Activity Report 2016

Section Contracts and Grants with Industry

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;color:red;font-weight:bold">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.

COAST Project-Team

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.

CTRL-A Team

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.

MIMOVE 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.

REGAL Project-Team

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.

<p style="text-align:center">**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® 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.

WHISPER Project-Team

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.

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.

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.

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.

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).

KERDATA Project-Team

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.

<p style="text-align:center; 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.

<div align="center">

ROMA Project-Team

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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).

STORM Team

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.

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.

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

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].

DIVERSE Project-Team (section vide)

FOCUS Project-Team (section vide)

INDES Project-Team (section vide)

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.

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

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.

<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.

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.

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.

<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.

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DIONYSOS Project-Team

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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).

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

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 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.

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

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.

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INFINE Project-Team

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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.

MADYNES Project-Team

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

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MAESTRO Project-Team

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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.

MUSE Team (section vide)

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

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.

URBANET Team

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.