



RESEARCH CENTER  
Saclay - Île-de-France

FIELD

# Activity Report 2017

## Section Contracts and Grants with Industry

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**COMETE Project-Team (section vide)**

## **DATASHAPE Project-Team**

# **8. Bilateral Contracts and Grants with Industry**

## **8.1. Bilateral Contracts with Industry**

- Collaboration with Sysnav, a French SME with world leading expertise in navigation and geopositioning in extreme environments, on TDA, geometric approaches and machine learning for the analysis of movements of pedestrians and patients equipped with inertial sensors (CIFRE PhD of Bertrand Beaufile).
- Collaboration with Fujitsu on TDA and Machine learning (started in Dec 2017).

## **8.2. Bilateral Grants with Industry**

- DATASHAPE and Sysnav have been selected for the ANR/DGA Challenge MALIN (funding: 700 kEuros) in September 2017.

**DEDUCTEAM Project-Team (section vide)**

## **GRACE Project-Team**

# **7. Bilateral Contracts and Grants with Industry**

## **7.1. Bilateral Contracts with Industry**

- **NOKIA BELL LABS**
  - New PhD student H. Khazaie is funded by ADR with NOKIA BELL LABS. The PhD topic is the security of distributed storage systems.
  - Post doctoral researcher N. Coxon is funded by ADR with NOKIA BELL LABS. The post doc topic is an information theoretically secure private information retrieval scheme.
- **SAFRAN Identity and Security (Ex Morpho and now Idemia)**
  - Post doctoral researcher W. George is funded by Idemia to design an identity management scheme based on Bitcoin's blockchain.

**MEXICO Project-Team (section vide)**



**PARSIFAL Project-Team (section vide)**

**SPECFUN Project-Team (section vide)**

## 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. Bilateral Contracts with Industry

#### 8.1.1. Safety Line

In the framework of an Ilab with startup Safety Line (<http://www.safety-line.fr>), 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. As an illustration, Fig. 1 shows the drag and lift coefficients for a Boeing 737, as functions of Mach and angle of attack. Latest results have been presented by Cedric Rommel at [15].

A second part is optimizing the fuel consumption during the climb and cruise phases. Fig. 2 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. The resulting commercial tool OptiClimb is currently under testing in several airplane companies, totalling about a hundred actual optimized flights per day. Recent improvements include better atmosphere models and more accurate data for temperature and wind, as well as a first demonstrator for cruise flight optimization, see Fig. 3 .

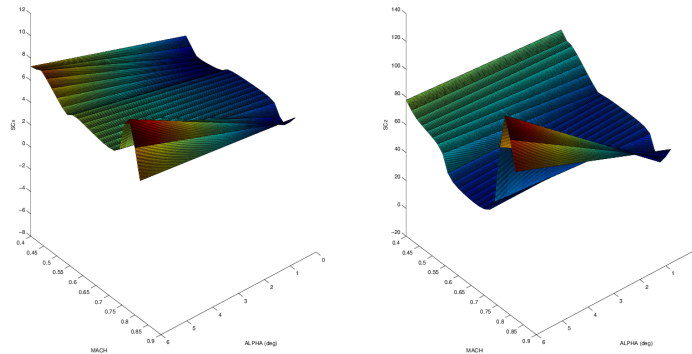


Figure 1. Lift and drag aerodynamic forces for a Boeing 737.

#### 8.1.2. IFPEN

This study is presently conducted in the framework of the PhD of Arthur Le Rhun, started in Fall 2016. The main axis is to design a traffic model suitable for optimizing the fuel consumption of a hybrid vehicle following a given route. The first step was to develop a new traffic model in which the consumption is inferred only on the functioning points in the (speed,torque) plane. More precisely, we are interested in the probability distribution of these functioning points when considering a space/time subdivision into road segments and timeframes (see Fig.4 ). In order to reduce the huge number of distributions obtained, we perform a clustering step using k-means (Fig.5 ). Since the objects to be clustered are distributions, we choose to use the Wasserstein distance based on optimal transport. The task of computing these Wasserstein barycenters was done by Sinkhorn iterations, and we also developed a variant of stochastic gradient that scales better for huge data sets.

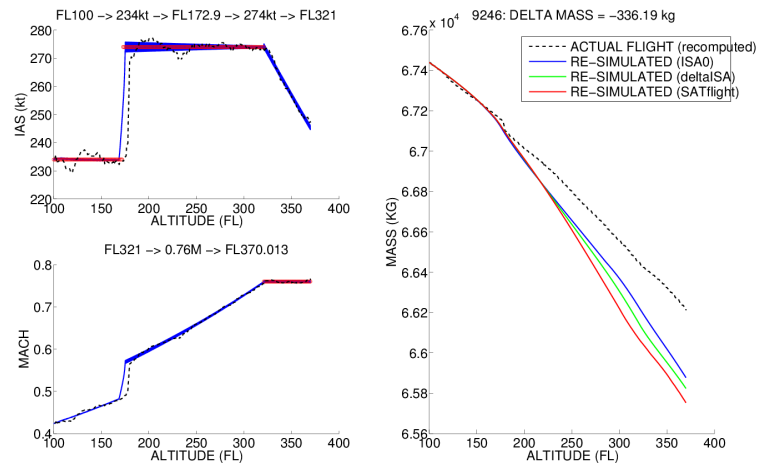


Figure 2. Simulated climb phase vs actual flight data

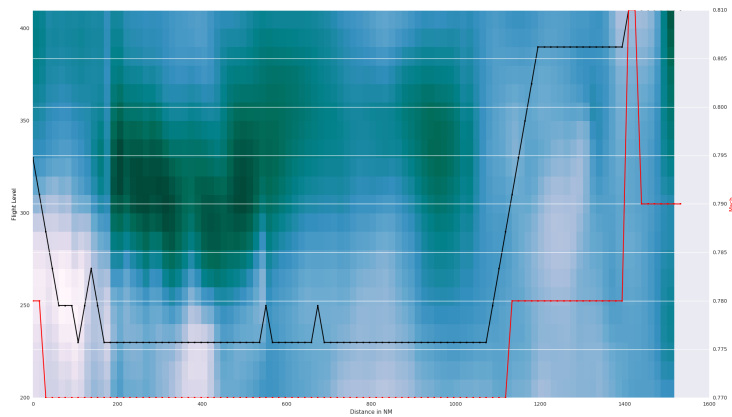


Figure 3. Simulated cruise flight (altitude in black, mach speed in red, wind speed in background)

In order to obtain the data for our traffic analysis, we work with a traffic simulator called SUMO, with the LUST scenario modeling the city of Luxembourg (<http://sumo.dlr.de>).

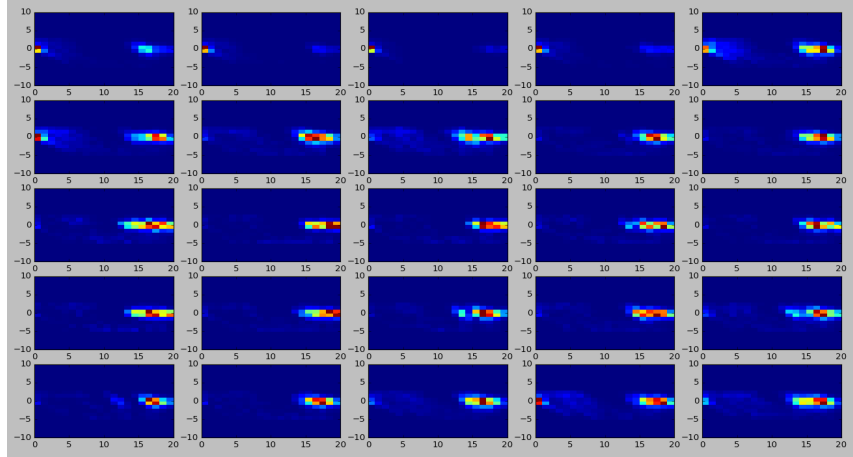


Figure 4. Distributions for all timeframes for a given road segment

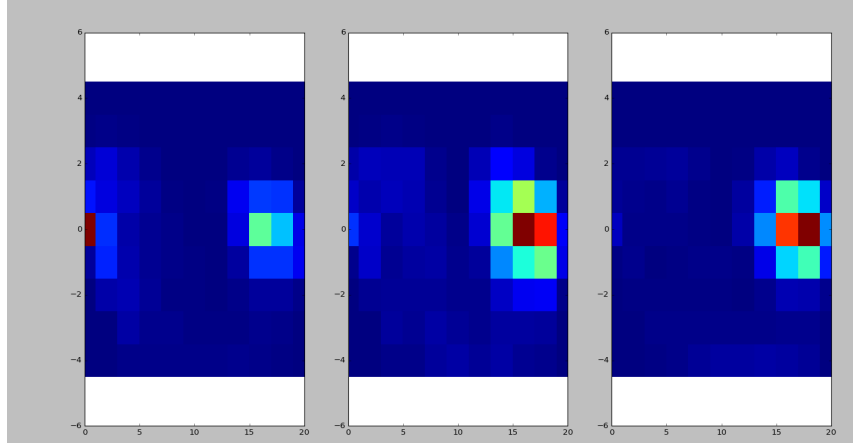


Figure 5. Barycenters after clustering ( $k=3$ )

## **DEFI Project-Team**

# **7. Bilateral Contracts and Grants with Industry**

## **7.1. Bilateral Contracts with Industry**

- A CIFRE PhD thesis started 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 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".
- A CIFRE PhD thesis started April 2017 with Safran Tech. The student is M. Florian Feppon who is working on "topology optimization for a coupled thermal-fluid-structure system".
- A CIFRE PhD thesis started October 2017 with Renault. The student is Mrs Lalaina Rakotondrainibe who is working on "topology optimization of connections between mechanical parts".
- A CIFRE PhD thesis started November 2017 with EDF. The student is H. Girardon who is working on "level set method for eddy current non destructive testing".

## **7.2. 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).
- G. Allaire is participating to the TOP project at IRT SystemX which started in February 2017. It is concerned with the development of a topology optimization platform with industrial partners (Renault, Safran, Airbus, ESI).
- 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.

## **DISCO Project-Team**

# **8. Bilateral Contracts and Grants with Industry**

## **8.1. Bilateral Contracts with Industry**

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 and control of district heating networks is undergoing (financial support of a PhD student).



## **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.

**GECO Project-Team (section vide)**

## POEMS Project-Team

# 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 equation

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.

**RANDOPT Team**

## **7. Bilateral Contracts and Grants with Industry**

### **7.1. Bilateral Grants and Contracts with Industry**

- CIFRE-DGA with Thales, for the PhD of Konstantinos Varelas (2017—2020)
- contract with Storengy to finance a part of the PhD of Cheikh Touré (2017—2020)

## SELECT Project-Team

# 7. Bilateral Contracts and Grants with Industry

## 7.1. Contract with NEXTER

**Participants:** Gilles Celeux, Florence Ducros, Patrick Pamphile.

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

## 7.2. Bilateral Grants with Industry

Benjamin Auder and Jean-Michel Poggi are participants in the grant PGMO-IRSDI, in the *Research Initiative In Industrial Data Science* context, on the subject: Disaggregated Electricity Forecasting using Clustering of Individual Consumers.

## TAU 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
- **ESA Tender** 2016-2017 (52 kEuros)  
Coordinator: Bart Boonacker (TNO)  
Participant: Marc Schoenauer, Dejan Tusar
- **Réseau Transport d'Electricité** 2015-2018 (72 kEuros), related to Benjamin Donnot's CIFRE PhD  
Coordinator: Olivier Teytaud (until May 2016), now Isabelle Guyon  
Participants: Benjamin Donnot, Antoine Marot, Marc Schoenauer
- **Therapixel** 2017 (6 mois, 3 kEuros), on the topic of 3D medical image non-rigid registration with neural networks  
Coordinators: Guillaume Charpiat, Olivier Clatz  
Participant: Priyanka Mandikal (master internship)
- **Myndblue**, 2017-2018 (1 an, 50kEuros) related to consulting activities with DMH (Digital for Mental Health).  
Coordinator: Aurélien Decelle  
Participants: all TAU members
- **La Fabrique de l'Industrie** 2017-2018 (1 an, 30kEuros) A COMPLETER (Michèle ?)
- **Renault (POC)** 2017-2018 (125 kEuros), *Clusterisation et optimisation de scenarii pour la validation des véhicules autonomes*  
Coordinator: Marc Schoenauer and Philippe Reynaud (Renault)  
Participants: Guillaume Charpiat, Raphaël Jaiswal (engineer), Marc Schoenauer
- **Renault (CIFRE)** 2017-2020 (45 kEuros), related to Marc Nabhan's CIFRE PhD *Sûreté de fonctionnement d'un véhicule autonome - évaluation des fausses détections au travers d'un profil de mission réduit*  
Coordinator: Hiba Hage and Yves Tourbier (Renault)  
Participants: Guillaume Charpiat, Marc Nabhan (PhD), Marc Schoenauer
- **RESTO** 2017 (14k Euros), *REseaux et Simulations : usages Technologiques et Opinions multiples sur les plateformes numériques dans les marchés de la restauration*, funded by Mission Interdisciplinarité of CNRS. Supported the internship of J. Posada.  
Coordinator: Paola Tubaro  
Participants: Philippe Caillou (with partners at Telecom ParisTech and Université Paris-Dauphine).
- **OPLa** 2017-2018, Organizing Platform Labor (27k euros), funded by Force Ouvrière.  
Coordinator: A.A. Casilli (Telecom ParisTech)  
Participants: Paola Tubaro
- **DiPLab** 2017-2018, Digital Platform Labor (24k euros), funded by MSH Paris-Saclay.  
Coordinators: Paola Tubaro (avec A.A. Casilli, Telecom ParisTech)

## **TROPICAL Team**

# **8. Bilateral Contracts and Grants with Industry**

## **8.1. Bilateral Contracts with Industry**

- Yield management methods applied to the pricing of data traffic 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 Oudjane, Olivier Beaude, and Riadh Zorgati from EDF-labs. This leads to the PhD work of Paulin Jacquot, supervised by Stéphane Gaubert (CIFRE PhD).

**AMIBIO Team (section vide)**



## **GALEN Project-Team**

# **8. Bilateral Contracts and Grants with Industry**

## **8.1. Bilateral Contracts with Industry**

Contract with General Electric Healthcare

Project title: Optimization methods for breast tomosynthesis

Duration: 2017-2020

Responsible: J.-C. Pesquet

**LIFEWARE Project-Team (section vide)**

## **M3DISIM Project-Team**

# **8. Bilateral Contracts and Grants with Industry**

## **8.1. Bilateral Contracts with Industry**

Technical contract with CEA-LIST on coupling strategies between subdomains for transient elastodynamics (8keuros)

Contract with the Sensome startup. Aims: feasibility of the measurement of blood clots mechanical properties. (1.6keuros)

## PARIETAL Project-Team

# 8. Bilateral Contracts and Grants with Industry

## 8.1. Bilateral Grants with Industry

### 8.1.1. 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

## **XPOP Project-Team**

# **8. Bilateral Contracts and Grants with Industry**

## **8.1. Bilateral Contracts with Industry**

Contract with Dassault Systèmes

## INFINE Project-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).
2. Fujitsu has funded further development of RIOT and sponsored the RIOT Summit 2017.
3. Cisco Systems Silicon Valley has sponsored the RIOT Summit 2017.
4. In the framework of the joint research lab between Nokia Bell Labs and Inria, we participate in the ADR (action de recherche) Network Information Theory.

## 7.2. GranData

- Participants: Aline Carneiro Viana, Guangshuo Chen, Adriano Di Luzio

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 GranDats. 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)**

**CEDAR Team (section vide)**



**EX-SITU Project-Team (section vide)**

## **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.

## **PETRUS Project-Team**

# **7. Bilateral Contracts and Grants with Industry**

## **7.1. Bilateral Contracts with Industry**

### **7.1.1. OwnCare II-Lab (Jul 2017 - Dec 2020)**

Partners: PETRUS (Inria-UVSQ), Hippocad (SME)

Funding: to be determined

End 2016, the Yvelines district launched a public call for tender to deploy an industrial solution aiming at covering the whole district (10.000 patients). The Hippocad company, in partnership with Inria, won this call for tender with a solution called DomYcile in May 2017 and the project was launched in July 2017. DomYcile is based on a home box combining the PlugDB hardware/software technology developed by the Petrus team and a communication layer based on SigFox. Hippocad and Petrus then decided to launch a joint II-Lab (Inria Innovation Lab) named OwnCare. The objective is threefold: (1) build an industrial solution based on PlugDB and deploy it in the Yvelines district in the short-term, (2) use this Yvelines testbed to improve the solution and try to deploy it at the national/international level in the medium-term and (3) design flexible/secure/mobile personal medical folder solutions targeting individual uses rather than professional uses in the long-term. The DomYcile project with the Yvelines district has started in July 2017 and the II-Lab should be officially created in January 2018.

## **7.2. Bilateral Grants with Industry**

### **7.2.1. Cozy Cloud CIFRE - Tran Van contract (Oct 2014 -Feb 2017)**

Partners: Cozy Cloud, PETRUS (Inria-UVSQ)

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).

### **7.2.2. 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 clouds 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.