



RESEARCH CENTER
Saclay - Île-de-France

FIELD

Activity Report 2015

Section Contracts and Grants with Industry

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COMETE Project-Team (section vide)

GEOMETRICA Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

8.1.1. Cifre Contract with Geometry Factory

Mael Rouxel-Labbé's PhD thesis is supported by a Cifre contract with GEOMETRY FACTORY (<http://www.geometryfactory.com>). The subject is the generation of anisotropic meshes.

8.1.2. Commercialization of cgal packages through Geometry Factory

In 2015, GEOMETRY FACTORY (<http://www.geometryfactory.com>) had the following new customers for CGAL packages developed by GEOMETRICA:

CSM3D (UK, Cad chaussures): surface parametrization

Silvaco (USA, simulation) : 3d mesh generation

Cimmi (Canada): Approximation of Ridges and Umbilics on Triangulated Surface Meshes, Estimation of Local Differential Properties, AABB Tree, Principal Component Analysis, Point Set Processing

Varel (France, forage): 2D triangulations

Powel (Norway, GIS): point set processing, surface reconstruction

ExxonMobil (USA) : 2D triangulations, surface parametrization

Metrologic (France, metrology): point set processing

Geomage (Israel, oil&gas): 2D and 3D triangulations

Corvid (USA, simulation) : 3D triangulations

Medicim (Belgium, medical imaging): 3D mesh generation

Huntsman (Belgium), Pasco (Japan), Qualcomm (USA), Facebook (USA): industrial research licenses

GRACE Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Grants with Industry

8.1.1. 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.

Our progress on information sets of multiplicity codes was presented at the ISIT 2015 conference [18]

MEXICO Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

At present, our industrial cooperations are centered in the IRT SystemX, see below; there are currently no *bilateral* agreements.

PARSIFAL Project-Team (section vide)

POSTALE Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- EDF R&D: this is a collaboration with the department SINETICS of EDF in the area of high-performance computing.

Participants: Marc Baboulin, Amal Khabou.

It concerns two different topics:

- Enhancing performance of numerical solvers using accelerators (postdoc started in October 2014).
 - Studying numerical quality and reproducibility in HPC exascale applications (ongoing ANR submission).
- NumScale: Collaboration with the small size company NumScale (PME, 10 people) NumScale on C++ parallel code generation technology. NumScale is a start-up created in 2012 as the result of a Digiteo/University Paris Sud technological transfer program (Digiteo OMTE). NumScale exploits scientific results and tools based around code generation for parallel programs as well as advanced code optimization techniques developed by members of the team.

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: G. Gonthier (MSR Cambridge). Participants: F. Chyzak, A. Mahboubi.
Website: <http://www.msr-inria.fr/projects/mathematical-components/>.

TOCCATA Project-Team

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.

COMMANDS Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Transportation

8.1.1. IFPEN

In the framework of the PhD thesis of F.Bleuse, 'Optimal control and robustness for rechargeable hybrid vehicles'. The study is focused on the so-called parallel architecture, with both the thermal and electric engines able to move the vehicle. The main axis is to optimize the use of the thermal engine.

8.1.2. Safety Line

(a startup in aeronautics), research and transfer contract, 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 flight data. A second part is optimizing the fuel consumption during the climb phase.

DEFI Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- Contract with EDF R&D on non destructive testing of concrete materials (in the framework of the PhD thesis of Lorenzo Audibert, defended in 2015)
- Contract with EDF R&D on data assimilation for temprature estimates in nuclear reactors (in the framework of the PhD thesis of Thibault Mercier, defended in 2015)
- 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".

7.2. Bilateral Grants with Industry

- The RODIN projet finished in September 2015. RODIN is the acronym of "Robust structural Optimization for Design in INdustry". This is a consortium of various companies and universities which has been sponsored by the FUI AAP 13 for 3 years, starting on July 2012. The industrial partners are: Renault, EADS, ESI, Eurodecision, Alneos, DPS. The academic partners are: CMAP at Ecole Polytechnique, Laboratoire J.-L. Lions at Paris 6 and 7 Universities, centre de recherches Bordeaux Sud-Ouest at Inria. The goal of the RODIN project is to perform research and develop a computer code on geometry and topology optimization of solid structures, based on the level set method. The software editor ESI is going to isse a commercial software in 2016. A sequel for RODIN is planned with a possible start in 2016.
- FUI project Nanolytix. This three years project started in October 2012 and involves Xenocs (coordinator), imXPAD, Arkema, Inria (DEFI) and CEA-Leti. It aims at building a compact and easy-to use device that images nonaparticles using X-ray diffraction at small or wide angles (SAXS and WAXS technologies). We are in charge of direct and inverse simulation of the SAXS and WAXS experiments.
- Electromagnetic simulation work package of the FUI project Tandem. This three years project started in December 2012 and 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, Cordouan and CEA. It is a followup of Saxsize where a focus is put on SAXS imaging of nanoparticles powders.

DISCO Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

A collaboration with SAGEM Défense Sécurité on the robust stabilization of the lines of sight for pointing systems is developed through the PhD thesis of G. Rance (CIFRE).

A CIFRE PhD with Renault is currently undergoing in collaboration with Univ. d'Orleans (Nicoleta Stroe as PhD student).

GECO Project-Team (section vide)

Maxplus Team

8. Bilateral Contracts and Grants with Industry

8.1. Contrats avec l'Industrie/Bilateral Contracts with Industry

- Modélisation et Résolution des problèmes de très grande taille dans les applications du yield management au réseau des télécommunications mobiles: CRE en cours avec Orange Labs (responsable du suivi Orange Labs: Mustapha Bouhtou).

POEMS Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

Contract POEMS-DGA

Participants: Anne-Sophie Bonnet-Ben Dhia, Sonia Fliss, Patrick Joly.

Start : 09/01/2011, End : 12/31/2015. Administrator : ENSTA.

This contract is about guided waves in photonic crystals : we want to develop new mathematical and numerical tools for the characterization, the study and the computation of the guided modes in photonic crystals.

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.

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.

SELECT works with the CEA on statistical modeling for battery state of charge.

Contract with AirNormand: Mixtures of experts for PM10 forecasting, and stability of kriging procedures.

Contract with EDF: Curve clustering and disaggregation of the load forecasting

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
Participants: Benjamin Donnot, Antoine Marot
- **Augure (SME)** 2013-2015 (150 kEuros). MoDyRum (Modélisation Dynamique d'un Réseau Médiateur), related to Marco Bressan's postdoc SME Augure)
Coordinator: Michèle Sebag
Participants: Philippe Caillou, Cyril Furtlehner, Marco Bressan

AMIB Project-Team (section vide)

GALEN Project-Team (section vide)

M3DISIM Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

We have signed a collaboration agreement with Clinique Pasteur (Toulouse), the 3rd private hospital in France in global activity and the 1st in cardiology, in particular with the motivation of performing research oriented towards the perspective of developing connected applications for the monitoring of cardiac pathologies.

PARIETAL Project-Team

8. Bilateral Contracts and Grants with Industry

8.1. The LearnClues Labcomm

The LearnClues LabComm has been granted in Oct, 2014, and the agreement was signed in Dec. 2015.

Statistical learning is a field of mathematics and computer science that enables the extraction of predictive models from data with weak signal to noise ratio. These techniques are behind the successes of Google or the progresses of automatic medical diagnostic. Combined with a knowledge of the field of application, they open the door to optimal decisions. Tynyclues is a start-up that applies statistical learning to e-commerce, adapting the marketing practice from customer databases. Parietal is an Inria research group that develops statistical learning for neurosciences and is the driving force behind the software tool "scikit-learn", that is a standard in statistical learning.

The goal of this proposed common lab is to transfer the expertise of Parietal on big data and to improve statistical learning techniques and implementation on distributed systems to open the door to faster analysis of very large datasets. Indeed, processing more data implies detecting smaller effects in the signals. Tynyclues already uses the tools developed par Parietal on the "cloud", and thus in distributed computing environments. The practical experience of Parietal enables us to plan substantial improvements to computational performance as well as to the amount of information extracted from big data.

From a strategical standpoint for Tynyclues, such progress are important to vary the number of domain scenarios that it can address, by analyzing jointly more data of a wider type, and to render fully automatic the data analysis platform that it is offering to its customers, replacing challenging tasks currently performed by experts. These developments are particularly important given that Tynyclues is developing at a very fast rate and is processing bigger and bigger datasets and an increasing number of different problems.

The project partners are:

- Parietal, Inria
- Tiny Clues

8.2. 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 www.wendelin.io.

The project partners are:

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

POPIX Team

8. Bilateral Contracts and Grants with Industry

8.1. Bilateral Contracts with Industry

POPIX has a contract with Lixoft (June 2011 - June 2015)

INFINE Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

1. Participation to Microsoft Research – Inria Joint Centre, which funds two PhD students (Lennart Gulikers and Remi Varloot) and funded postdoc Kuang Xu over 2015.
2. During 2015, Cisco Systems (through direct contract) and Google (through GSoC) have funded further development of RIOT.

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.

AVIZ Project-Team (section vide)

DAHU Project-Team

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.

EX-SITU Team

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.

ILDA Team (section vide)

OAK Project-Team (section vide)