ergonomic assessment, as a decision-support system for ergonomists. The software Kimea is one of the results of this collaboration. It is currently spread in the factories of Faurecia around the world, which demonstrates the maturity of this work for industrial transfer. The method has been published with ergonomic validation in the famous journal Applied Ergonomics (see Highlight section).

MIMOVE Team (section vide)

MINT Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

Hap2U SME is licenced two patents of MINT team.

MISTIS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

CIFRE PhD with SCHNEIDER (2015-2018). F. Forbes and S. Girard are the advisors of a CIFRE PhD (T. Rahier) with Schneider Electric. The other advisor is S. Marié from Schneider Electric. The goal is to develop specific data mining techniques able to merge and to take advantage of both structured and unstructured (meta)data collected by a wide variety of Schneider Electric sensors to improve the quality of insights that can be produced. The total financial support for MISTIS is of 165 keuros.

PhD contract with EDF (2016-2018). S. Girard is the advisor of a PhD (A. Clément) with EDF. The goal is to investigate sensitivity analysis and extrapolation limits in Extreme value theory with application to river flows analysis.

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

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- **Mock-up of a tool for dynamic media pre-production:** we are currently working with the HCOP holding company on the design of new tools for the pre-production of dynamic medias such as videos, e-learning animations, etc. This work involves interviews of professional video producers, the identification of opportunities for tools that could help them, and the production of descriptions and mock-ups of these tools.

- **Recognition and interpretation of piano fingering:** we have started a new collaboration with Hugues Leclère, concert pianist and professor at the "Conservatoire à rayonnement régional de Paris". Our objective is to investigate new sensing technology and interpretation algorithms for accurate live recognition of piano fingerings. Ultimately, this technology would ease the transcription of fingerings directly onto scores during play and support both the learning and training of piano fingerings, given appropriate visualization and interaction techniques that we will investigate in a second phase of this collaboration.

MNEMOSYNE Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Contract with Algotech

Participants: Frédéric Alexandre, Ikram Chraibi Kaadoud, Nicolas Rougier, Thierry Viéville.

Algotech is a SME working in the domain of CADD software edition for electrical circuit diagram interpretation and design. Its activity is interesting for our team because they are also interested in the design, by learning, of perception (for diagram identification) and action aspects of loops (for diagram genesis) with the specificity of working at a small scale, considering the variety of items to be manipulated. This is consequently a very interesting benchmark for transfering our bio-inspired models to the domain of classical machine learning, as we have begun this year.

MODAL Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Arcelor-Mittal

Participant: Christophe Biernacki.

Arcelor-Mittal is a leader company in steel industry. This 11 months contract aims at optimizing predictive maintenance from mixed data (continuous, categorical, functional) provided by multiple sensors disseminated in steel production lines.

It is a joint work with Martin Bue and Vincent Kubicki (InriaTech engineers).

8.2. Banque Accord

Participants: Christophe Biernacki, Vincent Vandewalle.

Banque Accord is a credit scoring company. This 3 months contract aims at improving credit scoring performance by using the clustering principle inside the predictive process. In addition, directly managing mixed data (continuous, categorical, missing) has to be taken into account.

It is a joint work with Quentin Grimonprez (InriaTech engineer).

8.3. Vallourec

Participant: Christophe Biernacki.

Vallourec is a world leader in premium tubular solutions for the energy markets and for other demanding industrial applications. This 9 months contract aims at predicting quality of tubular connections from mixed data (continuous, categorical, functional).

It is a joint work with Vincent Kubicki (InriaTech engineer).

8.4. Cylande

Participants: Christophe Biernacki, Vincent Vandewalle.

Cylande is a software editor for retail. This 12 months contract aims at predicting future sales from past sales, including also many other available information.

It is a joint work with Etienne Goffinet and Vincent Kubicki (InriaTech engineers).

8.5. NFID

Participants: Benjamin Guedj, Quentin Grimonprez.

NFID is the agency dedicated to innovation policies of the Hauts-de-France region.

This 3 months contract aims at clustering companies from Hauts-de-France based on their economic, social, environmental, innovation, activities data. The proposed methodology relies on the MixtComp software developed within Modal, and allows for the creation of a predictive analysis tool for NFID. This predictive tool aims at identifying regional companies with the highest innovative abilities, and has a great economic and politic impact.

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

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Optimal Transport applied to altimetric CTH dynamic interpolation

(S. Legrand V. Duval L. Chizat J-D. Benamou).

This collaboration between CLS and and funded by CNES intends to test on Column of Tropospheric Humidity data Optimal transportation interpolation techniques for balanced and unbalanced data.

MONC Project-Team (section vide)

MORPHEME Project-Team

6. Bilateral Contracts and Grants with Industry

6.1. Bilateral Contracts with Industry

General Electric Healthcare: a 36 months (from feb. 2016 to jan. 2019) companion contract for the Cifre thesis of E. Poulain.

Bayer, Lyon. In December, we signed a collaboration contract with Bayer, Lyon, to fund a Master 2 internship with some overhead on the topic of automatic cell classification. The intern will start working on the subject in January 2017.

8. Bilateral Contracts and Grants with Industry

8.1. QuickCSG Contract with undisclosed industrial partner

QuickCSG software was licensed in October 2015 to an industrial partner whose name is contractually kept undisclosed for a finite time period. Integration of QuickCSG into the partner's software is continuing and is scheduled to be sold with this industrial partner's products. An additional support contract has been signed with this partner for the purpose of the transfer.

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

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Venathec

Company: Venathec SAS

Other partners: ACOEM Group, GE Intelligent Platforms (contracted directly with Venathec)

Duration: June 2014 - August 2017

Supported by: Bpifrance

Abstract: The project aims to design a real-time control system for wind farms that will maximize energy production while limiting sound nuisance. This will leverage our know-how on audio source separation and uncertainty modeling and propagation.

MUSE Team (section vide)

MUTANT Project-Team (section vide)

MYCENAE Project-Team (section vide)

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

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Technicolor (2016-2017)
Participant: Guillaume Pierre.

Our collaboration with Technicolor focuses on the design of a scalable and elastic virtual vistumer premises equipment based on Network Function Virtualization, Software-Defined Networking and Cloud technologies. In 2016 we completed the system design and an engineer from Technicolor started implementing the system. We expect to conduct further experiments and write a joint publication on this topic in 2017.

8.2. Bilateral Grants with Industry

8.2.1. Thales Research and Technology (2016-2018)
Participants: Baptiste Goupille-Lescar, Christine Morin, Nikos Parlavantzas.

Our collaboration with Thales Research and Technology focuses on the development of distributed Cyber-Physical Systems, such as those developed by Thales to monitor and react to changing physical environments. These systems need to be highly adaptable in order to cope with the dynamism and diversity of their operating environments. Notably, they require distributed, parallel architectures that support dynamic sets of applications, not known in advance, while providing strong QoS guarantees. The objective of this collaboration is to explore adaptive resource management mechanisms for such systems that can adapt to changes in the requirements and in the availability of resources. This contract funds Baptiste Goupille-Lescar's PhD grant.

8.2.2. Nokia (2015-2018)
Participant: Christine Morin.

Together with CIDRE Inria project-team we are involved in a collaboration with Nokia on security policy adaptation driven by risk evaluation in modern communication infrastructures. To address the need for efficient security supervision mechanisms, approaches such as attack graphs generation, coupled to a risk-based assessment have been used to provide an insight into a system's threat exposure. In comparison to static infrastructures, clouds exhibit a dynamic nature and are exposed to new attack scenarios due to virtualization. The goal of this collaboration is thus to revisit existing methods in the context of clouds. This contract funds Pernelle Mensah's PhD grant. Pernelle is a member of CIDRE project-team.

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

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. Nucletudes

Participants: Patrick Breuilh [Nuclétudes, Les Ulis, France], Alexis Gobé, Stéphane Lanteri.

The objective of this collaboration with the Nucletudes company that has been initiated this year is to design a high order HDG formulation able to deal with non-conforming hybrid cubic/tetrahedral meshes, for the simulation of time-domain electromagnetic wave propagation problems with applications to radiation hardening. This first part of this study has been concerned with the specification and development of a preprocessing tool for the construction of such hybrid structured/unstructured meshes.
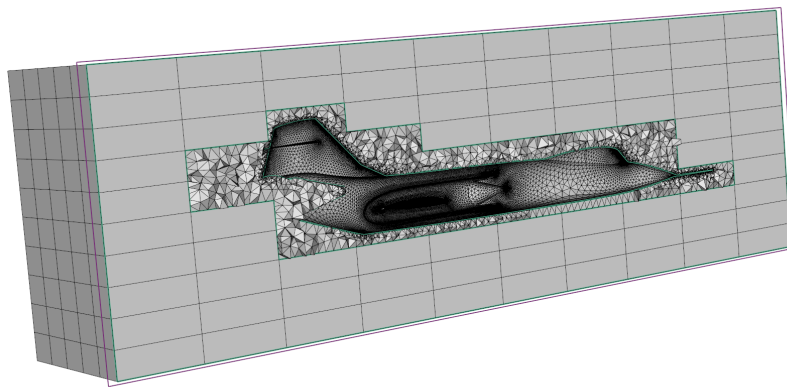
Figure 12. Non-confoming hybrid cubic/tetrahedral mesh around a jet fighter for Radar Cross Section evaluation using a frequency-domain Maxwell solver based on a HDG method.

NANO-D Project-Team (section vide)

NECS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. ALSTOM

Contract with ALSTOM in the framework of Inria/ALSTOM joint laboratory, and CIFRE PhD grant of Simon Gerwig. This thesis explores collaborative and reconfigurable resilient control design of hydroelectric power plants; current work is on improving performance of a hydro-electric power-plant outside its design operation conditions, by cancellation of oscillations that occur in such operation range.

NEUROSYS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. CertiViBE

Laurent Bougrain is a member of the steering committee of OpenViBE and CertiViBE.

CertiViBE is a medically certifiable core for OpenViBE, the software for Brain Computer Interfaces and Neuroscience research. It is an Inria innovation lab to boost technology transfers from the Inria project-team Hybrid to Mensia Technologies SA (http://www.mensiatech.com/).

Founded in 2012, Mensia Technologies is a medical-device spin-off of Inria owning an exclusive worldwide license of the OpenViBE software for commercial applications. So far, OpenViBE has raised a lot of interest in the research community, especially on medical applications. However, OpenViBE being a research software, it does not yet match the requirements of medical devices in terms of stability, performance, documentation, as well as engineering processes in general, slowing down the transfer of OpenViBE-based medical research to industry. Within the CertiViBE project, Inria and Mensia Technologies are putting their task forces and respective expertise together to deliver a certifiable core for the OpenViBE software. While the OpenViBE software will continue to be published as an Open Source software, the project will dramatically facilitate the transfer of the research made with OpenViBE as it will be built on ready-to-certify foundations, following the processes and normative regulation of medical devices development including risk analysis, quality assurance and medical device software development and maintenance.

NON-A Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

Contract with Neotrope (Tourcoing, France), Technologies & Augmented Human UX. Subject: De-correlation of GSR measurements with acceleration, from March 2016 to September 2016, D. Efimov, R. Ushirobira.

8.2. Bilateral Grants with Industry

Project of Autonomous control of clinic table with La Maison Attentive, 2016.

8.3. Bilateral Grants with Industry

Collaboration with Safran Electronics & Defense (Massy-Palaiseau) in the framework of the CIFRE PhD thesis of Guillaume Rance on robust stabilization of gyrostabilized platforms (2014-2018).

NUMED Project-Team

6. Bilateral Contracts and Grants with Industry

6.1. Bilateral Contracts with Industry

- Long standing contract with Sanofi company, on the stability of vaccines. This contract leads to the design and coding of a complete software devoted to the study of the degradation of vaccines. This software has been used in presentations of new vaccines to the FDA.
- Modeling of the quality of glass for a small French company.

ORPAILLEUR Project-Team (section vide)

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

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Nano 2017 PSAIC

Participants: Arif Ali Ana-Pparakkal, Erven Rohou, Emmanuel Riou.

Nano 2017 PSAIC is a collaborative R&D program involving Inria and STMicroelectronics. The PSAIC (Performance and Size Auto-tuning through Iterative Compilation) project concerns the automation of program optimization through the combination of several tools and techniques such as: compiler optimization, profiling, trace analysis, iterative optimization and binary analysis/rewriting. For any given application, the objective is to devise through a fully automated process a compiler profile optimized for performance and code size. For this purpose, we are developing instrumentation techniques that can be focused and specialized to a specific part of the application aimed to be monitored.

The project involves the Inria teams PACAP, AriC, CAMUS and CORSE. PACAP contributes program analyses at the binary level, as well as binary transformations. We will also study the synergy between static (compiler-level) and dynamic (run-time) analyses.

8.2. Bilateral Grants with Industry

8.2.1. Intel research grant INTEL2014-8957

Participants: André Seznec, Biswabandan Panda, Arthur Perais, Fernando Endo.

Intel is supporting the research of the PACAP project-team on "Mixing branch and value prediction to enable high sequential performance".

8.2.2. Intel research grant INTEL2016-11174

Participants: André Seznec, Pierre Michaud, Kleovoulos Kalaitzidis.

Intel is supporting the research of the PACAP project-team on "Design tradeoffs for extreme cores".

PANAMA Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. *Licensing agreement contract with Cedar Audio Limited*
Participants: Nancy Bertin, Srdan Kitic, Rémi Gribonval.

This contract aimed at licensing an audio desaturation (declipping) software developed in the team.

8.2. Bilateral Grants with Industry

8.2.1. *CIFRE contract with Technicolor R&I France on Very large scale visual comparison*
Participants: Rémi Gribonval, Himalaya Jain.

> *Duration: 3 years (2015-2018)*
>
> *Research axis:* *3.1.2*
>
> *Partners: Technicolor R&I France, Inria-Rennes*
>
> *Funding: Technicolor R&I France, ANRT*

The grand goal of this thesis is to design, analyze and test new tools to allow large-scale comparison of high-dimensional visual signatures. Leveraging state of the art visual descriptors, the objective is to obtain new compact codes for visual representations, exploiting sparsity and learning, so that they can be stored and compared in an efficient, yet meaningful, way.

PARIETAL Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Grants with Industry

7.1.1. *The Wendelin FUI project*

The Wendelin project has been granted on December 3rd, 2014. It has been selected at the *Programme d'Investissements d'Avenir (PIA)* that supports "cloud computing et Big Data". It gives visibility and fosters the French technological big data sector, and in particular the scikit-learn library, the NoSQL "NEO" et the decentralized "SlapOS" cloud, three open-source software supported by the Systematic *pôle de compétitivité*.

Scikit-learn is a worldwide reference library for machine learning. Gaël Varoquaux, Olivier Grisel and Alexandre Gramfort have been major players in the design of the library and Scikit-learn has then been supported by the growing scientific Python community. It is currently used by major internet companies as well as dynamic start-ups, including Google, Airbnb, Spotify, Evernote, AWeber, TinyClues; it wins more than half of the data science "Kaggle" competitions. Scikit-learn makes it possible to predict future outcomes given a training data, and thus to optimize company decisions. Almost 1 million euros will be invested to improve the algorithmic core of scikit-learn through the Wendelin project thanks to the Inria, ENS and Institut Mines Télécom teams. In particular, scikit-learn will be extended in order to ease online prediction and to include recent stochastic gradient algorithms.

NEO is the native NoSQL base of the Python language. It was initially designed by Nexedi and is currently used and embedded in the main software of company information systems. More than one million euros will be invested into NEO, so that scikit-learn can process within 10 years (out-of-core) data of 1 exabyte size.

Paris13 university and the Mines Télécom institute will extend the SlapOS distributed mesh cloud to deploy Wendelin in *Big Data as a Service* (BDaaS) mode, to achieve the interoperability between the Grid5000 and Teralab infrastructures and to extend the cloud toward smart sensor systems.

The combination of scikit-learn, NEO and SlapOS will improve the predictive maintenance of industrial plants with two major use cases: connected windmills (GDF SUEZ, Woelfel) and customer satisfaction in car sale systems (MMC Rus). In both cases it is about non-personal, yet profitable big data. The Wendelin project actually demonstrates that Big data can improve infrastructure and everyday-life equipment without intrusive data collection. For more information, please see http://www.wendelin.io.

The project partners are:

- Nexedi (leader)
- GDF SUEZ
- Abilian
- 2ndQuadrant
- Institut Mines Télécom
- Inria
- Université Paris 13

PARKAS Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

Technology Transfer Project, partly funded by the TETRACOM grant and by Kalray.

7.2. Bilateral Grants with Industry

Polly Labs initiative. Funded by ARM for 4 years with complementary support from Xilinx, in cooperation with ETH Zürich and Qualcomm.

PARSIFAL Project-Team (section vide)

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

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- In December, PERCEPTION started a one year collaboration with the **Digital Media and Communications R&D Center, Samsung Electronics** (Seoul, Korea). The topic of this collaboration is *multi-modal speaker localization and tracking* (a central topic of the team) and is part of a strategic partnership between Inria and Samsung Electronics.

- Over the past six years we have collaborated with Aldebaran Robotics (now SoftBank). This collaboration was part of two EU STREP projects, HUMAVIPS (2010-2012) and EARS (2014-2016). This enabled our team to establish strong connections with SoftBank, to design a stereoscopic camera head and to jointly develop several demonstrators using three different generations of the NAO robot.
  Website: https://team.inria.fr/perception/nao/

- In 2015 we started a collaboration with Xerox Research Center India (XRCI), Bangalore. This three-year collaboration (2015-2017) is funded by a grant awarded by the **Xerox Foundation University Affairs Committee (UAC)** and the topic of the project is *Advanced and Scalable Graph Signal Processing Techniques*. The work is done in collaboration with EPI MISTIS and our Indian collaborators are Arijit Biswas and Anirban Mondal.

PERVASIVE INTERACTION Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. *Learning daily routines by observing activity in a smart home.*

Members of the Pervasive interaction team are working with Orange Labs on techniques for observing activity and learning routines in a smart home. Activity is observed by monitoring use of electrical appliances and Communications media (Telephone, Television, Internet). Activities are described using Bayesian Situation Modeling techniques demonstrated in earlier projects. A log of daily activities is used to discover daily routines expressed as temporal sequences of contexts, where each context is expressed as a network of situations. Experiments will be performed using the Smart home living lab that has been constructed as part of the EquipEx Amiqual4home.

7.1.2. *IRT Silver Economy*

Participants: James Crowley, Pierre Baret, Maxime Belgodere Partners: CEA, Schneider Electric.

Members of the Pervasive Interaction team are working with the CEA and Schneider Electric to develop environmental sensors that can detect when a hospital patient or elderly person has fallen and is unable to get up. The project uses an infrared Bolometric image sensor to observe human activity. Image processing and fall detection logic are to be performed by an embedded image processor on board.

8. Bilateral Contracts and Grants with Industry

8.1. Electronic Voting Systems

Participants: Véronique Cortier, Mathieu Turuani.

Since 2014, a collaboration agreement has been signed between Loria and Scytl, a Spanish company who is proposing solutions for the organization of on-line elections, including legally binding elections, in several countries. In this context, Scytl has signed a contract with the Pesto team as well as the University of Birmingham (David Galindo) to design a formal proof of both verifiability and privacy of the protocol developed by Scytl, for a deployment in Switzerland.

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

Funding for the DomAssist500 project was obtained from the following industrial partner: AG2R La Mondiale.

PI.R2 Project-Team (section vide)

PLEIADE Team (section vide)

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

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

Contract POEMS-DGA
Participants: Eric Lunéville, Marc Lenoir, Séphanie Chaillat, Nicolas Kielbasiewicz, Nicolas Salles.

Start : 2015, End : 2018. Administrator : ENSTA.
This contract is in partnership with François Alouges and Matthieu Aussal (CMAP, Ecole Polytechnique) and concerns the improvement of Boundary Element Methods for wave propagation problems.

Contract POEMS-CEA-LIST
Participants: Marc Bonnet, Laure Pesudo.

Start : 12/01/2014, End : 11/31/2017. Administrator : CNRS.
This contract is about the coupling between high frequency methods and integral equations.

Contract POEMS-SHELL
Participants: Stéphanie Chaillat, Patrick Ciarlet, Luca Desiderio.

Start : 10/01/2013, End : 09/31/2016. Administrator : CNRS.
This contract is about fast direct solvers to simulate seismic wave propagation in complex media.

Contract POEMS-EDF
Participants: Stéphanie Chaillat, Marc Bonnet, Zouhair Adnani.

Start : 12/01/2014, End : 11/31/2017. Administrator : CNRS.
This contract is about fast solvers to simulate soil-structure interactions.

<p align="center" style="color:red">**POLARIS Team**</p>

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry: Alcatel Lucent-Bell

A common laboratory between Inria and the Alcatel Lucent-Bell Labs was created in early 2008 and consists on three research groups (ADR). POLARIS leads the ADR on self-optimizing networks (SELFNET). The researchers involved in this project are Bruno Gaujal and Panayotis Mertikopoulos.

- Contract with Schneider Electric (2015–2018). Distributed optimization in electrical distribution networks. Associated to a CIFRE PhD grant (Benoît Vinot, started in 4/2015). Partners: Inria (Polaris), Schneider Electric, G2ELab.

7.2. National Initiatives

7.2.1. ANR

- *GAGA (2014–2017)*
  GAGA is an ANR starting grant (JCJC) whose aim is to explore the Geometric Aspects of GAmes. The GAGA team is spread over three different locations in France (Paris, Toulouse and Grenoble), and is coordinated by Vianney Perchet (ENS Cachan). Its aim is to perform a systematic study of the geometric aspects of game theory and, in so doing, to establish new links between application areas that so far appeared unrelated (such as the use of Hessian Riemannian optimization techniques in wireless communication networks).

- *MARMOTE (2013–2016)*
  Partners: Inria Sophia (MAESTRO), Inria Rocquencourt (DIOGEN), Université Versailles-Saint-Quentin (PRiSM lab), Telecom SudParis (SAMOVAR), Université Paris-Est Créteil (*Spécification et vérification de systèmes*), Université Pierre-et-Marie-Curie/LIP6.
  The project aims at realizing a software prototype dedicated to Markov chain modeling. It gathers seven teams that will develop advanced resolution algorithms and apply them to various domains (reliability, distributed systems, biology, physics, economy).

- *NETLEARN (2013–2017)*
  Partners: Université Versailles – Saint-Quentin (PRiSM lab), Université Paris Dauphine, Inria Grenoble (POLARIS), Institut Mines–Telecom (Telecom ParisTech), Alcatel–Lucent Bell Labs (ALBF), and Orange Labs.
  The main objective of the project is to propose a novel approach of distributed, scalable, dynamic and energy efficient algorithms for mobile network resource management. This new approach relies on the design of an orchestration mechanism of a portfolio of algorithms. The ultimate goal of the proposed mechanism is to enhance the user experience, while at the same time ensuring the more efficient utilization of the operator's resources.

- *ORACLESS (2016–2021)*
  ORACLESS is an ANR starting grant (JCJC) coordinated by Panayotis Mertikopoulos. The goal of the project is to develop highly adaptive resource allocation methods for wireless communication networks that are provably capable of adapting to unpredictable changes in the network. In particular, the project will focus on the application of online optimization and online learning methodologies to multi-antenna systems and cognitive radio networks.

- *ANR SONGS, 2012–2016*. Partners: Inria Nancy (Algorille), Inria Sophia (MASCOTTE), Inria Bordeaux (CEPAGE, HiePACS, RunTime), Inria Lyon (AVALON), University of Strasbourg, University of Nantes.

  The last decade has brought tremendous changes to the characteristics of large scale distributed computing platforms. Large grids processing terabytes of information a day and the peer-to-peer technology have become common even though understanding how to efficiently exploit such platforms still raises many challenges. As demonstrated by the USS SimGrid project funded by the ANR in 2008, simulation has proved to be a very effective approach for studying such platforms. Although even more challenging, we think the issues raised by petaflop/exaflop computers and emerging cloud infrastructures can be addressed using similar simulation methodology.

  The goal of the SONGS project (Simulation of Next Generation Systems) is to extend the applicability of the SimGrid simulation framework from grids and peer-to-peer systems to clouds and high performance computation systems. Each type of large-scale computing system will be addressed through a set of use cases and led by researchers recognized as experts in this area. Any sound study of such systems through simulations relies on the following pillars of simulation methodology: Efficient simulation kernel; Sound and validated models; Simulation analysis tools; Campaign simulation management. Such aspects are also addressed in the SONGS project.

7.2.2. National Organizations

- Jean-Marc Vincent is member of the scientific committees of the CIST (Centre International des Sciences du Territoire).
- *REAL.NET (2016)*
  REAL.NET is a CNRS PEPS starting grant (JCJC) coordinated by Panayotis Mertikopoulos. Its objective is to provide dynamic control methodologies for nonstationary stochastic optimization problems that arise in wireless communication networks.

POLSYS Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Grants with Industry

Until the mid 2000's, multivariate cryptography was developing very rapidly, producing many interesting and versatile public-key schemes. However, many of them were soon successfully cryptanalysed (a lot have been done in this group). As a consequence, the confidence in multivariate cryptography cryptosystems declined. It seems that there have emerged new important reasons for renewal of the interest in a new generation of multivariate schemes. In the past two years, the algorithms for solving the Discrete Logarithm Problem over small characteristic fields underwent an extraordinary development. This clearly illustrates the risk to not consider alternatives to classical assumptions based on number theory. In parallel, two of the most important standardization bodies in the world, NIST and ETSI have recently started initiatives for developing cryptographic standards not based on number theory, with a particular focus on primitives resistant to quantum algorithms. An objective here is then to focus on the design of multivariate schemes.

The team is now involved in the industrial transfer of post-quantum cryptography. The project is supervised by SATT-LUTECH. SATT-LUTECH specializes in the processing and transfer of technologies from research laboratories of its shareholders: Inria, CNRS, University of Technology of Compiègne, National Museum of Natural History, Institute Curie, Université Panthéon-Assas, Paris Sorbonne University and National School of Industrial Creation).

The team has recently developed, in partnership with a mobile application development company (WASSA), an Android app for smartphones (Samsung G5 type) that uses multivariate cryptography. The application has been tested mid-November in a series of experiments supervised by DGA and French Ministry of Defense. The experiment gathered a total of hundred participants from various operational units. This is a first milestone in the maturation project whose goal is to create a start-up.

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- PhD Grant CIFFRE, 2015-2018, for Jean-Michael Célérier, in partnership with Blue Yeti (Royan),

POTIOC Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

Interactive Collaboration in Virtual Reality for Aerospace Scenarii:

Duration: 2014-2017

PhD Thesis of Damien Clergeaud

Partners: Airbus Group

The Airbus company regularly uses virtual reality for design, manufacturing and maintenance. We work with them on collaborative interaction in order to enable an efficient collaboration between operators immersed in the virtual environment from remote locations and with heterogeneous equipment. More precisely, we have developed tools to point and manipulate objects, to remotely visualize the virtual environment, to be aware of remote manipulations and to describe tools and components trajectories (see Section 7.5).

PRIVATICS Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. IPSec with pre-shared key for MISTIC security

Title: IPSec with pre-shared key for MISTIC security.

Type: CIFRE.

Duration: Juillet 2014 - Juillet 2017.

Coordinator: Inria

Others partners: Privatics, Moais and Incas-ITSec.

PROSECCO Project-Team (section vide)

QUANTIC Project-Team (section vide)

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

5. Bilateral Contracts and Grants with Industry

5.1. Bilateral Contracts with Industry

- Contrat de recherche externalisé avec ORANGE SA "Scheduling Global OS". Duration three years 2014-2016.
- *Christine Fricker* is the leader of PGMO project "Systèmes de véhicules en libre-service: Modélisation, Analyse et Optimisation" with G-Scop (CNRS lab, Grenoble) and Ifsttar. From 1 to 3 years. From 1/10/2013 to 30/9/2016.
- PhD grant CJS (Contrat Jeune Scientifique) Frontières du vivant of INRA for Renaud Dessalles.
- PhD grant from Fondation Sciences Mathématiques de Paris for Wen Sun.
- PhD grant from Brazilian Government for Guilherme Thompson.
- CELTIC+ Contract "SENDATE".

<p align="center">**RAPSODI Team**</p>

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

C. Cancès supervises the PhD Thesis of Nicolas Peton at IFPEN since October 15, 2015. The bilateral contract enters the framework agreement between Inria and IFPEN.

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

8. Bilateral Contracts and Grants with Industry

8.1. Contract with EDF on robust maintenance planning

Our project with EDF concerns the optimization of the long term energy production planning, allowing for nuclear power plants maintenance. The challenges are to handle the large-scale instance of a five year planning and to handle the stochastic aspects of the problem: the stochastic variation of the electricity demand, the production capacity and the duration of maintenance period. The key decisions to be optimized are the dates of outages (for maintenance) and the level refuelling that determines the production of the year to come. We previously developed a column generation approach based on extended formulation which enables to solve within a few minutes a deterministic instance of the problem, which is within the time frame of the operational tools currently used by EDF. We now investigate stochastic and robust versions of the problem, where the duration of maintenance operations and the power demand are uncertain. Our approaches shall be evaluated on real life instances within a rolling horizon framework.

8.2. Collaboration with ERTUS on phytosanitary treatment planning

In planning winary operations (most importantly phytosanitary treatments on the wine tree) under wheather forcast uncertainty, one searches for solutions that remain feasible and "cheap" in case of perturbation in the data. We consider the planning and scheduling of the operations that arise over a one-year horizon. More precisely, the operations to be sheduled include tasks related to soil care, or grape tree care: cutting, line building, thinning out leaves, ..., and chemical treatments. The latter are a main focus of our study since one of the principal goals of better planning is to reduce the amount of chemical treatments by selecting the appropriate products and schemes, but also by spacing out treatements while guarantying a desease free vineyard with some confidence. Each of the scheduled tasks requires its own resource, so the planning also triggers equipement and raw products selection decisions. The objective is to minimize both equipment and product costs augmented by an evaluation of the hazard of chemical product use. The planning should be "robust" to seasonal variations on the proper time frame for scheduling tasks.

8.3. Collaboration with St-Gobain Recherche on glass cutting

Through the PhD of Quentin Viaud, we study a hard glass-cutting problem. The objective is to minimize the quantity of trim loss when rectangular pieces are cut from large rectangles. This first study has shown that our methodologies are able to cope with this problem for medium-size instances. Solving the problem with large instances is a scientific challenge that we will address in the a follow-up contract.

8.4. Collaboration with Greycon Ltd. on industrial cutting

Through a research internship, we have studied a hard one-dimensional industrial cutting problem with manu practical constraints. We have designed a non-standard diving heuristic , where some complicating constraints are handled trough branching. Our heuristic was able to improve the solutions found by the industrial partner for several hard instances.

8.5. Collaboration with SNCF on timetable and rolling stock rotation planning

Our projet with SNCF concerns the optimisation of timetable and rolling stock rotation planning. The railway production planning process combines heterogeneous resources and is usually decomposed into different sequential sub-problems, beginning by line planning, timetabling, rolling stock rotations and crew scheduling. Our goal is to solvie the timetable and rolling stock problems in an integrated manner. Given a line planning and service requirement constraints, the problem is to produce a timetable for a set of trains and the objective is to minimize the cost of the railcars used. An originality of our approach is to deal with railcars composed of multiple units, which can be coupled or decoupled at some stations. The PhD thesis of Mohamed Benkirane is funded by this project.

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. *Joint industrial PhD with Renault*

- Renault, 2014-2016, 45 000 euros. The purpose of this contract is to develop solutions for running a mix of real-time and best-effort applications on a small embedded multicore architecture. Our goal is to optimize the usage of the processor resource. The PhD of Antoine Blin is supported by a CIFRE fellowship with Renault.

7.1.2. *Joint industrial PhD with Scality SA: CRDTs for Large-Scale Storage Systems*

This year, we continued the joint CIFRE (industrial PhD) research of Tao Thanh Vinh, with the French start-up company Scality, as described above (under "Large-Scale File Systems").

The objective of this research is to design new algorithms for file and block storage systems, considering both the issues of scaling the file naming tree to a very large size, and the issue of conflicting updates to files or to the name tree, in the case of high latency or disconnected work.

A new CIFRE agreement with Scality is awaiting the agreement from ANRT and will start ASAP. The PhD student is Dimitrios Vasilas, and his topic is "Scalable indexing for large-scale distributed storage systems."

7.1.3. *Joint industrial PhDs: data sharing in mobile networks and automatic resizing of shared I/O caches, with Magency*

Magency organizes large events during which participants can use mobile devices to access related data and interact together.

The thesis of Lyes Hamidouche concerns efficient data sharing among a large number of mobile devices. Magency brings traces captured during real events (data accesses and user mobility). We are jointly working on the design of algorithms allowing a large number of mobile devices to efficiently access remote data.

Magency also runs servers. A server is used before an event in order to be prepared and tested, and then, during the event to serve the numerous mobile devices accesses. Many servers are run on a single physical machine using containers. Using this configuration, the memory is partitioned, leading to poor performances for applications that need a large amount of memory for caching purpose. In the context of Damien Carver's PhD thesis, we are designing kernel-level mechanisms that automatically give more memory to the most active containers, leveraging the expertise acquired during Maxime Lorrillere's PhD thesis.

7.1.4. *EMR CREDIT, with Thales*

Franck Petit and Swan Dubois participate to the creation of the EMR (Equipe Mixte de Recherche) *CREDIT*, (Compréhension, Représentation et Exploitation Des Interactions Temporelles) between LIP6/UPMC and Thales.

Nowadays, networks are the field of temporal interactions that occur in many settings networks, including security issues. The amount and the speed of such interactions increases everyday. Until recently, the dynamics of these objects was little studied due to the lack of appropriate tools and methods. However, it becomes crucial to understand the dynamics of these interactions. Typically, how can we detect failures or attacks in network traffic, fraud in financial transactions, bugs or attacks traces of software execution. More generally, we seek to identify patterns in the dynamics of interactions. Recently, several different approaches have been proposed to study such interactions. For instance, by merging all interactions taking place over a period (e.g. one day) in a graph that are studied thereafter (evolving graphs). Another approach was to built meta-objects by duplicating entities at each unit of time of their activity, and by connecting them together.

The goal of the EMR is to join both teams of LIP6 and Thales on these issues. More specifically, we hope to make significant progress on security issues such as anomaly detection. This requires the use of a formalism sufficiently expressive to formulate complex temporal properties. Recently, a vast collection of concepts, formalisms, and models has been unified in a framework called Time-Varying Graphs. We want to pursuit that way. In the short run, the challenges facing us are: (1) refine the model to capture some interaction patterns, (2) design of algorithms to separate sequences of interactions, (3) Identify classes of entities playing a particular role in the dynamics, such as bridges between communities, or sources and sinks.

REO Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. *Air Liquide Santé International*
Participants: Céline Grandmont, Nicolas Pozin, Irene Vignon-Clementel.

CIFRE convention and contract with Air Liquide Santé International in the context of the ANRT on "Multiscale lung ventilation modeling in health and disease", for the PhD thesis of Nicolas Pozin (March 2014 - February 2017).

8.1.2. *Philips Research*
Participants: Miguel Ángel Fernández Varela, Jean-Frédéric Gerbeau, Alexandre This.

CIFRE convention and contract with Philips Research for the PhD thesis of Alexandre This (January 2016 - December 2018) on fusion data/simulation for the assessment of mitral regurgitation.

8.1.3. *Kephalios & Epygon*
Participants: Miguel Ángel Fernández Varela, Jean-Frédéric Gerbeau, Ludovic Boilevin-Kayl, Marina Vidrascu.

REO is an academic partner of the industrial project MIVANA, dedicated to the development of new technologies for mitral valve treatment. It is led by the start-up company Kephalios, with the participation of the start-up company Epygon, by the company MDB Texinov and the research institute IFTH. In this framework, REO has two bilateral contracts with Kephalios and Epygon on the modeling and simulation of two medical devices for mitral valve repair.

8.1.4. *Instem/NOTOCORD*
Participants: Muriel Boulakia, Damiano Lombardi, Jean-Frédéric Gerbeau, Fabien Raphel, Eliott Tixier.

REO partners with the software company NOTOCORD in the framework of the LabCom "cardioXcomp" (see ANR projects section). In 2016, the ANR funding came to an end, and NOTOCORD was acquired by the company Instem. Our collaboration with Instem/NOTOCORD will continue as a bilateral partnership with the purpose of developing the software cardioXcomp dedicated to the safety pharmacology industry.

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

VALEO Group: a very strong partnership is under reinforcement between VALEO and Inria. Several bilateral contracts were signed to conduct joint works on Driving Assistance, some of which VALEO is funding. This joint research includes:

- The PhD thesis of Pierre de Beaucorps and the post-doc of Thomas Streubel under the framework of VALEO project "Daring"

- *SMART* project: on the *Design and development of multisensor fusion system for road vehicles detection and tracking*. This project funds the internship of Alfredo Valle Bario.

- A CIFRE like PhD thesis is ongoing between VALEO and Inria (M. Maximilian JARITZ), dealing with multisensor processing and learning techniques for free navigable road detection.

- VALEO is currently a major financing partner of the "GAT" international Chaire/JointLab in which Inria is a partner. The other partners are: UC Berkeley, Shanghai Jiao-Tong University, EPFL, IFSTTAR, MPSA (Peugeot-Citroën) and SAFRAN.

- Technology transfer is also a major collaboration topic between RITS and VALEO as well as the development of a road automated prototype.

- Finally, Inria and VALEO are partners of the CAMPUS project (PIA french project) including SAFRAN, Invia and Gemalto. The aim of the project is the development of autonomous vehicles and the realization of two canonical uses-cases on highways and urban like environments.

TATA Motors European Technical Centre (TMETC): a new partnership was born in 2016 with the aim of developing a highly automated vehicle. Technology transfer from Inria to TATA Motors includes localization and mapping as well as control-command codes.

Renault Group: Collaboration between Renault and RITS re-started in 2016 and is expected to know a major growth in 2017. Three different research teams in Renault are now working separately with RITS on different topics.

A first concrete action was the beginning of a CIFRE PhD thesis funded by Renault and the French ANRT. The thesis deals with the accurate localization of an autonomous vehicle on a highway using mainly on-board low-cost perception sensors.

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

8.1.1. BlockChain

We started a new collaboration with a local company about tools and languages in the context of Blockchain systems. The collaboration started with a 2 month exploration phase involving an engineer at Inria Tech. A postdoc or PhD will start in 2017.

8.1.2. Worldline CIFRE

We are working on improving the testing behaviour of the developers. The PhD started in October 2014 and is ongoing.

8.1.3. Thales CIFRE

We are working on large industrial project rearchitecturization. The PhD started in January 2015 and is ongoing.

8.1.4. Pharo Consortium

The Pharo Consortium was founded in 2012 and is growing constantly. As of end 2016, it has 23 company members, 12 academic partners and 3 sponsoring companies. Inria supports the consortium with one full time engineer starting in 2011. More at http://consortium.pharo.org.

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Mumps Consortium (2014-2019)

In 2016, in the context of the MUMPS consortium (http://mumps-consortium.org):

- We have signed two new membership agreements, with Free Field Technologies and Safran in 2016, on top of the on-going agreements signed in 2014 and 2015 with Altair, EDF, ESI-Group, LSTC, Michelin, Siemens SISW (Belgium) and TOTAL.

- We have organized point-to-point meetings with several members.

- We have provided technical support and scientific advice to members.

- We have provided non-public releases in advance to members, with a specific licence.

- We have organized the second consortium committee meeting, at Michelin (Clermont-Ferrand).

- Two engineers have been funded by the membership fees, for software engineering and software development, performance study and comparisons, business development and management of the consortium.

- 0.5 year of a PhD student were funded by the membership fees (see Section 9.1).

8.2. Technological Transfer: XtremLogic Start-Up

The XTREMLOGIC start-up (former Zettice project) was initiated 5 years ago by Alexandru Plesco and Christophe Alias.

The goal of XTREMLOGIC is to provide energy-efficient circuit blocks for FPGA reconfigurable circuits. These circuits are produced automatically through an high-level synthesis (HLS) tool based on state-of-the-art automatic parallelization technologies, notably from the polyhedral community. The compiler technology transfered to XTREMLOGIC is the result of a tight collaboration between Christophe Alias and Alexandru Plesco. In a way, XTREMLOGIC can be viewed as "applied research" targetting a direct industrial application.

XTREMLOGIC won several awards and grants: Rhône Développement Initiative 2015 (loan), "concours émergence OSEO 2013" at Banque Publique d'Investissement (grant), "most promising start-up award" at SAME 2013 (award), "lean Startup award" at Startup Weekend Lyon 2012 (award), "excel&rate award 2012" from Crealys incubation center (award).

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

- **Thales** ($02/14 \rightarrow 01/17$)
  Funding for the supervision of Julia Chaulet's PhD.
  30 kEuros.

SELECT Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Contract with SNECMA

Participants: Gilles Celeux, Florence Ducros, Patrick Pamphile.

SELECT has a contract with Nexter regarding modeling the reliability of vehicles.

SEMAGRAMME Project-Team (section vide)

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

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- contract with "500px"; PI: Romaric Gaudel.

  Title: Recommender System for Photos

  Duration: May 2016 – Oct. 2016 (6 months)

  Abstract: Recommender Systems aim at recommending items to users. Advances in that field are targeting more and more personalized recommendation. From a recommendation based on market segment to a recommendation based on individual user taste. From a recommendation based on user's information to a recommendation based on any feedback from any user. From a recommendation based on logged data to a recommendation including latest trends... 500px is a Canadian company which is part of this trend. 500px offers solutions to store pictures online, to share pictures, and to browse among pictures exhibited by other users. Given the huge amount of pictures stored by 500px, users need help to find pictures which corresponds to their tastes. 500px offers several tools to filter the content presented to users. But the tools allowing exploration of the pictures landscape are not personalized, the selection is mostly based on the popularity of pictures/galleries. The most personalized recommendations are obtained by following other users: you see recent pictures of that users. But such recommendations requires you (i) to discover by yourself relevant users, (ii) to explicitly tag these users. The aim of the project is to scan state of the art in Collaborative Filtering and to design a tool which recommends pictures to users based on their implicit actions: given the list of followed users, famed pictures, commented pictures, browsed pictures, ..., infer user's tastes and recommend to that user pictures and/or other user to look at. The system would also make use of informations on the pictures and of user profiles.

- contract with "Orange Labs"; PI: Philippe Preux

  Title: Sequential Learning and Decision Making under Partial Monitoring

  Duration: Oct. 2014 – Sep. 2017

  Abstract: In applications such as recommendation systems, or computational advertising, the return collected from the user is partial: (s)he clicks on one item, or no item at all. We study this setting in which only a "partial" information is gathered in particular how to learn to behave optimaly in such a setting.

- contract with "55"; PI: Jérémie Mary

  Title: Novel Learning and Exploration-Exploitation Methods for Effective Recommender Systems

  Duration: Oct. 2015 – Sep. 2018

  Abstract: In this Ph.D. thesis we intend to deal with this problem by developing novel and more sophisticated recommendation strategies in which the collection of data and the improvement of the performance are considered as a unique process, where the trade-off between the quality of the data and the performance of the recommendation strategy is optimized over time. This work also consider tensor methods (one layer of the tensor can be the time) with the goal to scale them at RS level.

- contract with "What a nice place" ; PI: Jérémie Mary

  Title: Deduplication of pictures

  Duration: Mar. 2016 – Jan. 2017

  Abstract: "What is nice place" is a start up which aggregates products from different sources in order to provide some home staging advises. Uniqueness of presence for the items in their database can be

hard to achieve because of the differences over names and variations of a product. Here we build a
classification and deduplication system based on deep neural networks. In this contract we received
support from Inria Tech and transferred them some knowledge about deep neural networks.

- contract with "What a nice place" and "Leroy Merlin"; PI: Jérémie Mary

  Title: New Shopping Experience - Virtual Coach

  Duration: Jun. 2016 – Fev. 2017

  Abstract: The goal of this project is to use pictures of house interiors in order to propose automatically some products which would fit in nicely. The relations are learnt automatically using deep
  neural networks and recommendation systems techniques. We made a first version which focuses on
  lamps which is available for demonstration at https://whataniceplace.leroymerlin.fr/

<div align="center" style="color:red">**SERENA Team**</div>

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- Three-parts contract Inria–EDF–Sciworks Technologies (November 2015–April 2016) on "Form-L for the formalization of constraints of complex systems".

- Contract Inria–IFP Energies Nouvelles (December 2016–December 2017) on "A posteriori error analysis for porous media flow problems with fractures".

- Numerous contracts accompanying Ph.D. theses and post-doc positions, see Section 1.

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

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Contract with Innopsys: Tissue microarrays (TMA) image analysis

Participants: Hoai Nam Nguyen, Charles Kervrann.

Collaborators: Vincent Paveau and Cyril Cauchois (Innopys company).

A three-year contract has been established with Innopsys in 2013 to support Hoai Nam Nguyen's PhD thesis. The objective is to investigate and develop methods and algorithms dedicated to fluorescence images acquired by the scanners and devices designed by the company. In this project, we focus on i/ localization and segmentation fluorescence tissue microarrays (TMA) cores in very large 2D images; ii/ de-arraying of digital images and correction of grid deformation adapted to devices; iii/ correction of scanning artifacts to improve image reconstruction; iv/ deconvolution, denoising and superresolution of fluorescence TMA images corrupted by Poisson noise. The algorithms will be integrated into the plateforms and devices designed by Innopsys.

8.1.2. Contract (CIFRE) with Technicolor: Semantically meaningful motion descriptors for video understanding

Participants: Juan Manuel Perez Rua, Patrick Bouthemy.

Collaborators: Tomas Crivelli and Patrick Pérez (Technicolor).

A three-year contract has been established with Technicolor on January 2015 for a CIFRE grant supporting Juan Manuel Perez Rua's PhD thesis. The purpose is to investigate new methods for extracting meaningful mid-level motion-related descriptors that may help for the semantic discovery of the scene. In 2015, we started with the occlusion detection problem. We have proposed a novel approach where occlusion in the next frame or not is formulated in terms of visual reconstruction. Our approach outperforms state-of-the-art occlusion detection methods on the challenging MPI Sintel dataset. In 2016, we have developed two hierarchical motion segmentation methods involving a compositional motion representation. The first one follows a frame-based labeling approach which amounts to the minimization of a global energy function. The second one is trajectory-based and relies on tree-structured learning and sparse coding.

8.1.3. Contract with OBSYS: microscope set-up control and inverse problems in microscopy

Participants: Giovanni Petrazzuoli, Charles Kervrann.

Collaborators: Charles Gudeudry (OBSYS).

A three-year contract has been established with OBSYS in 2016. The objective is to investigate and develop methods and algorithms dedicated to the control of a microscope set-up and to the analysis of fluorescence images. Fast and robust algorithms will be especially developed to improve image reconstruction of 3D-TIRF microscope images. The algorithms will be integrated into the plateforms and devices designed by OBSYS.

8.2. Bilateral grants with industry

8.2.1. Fourmentin-Guilbert Foundation: Macromolecule detection in cryo electron tomograms

Participants: Emmanuel Moebel, Charles Kervrann.

Collaborator: Damien Larivière (Fourmentin-Guilbert Foundation).

The Fourmentin-Guilbert Foundation strives for building a virtual E. coli bacteria. Information about the position of macromolecules within the cell is necessary to achieve such a 3D molecularly-detailed model. The Fourmentin-Guilbert Foundation supports cutting-edge *in-situ* cryo electron tomography combined with image processing at the Max-Planck Institute of Biochemistry to map the spatial distribution of the ribosomes, and obtain structural information on the complexes they form *in-situ* with cofactors and other ribosomes. The objective of the project is to explore and evaluate novel methods from the field of 3D shape retrieval for identifying, localizing and counting macromolecules (e.g., 70S ribosome) within a tomogram. This project is also supported by "Region Bretagne".

SIERRA Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

Microsoft Research: "Structured Large-Scale Machine Learning". Machine learning is now ubiquitous in industry, science, engineering, and personal life. While early successes were obtained by applying off-the-shelf techniques, there are two main challenges faced by machine learning in the "big data" era: structure and scale. The project proposes to explore three axes, from theoretical, algorithmic and practical perspectives: (1) large-scale convex optimization, (2) large-scale combinatorial optimization and (3) sequential decision making for structured data. The project involves two Inria sites (Paris and Grenoble) and four MSR sites (Cambridge, New England, Redmond, New York). Project website: http://www.msr-inria.fr/projects/structured-large-scale-machine-learning/.

7.2. Bilateral Grants with Industry

- A. d'Aspremont: AXA, "mécénat scientifique, chaire Havas-Dauphine", machine learning.
- A. d'Aspremont: Société Générale - fondation ENS, "mécénat scientifique".
- A. d'Aspremont: Projet EMMA at Institut Louis Bachelier. Collaboration with Euroclear on REPO markets.
- S. Lacoste-Julien (with J. Sivic and I. Laptev in Willow project-team): Google Research Award "Structured Learning from Video and Natural Language".
- F. Bach: Gift from Facebook AI Research.

<p style="text-align:center;">SIROCCO Project-Team</p>

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

8.1.1. Consulting contract with Enensys technologies
Participant: Aline Roumy.

- Title : Matrix inversion for video streaming.
- Research axis : REF AT 7.4. Distributed processing and robust communication
- Partners : Enensys, Inria-Rennes.
- Funding : Enensys.
- Period : Apr. 2016 - May 2016.

This contract with Enensys technologies aimed at studying solutions for reducing the complexity of matrix inversion used for encoding data in the context of video streaming. First a bibliographical study has been carried out related to the problem of matrix inversion in a finite field, then a novel solution has been proposed together with some recommendations regarding the algorithmic implementation.

8.1.2. Google faculty research award
Participants: Christine Guillemot, Xiaoran Jiang, Mikael Le Pendu.

- Title : Light fields low rank and sparse approximation
- Research axis : 7.3.2
- Partners : Inria-Rennes.
- Funding : Google.
- Period : Oct.2015-Sept.2016.

The goal of the project was to study low-rank and sparse approximation models for light fields compression. A homography-based low-rank approximation has been developed showing significant PSNR-rate gains compared to a direct encoding of light field views with HEVC-inter coding.

8.1.3. CIFRE contract with Envivio/ Ericsson on LDR compatible HDR video coding
Participants: Christine Guillemot, David Gommelet, Aline Roumy.

- Title : LDR-compatible coding of HDR video signals.
- Research axis : § 7.3.5 .
- Partners : Envivio.
- Funding : Cifre Envivio.
- Period : Oct.2014-Sept.2017.

The goal of this Cifre contract is to design solutions for LDR-compatible coding of HDR videos. This involves the study of rate-distortion optimized tone mapping operators taking into account constraints of temporal coherency to avoid the temporal flickering which results from a direct frame-by-frame application of classical tone mapping operators. The goal is also to design a coding architecture which will build upon these operators, integrating coding tools tailored to the statistics of the HDR refinement signals.

8.1.4. CIFRE contract with Harmonic on image analysis for HDR video compression

Participants: Maxime Rousselot, Olivier Le Meur.

- Title : image and video analysis for HDR video compression
- Partners : Harmonic, Univ. Rennes 1
- Funding: Harmonic, ANRT
- Period: April 2016-April 2019

This project (in collaboration with Rémi Cozot, FRVSense) aims to investigate two main axes. First, we want to assess whether the representation of High Dynamic Range signal has an impact on the coding efficiency. We will focus mainly on the Hybrid Log-Gamma (HLG) and Perceptual Quantizer (PQ) OETF (Opto-Electronic Transfer Function)approaches. The former defines a nonlinear transfer function which is display-independent and able to produce high quality images without compromising the director's artistic intent. The latter approach is based on Just Noticeable Difference curve. If it turns out that this representation has an impact, the coding strategy should be adjusted with respect to the representation. In addition, specific preprocessing tools will be defined to deal with the limitations of PQ and HLG approaches.

8.1.5. CIFRE contract with Technicolor on image collection analysis

Participants: Dmitry Kuzovkin, Olivier Le Meur.

- Title : Spatiotemporal retargeting and recomposition based on artistic rules
- Partners : Technicolor, Univ. Rennes 1
- Funding: Technicolor, ANRT
- Period: Nov. 2015 – Nov. 2018

The goal of the project (in collaboration with Rémi Cozot, FRVSense) is to take advantage of the huge quantities of image and video data currently available - captured by both amateur and professional users - as well as the multiple copies of each scene that users often capture, to improve the aesthetic appeal of content. Additionally, given Technicolor's unique position, we propose to take advantage of insights as well as content from professional artists and colorists to learn how different content types can be enhanced.

8.1.6. CIFRE contract with Technicolor on light fields editing

Participants: Christine Guillemot, Matthieu Hog.

- Title : Light fields editing
- Research axis : 7.1.2
- Partners : Technicolor, Inria-Rennes.
- Funding : Technicolor, ANRT.
- Period : Oct.2015-Sept.2018.

Editing is quite common with classical imaging. Now, if we want light-fields cameras to be in the future as common as traditional cameras, this functionality should also be enabled with light-fields. The goal of the PhD is to develop methods for light-field editing, and the work in 2016 has focused on the design of fast semi-supervised segmentation algorithms with coherence constraints across sub-aperture images (see 7.1.2).

8.1.7. CIFRE contract with Technicolor on light fields compressed representation

Participants: Christine Guillemot, Fatma Hawary.

- Title : Light fields compressed representation
- Partners : Technicolor, Inria-Rennes.
- Funding : Technicolor, ANRT.
- Period : Feb.2016-Jan.2019.

The goal of this PhD is to study reconstruction algorithms from compressed measurements based on the assumption of sparsity in the Fourier domain. The goal is to apply these algorithms to scalable compression of light fields.

8.1.8. CIFRE contract with Technicolor on cloud-based image compression

Participants: Jean Begaint, Christine Guillemot.

- Title : Cloud-based image compression
- Research axis : 7.3.6
- Partners : Technicolor, Inria-Rennes.
- Funding : Technicolor, ANRT.
- Period : Nov.2015-Oct.2018.

The goal of this Cifre contract is to develop a novel image compression scheme exploiting similarity between images in a cloud. The objective will therefore be to develop rate-distortion optimized affine or homographic estimation and compensation methods which will allow us to construct prediction schemes and learn adapted bases from most similar images retrieved by image descriptors. One issue to be addressed is the rate-distortion trade-off induced by the need for transmitting image descriptors.

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

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

Implication in research for the development of vaccine has lead to a direct contracts with industry such as withs Iliad Biotechnologies. This contract had been signed for the BPZE-1 pertussis vaccine trial. This study evaluates the safety and immunogenicity of a higher dose formulation of a new live attenuated vaccine, BPZE1, intended to prevent Bordetella pertussis nasopharyngeal colonization and pertussis disease, and investigates whether higher doses of BPZE1 induce the live vaccine to colonize subjects' nasopharynx. The study is a Phase Ib (high dose), single centre, dose-escalating, placebo-controlled study of the live attenuated B. pertussis strain BPZE1 given as a single intranasal dose to healthy adult volunteer. This contrat is part of the EUCLID platform (via the CIC 1401) in which Laura Richert and Rodolphe Thiébaut are involved.

8.2. Bilateral Grants with Industry

Implication in research for the development of Ebola vaccine has lead to several indirect contracts with industry:

- The EBOVAC2 project, which is presented in Section 'FP7 & H2020 Projects', leads to collaboration with Janssen from Johnson et Johnson.

- The BPZE-1 pertussis vaccine trial , which is presented in Section 'Bilateral Contracts with Industry', leads to collaboration with Iliad Biotechnologies. (Via the EUCLID platform and CIC 1401)

- The Prevac trial vaccine trial leads to collaboration with Merck. The purpose of this study is to evaluate the safety and immunogenicity of three vaccine strategies that may prevent Ebola virus disease (EVD) events in children and adults. Participants will receive either the Ad26.ZEBOV (rHAd26) vaccine with a MVA-BN-Filo (MVA) boost, or the rVSVΔG-ZEBOV-GP (rVSV) vaccine with or without boosting, or placebo. (Via the EUCLID platform and CIC 1401)

<center>**SMIS Project-Team**</center>

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. Cozy Cloud bilateral contract (Dec 2014 - Nov. 2015)

Partners: Cozy Cloud, Inria-SMIS
SMIS funding: 50k€.
While this initial contract is over, we mention it to explain the increasing relationship being built between Cozy Cloud and our team. Cozy Cloud is a French startup providing a personal Cloud platform. The Cozy product is a software stack that anyone can deploy to run his personal server in order to host his personal data and web services. While centralizing all personal data in the holder's hand is a natural way to reestablish his control on his privacy, this represents an unprecedented threat in case of attacks by an intruder, especially for individuals who are not security experts. The objective of this bilateral contract is to address this issue by integrating the PlugDB solution into the Cozy stack. Roughly speaking, the Cozy data system will be modified in such a way to store only encrypted files and each file access will be intercepted and routed to PlugDB. PlugDB will act as a doorkeeper for the whole individual dataspace by managing the files' metadata, the access control rules defined on these metadata, the decryption keys and the user/application authentication.

7.1.2. Cozy Cloud CIFRE - Tran Van contract (Oct 2014 - Sept 2017)

Partners: Cozy Cloud, Inria-SMIS
SMIS funding: 30k€
In relation with the bilateral contract mentioned above, a CIFRE PhD thesis has been started by Paul Tran Van. The objective is to capitalize on the Cozy-PlugDB platform to devise new access and usage control models to exchange data among devices of the same user (devices may have different levels of trustworthiness) and among different users thanks to a user-friendly sharing model (see the work on the SWYSWYK - Share What You See with Who You Know - model presented above) .

7.1.3. Cozy Cloud CIFRE - Loudet contract (Apr 2016 - Apr 2019

Partners: Cozy Cloud, Inria-SMIS
SMIS funding: 45k€
In relation with the bilateral contract mentioned above, a second CIFRE PhD thesis has been started by Julien Loudet. The objective is to allow for a secure execution of distributed queries on a set of personal clouds associated to users, depending on social links, user's localization or user's profile. The general idea is to build secure indexes, distributed on the users' personal cloud and to devise a secure execution protocol revealing solely the query result to the querier. Such highly distributed secure queries potentially enable new (social) applications fed by user's personal data which could be developed on the Cozy-PlugDB platform.

SOCRATE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Grants with Industry

7.1.1. Research Contract with Orange Labs (2015-2017)

The goal of this project "PErformances Théoriques des réseaux cellulaires pour la 5G" No. F05151 (50KEuro) is to develop a theoretical approach allowing to study the energy efficiency spectral efficiency tradeoff for 5G networks, by revisiting information theory for dense networks and short packets transmissions.

7.1.2. Research Contract with Bosch (2015-2016)

This contract between Bosch and two project-teams (AriC and Socrate) focusses on the evolution of high-performance embedded controllers.

7.1.3. Research Contract with Sigfox (2015-2016)

A collaboration with Sigfox to work on extension of Sigfox Network to dense cities: 2 years of engineering associated to a Cifre grant

7.1.4. Research Contract with Atlantic

Socrate has a collaborative contract with Atlantic, around wireless communications in HVAC systems.

SPADES Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- INRIA and Orange Labs have established this year a joint virtual research laboratory, called I/O LAB. We have been heavily involved in the creation of the laboratory and are actively involved in its operation (Jean-Bernard Stefani is one of the two co-directors of the lab). I/O LAB focuses on the network virtualization and cloudification. As part of the work of I/O LAB, we have cooperated with Orange Lab, as part of a cooperative research contract funded by Orange, on defining architectural principles and frameworks for network cloud infrastructures encompassing control and management of computing, storage and network resources.

- With Daimler (subcontracting via iUTBS): We have shown how to extend our current method for computing deadline miss models to real-time systems designed according to the Logical Execution Time paradigm.

7.2. Bilateral Grants with Industry

With Thales: Early Performance assessment for evolving and variable Cyber-Physical Systems. This CIFRE grant funds the PhD of Christophe Prévot.

SPECFUN Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- *Mathematical Components* (project of the MSR–INRIA Joint Centre).
  Goal: Investigate the design of large-scale, modular and reusable libraries of formalized mathematics, using the Coq proof assistant. This project successfully formalized the proof of the Odd Order Theorem, resulting in a corpus of libraries related to various areas of algebra.
  Leader: Georges Gonthier (MSR Cambridge). Participants: Georges Gonthier, Assia Mahboubi.
  Website: http://www.msr-inria.fr/projects/mathematical-components/.

SPHINX Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

The Ph.D thesis of Boris Caudron is funded through a CIFRE contract with Thalès and a contract with the IECL. The goal of the Ph.D. thesis is to design new coupling techniques between integral equation methods and the finite element method for solving electromagnetic scattering problems. The advisors are Xavier Antoine (Sphinx) and Christophe Geuzaine (University of Liège).

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

8. Bilateral Contracts and Grants with Industry

8.1. ip-label

Participant: Romain Rouvoy [correspondant].

A software exploitation license of the APISENSE$^{\circledR}$ crowd-sensing platform has been sold to the ip-label company. They use this platform as a solution to monitor the quality of the GSM signal in the wild. The objective is to provide developers and stakeholders with a feedback on the quality of experience of GSM connection depending on their location.

8.2. Orange Labs

Participants: Laurence Duchien [correspondant], Amal Tahri.

This collaboration aims at bridging the gap between home networks and cloud environments for the design, the provisioning and the administration of distributed services. The purpose is to define solutions, essentially software design tools and runtime infrastructures, for the seamless migration of distributed applications and services between home networks and cloud environments. The envisioned approach is based on the research activities that we are conducting in the domain of software product lines.

This collaboration is conducted in the context of the ongoing PhD thesis of Amal Tahri.

8.3. Scalair

Participants: Yahya Al-Dhuraibi, Philippe Merle [correspondant].

This collaboration aims at proposing a framework to deal with elasticity in cloud computing environments. This framework must cover all kind of resources, IaaS, PaaS, SaaS, must provide a solution for interoperability between different clouds and virtualization technologies, and must enable the specification and composition of reactive and predictive strategies.

This collaboration is conducted in the context of the ongoing PhD thesis of Yahya Al-Dhuraibi.

8.4. OpenIO

Participants: Philippe Merle, Romain Rouvoy [correspondant], Lionel Seinturier.

This collaboration aims at producing a scientific and technical state-of-the-art analysis of solutions for the large scale storage of object data in the cloud. This study aims at identifying the main properties of the existing solutions, and their differentiating factors. The solution provided by the OpenIO company will be positioned with respect to the other solutions existing on the market and in the international scientific community. Starting from this state-of-the-art, several perspectives will be identified and a research roadmap will be defined.

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- **Toyota Europ**: this project with Toyota runs from the 1st of August 2013 up to 2017 (4 years). It aims at detecting critical situations in the daily life of older adults living home alone. We believe that a system that is able to detect potentially dangerous situations will give peace of mind to frail older people as well as to their caregivers. This will require not only recognition of ADLs but also an evaluation of the way and timing in which they are being carried out. The system we want to develop is intended to help them and their relatives to feel more comfortable because they know potentially dangerous situations will be detected and reported to caregivers if necessary. The system is intended to work with a Partner Robot (to send real-time information to the robot) to better interact with older adults.

- **LinkCareServices**: this project with Link Care Services runs from 2010 upto 2015. It aims at designing a novel system for Fall Detection. This study consists in evaluating the performance of video-based systems for Fall Detection in a large variety of situations. Another goal is to design a novel approach based on RGBD sensors with very low rate of false alarms.

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

The PhD thesis of Jean-Yves Courtonne has been co-sponsored by ARTELIA and Inria, via a bilateral contract.

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- HiBOX project, with Airbus and IMACS (2013-2017).
- CEA contracts:
    - Several PhD contracts: for Hugo Brunie, Raphaël Prat, Marc Sergent and Arthur Loussert.
    - Industrial contract with CEA-DAM on particle simulation.

SUMO Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

Joint Alstom-Inria research lab: Several researchers of SUMO are involved in the joint research lab of Alstom and Inria, in a common research team called P22. On Alstom side, this joint research team involves researchers of the ATS division (Automatic Train Supervision). The objective of this joint team is to evaluate regulation policies of urban train systems, to assess their robustness to perturbations and failures, to design more efficient regulation policies and finally to provide decision support for human regulators. The project started in march 2014. A second phase of the project started in 2016, for a duration of three years. This covers in particular the CIFRE PhD of Karim Kecir.

Joint Nokia Bell Labs - Inria research lab: Several members of the team are involved in the joint research lab of Nokia Bell Labs and Inria. This lab is co-directed by Éric Fabre (Inria) and Olivier Audouin (Bell Labs), and funds joint research teams over a period of 4 years. The 3rd phase of the lab is in preparation, and 6 new joint teams will be launched in the first quarter of 2017. Sumo is involved in the proposal *Softwarization of Everything* that aims at developing techniques for the programmability, the verification and the management of software-defined networks (SDN). This covers in particular the CIFRE PhD of Arij El Majed, to start in January 2017, on the topic of Root cause analysis in reconfigurable dynamic systems.

Joint Orange Labs - Inria research lab: Éric Fabre takes part to the joint research lab of Orange Labs and Inria. This lab funds around 5 new PhD grants every year. This covers in particular the CIFRE PhD of Sihem Cherrared on the topic of Fault management in multi-tenant programmable networks.

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

7. Bilateral Contracts and Grants with Industry

7.1. SIMHet

Partner: YoGoKo

Starting: Nov 2015; ending: Oct 2018

Abstract: The SIMHet project is performed in partnership with YoGoKo, a start-up that develops innovative communication solutions for cooperative intelligent transport systems. The SIMHet project aims to develop a decision making mechanism that would be integrated in the ISO/ETSI ITS communication architecture. It will allow mobile devices or mobile routers to choose the best network interface for each embedded application/flow. For example, in a vehicular environment this mechanism could manage global (Internet) and local connections for each on board device/application, in order to ensure that applications and services are always best connected. Aware that "best" concept is context-dependent, such a decision making mechanism should take into account requirements from different actors (e.g., applications, user, network administrators) and contextual information. One of the difficulties is to take advantage of the knowledge the system could have about near future connectivity. In the vehicular context such information about the movement and the availability of network resources is available. If taking into account the future makes the decision making more complex, this could allow a better usage of network resources when they are available. Once current solutions in the market are based on very simple decisions, this smart mechanism will give competitive advantage for YoGoKo over its competitors.

TADAAM Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contract with CEA

CEA is granting the PhD thesis of Hugo Taboada on specialized thread management in the context of multi programming models, and the PhD thesis of Rémi Barat on multi-criteria graph partitioning.

8.2. Bilateral Grant with Bull/Atos

Bull/ATOS is granting the CIFRE PhD thesis on Nicolas Denoyelle on advanced memory hierarchies and new topologies.

8.3. Bilateral Grant with Onera

Onera is granting the PhD thesis of Raphaël Blanchard on the parallelization and data distribution of discontinuous Galerkin methods for complex flow simulations.

8.4. Bilateral Grant with EDF

EDF is granting the CIFRE PhD thesis of Benjamin Lorendeau on new programming models and optimization of Code Saturn.

8.5. Bilateral Grant with Intel

Intel is granting $30k and providing information about future many-core platforms and memory architectures to ease the design and development of the HWLOC software with early support for next generation hardware.

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- CISCO (http://www.cisco.com)
- Thales (https://www.thalesgroup.com)
- Oberthur Technologies (http://www.oberthur.com/)

TAO Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- **Thales Research & Technology** 2014-2017 (30 kEuros), related to Nacim Belkhir's CIFRE PhD
  Coordinator: Marc Schoenauer
  Participants: Johann Dréo, Pierre Savéant, Nacim Belkhir

- **Orange** 2013-2016 (30 kEuros), related to Robin Allesiardo's CIFRE PhD
  Coordinator: Michèle Sebag
  Participants: Raphael Feraud, Robin Allesiardo

- **Réseau Transport d'Electricité** 2015-2018 (30 kEuros), related to Benjamin Donnot's CIFRE PhD
  Coordinator: Olivier Teytaud (until May 2016), now Isabelle Guyon and Marc Schoenauer
  Participants: Benjamin Donnot, Antoine Marot

TAPDANCE Team (section vide)

TASC Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. *Labcom TransOp*

Participants: Charles Prud'Homme, Xavier Lorca.

Title: TransOp.

Duration: 2014-2016.

Type: **ongoing project**.

Others partners: Eurodécision.

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

8.2. Bilateral Grants with Industry

8.2.1. *Gaspard Monge*

Participants: Nicolas Beldiceanu, Helmut Simonis.

Title: Gaspard Monge 3.

Duration: 2016.

Type: **ongoing project**.

Others partners: EDF.

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 years projects) is to provide a systematic reformulation of time-series constraints in term of linear constraints that can be used in a MIP solver.

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Toyota Info-Technology Centre (2014-2016)

Title: Co-Modeling of Safety-Critical Multi-threaded Embedded Software for Multi-Core Embedded Platforms

Inria principal investigator: Jean-Pierre Talpin

International Partner (Institution - Laboratory - Researcher):

Toyota Info-Technology Centre, Mountain View, California

Virginia Tech Research Laboratories, Arlington

Duration: renewed yearly since 2014

Abstract: We started a new project in April 2014 funded by Toyota ITC, California, to work with Huafeng Yu (a former post-doctorate of team ESPRESSO) and with VTRL as US partner. The main topic of our project is the semantic-based model integration of automotive architectures, virtual integration, toward formal verification and automated code synthesis. This year, Toyota ITC is sponsoring our submission for the standardization of a time annex in the SAE standard AADL.

In a second work-package, we aim at elaborating a standardized solution to virtually integrate and simulate a car based on heterogeneous models of its components. This year, it will be exemplified by the elaboration of a case study in collaboration with Virginia Tech. The second phase of the project will consist of delivering an open-source, reference implementation, of the proposed AADL standard and validate it with a real-scale model of the initial case-study.

8.2. Bilateral Grants with Industry

8.2.1. Mitsubishi Electric R&D Europe (2015-2018)

Title: Analysis and verification for correct by construction orchestration in automated factories

Inria principal investigator: Jean-Pierre Talpin, Simon Lunel

International Partner: Mitsubishi Electric R&D Europe

Duration: 2015 - 2018

Abstract: The primary goal of our project is to ensure correctness-by-design in cyber-physical systems, i.e., systems that mix software and hardware in a physical environment, e.g., Mitsubishi factory automation lines. We plan to explore a multi-sorted algebraic framework for static analysis and formal verification starting from a simple use case extracted from Mitsubishi factory automation documentations. This will serve as a basis to more ambitious research where we intend to leverage recent advance in type theory, SMT solvers for nonlinear real arithmetic (dReal and δ-decidability) and contracts theory (meta-theory of Benveniste et al., Ruchkin's contracts) to provide a general framework of reasoning about heterogeneous factory components.

8. Bilateral Contracts and Grants with Industry

8.1. MSR-Inria joint lab: scientific image and video mining

Participants: Cordelia Schmid, Karteek Alahari, Yang Hua.

This collaborative project, which started in September 2008, brings together the WILLOW and Thoth project-teams with researchers at Microsoft Research Cambridge and elsewhere. It builds on several ideas articulated in the "2020 Science" report, including the importance of data mining and machine learning in computational science. Rather than focusing only on natural sciences, however, we propose here to expand the breadth of e-science to include humanities and social sciences. The project focuses on fundamental computer science research in computer vision and machine learning, and its application to archeology, cultural heritage preservation, environmental science, and sociology.

8.2. MSR-Inria joint lab: structured large-scale machine learning

Participants: Julien Mairal, Alberto Bietti, Hongzhou Lin.

Machine learning is now ubiquitous in industry, science, engineering, and personal life. While early successes were obtained by applying off-the-shelf techniques, there are two main challeges faced by machine learning in the " big data " era : structure and scale. The project proposes to explore three axes, from theoretical, algorithmic and practical perspectives: (1) large-scale convex optimization, (2) large-scale combinatorial optimization and (3) sequential decision making for structured data. The project involves two Inria sites and four MSR sites and started at the end of 2013.

8.3. Amazon

Participants: Grégory Rogez, Cordelia Schmid.

We received an Amazon Faculty Research Award end of 2016. The objective is 3D human action recognition from monocular RGB videos. The idea is to extend our recent work on human 3D pose estimation [19] to videos and to develop an approach for action recognition based on temporal pose based on appropriate 3D features.

8.4. Google

Participants: Karteek Alahari, Cordelia Schmid.

We received a Google Faculty Research Award in 2015. The objective is to interpret video semantically in the presence of weak supervision. We will focus on answering questions such as *who* is in the scene, *what* they are doing, and *when* exactly did they perform their action(s). We propose to develop models for detection and recognition of objects and actions learned from minimally annotated training data.

8.5. Facebook

Participants: Cordelia Schmid, Jakob Verbeek, Karteek Alahari, Julien Mairal.

The collaboration started in 2016. The topics include image retrieval with CNN based descriptors, weakly supervised semantic segmentation, and learning structure models for action recognition in videos. In 2016, Pauline Luc started her PhD funded by a CIFRE grant, jointly supervised by Jakob Verbeek (Inria) and Camille Couprie (Facebook). THOTH has been selected in 2016 as a recipient for the Facebook GPU Partnership program. In this context Facebook will donate a state-of-the-art server with 8 GPUs.

8.6. MBDA

Participants: Jakob Verbeek, Julien Bardonnet.

Since 2004 we have collaborated with MBDA on a variety of subjects, namely object detection, tracking and matching. Several PhD students have been funded by MBDA, and code has been transferred which is integrated in products. Our collaboration resulted in 2010 in the award of the MBDA prize for innovation. Since May 2015 we have one engineer funded by MBDA working on incremental learning of object detection models. The goal is to take pre-existing vehicle models, and to quickly adapt them to new images of these vehicles when they are acquired in the field.

8.7. Xerox Research Center Europe

Participants: Mattis Paulin, Karteek Alahari, Vladyslav Sydorov, Cordelia Schmid, Julien Mairal, Jakob Verbeek.

The collaboration with Xerox has been on-going since October 2009 with two co-supervised CIFRE scholarships (2009–2012; 2011-2014). Starting June 2014 we signed a third collaborative agreement for a duration of three years. The goal is to develop approaches for deep learning based image description and pose estimation in videos. Jakob Verbeek (Inria) and Diane Larlus (XRCE) jointly supervise a PhD-level intern for a period of 6 months in 2016-2017.

<div align="center">

TITANE Project-Team

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8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. *Geoimage*
Participants: Liuyun Duan, Florent Lafarge.

The aim of this collaboration is to devise a new type of 2.5D representation from satellite multi-view stereo images which is more accurate, compact and meaningful than the conventional digital elevation models (DEMs). A key direction consists in incorporating semantic information directly during the image matching process. This semantic is related to the type of components of the scene, such as vegetation, roofs, building edges, roads and land.

- Starting date: November 2013 - Duration: 4 years

8.1.2. *CSTB 1*
Participants: Sven Oesau, Florent Lafarge.

The goal of this collaboration was to consolidate and integrate research codes developed in Titane on urban semantization and reconstruction into the CSTB reconstruction platform.

- Starting date: September 2015 - Duration: 6 months

8.1.3. *CSTB 2*
Participants: Hao Fang, Florent Lafarge.

The goal of this recent collaboration is to develop methods for analyzing and exploring scale-spaces into urban 3D data.

- Starting date: March 2016 - Duration: 3 years

8.1.4. *Luxcarta*
Participants: Jean-Philippe Bauchet, Florent Lafarge.

The goal of this recent collaboration is to design automatics approaches for producing LOD2 city models from the last generation of satellites.

- Starting date: October 2016 - Duration: 3 years

8.2. Bilateral Grants with Industry

8.2.1. *CNES Toulouse*
Participants: Emmanuel Maggiori, Yuliya Tarabalka [PI].

Hierarchical approaches for object-oriented classification of multi-source images. Contract 150490/00.

- Starting date: November 2015
- Duration: 2 years

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

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. *ProofInUse Joint Laboratory*

Participants: Claude Marché [contact], Jean-Christophe Filliâtre, Andrei Paskevich.

ProofInUse is a joint project between the Toccata team and the SME AdaCore. It was selected and funded by the ANR programme "Laboratoires communs", starting from April 2014, for 3 years http://www.spark-2014.org/proofinuse.

The SME AdaCore is a software publisher specializing in providing software development tools for critical systems. A previous successful collaboration between Toccata and AdaCore enabled *Why3* technology to be put into the heart of the AdaCore-developed SPARK technology.

The goal is now to promote and transfer the use of deduction-based verification tools to industry users, who develop critical software using the programming language Ada. The proof tools are aimed at replacing or complementing the existing test activities, whilst reducing costs.

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

We are involved in a common project with the company AxesSim in Strasbourg. The objective is to help for the development of a commercial software devoted to the numerical simulation of electromagnetic phenomena. The applications are directed towards antenna design and electromagnetic compatibility. This project was partly supported by DGA through "RAPID" (*régime d'appui à l'innovation duale*) funds. The CIFRE PhD of Thomas Strub is part of this project. Another CIFRE PhD has started in AxesSim on the same kind of topic in March 2015 (Bruno Weber). The new project is devoted to the use of a runtime system in order to optimize DG solvers applied to electromagnetism. The resulting software will be used for the numerical simulation of connected devices for clothes or medicine. The project is supported by the "Banque Public d'Investissement" (BPI) and coordinated by the Thales company.

TOSCA Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- TOSCA Sophia is involved in a Cifre convention with Koris International. M. Bossy supervises M. Bonelli's Ph.D. thesis.

- M. Deaconu is involved in a bilateral contract with Venathec. She is supervising, with E. Vincent (EPI MULTISPEECH), the Ph.D. thesis of B. Dumortier on the acoustic control of wind farms noise.

7.2. Bilateral Grants with Industry

- Mireille Bossy is the Coordinator of the PEPS from AMIES granted with the SME Seatopic, on the wind downscaling, using finer local topography, for coastal activities.

- Mireille Bossy is the Coordinator of the TER project from the PGMO (FMJH) granted with the SME METIGATE, on the statistical description of coupled regional temperatures.

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

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- Yield management methods applied to the pricing of data trafic in mobile networks. CRE (research contract) with Orange Labs (Orange Labs partner: Mustapha Bouhtou).

- Decentralized mechanisms of operation of power systems: equilibria and efficiency. A collaboration started on this topic at the fall, Nadia Oujdane, Olivier Beaude, and Riadh Zorgati from EDF-labs. This leads to the PhD work of Paulin Jacquot, supervised by Stéphane Gaubert (starting CIFRE PhD).

TYREX Project-Team (section vide)

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

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- We have contracted bilateral cooperation with Rtone, an SME focusing on the connected objects area. This collaboration is associated with the CIFRE PhD grant for Alexis Duque, on the subject of Visible Light Communication.

- We have contracted bilateral cooperation with industrial and academic partners in the context of the PSPC Fed4PMR project (2015-2018). In this context, we are working on the design of new professional mobile radio solutions, compatible with 4G and 5G standards. This collaboration funds the PhD thesis of Jad Oueis and a part of the PhD thesis of Abderrahman Ben Khalifa.

8.2. Bilateral Grants with Industry

- Common Laboratory Inria/Nokia Bell Labs - ADR Green.
  UrbaNet is part of the ADR Green of the common laboratory Inria/Nokia Bell Labs. This ADR provides the PhD grant of Soukaina Cherkaoui on the channel access capacity evaluation in 5G networks.

- Spie - INSA Lyon IoT Chaire.
  Urbanet is involved in the SPIE INSA Lyon IoT Chaire, launched in November 2016. The PhD thesis work of Alexis Duque and Abderrahman Ben Khalifa are our main contributions in this structure.

- Volvo - INSA Lyon Chaire.
  Urbanet is involved in the Volvo Chaire at INSA Lyon, on the area of autonomous electrical distribution vehicle in urban environments. Razvan Stanica is a member in the steering committee of this structure.

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

A two years licence and cooperation agreement was signed on April 1st, 2016 between WATERLOO MAPLE INC., Ontario, Canada (represented by Laurent Bernardin, its Executive Vice President Products and Solutions) and Inria. On the Inria side, this contract involves the teams VEGAS and OURAGAN (Paris), and it is coordinated by Fabrice Rouillier (OURAGAN).

F. Rouillier and VEGAS are the developers of the ISOTOP software for the computation of topology of curves. One objective of the contract is to transfer a version of ISOTOP to WATERLOO MAPLE INC.

VERIDIS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Modeling a Distributed File System

Participant: Stephan Merz.

Our group was contacted by Huawei R&D Silicon Valley for evaluating the suitability of using the TLA$^+$ specification language for describing high-level protocols used in Cloud systems. We provided a specification of protocols used in the Ceph file system [53]. We also provided on-site training for Huawei engineers in Chengdu, China.

8.2. Logic for Business

Participant:

The group in Saarbrücken has established a master agreement with L4B (Logic for Business) on the exchange of data and the creation of bilateral research projects. L4B is involved in several consulting projects with the German car industry on product specification strategies, including software.

VIRTUAL PLANTS Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

Guillaume Garin has been funded by itk (http://www.itk.fr/en/). With itk, a generic model of plant pathosystem was developed in the OpenAlea platform and illustrated on Vine and Wheat.

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. *Siemens*

duration: 5 years from 2011/10/26, extended until end of 2017.

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 is a major advance in the collaboration since it will enable the development of MRI sequences on site.

8.2. Bilateral Grants with Industry

8.2.1. *MEDday*

As part of its activities, MEDday led the final testing phase on patients diagnosed from Multiple Sclerosis in order to find treatment of progressive multiple sclerosis. This is done in partnership with several hospitals in France. The goal is to achieve an effective treatment for this disease. The role of the team in this industrial grant is to develop new algorithms to perform the processing and the analysis of the images from this study.

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

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

- Renault, 2014-2016, 45 000 euros. The purpose of this contract is to develop solutions for running a mix of real-time and best-effort applications on a small embedded multicore architecture. Our goal is to optimize the usage of the processor resource. The PhD of Antoine Blin is supported by a CIFRE fellowship with Renault.

- Orange Labs, 2016-2017, 60 000 euros. The purpose of this contract is to apply the techniques developed in the context of the PhD of Antoine Blin to the domain of Software Defined Networks where network functions are run using virtual machines on commodity multicore machines.

- Thales Research, 2016-2018, 45 000 euros. The purpose of this contract is to enable the usage of multicore architectures in avionics systems. More precisely, our goal is to develop optimizations for a software TDMA hypervisor developed by Thales that provides full time-isolation of tasks. The PhD of Cédric Courtaud is supported by a CIFRE fellowship with Thales Research.

- OSADL, 2016-2017, development of the Prequel patch query language, 20 000 euros. OSADL is an organization headquartered in Germany that promotes and supports the use of open source software in the automation and machine industry. The project is in the context of the OSADL project SIL2LinuxMP bringing together various companies in automotive and embedded sytems with the goal of developing methodologies for certifying the basic components of a GNU/Linux-based RTOS.

WILLOW Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Facebook AI Research Paris: Weakly-supervised interpretation of image and video data (Inria)

Participants: Jean Ponce, Minsu Cho, Ivan Laptev, Josef Sivic.

We will develop in this project (Facebook gift) new models of image and video content, as well as new recognition architectures and algorithms, to address the problem of understanding the visual content of images and videos using weak forms of supervision, such as the fact that multiple images contain instances of the same objects, or the textual information available in television or film scripts.

8.2. Google: Learning to annotate videos from movie scripts (Inria)

Participants: Josef Sivic, Ivan Laptev, Jean Ponce.

The goal of this project is to automatically generate annotations of complex dynamic events in video. We wish to deal with events involving multiple people interacting with each other, objects and the scene, for example people at a party in a house. The goal is to generate structured annotations going beyond simple text tags. Examples include entire text sentences describing the video content as well as bounding boxes or segmentations spatially and temporally localizing the described objects and people in video. This is an extremely challenging task due to large intra-class variation of human actions. We propose to learn joint video and text representations enabling such annotation capabilities from feature length movies with coarsely aligned shooting scripts. Building on our previous work in this area, we aim to develop structured representations of video and associated text enabling to reason both spatially and temporally about scenes, objects and people as well as their interactions. Automatic understanding and interpretation of video content is a key-enabling factor for a range of practical applications such as content-aware advertising or search. Novel video and text representations are needed to enable breakthrough in this area.

8.3. Google: Structured learning from video and natural language (Inria)

Participants: Simon Lacoste-Julien, Ivan Laptev, Josef Sivic.

People can easily learn how to change a flat tire of a car or assemble an IKEA shelve by observing other people doing the same task, for example, by watching a narrated instruction video. In addition, they can easily perform the same task in a different context, for example, at their home. This involves advanced visual intelligence abilities such as recognition of objects and their function as well as interpreting sequences of human actions that achieve a specific task. However, currently there is no artificial system with a similar cognitive visual competence. The goal of this proposal is to develop models, representations and learning algorithms for automatic understanding of complex human activities from videos narrated with natural language.

8.4. MSR-Inria joint lab: Image and video mining for science and humanities (Inria)

Participants: Leon Bottou [Facebook], Ivan Laptev, Maxime Oquab, Jean Ponce, Josef Sivic, Cordelia Schmid [Inria Lear].

This collaborative project brings together the WILLOW and LEAR project-teams with MSR researchers in Cambridge and elsewhere. The concept builds on several ideas articulated in the "2020 Science" report, including the importance of data mining and machine learning in computational science. Rather than focusing only on natural sciences, however, we propose here to expand the breadth of e-science to include humanities and social sciences. The project we propose will focus on fundamental computer science research in computer vision and machine learning, and its application to archaeology, cultural heritage preservation, environmental science, and sociology, and it will be validated by collaborations with researchers and practitioners in these fields.

In October 2013 a new agreement has been signed for 2013-2016 with the research focus on automatic understanding of dynamic video content. Recent studies predict that by 2018 video will account for 80-90% of traffic on the Internet. Automatic understanding and interpretation of video content is a key enabling factor for a range of practical applications such as organizing and searching home videos or content aware video advertising. For example, interpreting videos of "making a birthday cake" or "planting a tree" could provide effective means for advertising products in local grocery stores or garden centers. The goal of this project is to perform fundamental computer science research in computer vision and machine learning in order to enhance the current capabilities to automatically understand, search and organize dynamic video content.

WIMMICS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

We have CIFRE PhD funding with Synchronext for the design of a conversational agent assistant endowed with natural language and intuition.

We have CIFRE PhD funding with Educlever on the topic of semantic analysis of activities in a learning environment.

8.2. Bilateral Grants with Industry

8.2.1. *Semantic EDUCLOUD Carnot Project*

Participants: Oscar Rodríguez Rocha, Catherine Faron-Zucker.

Partner : GAYAtech. This project was just accepted this year on the topic of *semantic Web for e-learning*. This is a joint project with Gayatech on the recommendation of pedagogical resources adapted to user profile and context in the EDUCLOUD 06 Serious Game. To get help in his quests and various quiz testing his knowledge, the gamer can use external digital resources (books, video, TV, Web) and an in-game social network to work with his teacher and comrades. In this context, and to meet the needs of GAYATECH developing edutainment solutions, the Semantic EDUCLOUD project aims to improve the recommendation of educational resources to learners in EDUCLOUD 06, by using semantic Web and social Web models and techniques.

8.2.2. *Vigiglobe Carnot Project*

Participants: Elena Cabrio, Serena Villata.

Partner : Vigiglobe.

This project was just accepted this year on the topic of *Natural Language Argumentation on Twitter: Retrieval of Argumentative Structures and Reasoning*. this is a joint project with Vigiglobe on the natural language processing of argumentation on Twitter to retrieve argumentative structures and reason on them. The goal of the project is to : (1) Automate the selection and annotation of tweets, i.e., retrieval of those tweets that can be considered as arguments (2) Automate the assignment of labels to the type of relation holding between arguments - positive relation or negative relation. (3) Create an argumentation graph illustrating the relations between the arguments about a certain subject, and the further application of argumentation semantics to compute the set of "winning" arguments This graph-based visualization provides a summary of the ongoing discussion on Twitter.

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contract with Industry

Contract with Lixoft

ZENITH Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Microsoft ZcloudFlow (2013-2017)

Participants: Jalexis Joly, Ji Liu, Esther Pacitti, Patrick Valduriez.

ZcloudFlow is a project in collaboration with the Kerdata team in the context of the Joint Inria–Microsoft Research Centre. It addresses the problem of advanced data storage and processing for supporting scientific workflows in the cloud. The goal is to design and implement a framework for the efficient processing of scientific workflows in clouds. The validation is performed using synthetic benchmarks and real-life applications from bioinformatics on the Microsoft Azure cloud with multiple sites.

8.2. Triton I-lab (2014-2016)

Participants: Benjamin Billet, Didier Parigot.

Triton is a common Inria lab (i-lab) between Zenith and Beepeers (http://beepeers.com/) to work on a scalable platform for developing social networks in mobile/Web environments. The main objective of this project is to design and implement a new architecture for Beepeers applications to scale up to high numbers of participants. The new platform relyes on our SON middleware and NoSQL graph databases.