Activity Report 2014

Section Contracts and Grants with Industry

ASAP Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Technicolor

Participants: Fabien André, Anne-Marie Kermarrec.

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

7.2. Orange Labs

Participants: Ali Gouta, Anne-Marie Kermarrec.

We have had a contract with Orange Labs for collaboration on peer-assisted approaches for caching and recommendation in streaming applications. In this context, Anne-Marie Kermarrec has been the PhD advisor of Ali Gouta since 2012.

7.3. Web Alter-Egos Google Focused Award

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

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

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

ATLANMOD Project-Team (section vide)

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

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- **Thales contract (2014): "Capalid v2"**

  This contract consists in validating an intrusion detection strategy in a supervised distributed system. This work relies on the results obtained by Erwan Godefroy in his PhD Thesis: considering the description of an attack and a description of the deployed system (topology, cartography, IDS deployment), we must answer the question: "Is it possible to detect this attack?". This answer consists in determining if it is possible to build a correlation rule that a correlation system can use to detect the attack.

- **CS contract (2014-2015): "SecEF"**

  The COSCOM contract consists in analyzing current used standards for information security events. Such events following a standardized structure are needed to allow communications between the various security tools, in order to consolidate and correlate information, and for communications between different security response teams, to share information relative to incidents. Examples of such events are IDMEF (Intrusion Detection Message Exchange Format, RFC 4765) or IODEF (Incident Object Description Exchange Format, RFC 5070). Unfortunately, these two standards are insufficiently deployed on a market still dominated by proprietary formats. The objective of the SecEF (Security Exchange Format) project is thus to propose evolutions of these formats, based on the initial feedback form current users.

- **Technicolor contract (2011-2014): "Data Aggregation in Large Scale Systems"**

  The theme of this contract focuses on the management of massively distributed data sets. In a nutshell, our goal is to provide a lightweight yet continuous flow of aggregate and relevant data from a very large number of distributed sources to a management system. Collaborative data aggregation are relevant mechanisms that could help in securely providing digests of information. However, an important aspect that we want to preserve is the privacy of the aggregated information. This is of particular interest for Telco operators or software/hardware providers in order to smoothly manage the current state of their deployed platforms, allowing accordingly to develop new applications based on quick reactions/optimizations to identify and handle services inconsistencies.

  This study is conducted in cooperation with the Inria project Dionysos.

- **HP contract (2013-2014): "Embedded Systems Security"**

  We have initiated a research program in collaboration with HP Labs in the domain of 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 device architectures. Details about this research program cannot be provided as they are covered by a non-disclosure agreement.

7.2. Bilateral Grants with Industry

- **Amossys: "Evaluation of intrusion detection mechanisms"**

  The PhD of Georges Bossert is done in the context of a CIFRE contract with the SME Amossys (http://www.amossys.fr/). His work consists in proposing new approaches for protocol reverse-engineering. He developed Netzob, a tool dedicated to this task. The goal is to use this tool to generate realistic traffic during IDS assessment. In 2013, Georges has developed two important

improvements of the protocol inference process he previously proposed. First, he improved the message format reverse engineering phase. Unlike previous work, our approach uses contextual information and its semantic definition as a key parameter in both the processes of message clustering and field partitioning. We can also detect complex linear and nonlinear relationships between value, size and offset of message fields using correlation-based filtering. Besides, our multi-step pre-clustering phase reduces the required computation time of the main clustering phase. These results have been presented in an article that is under review. The second aspect of his work consisted in enhancing the grammar inference phase. He proposed a new approach that combines passive and active algorithms to infer protocol grammars. This approach also relies on grammar decompositions. Thus, he decreased inference time by using an action-based sequential decomposition and we took into account background noise by using a parallel decomposition. The PhD defense of Georges Bossert was held in December 2014.

- **Orange Labs: "Data persistence and consistency in ISP infrastructures"**

  Pierre Obame is doing his PhD thesis in the context of a CIFRE contract with Orange Labs at Rennes. Pierre Obame has proposed a distributed storage system called Mistore, dedicated to users who access Internet via a Digital Subscriber Line (DSL) technology. This system aims at guaranteeing data availability, persistence, and low access latency by leveraging millions of home gateways and the hundreds of Points of Presence (POP) of an Internet Service Provider (ISP) infrastructure. Pierre Obame has also proposed a mathematical framework for defining both strong and weak consistency criteria within the same formalism. These criteria are offered by Mistore to its clients when they manipulate their data. Pierre Obame, whose PhD thesis is planned to terminate in February 2015, is in the process of writing his PhD manuscript so as to defend it by April 2015.

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

  Solenn Brunet has started her PhD thesis since 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 will adapt 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-MI: "Security events visualization"**

  The PhD of Christopher Humphries on visualization is done in the context of a cooperation with DGA-MI. The objective is to propose new visulization mechanisms dedicated to the analysis of security events, for instance for forensic purposes. The CORGI tool presented earlier in this documents is the most recent contribution to this contract.

- **DGA-MI: "Alerts correlation taking the context into account"**

  The PhD of Erwan Godefroy is done in the context of a cooperation with DGA-MI. This PhD started in November 2012. The current work consists in the automatic generation of alert correlation rules in the context of deployed distributed systems. The correlation rules aim at being used by our GnG correlation system.

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

6. Bilateral Contracts and Grants with Industry

6.1. Bilateral Grants with Industry

6.1.1. CIFRE Grant with Bonitasoft

Participants: François Charoy, Samir Youcef.

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 both the business knowledge, the process models and the execution history of process instances and correlate them with cloud resource consumption. Guillaume Rosinoski 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 Exploratory Action

7. Bilateral Contracts and Grants with Industry

7.1. CIFRE PhD grant Orange

This Cifre PhD started in the beginning of 2012, and is going to be defended in april 2015, on the topic of "Discrete Control for Smart Environments through a Generic Finite-State-Models-Based Infrastructure". Hassane Alla and Eric Rutten are advising the PhD student for 10%.

One result of this cooperation is that a patent deposited at the INPI on "Configuration automatique du controle discret d'entites physiques dans un systeme de supervision et de controle", by Gilles Privat et Mengxuan Zhao (Orange labs), Hassane Alla (Gipsa-lab), Eric Rutten (Inria).

7.2. Bilateral Grants with Industry

Our cooperation with CEA LETI/LIST (V. Olive) at Grenoble Minatec is bilateral, involving:

- the Inria Post-Doc grant of Julio Cano, to work with L. Guergen on ECA-based programming in the IoT
- 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)

MYRIADS Project-Team (section vide)

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

6. Bilateral Contracts and Grants with Industry

6.1. Bilateral Contracts with Industry

- Orange Lab, 30,000 euros for 1 PhD Students (CIFRE), Ralucca Diaconu
- Renault, 60,000 over 3 years (2013 - 2016) for a CIFRE. In the context of a Cifre cooperation with Renault, we are supervising with Whipser the PhD of Antoine Blin on the topic of scheduling processes on a multicore machine for the automotive industry. The goal is to allow real-time and multimedia applications to cohabit on a single processor. The challenge here is to control resource consumption of non real-time processes so as to preserve the real-time behavior of critical ones. As part of this cooperation, we will use the Bossa DSL framework for implementing process schedulers that we have previously developed.

6.2. Bilateral Grants with Industry

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

We have started a joint CIFRE (industrial PhD) research 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.

6.2.2. *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; color:red">SCALE Team</p>

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. Amadeus

Duration: May 2014 - April 2015

Inria teams: Scale, Coati

Abstract:This collaboration aims to assess the benefits that digital technologies can bring in complex travel distribution applications. Indeed, these applications require both high performance algorithms and distributed programming methods to search for the best solutions among billions of combinations, in a very short time thanks to the simultaneous use of several hundreds (if not thousands) of computers. These benefits will be demonstrated in an application to build 'of the shelf' optimized packages, fully customized to best meet the complex demands of the traveler.

SPIRALS Team

7. Bilateral Contracts and Grants with Industry

7.1. ip-label

Participants: Nicolas Haderer, Christophe Ribeiro, Romain Rouvoy [correspondant].

A software exploitation licence of the APISENSE$^{®}$ crowdsensing 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.

7.2. Microsoft Windows Azure for Research Grant

Participants: Nicolas Haderer, Christophe Ribeiro, Romain Rouvoy [correspondant].

The research program associated with this grant consists in leveraging the APISENSE$^{®}$ crowdsensing platform to support the real-time processing of "big" datasets collected in the physical world by a "large" crowd of smartphones. Examples of case studies covered in this area include the automatic inference of roadmaps, the continuous cartography of network coverage quality, or even the detection and the dynamic analysis of earthquakes. However, the unpredictable volume of data to be collected in the wild requires the adoption of elastic computation models and infrastructures to continuously provision the processing capabilities to fit uploads of information reports.

The grant takes the form of virtual credits for accessing the Microsoft Azure cloud computing platform.

7.3. 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 provisionning 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.

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

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

A 5-month contract with the company Metaware to provide support for Metaware's use of Coccinelle ended in February 2014. This contract resulted in numerous improvements in Coccinelle of interest to the general Coccinelle user community, including better handling of declarations involving multiple variables and better pretty printing of the gernated code.

The PhD of Koutheir Attouchi [10] on managing resources in the context of Smart Home gateway was supported by a CIFRE grant with Orange Labs.

Together with Julien Sopena from REGAL, we are collaborating with Renault, in the context of the PhD of Antoine Blin (CIFRE), on hierarchical scheduling in multicore platforms for real-time embedded systems. This work is a dissemination of our previous research on the Bossa domain-specific language [6].

ALGORILLE Project-Team (section vide)

ALPINES Project-Team (section vide)

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. Animerique

One of the goals of the CapRézo company is to provide an original tool to make 2D/3D animation films. This tool is an innovative and distributed numerical platform. This platform is built on software developed by Avalon like DIET. Technologies developed in collaboration between CapRézo and Inria are based on Cloud federation environment. The collaboration, started in 2014, is scheduled for the next 5 years.

7.2. Bilateral Grants with Industry

7.2.1. NewGeneration-SR

We have a collaboration with the company NewGeneration-SR. The aim of this company is to reduce the energy impact through solutions on each layer of the energy consumption (from the data- center design and the production to usage). NewGeneration-SR improve 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), we are developing models to reduce the energy consumption for the benefit of data-center

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

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

Airbus Defence and Space research and development contract:

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

CEA DPTA research and development contract:

- Olivier merci de compléter, lien avec Runtime

CEA-CESTA research and development contract:

- Performance analysis of the recent improvements in PaStiX sparse direct solver for matrices coming from different applications developped at CEA-CESTA.

CEA Cadarache (ITER) research and development contract:

- Peta and exaflop algorithms for turbulence simulations of fusion plasmas (Fabien Rozar (PhD); Guillaume Latu, Jean Roman).

EDF R & D - SINETICS research and development contract:

- Design of a massively parallel version of the SN method for neutronic simulations (Moustapha Salli (PhD); Mathieu Faverge, Pierre Ramet, Jean Roman).

TOTAL research and development contracts:

- Parallel hybrid solver for massivelly heterogeneoux manycore platforms (Stojce Nakov (PhD); Emmanuel Agullo, Luc Giraud, Abdou Guermouche, Jean Roman).

7.2. Bilateral Grants with Industry

Airbus Group Innovations research and development contract:

- 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.

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

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

Microsoft: Z-CloudFlow (2013–2016).   In the framework of the Joint Inria-Microsoft Research Center, this project is a follow-up to the A-Brain project. 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, started in 2014. The project is being conducted in collaboration with the Zenith team from Montpellier, led by Patrick Valduriez.

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

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. *RealTimeAtWork.com*

is a startup from Inria Lorraine created in December 2007. Bruno Gaujal is a founding partner and a scientific collaborator of the startup. Its main target is to provide software tools for solving real time constraints in embedded systems, particularly for superposition of periodic flows. Such flows are typical in automotive and avionics industries who are the privileged potential users of the technologies developed by RealTimeAtWork.com

7.1.2. *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). MESCAL leads the ADR on self-optimizing networks (SELFNET). The researchers involved in this project are Bruno Gaujal and Panayotis Mertikopoulos.

7.1.3. *Stimergy*

Stimergy is a startup that aims at developing a distributed data center built by connecting mini data centers embedded in digital boilers installed in multi-unit residential buildings. Each boiler contains several servers and the dissipated power can thus be used to cover a large part of the annual energy requirements for preparing domestic hot water for a building. Such infrastructure drastically reduces the energy required to operate data centers, while reducing total cost of infrastructure and ownership. Mescal (Olivier Richard, and Michael Mercier, full-time Inria engineer) provides the necessary expertise for the realization and implementation of software infrastructure allowing the coordination of operating such mini data center.

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

6. Bilateral Contracts and Grants with Industry

6.1. Bilateral Contracts with Industry

- Contract with Bull (2013–2016). Multiobjective scheduling on supercomputer towards exascale. Associated to a CIFRE PhD grant (David Glesser, started in 4/2013). Partners: Inria - LIG Moais, Bull

- Contract with CEA Saclay (2014): Hierarchical work stealing for Eruoplexus. Partners: Moais and CEA Saclay.

- Contract with CEA Bruyères-le-Châtel. (2014): Multi-core and many-core parallelization for scientific visualization. Partners: Moais and CEA Bruyères-le-Châtel.

- Contract with CEA Saclay. (2015): Multi-core and many-core parallelization of EPX code. Partners: Moais and CEA Saclay.

- Contract with Bulll (2014-2016): Multi-objective batch scheduling. Partners: Moais and Bull.

- Contract with Incas-ITSec (2014): IPSec with pre-shared key for MISTIC security module. Partners: Moais, Privatics and Incas-ITSec

- Contract with XYALIS (2014): remote software distributed protection (internship support). Partners: Floralis (Moais and UJF-IF [P. Elbaz-Vincent] and XYALIS.

6.2. Bilateral Grants with Industry

- Contract with EDF (2010-2014). High performance scientific visualization. Funds 1 PhD (Mathias Ettinger). Partners: Inria (MOAIS and EVASION), EDF R&D.

- Collaboration with CEA (2012-2015): Europlexus Parallelization with XKaapi. Partners: Inria Rhônes-Alpes and CEA Saclay (CEA funds the PhD of Marwa Sridi started in 4/2013).

- Contract with IFPEN (2014-2017). Multi-CPUs-Multi-GPUs parallelization of numerical solvers. Funds 1 PhD (Adrien Roussel). Partners: Inria (MOAIS), IFPEN.

ROMA Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

Related to the evolutions and support of the MUMPS solver (see Section 5.1), we worked on:

- setting up a consortium of industrial users to fund the project. Four membership contracts were signed this year by Altair, EDF, LSTC and Michelin.
- a contract with EMGS (Norway) related to low-rank compression for geophysics applications; the contract is managed by INP Toulouse.

RUNTIME Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Grants with Industry

STMicroelectronics   STMicroelectronics is granting the CIFRE PhD Thesis of Paul-Antoine Arras on The development of a flexible heterogeneous system-on-chip platform using a mix of programmable processing elements and hardware accelerators from October 2011 to October 2014. TOTAL

TOTAL   Total is granting the CIFRE PhD thesis of Corentin Rossignon on Sparse GMRES on heterogeneous platforms in oil extraction simulation from april 2012 to march 2015. CEA

CEA   CEAis granting the CIFRE PhD thesis of Emmanuelle Saillard (2012-2015) on Static/Dynamic Analysis for the validation and optimization of parallel applications and Grégory Vaumourin (2013-2016) on Hybrid Memory Hierarchy and Dynamic data optimization for embedded parallel architectures

CEA - REGION AQUITAINE   CEA together with the Aquitaine Region Council is funding the PhD thesis of Marc Sergent (2013-2016) on Scalability for Task-based Runtimes.

TYREX Project-Team (section vide)

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

7. Bilateral Contracts and Grants with Industry

7.1. 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 2014, we have performed real world evaluations within Sigma's data centers that validated the results on new techniques for the management of elasticity within Cloud applications [27]. We have also presented our current work at [0].

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[0] GreenTouch @ Nantes Digital Week

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

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. *Bilateral industrial partnerships*

7.1.1.1. Partnership with Thales

Dates: 2011-2014

This partnership with Thales Research and Technology explores variability management both in modeling and metamodeling (*i.e.*, design and implementation of software languages). At the model level, this collaboration is a direct follow-up of the MOVIDA and the MUTATION projects, in which we explore the challenges related to software product line and multi-view engineering for the different development phases of systems of systems construction. At the metamodeling level, we investigate how the notions of variability modeling and management can serve the rigorous definition of families of modeling languages, which address the different interpretations of UML needed to model the different viewpoints in the systems engineering.

The project enrolls 4 faculty members and 2 PhD students from the Triskell team. This year, we keep working on the CVL usage in the Thales context.

7.1.1.2. CIFRE grants

- All4Tec (2011-2014). In this project with the All4Tec company we investigate the support of variability modelling for model-based test generation with Matelo (a tool developed by All4Tec). In this context, Benoit Baudry acts as Ph.D advisor for Hamza Samih.

- Zenexity (2011-2014). In this project with the Zenexity company we investigate the new architecture model for efficient web development on top of the play framework (a web framework developed by Zenexity). In this context, Jean-Marc Jézéquel and Olivier Barais act as Ph.D advisor for Julien Richard Foy.

- Orange (2014-2017). In this project with the Orange company we investigate the support of trust in web communication using software reconfiguration techniques. In this context, Olivier Barais acts as Ph.D advisor for Kevin Corre with Gerson Sunye.

FOCUS Project-Team (section vide)

INDES Project-Team (section vide)

PHOENIX Project-Team (section vide)

RMOD Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. SafePython FUI

Participants: Damien Cassou [Correspondant], Jean-Baptiste Arnaud, Stephane Ducasse.

Contracting parties: CEA, Evitech, Inria, Logilab, Opida, Thales, Wallix.

Beyond embedded computing, there is not so much research and development on the verification of software safety. Recently, some tools have been created for languages such as JAVA, SQL, VB or PHP. Nevertheless, nothing exists for Python even though this language is growing fast. SafePython's goal is to provide code analysis tools applicable to Python programs. This project will define a subset of Python that the developers will have to use to have their programs analyzed.

7.2. Sponsoring LAM

Participants: Stéphane Ducasse [Correspondant], Marcus Denker.

Contracting parties: Inria, LAM Research, Inc.

LAM Research Inc.(http://lamrc.com) is a leading supplier of wafer fabrication equipment and services to the global semiconductor industry. LAM has started to sponsor RMOD in 2014. RMOD used the sponsored funds to pay student internships in 2014.

7.3. Resilience FUI

Participants: Stéphane Ducasse [Correspondant], Nicolas Petton, Damien Cassou.

Contracting parties: Nexedi, Morphom Alcatel-Lucent Bell Labs, Astrium Geo Information, Wallix, XWiki, Alixen, Alterway, Institut Télécom, Université Paris 13, CEA LIST.

Resilience's goal is to protect private data on the cloud, to reduce spying and data loss in case of natural problems. Resilience proposes to develop a decentralized cloud architecture: SafeOS. Safe OS is based on replication of servers. In addition a safe solution for documents should be developed. Sandboxing for Javascript applications should be explored.

We proposed to use WebWorkers as a way to control DOM edition. There is a plethora of research articles describing the deep semantics of JavaScript. Nevertheless, such articles are often difficult to grasp for readers not familiar with formal semantics. We proposed a digest of the semantics of JavaScript centered around security concerns.

7.4. Worldline CIFRE

Participants: Anne Etien [Correspondant], Nicolas Anquetil, Stéphane Ducasse, Vincent Blondeau.

In the context of a CIFRE PhD we are working on large industrial project characterization. The PhD started in October 2014.

7.5. Pharo Consortium

The Pharo Consortium was founded in 2012 and is growing constantly. As of end 2014, it has 14 company members, 10 academic partners and 3 sponsoring companies. Inria supports the consortium with one full time engineer starting in 2011. More at http://consortium.pharo.org.

TACOMA Team (section vide)

COATI Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. Amadeus (May 2014 - April 2015)
Participants: Marco Biazzini, David Coudert, Stéphane Pérennes, Michel Syska.

Duration: May 2014 - April 2015

Inria teams: Scale, Coati

Abstract: This collaboration aims to assess the benefits that digital technologies can bring in complex travel distribution applications. Indeed, these applications require both high performance algorithms and distributed programming methods to search for the best solutions among billions of combinations, in a very short time thanks to the simultaneous use of several hundreds (if not thousands) of computers. These benefits will be demonstrated in an application to build 'off the shelf' optimized packages, fully customized to best meet the complex demands of the traveler.

7.2. Bilateral Grants with Industry

7.2.1. Contract CIFRE with Orange Labs, 02/2011 - 01/2014
Participants: Jean-Claude Bermond, Sébastien Félix.

"Convention de recherche encadrant une bourse CIFRE" on the topic *Smart Transports: optimisation du trafic dans les villes*.

7.2.2. Contract CIFRE with KONTRON, 11/2011 - 4/2015
Participants: Michel Syska, Mohamed Amine Bergach.

"Convention de recherche encadrant une bourse CIFRE" on the topic *Graphic Processing Units for Signal Processing* with joint supervision with AOSTE project.

7.2.3. ADR Network Science, joint laboratory Inria / Alcatel-Lucent Bell-labs France, 01/2013 - 12/2015
Participants: David Coudert, Aurélien Lancin, Bi Li, Nicolas Nisse.

COATI is part of the joint laboratory Inria / Alcatel-Lucent Bell-labs France within the ADR Network Science and works on the fast computation of topological properties (hyperbolicity, covering, etc.).

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

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. HiKoB

Participant: Éric Fleury.

A bilateral contract has been signed between the DANTE Inria team and HiKoB to formalise their collaboration in the context of the Equipex FIT (Futur Internet of Things) FIT is one of 52 winning projects in the Equipex research grant program. It will set up a competitive and innovative experimental facility that brings France to the forefront of Future Internet research. FIT benefits from 5.8 euros million grant from the French government Running from 22.02.11 – 31.12.2019. The main ambition is to create a first-class facility to promote experimentally driven research and to facilitate the emergence of the Internet of the future.

7.1.2. 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.

7.1.3. 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 "big data" to social relationships and human behavior) to identify market trends and predict customer actions. Leading telecom and financial services firms are using Grandata's Social Universe product to transform "big data" 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. As a part of this collaboration Carlos Sarraute (Grandata - R&D Director) visited the Dante team on November and Yannick Leo (DANTE - PhD student) visited Grandata office in Buenos Aires in 2014 December.

7.1.4. 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 modeling the adoption dynamics of online services.

7.2. Inria Alcatel-Lucent Bell Labs joint laboratory

Participants: Isabelle Guérin Lassous, Paulo Gonçalves, 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.

DIANA Team

6. Bilateral Contracts and Grants with Industry

6.1. Bilateral Contracts with Industry

In the context of the common Inria - Alcatel Lucent Bell-Labs laboratory on Communication networks of the future, we participate to the Content Centric Networking ADR (Action de Recherche). We are currently discussing with Diego Perino team from Alcatel Lucent Bell-Labs to define a research program for a post-doctoral position.

6.2. Bilateral Grants with Industry

We are collaborating with the startup Novathings to deploy early stage privacy leaks monitoring and control solutions. We have proposed in Meddle a VPN based infrastructure performing SSL-bumping in order to capture all the mobile data traffic and to inspect even the SSL flows. The biggest advantage is that, as most mobile platforms support VPNs, we don't need any installation or root access on the devices to perform traffic redirection and inspection. We have a Carnot funding for one year engineer position that will start in April 2015 to implement a new solution on a home appliance sold by Novathings to improve transparency and control for personal devices.

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

6. Bilateral Contracts and Grants with Industry

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

Participants: Bruno Tuffin, Gerardo Rubino.

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

The group currently 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 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.

6.2. 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.

6.3. Bilateral Contract with Industry: Data-aggregation for large-scale distributed networks

Participants: Bruno Sericola, Romaric Ludinard.

This was a 3-year (2011 - 2014) bilateral project with Technicolor R & D, France, on data-aggregation for large-scale distributed networks. Along with the ubiquity of data and computing devices, comes the complexity of extracting and gathering relevant information for management purposes. The very distributed nature of sources of data (be they partially local applications at user's place, or hardware as gateways), as well as their ever increasing number prohibit a systematic and exhaustive gathering on a single (or few) central server for offline analysis. In this context, collaborative data aggregation, where some computing resources collaborate securely to provide digests, appears as an interesting application for both scalability and efficiency. Moreover, collecting information at a large scale pose the problem of privacy and data aggregation may allow preserving the privacy while collecting data.

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

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

This is a Cifre contract (2012-2015) including a PhD thesis supervision, done with Orange Labs, on evaluating and developing a new plug-and-play routing protocol (called Low Opex and Capex Architecture for Resilient Networks, or LOCARN), which do not require any network management or configuration.

6.5. Cifre contract on Small Cell Networks

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

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

6.6. Cifre contract on a dynamic adaptive service-driven SDN architecture

Participants: Jean-Michel Sanner, Yassine Hadjadj-Aoul, Gerardo Rubino.

This is a Cifre contract (2013-2016) including a PhD thesis supervision, done with Orange Labs, on defining a dynamic adaptive service-driven network architecture based on the SDN concept.

6.7. Cifre contract on defining an open, a flexible and a unified network architecture

Participants: Yue Li, Yassine Hadjadj-Aoul, Gerardo Rubino.

This is a Cifre contract (2013-2016) including a PhD thesis supervision, done with Orange Labs, on designing an open, flexible and unified network architecture.

6.8. DGA Grant

Participant: Adlen Ksentini.

This DGA grant, with Cidre Inria team, is for the PhD supervision of Florient Grandhomme. The aim of the PhD program is to study a new routing protocol for MANET.

6.9. DVD2C

Participant: Adlen Ksentini.

We are working in the 3-year (September 2014 to 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).

6.10. IPChronos

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

The 3-year (September 2011 – September 2014) FUI Project IPChronos, where the main focus is in the use of the IEEE 1588 synchronization protocol over IP, ended. Our contribution focused on developing analytical models to estimate, based on the IEEE 1588 protocol, the end-to-end delay. IPChronos was leaded by ORALIA SPECTRACOM, and the partners are IPlabel and our team.

6.11. Camion

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

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.

DYOGENE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. MSR-Inria Joint Lab

- Social Information Networks and Privacy
  Online Social networks provide a new way of accessing and collectively treating information. Their efficiency is critically predicated on the quality of information provided, the ability of users to assess such quality, and to connect to like-minded users to exchange useful content.

  To improve this efficiency, we develop mechanisms for assessing users' expertise and recommending suitable content. We further develop algorithms for identifying latent user communities and recommending potential contacts to users.

- Machine Learning and Big Data
  Multi-Armed Bandit (MAB) problems constitute a generic benchmark model for learning to make sequential decisions under uncertainty. They capture the trade-off between exploring decisions to learn the statistical properties of the corresponding rewards, and exploiting decisions that have generated the highest rewards so far. In this project, we aim at investigating bandit problems with a large set of available decisions, with structured rewards. The project addresses bandit problems with known and unknown structure, and targets specific applications in online advertising, recommendation and ranking systems.

7.1.2. CRE with Orange

CRE contract titled "Distribution of the SINR in real networks" between Inria and Orange Labs have been realized. P. Keeler was hired by Inria as a research engineer within this contract. 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.

6. Bilateral Contracts and Grants with Industry

6.1. Etineo Partnership

Participants: Roudy Dagher, Salvatore Guzzo Bonifacio, Nathalie Mitton [correspondant].

EtiPOPS focuses on portability and flexibility of GOLIATH on several hardwares and in different environments (indoor and outdoor) through the deployment of different applications such as geolocalization. In order to favor the portability, designed solutions in EtiPOPS will respect on-going communication standards which will allow a greater interoperability between heterogeneous hardwares. Publications in 2014 in the framework of EtiPOPS are [32], [11] and software modules.

6.2. Traxens partnership

Participants: Natale Guzzo, Nathalie Mitton [correspondant].

This collaboration aims to set up a full protocol stack for TRAXENS's guideline.

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

6. Bilateral Contracts and Grants with Industry

6.1. Alcatel-Lucent Bell Labs

Participants: François Durand, The-Dang Huynh, Leonardo Linguaglossa, Laurent Viennot.

Gang has a strong collaboration with Alcatel-Lucent. We notably collaborate with Fabien Mathieu and Diego Perino who are former members of Gang that have joined Alcatel-Lucent. A Cifre grant allows to fund the PhD thesis of The-Dang Huynh to study ranking techniques and their application to social networks. An ADR (joint research action) is dedicated to content centric networks and forwarding information verification. The PhD thesis of Leonardo Linguaglossa is funded by this contract. We also collaborate with Ludovic Noirie on voting systems.

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

HIPERCOM2 Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

7.1.1. OCARI2

Participants: Ichrak Amdouni, Pascale Minet, Cédric Adjih, Ridha Soua.

Partners: EDF, Inria.

The OCARI (Optimization of Ad hoc Communications in Industrial networks) project, funded by ANR, started in February 2007 and ended in 2010, EDF the coordinator decided to continue the project that deals with wireless sensor networks in an industrial environment. It aims at responding to the following requirements which are particularly important in power generation industry and in warship construction and maintenance:

- Support of deterministic MAC layer for time-constrained communication,
- Support of optimized energy consumption routing strategy in order to maximize the network lifetime,
- Support of human walking speed mobility for some particular network nodes, (e.g. sinks).

The development of OCARI targets the following industrial applications:

- Real time centralized supervision of personal dose in electrical power plants,
- Condition Based Maintenance of mechanical and electrical components in power plants as well as in warships,
- Environmental monitoring in and around power plants,
- Structure monitoring of hydroelectric dams.

To meet the requirements of supported applications (remote command of actuators, tele-diagnostic...), new solutions are brought to manage several communication modes, ranging from deterministic data transfers to delay tolerant transfers. A key issue is how to adapt routing algorithms to the industrial environment, taking into account more particularly limited network resources (e.g.; bandwidth), node mobility and hostile environment reducing radio range. The OCARI project aimed at developing a wireless sensor communication module, based on IEEE 802.15.4 PHY layer.

In 2014, Inria took part with EDF to the specification of a simplified OCARI stack for a porting to a 32 bit platform and provided support to the SME in charge of developing this stack.

7.2. Bilateral Grants with Industry

Participants: Paul Muhlethaler, Gerard Le Lann.

This work aims at improving the reliability of some SAGEM communications systems.

INFINE Team

7. Bilateral Contracts and Grants with Industry

7.1. 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 mobiliy analysis.

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

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Grants with Industry

7.1.1. *Inria-EDF Strategic action MS4SG*

Participants: Yannick Presse, Benjamin Segault, Laurent Ciarletta [contact].

Vincent Chevrier (Maia team, LORIA) is a collaborator and correspondant for the MS4SG project. Benjamin Camus, Victorien Elvinger (Maia team, LORIA) are extrenal collaborators.

The MS4SG (multi-simulation for smart grids) project is granted as a strategic action between Inria and EDF. It is a joint work between the Madynes and MAIA teams from Inria-NGE and EDF R&D. The aim of the project is to provide primitives based on AA4MM in order to enable the multi-modeling and the multi-simulation of smart-grids. They can be seen as a combination of at least 3 layers: the power grid, the network used to collect information and control the system and an Information System. As these domains can influence each other, smart-grids can be considered as a kind of complex system and we are faced with multi-modeling and multi-simulation issues. Models in these simulators (and therefore simulators) are heterogeneous (at least equation based and event based models).

The idea behind MS4SG is to use simulation to help develop and evaluate future smart grids architectures, novel supervision techniques and to eventually control these systems. Instead of building a "super simulator", our approach is stemming from our AA4MM work, and consists in integrating simulators (and models) coming from at least the three aforementioned initial different domains: electrical networks, communication networks and information systems.

7.1.2. *Alerion, project*

Participants: Laurent Ciarletta, Maxence Ho, Yael Kolasa, Martin Thiriau, Emmanuel Nataf [contact].

Alerion is an e-falconry startup created by a member of Madynes. Its goal is to provide novel solutions and services "for, using and eventually against" UxV (Unmanned Air ... Vehicle). The concept is to enhance existing system and design new ones by combining well designed components seen as Cyber Physical bricks.

As part of its national grant by the "Concours national d'aide à la création d'entreprises de technologies innovantes" (for the emerging category in 2013), Alerion is funding a Proof of Concept project to help in developing and validating the requirements of a couple of basic components related to functionalities such as safety mechanisms and sensor data collection.

Alerion has also actively supported the UAV Challenge team that participated to the "Outback Joe Challenge".
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MAESTRO Project-Team

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7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

MAESTRO members are involved in the

- Inria Alcatel-Lucent 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 §7.1.1 and §7.1.2).

- Inria ALSTOM joint laboratory: the joint laboratory consists of four projects. MAESTRO members participate in project P11 (see §7.1.3).

7.1.1. ADR "Self-Organized Networks in Wireless" (October 2012 – December 2015)

Participants: Eitan Altman, Majed Haddad.

- Contractor: Alcatel-Lucent Bell Labs (http://www.alcatel-lucent.com/bell-labs)
- Collaborators: Laurent Roullet (coordinator), Véronique Capdevielle.

Coordinator for Inria: Bruno Gaujal (team MESCAL).

During the investigations carried out within this ADR, in collaboration with Alcatel-Lucent Bell Labs and WIRELESS ENB teams (System Engineering and Modem), M. Haddad and E. Altman have proposed three technical solutions to the LTE Mobility State Estimation problem. In particular,

- Three patents have been submitted and filed (two in 2013, and one in 2014);
- A white paper written by the joint team (Inria/Bell-Labs and Wireless SE) summarizing the theoretical baseline of the methods, their performances, as well as the implementation issues, is documented.

These solutions have been set up between Inria and Alcatel-Lucent Bell Labs iteratively after numerous meetings, in order to cope with the product requirements. This work is on-going and has not been submitted for publication yet.

7.1.2. ADR "Network Science" (January 2013 – January 2016)

Participants: Konstantin Avrachenkov [coordinator], Jithin Kazhuthuveettil Sreedharan, Philippe Nain, Giovanni Neglia, Marina Sokol.

- Contractor: Alcatel-Lucent Bell Labs (http://www.alcatel-lucent.com/bell-labs)
- 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 (see §6.2.3) and models of influence/information propagation over the complex networks (see §6.2.4).

7.1.3. Project P11 "Data Communication Network Performance" (December 2013 – May 2016)

Participants: Sara Alouf [coordinator], Konstantin Avrachenkov, Abdulhalim Dandoush, Philippe Nain, Giovanni Neglia.

- Contractor: ALSTOM Transport (http://www.alstom.com/transport/)
- Collaborators: Pierre Cotelle, Pierre Dersin, Sébastien Simoens (coordinator).

The objective of this study is to build a simulation platform (see §5.1.1) 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.

7.2. Bilateral Grants with Industry

7.2.1. "Multi-Objective Optimization for LTE-Advanced Networks" (December 2012 – November 2015)

Participant: Eitan Altman.

- Contractor: Orange Labs (http://www.orange.com/en/innovation)
- Collaborators: Zwi Altman, Abdoulaye Tall.

The objective of this Cifre thesis is threefold: (1) to develop solutions based on stochastic approximations and optimal control for the optimization and setting of LTE-Advanced Networks; (2) to develop queuing models to capture the dynamics of the traffic and the physical layer mechanisms (e.g. relay, MIMO, scheduling); and (3) to apply the developed methods to engineering problems such the interference management, load balancing, optimization of coverage and capacity, and mobility management.

MUSE Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- "Improving the quality of recommendation using semi-structured user feedback" CIFRE contract with Technicolor for thesis of Sara el Aouad from May 2014 to April 2017.

- "Crowdsourced Home Network Diagnosis" CIFRE contract with Technicolor for thesis of Diego da Hora from February 2014 to January 2017.

- "Exploiting Network Content-awareness to provide novel added value services" contract under the Inria-Alcatel Lucent Bell Labs common Lab (ADR ICN) to fund the doctoral thesis of Giuseppe Scavo from November 2013 to October 2016.

- "Automated Network Troubleshooting Based on Collaboration of Home Devices" CIFRE contract with Technicolor for thesis of Stephene Wustner from Feb 2012 to Nov 2014.

7.2. Bilateral Grants with Industry

- "Home Network Troubleshooting with the Fathom Measurement Platform" in collaboration with Christian Kreibich (ICSI), gift from Google/M-lab, 2013-2014.

<h2 style="color:red; text-align:center">RAP Project-Team</h2>

5. Bilateral Contracts and Grants with Industry

5.1. Contracts

- CELTIC-Plus Saser "Safe and Secure European Routing'. RAP participates in the section on optical networks. Participants include Orange labs, Alcaltel-Lucent, Telecom Institute, ENSSAT as well as a number of German laboratories. Duration three years.
- Contrat de recherche externalisé avec ORANGE SA "Scheduling Global OS". Duration three years 2014-2016.
- 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. Starting at 1/10/2013.
- PhD grant CJS (Contrat Jeune Scientifique) Frontières du vivant of INRA for Emanuele Leoncini.
- 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.

5.2. Bilateral Grants

- The project RNA "Connectivity and distances in models of random networks and applications" is jointly funded by Inria through the Associate Team program, and Quebec's FQRNT team grant CARP. https://who.rocq.inria.fr/Nicolas.Broutin/aap-rna.html. Duration 2013-2014.

SOCRATE Project-Team

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

Socrate has strong collaboration with Orange Labs (point to point collaboration) and Alcatel Lucent through the Inria-ALU common lab and the Green Touch initiative. Socrate also works in collaboration with Siradel, a french worldwide company working on wireless system simulations, Sigfox a french young compagny deploying the first cellular network operator dedicated to M2M and IoT, and HIKOB a start-up originated from the Citi laboratory providing sensor networks solutions. A bilateral cooperation supports the PhD of Laurent Maviel, and Siradel is a member of the Ecoscell ANR project in which Socrate is involved.

Socrate started in September 2011 a strong bilateral cooperation with the Euromedia group about Body Area Networks in which Tanguy Risset, Guillaume Villemaud and Jean-Marie Gorce are involved and the project supports the thesis of Matthieu Lauzier.

A collaboration with Bosch on arithmetic for automotive embedded platforms involves Florent de Dinechin and members of the AriC team.

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

7. Bilateral Contracts and Grants with Industry

7.1. Bilateral Contracts with Industry

- We have contracted bilateral cooperation with some industrial partners that are under non disclosure agreements and cannot be mentioned here.