Activity Report 2015

Section Partnerships and Cooperations

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

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. Master Software Engineering

ATEAMS is a core partner in the Master Software Engineering at Universiteit van Amsterdam. This master is a collaboration between SWAT/ATEAMS, Universiteit van Amsterdam, Vrije Universiteit and Hogeschool van Amsterdam.

8.1.2. Early Quality Assurance in Software Production

The EQUA project is a collaboration among Hogeschool van Amsterdam (main partner) Centrum Wiskunde & Informatica (CWI), Technisch Universiteit Delft, Laboratory for Quality of Software (LaQuSo), Info Support, Software Improvement Group (SIG), and Fontys Hogeschool Eindhoven.

8.1.3. Next Generation Auditing: Data-assurance as a service

This project is a collaboration between Centrum Wiskunde & Informatica (CWI) PriceWaterhouseCoopers (PWC), Belastingdienst (National Tax Office), and Computational Auditing, is to enable research in the field of computational auditing.

8.1.4. Domain-Specific Languages: A Big Future for Small Programs

Software and programming have a brilliant past that has brought us the automation of many expected and unexpected human and societal activities ranging from banking and consumer electronics to mobile networking, search engines and social networks. The present of software is overwhelming: many software systems have sizes in the range of 10–100 million lines of source code and contain tens of thousands of errors that are yet to be discovered. We claim that software will only have a big future if software itself becomes smaller. Smaller software leads to higher software productivity (we have to write less) and higher software quality (quality guarantees become part of the language and not of the program).

This project is funded by NWO (the Dutch national science foundation).

8.2. European Initiatives

8.2.1. FP7 & H2020 Projects

- FP7 STREP "OSSMETER — Automated Measurement and Analysis of Open Source Software" (ended in 2015)

8.2.2. Collaborations with Major European Organizations

Centrum Wiskunde & Informatica (CWI): Software Analysis & Transformation (Netherlands)
CWI SWAT is the research team associated directly with ATEAMS.

8.3. International Initiatives

8.3.1. Inria International Partners

8.3.1.1. Informal International Partners

ATEAMS collaborates with the following research teams:

- Eindhoven Technical University - SET (Eindhoven, The Netherlands)
- Universiteit van Amsterdam - Systems and Network Engineering (Amsterdam, The Netherlands)
- Royal Holloway University of London - Dept. of Computer Science
- The University of Hong Kong (China) - Computer Science
- Delft Technical University (The Netherlands)
- University of Texas at Austin (USA)
- TU Darmstadt (Germany)

8.3.1.2. Research stays abroad

- Michael Steindorfer stayed for 3 months at Oracle Labs in Austria to study efficient data-structures and data-structure optimisations on the JVM.

BONSAI Project-Team

9. Partnerships and Cooperations

9.1. National Initiatives

9.1.1. ANR

- PIA France Génomique: National funding from "Investissements d'Avenir" (call *Infrastructures en Biologie-Santé*). France Génomique is a shared infrastructure, whose goal is to support sequencing, genotyping and associated computational analysis, and increase French capacities in genome and bioinformatics data analysis. It gathers 9 sequencing and 8 bioinformatics platforms. Within this consortium, we are responsible for the workpackage devoted to the computational analysis of sRNA-seq data, in coordination with the bioinformatics platform of Génopole Toulouse-Midi-Pyrénées

9.1.2. ADT

- ADT Vidjil (2015–2017): The purpose of this ADT is to strengthen Vidjil development and to ensure a better diffusion of the software by easing the installation, administration and usability. This will make the software well suited for a daily clinical use. The software is already used in test on our own web server (more than 1,000 samples processed by now). Our goal is that several labs use Vidjil on a daily basis by the end of the ADT, and that they all have their own Vidjil server.

9.1.3. Others

- PEPS Gen-CoV: *Global bioinformatics analysis of coronavirus strain 229E in hospital outbreak.* The goal of this PEPS is to provide with a better characterization of coronavirus infections and to understand underlying mecanisms that lead to the high diversity of coronaviruses. To achieve this goal, we will sequence and analyze a number of coronavirus 229E genomes in order to characterize their diversity, identify features that influence pathogenicity and propose a model of evolution. All those results will be correlated with epidemiologic data thanks to a partnership with Lille hospital.

- PEPS JCJC: *Frugal algorithms for third-generation DNA sequencing.* The goal of this PEPS is to develop lightweight algorithms and data structures for the analysis of third-generation sequencing data. Among third-generation technologies, the MinION sequencer is a new, portable USB device that can perform DNA sequencing using only common lab equipment and a laptop computer. However, analysis of the data produced by the MinION can only be carried by uploading data to a cloud server. Indeed, all algorithms and data structures that are currently known require large computational resources to process such data. This is unfortunate for at least two reasons: analysis of the data now takes more time than its production, and confidential data needs to be processed on potentially insecure cloud servers. We seek to design methods that would enable analysis of sequenced data on the same machine as the one that performed sequencing.

9.2. European Initiatives

9.2.1. Collaborations in European Programs, except FP7 & H2020

International ANR RNAlands (2014-2017): National funding from the French Agency Research (call *International call*). The subject is fast and efficient sampling of structures in RNA Folding Landscapes. The project gathers three partners: Amib from Inria Saclay, the Theoretical Biochemistry Group from Universität Wien and Bonsai.

9.3. International Initiatives

9.3.1. Inria Associate Teams not involved in an Inria International Labs

9.3.1.1. CG-ALCODE

Title: Comparative Genomics for the analysis of gene structure evolution: ALternative CODing in Eukaryote genes through alternative splicing, transcription, and translation.

International Partner (Institution - Laboratory - Researcher):

Université du Québec À Montréal (Canada) - Laboratoire de combinatoire, informatique et mathématique (LaCIM) - Anne Bergeron

Start year: 2014

See also: http://thales.math.uqam.ca/~cgalcode/

The aim of this Associated Team is the development of comparative genomics models and methods for the analysis of eukaryotes gene structure evolution. The goal of the project is to answer very important questions arising from recent discoveries on the major role played by alternative transcription, splicing, and translation, in the functional diversification of eukaryote genes.

Two working meetings of CG-ALCODE researchers took place in 2015. First, Samuel Blanquart, Anne Bergeron and Krister Swenson met each other in Montpellier, from 27th to 30th of April. Second, Samuel Blanquart, Jean Stéphane Varré spent two weeks in Montréal, from 1st to 11th November, to work with Anne Bergeron.

9.3.1.2. Informal International Partners

- *Astrid Lindgrens Hospital, Stockholm University:* Collaboration with Anna Nilsson and Shanie Saghafian-Hedengren on RNA sequencing of stromal cells.
- *CWI Amsterdam:* Collaboration with Alexander Schoenhuth and Jasmijn Baaijens on succinct data structures and algorithms for the assembly of viral quasispecies.
- *Department of Statitics, North Carolina State University:* Collaboration with Donald E. K. Martin on spaced seeds coverage.
- *Gembloux Agro-Bio Tech, Université de Liège:* Collaboration with Philippe Jacques on nonribosomal peptides.
- *Institut für Biophysik und physikalische Biochemie, University of Regensburg:* Collaboration with Rainer Merkl on ancestral sequence inference and synthesis.
- *Makova lab, The Pennsylvania State University:* Collaboration with Kateryna Makova and Samarth Rangavittal on the assembly of the gorilla Y chromosome, and visualisation of assembly graphs.
- *Medvedev lab, The Pennsylvania State University:* Collaboration with Paul Medvedev on algorithms for constructing de Bruijn graphs.
- *Novo Nordisk Foundation Center for Biosustainability, Technical University of Denmark:* Collaboration with Tilmann Weber on nonribosomal peptides.
- *Proteome Informatics Group, Swiss Institute of Bioinformatics:* Collaboration with Frédérique Lisacek and Markus Mueller on nonribosomal peptides.
- *School of Social and Community Medicine, University of Bristol:* Collaboration with John Moppett on leukemia follow-up.
- *Science for Life Laboratory, Stockholm University:* Collaboration with Lars Arvestad and Kristoffer Sahlin on genome scaffolding of contaminated libraries.
- *Theoretical Biochemistry Group, Universität Wien:* Collaboration with Andrea Tanzer and Ronny Lorenz on RNA folding and RNA kinetics.

9.4. International Research Visitors

9.4.1. Visits of International Scientists

- Kristina Heyn, PhD student, Institut für Biophysik und physikalische Biochemie, University of Regensburg (from 6th to 11th of July)
- Burkhard Morgenstern, professeur, Universität Gottingen (from 20th to 23th of April)
- Samarth Rangavittal, PhD student, The Pennsylvania State University (from October 18th to December 6th)
- Gabriele Valiente, professeur, Universitat Politècnica de Catalunya (from 25th to 29th of May)
- Tilmann Weber, senior researcher, Novo Nordisk Foundation Center for Biosustainability, Technical University of Denmark (from 18th of October to 31st of October)

DEFROST Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR

+ **IDeaS (ANR JCJC)**: this is a project targeted at per-operative guidance for interventional radiology procedures. Our main goal is to provide effective solutions for the two main drawbacks of interventional radiology procedures, namely: reduce radiation exposure and provide a fully 3D and interactive visual feedback during the procedure. To do so, our project relies on an original combination of computer vision algorithms and interactive physics-based medical simulation. Defrost is involved with Magrit, MIMESIS and Nancy Hospital.

8.2. European Initiatives

8.2.1. Collaborations with Major European Organizations

Partner 1: King's College, Robotics Dept (UK)

Soft robot modeling and control using pneumatic and hydraulic technology

<div align="center">

DOLPHIN Project-Team

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9. Partnerships and Cooperations

9.1. Regional Initiatives

- CPER "data" (2015-2020) : co-leader of a workpackage "Research infrastructure". The objective is to support research related to data science including high performance computing for combinatorial optimization using the Grid'5000 grid infrastructure.
- ELSAT (2015-2019) of CPER (Contrat Plan Etat Région) : transversal research action "Planning and scheduling of maintenance logistics in transportation".
- PPF (Bioinformatics) : This national program within the University of Lille 1 deals with solving bioinformatics and computational biology problems using combinatorial optimization techniques.
- PPF HPC (High performance computing) : the objective is to support the coordination in terms of scientific animation, training, equipement and patnership development related to simulation and high performance computing. This action is granted 17K€ per year by University Lille 1.

9.2. National Initiatives

9.2.1. ANR

- ANR project Modèles Numériques "NumBBO - Analysis, Improvement and Evaluation of Numerical Blackbox Optimizers" (2012-2016) in collaboration with Inria Saclay, TAO team, Ecole des Mines de St. Etienne, CROCUS team, and TU Dortmund University, Germany (2012-2016).
- ANR project TECSAN (Technologies pour la Santé) "ClinMine - Optimisation de la prise en Charge des Patients à l'Hôpital" in collaboration with University Lille 1, Université Lille 2, CHRU Lille, CHRU Montpelier, CHICL, Alicante (7 partners) (2014-2017) - Coordinator -
- PGMO project "Towards a Complexity Theory for Black-Box Optimization", together with Carola Doerr (CNRS, LIP6), Benjamin Doerr (Ecole Polytechnique), Anne Auger, Nikolaus Hansen (both Inria Saclay), Timo Koetzing (University of Jena, Germany), Johannes Lengler (ETH Zurich, Switzerland), and Jonathan Rowe (The University of Birmingham, UK), (2014-2016)
- PGMO project "Demand side management in smart grids", together with EDF, (2015-2017).

9.3. European Initiatives

9.3.1. Collaborations in European Programs, except FP7 & H2020

Program: COST

Project acronym: cHiPSet

Project title: High-Performance Modelling and Simulation for Big Data Applications

Duration: 01 2015 - 01 2018

Coordinator: Joanna Kolodziej

Other partners: organisme, labo (pays): Spain, Poland, Germany, France, Luxembourg, italy, ...

Abstract: The Big Data era poses a critically difficult challenge and striking development opportunities in High-Performance Computing (HPC): how to efficiently turn massively large data into valuable information and meaningful knowledge. Computationally effective HPC is required in a rapidly-increasing number of data-intensive domains, such as Life and Physical Sciences, and Socio-economical Systems.

Modelling and Simulation (MS) offers suitable abstractions to manage the complexity of analysing Big Data in various scientific and engineering domains. Unfortunately, Big Data problems are not always easily amenable to efficient MS over HPC. Also, MS communities may lack the detailed expertise required to exploit the full potential of HPC solutions, and HPC architects may not be fully aware of specific MS requirements.

Therefore, there is an urgent need for European co-ordination to facilitate interactions among data-intensive MS and HPC experts, ensuring that the field, which is strategic and of long-standing interest in Europe, develops efficiently - from academic research to industrial practice. This Action will provide the integration to foster a novel, coordinated Big Data endeavour supported by HPC. It will strongly support information exchange, synergy and coordination of activities among leading European research groups and top global partner institutions, and will promote European software industry competitiveness

9.3.2. Collaborations with Major European Organizations

University of Luxembourg: (Luxembourg)

Energy aware scheduling in Cloud computing systems

9.4. International Initiatives

9.4.1. Inria International Labs projects

- Collaboration with University of Mons (UMONS). The collaboration consists mainly in the joint supervision of three Ph.D theses: the thesis of Rudi Leroy defended on November 19th, 2015, the thesis of Jan Gmys started last year, and the thesis of Gautier Vaillant started in September 2015.

9.4.2. Inria Associate Teams not involved in an Inria International Labs

9.4.2.1. s3-bbo

Title: Threefold Scalability in Any-objective Black-Box Optimization (s3-bbo)

International Partner (Institution - Laboratory - Researcher):

Shinshu University, Japan

Duration: 2015-2017

See also: http://francejapan.gforge.inria.fr/doku.php?id=associateteam

The main scientific goals of this collaboration is to theoretically derive, analyze, design, and develop scalable evolutionary and other stochastic local search algorithms for large-scale optimization considering three different axes of scalability: (i) decision space, (ii) objective space, and (iii) availability of distributed and parallel computing resources. This research will allow us to design, control, predict, analyze and optimize parameters of recent complex, large-scale, and computationally expensive systems, providing the basic support for problem solution and decision-making in a variety of real world applications. For single-objective continuous optimization, we want to theoretically derive variants of the state-of-the-art CMA-ES with linear time and space complexity scalings with respect to the number of variables. We will exploit the information geometry framework to derive updates using parametrization of the underlying family of probability distribution involving a linear number of components. The challenges are related to finding good representations that are theoretically tractable and meaningful. For the design of robust algorithms, implementing the derived updates, we plan to follow the same approach as for the design of CMA-ES. For multi- and many-objective

optimization, we will start by characterizing and defining new metrics and methodologies to analyze scalability in the objective space and in terms of computational resources. The first challenge is to accurately measure the impact of adding objectives on the search behavior and on the performance of evolutionary multi- and many- objective optimization (EMyO) algorithms. The second challenge is to investigate the new opportunities offered by large-scale computing platforms to design new effective algorithms for EMyO optimization. To this end, we plan to follow a feature-based performance analysis of EMyO algorithms, to design new algorithms using decomposition-based approaches, and to investigate their mapping to a practical parallel and distributed setting.

9.4.3. Inria International Partners

9.4.3.1. Declared Inria International Partners

- Memorandum of Understanding between Shinshu University (Nagano, Japan) and Inria, signed on March 2014.

9.4.3.2. Informal International Partners

- University of Coimbra, Portugal.
- IRIDIA, Université Libre de Bruxelles.
- Cologne University of Applied Sciences, Germany.
- Leiden University, Netherlands.
- UMONS University and Tractebel company, Belgium.
- EMI - Univ. Rabat, Morocco.
- Univ. Oviedo, Spain.
- Univ. Istanbul, Turkey.
- University of KULAK Team Codes (Belgium) - Data science for Optimization
- University of KENT (UK) - Knowledge and Optimization
- University of Aberdeen (UK) - Fitness landscape, representation and performance
- University of British Columbia, Canada
- University of Münster, Germany

9.4.4. Participation In other International Programs

- JSPS-MEXT project on Evolutionary multi-objective optimization, landscape analysis, and search performance, with Shinshu University, Nagano, Japan (2013—2016).
- Excellencia project(2015-2017) with University of Valencia (Spain) and University of Oviedo (Spain) on intelligent techniques for robust scheduling and energy-aware transportation systems.

9.5. International Research Visitors

9.5.1. Visits of International Scientists

- Prof. Hernan Aguirre, Shinshu University, Nagano, Japan
- Prof. Kiyoshi Tanaka, Shinshu University, Nagano, Japan
- Fabio Daolio [PostDoc, Shinshu University, Nagano, Japan, from Sept 2014 to Sept 2015]
- Saúl Zapotecas-Martínez [PostDoc, Shinshu University, Nagano, Japan, from Nov 2014 to Dec 2015]
- Prof. Qingfu Zhang, CityU, Hong-Kong
- Dr. Oliver Schuetze, CINVESTAV-IPN, Mexico
- Prof. H-J. Siegel (Univ. Colorado, USA)
- Prof. R. Ellaia (EMI, Morocco)

- Prof. A. Tchernik (Mexico)
- Prof. B. Gendron (Canada)
- Dr. Myriam Delgado (Federal University of Technology of Paraná, Brazil), 1 week, December 2015
- Tiago-Carneiro Pessoa [Universidade Federal do CEARA, Brazil, from 09/2015 to 08/2016]

9.5.1.1. Internships (Master & PhD)

- Tiago-Carneiro Pessoa [Phd student from Universidade Federal do CEARA, Brazil. from Sept 2015 to Jan 2017].
- Juan Palacios Alonso (Univ. Oviedo Spain).
- Igor Machado Coelho (Univ. Fluminense Brazil).

9.5.1.2. Research stays abroad

- A. Liefooghe, May 2015, Shinshu University, Nagano, Japan.
- A. Liefooghe, Dec 2015, Shinshu University, Nagano, Japan.
- M-E Marmion, C. Dhaenens, invited at Shinshu University (1 week, february 2015)
- E-G. Talbi, Mar 2015, Univ. Murcia, Spain.
- E-G. Talbi, Juin 2015, EMI, Univ. Agdal Rabat, Morocco.
- E-G. Talbi, Jul 2015, Univ. Luxembourg.

DREAMPAL Project-Team

8. Partnerships and Cooperations

8.1. International Initiatives

8.1.1. Inria International Partners

8.1.1.1. Informal International Partners

We have a long-lasting collaboration with the universities of Illinois at Urbana Champaign (USA) and Iasi (Romania), which has been particularly fruitful in 2015 with 5 co-signed articles published or accepted for publication in high-quality journals.

FUN Project-Team

9. Partnerships and Cooperations

9.1. Regional Initiatives

9.1.1. Tracaverre

Participants: Nathalie Mitton [correspondant], Gabriele Sabatino.

Title: Tracaverre

Type: FUI

Duration: November 2012 - Avril 2015

Coordinator: Saver Glass

Others partners: Inria FUN IEMN Courbon Camus La Grande Marque LIRIS DISP

Tracaverre studies the use of RFID for traceability of prestigious bottles. Tracaverre has yielded to the implementation of the T-Scan software.

9.1.2. PIPA

Participant: Nathalie Mitton [correspondant].

Title: Partager de l'Info PArtout à bas coût

Type: Chercheur citoyen

Duration: Dec 2015 - Dec 2017

Coordinator: Inria FUN

Others partners: SpotTrotter

PIPA project aims to provide an innovative low cost solution to share information in places where communication infrastructure are lacking, insuffisant or not adapted, going beyond technical, economical or political limitations.

9.2. National Initiatives

9.2.1. Inria Project Lab

9.2.1.1. CityLab@Inria

Participants: Valeria Loscri, Aziz Mbacke, Nathalie Mitton [correspondant].

Title: CityLab@Inria

Type: IPL

Duration: 2015 - 2019

Coordinator: Valerie Issarny

CityLab@Inria studies ICT solutions toward smart cities that promote both social and environmental sustainability. A strong emphasis of the Lab is on the undertaking of a multi-disciplinary research program through the integration of relevant scientific and technology studies, from sensing up to analytics and advanced applications, so as to actually enact the foreseen smart city Systems of Systems. Obviously, running urban-scale experiments is a central concern of the Lab, so that we are able to confront proposed approaches to actual settings. The Lab's research leverages relevant effort within Inria project-teams that is further revisited as well as integrated to meet the challenges of smart cities. Research themes span: energy-efficient wireless communication protocols, urban-scale social and physical sensing, privacy by design, cloud-based urban data management, data assimilation, visual analysis, and urban system software engineering.

In addition, CityLab Inria research builds upon collaborative effort at the International level, and especially collaboration in the context of the Inria SiliconValley program.

This project has yield to the set up of a full course on Smart Cities via a MOOC.

9.2.2. ADT

9.2.2.1. RFunID

Participants: Clement Fumey, Nathalie Mitton [correspondant], Julien Vandaele.

Duration: September 2015 - August 2017

Coordinator: Inria FUN

The purpose of this project is to deploy a large scale experimental RFID platform that enables remote programmation of RFID scenario on heterogeneous devices.

9.2.2.2. ARUNTA

Participants: Emilio Compagnone, Valeria Loscri [correspondant], Julien Vandaele.

Title: Arduino-based Robots for Ubiquitous Network (ARUNTA)

Type: ADT

Duration: September 2014 - August 2016

Coordinator: Inria FUN

Abstract: This ADT focuses on the use of Arduino, an open-source electronics prototyping platform, really flexible and easy-to-use [1] to allow a fleet of robots to perform specific tasks. The goal of the ADT is to make experiments on Arduino-based robotic platforms, by implementing two robot cooperation algorithms that have been already tested through simulation tools. In order to extend the users' community and to allow more people to benefit from this research on robot cooperation, this ADT will output a tutorial and a test-bed will be developed. Moreover, the final project will be shared with the Arduino community and every interested user.

9.2.3. Equipements d'Excellence

9.2.3.1. FIT

Participants: Raymond Borenstein, Nathalie Mitton [correspondant], Julien Vandaele.

Title: Future Internet of Things

Type: EquipEx

Duration: March 2010 - December 2019

Coordinator: UPMC

See also: http://fit-equipex.fr/

Abstract: FIT (Future Internet of Things) aims to develop an experimental facility, a federated and competitive infrastructure with international visibility and a broad panel of customers. It will provide this facility with a set of complementary components that enable experimentation on innovative services for academic and industrial users. The project will give French Internet stakeholders a means to experiment on mobile wireless communications at the network and application layers thereby accelerating the design of advanced networking technologies for the Future Internet.

FIT is one of 52 winning projects from the first wave of the French Ministry of Higher Education and Research's "Equipements d'Excellence" (Equipex) research grant program. Coordinated by Professor Serge Fdida of UPMC Sorbonne Universités and running over a nine-year period, the project will benefit from a 5.8 million euro grant from the French government.

This project has yield to several publications in 2015: [2], [8], [17], [19], [27].

9.3. European Initiatives

9.3.1. FP7 & H2020 Projects

9.3.1.1. VITAL

Participants: Salvatore Guzzo Bonifacio, Valeria Loscri, Nathalie Mitton [correspondant], Riccardo Petrolo.

Title: Virtualized programmable InTerfAces for innovative cost-effective IoT depLoyments in smart cities

Programm: FP7

Duration: September 2013 - August 2016

Coordinator: National University of Ireland Galway (NUIG)

Partners:

> Research and Education Laboratory in Information Technologies (Greece)
>
> Atos Spain (Spain)
>
> Camden Town Center (United Kingdom)
>
> Images & Co (United Kingdom)
>
> Istanbul Metropolitan Municipality (Turkey)
>
> Istanbul Teknik Universitesi (Turkey)
>
> National University of Ireland, Galway (Ireland)
>
> Santer Reply Spa (Italy)
>
> Singularlogic Anonymi Etairia Pliroforiakon Sistimaton Kai Efarmogon Pliroforikis (Greece)

Inria contact: Nathalie Mitton

Internet-of-Things (IoT) applications are currently based on multiple architectures, standards and platforms, which have led to a highly fragmented IoT landscape. This fragmentation is evident in the area of smart cities, which typically comprise several technological silos (i.e. IoT systems that have been developed and deployed independently). Nowadays there is a pressing need to remove these silos in order to allow cities to share data across systems and coordinate processes across domains, thereby essentially improving sustainability and quality of life. In response to this need, VITAL will realize a radical shift in the development, deployment and operation of IoT applications, through introducing an abstract virtualized digital layer that will operate across multiple IoT architectures, platforms and business contexts. Specifically, VITAL will provide platform and business context agnostic access to Internet-Connected-Objects (ICO). Moreover, it will research virtualized filtering, complex event processing (CEP) and business process management mechanisms, which will be operational over a variety of IoT architectures/ecosystems. The mechanisms will compromise the diverse characteristics of the underlying ecosystems, thereby boosting interoperability at the technical and business levels. VITAL will also provide development and governance tools, which will leverage the project's interfaces for virtualized access to ICOs.VITAL will allow solution providers to (re)use a wider range of data steams, thereby increasing the scope of potential applications. It will also enable a more connected/integrated approach to smart city applications development, which will be validated in realistic deployments in London and Istanbul. The partners will contribute and adapt a host of readily available urban infrastructures, IoT platforms and novel IoT applications, which will ease the accomplishment of the project's goals based on an optimal value for EC money. Publications in 2015 in the framework of this project are: [7], [16], [18].

9.4. International Initiatives

9.4.1. Inria International Labs

9.4.1.1. PREDNET
Participants: Nathalie Mitton [correspondant], Viktor Toldov, Julien Vandaele.

Title: Predator network

Type: LIRIMA

Duration: January 2013 - December 2016

See also: https://iww.inria.fr/prednet/en/

Abstract: PREDNET (PREDator adhoc NETwork) proposes to do research on the most suitable topology and subsequent deployment of a wireless sensor network for sparsely populated outlying rural and wilderness areas, for effective monitoring and protection of resources and ecosystems. This collaboration gave birth to joint project submission, joint conference organization and several publications, among them for 2015.

9.4.2. Inria International Partners

9.4.2.1. Declared Inria International Partners
Université Mediterranea di Reggio Calabria (UNIC) (Italy)

Objective of this collaboration is the design of an innovative architecture that enables autonomic and decentralized fruition of the services offered by the network of smart objects in many heterogeneous and dynamic environments, in a way that is independent of the network topology, reliable and flexible. The result is an 'ecosystem' of objects, self-organized and self-sustained, capable of making data and services available to the users wherever and whenever required, thus supporting the fruition of an 'augmented' reality thanks to a new environmental and social awareness. This collaboration gave birth to the PALMARES project (see section International programs), students and researchers exchanges (see section international visits) and joint publications, among them for 2015: [4], [3].

9.4.2.2. Informal International Partners
Southern University, China

The purpose of this collaboration is to study the green (or energy-efficient) communication problem in vehicular ad hoc networks (VANETs) and the application of vehicular network communication in green transportation. It gave birth to joint project submission, joint conference organization (UIC 2016) and several publications, among them for 2015: [9].

9.4.2.3. PhD co-supervision
Participants: Nathalie Mitton [correspondant], Mouna Rekik.

Since January 2013, Nathalie Mitton co-supervises Mouna Rekik as a PhD student with Pr Zied Chtourou from Université de Sfax, Tunisia. Her topic is about swarm intelligence based multi-path geographic routing for wireless sensor and actuator networks.

This work has led to the following publications in 2015: [22], [23], [24], [25].

9.4.3. Participation In other International Programs

9.4.3.1. CROMO
Participants: Valeria Loscri, Nathalie Mitton [correspondant], Riccardo Petrolo, Tahiry Razafindralambo.

Title: Crowd Data In the mobile cloud)

Duration: January 2015 - December 2019

CroMo (Crowd Data In the mobile cloud) is a submission to the CAPES-COFECUB project call lead by Inria from the French side and University of Rio de Janeiro from Brasilian Side. Other partner institutions are Université Pierre et Marie Curie and Université de la Rochelle.

Mobile cloud computing is an emerging paradigm to improve the quality of mobile applications by transferring part of the computational tasks to the resource-rich cloud. The multitude data sources combined with the known difficulties of wireless communications represent an important issue for mobile cloud computing. Therefore, the additional computational power added by the cloud has to deal with the constraints of the wireless medium. One could imagine a situation where different sensors collect data and require intensive computation. This data must be transmitted at high rates before becoming stale. In this case, the network becomes the main bottleneck, not the processing power or storage size. To circumvent this issue, different strategies can be envisioned. As usual alternatives, wireless data rates must be increased or the amount of data sent to the cloud must be reduced. CROMO tackles challenges from all these three components of the mobile clouds (data generation, collect and processing) to then integrate them as a whole enhanced mobile cloud with improved network performances in terms of delay, energy consumption, availability, and reliability.

9.5. International Research Visitors

9.5.1. Visits of International Scientists

Several researchers have visited our group in 2015, mainly from our partner universities but not only:

- Zied Chtourou, Univ. Sfax, Tunisia, March 2015
- Sajid Mubashir Sheikh, Univ. Stellenbosch, South Africa, July-August 2015
- Arun Sen, Arizona State University, USA, June-Nov 2015
- OP Vyas, Indian Institute of Information Technology, India July 2015
- Riaan Wolhuter, Univ. Stellenbosch, South Africa, July 2015

9.5.1.1. Internships

We have hosted and supervised several master students. Some came to run their master internship in our lab, like

Ana Garcia Alcala from University of Lille (4 months), Mohamed El Amine Seddik from Telecom Lille (6 months), Ayoub El Yagoubi (4 months).

Other students have visited us from our partner universities in the framework of the joint project we run together. This is the case for Solomon Peterus Le Roux (2 months) who came from Stellenbosch university, South Africa, in the framework of the PredNET program and Anup Bhattacharjee from IIIT Allahabad, India (2 months).

9.5.2. Visits to International Teams

9.5.2.1. Research stays abroad

- Nathalie Mitton visited IIIT Allahabad, India for 2 weeks in March 2015.
- Riccardo Petrolo visited UFRJ, Brasil for 2 months (Oct-dec 2015).

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

6. Partnerships and Cooperations

6.1. National Initiatives

6.1.1. ANR

ANR project Transports Terrestres Durable "RESPET - Gestion de réseaux de service porte-à-porte efficace pour le transport de marchandises", in collaboration with LAAS (Toulouse), DHL, JASSP, LIA (Univ. Avignon) (2011-2015).

6.1.2. National Initiatives (Belgium)

Combinatorial Optimization: Meta-heuristics and Exact Methods (2012-2017, coordinator: Bernard Fortz (GOM-ULB/INOCS-Inria). Study and modeling of combinatorial optimization problems; Advancements in algorithmic techniques; Implementation of solution methods for large-scale, practically relevant problems.

6.2. European Initiatives

6.2.1. FP7 & H2020 Projects

Program: BEWARE FELLOWSHIPS Academia

Project acronym: PARROT

Project title: Planning Adapter performing ReRouting and Optimization of Timing

Duration: 10/2014 - 09/2017

Coordinator: Martine Labbé (ULB)

Other partners: INFRABEL (Belgique).

Abstract: The Belgian railway company needs a new tool for the trains which have to be rescheduled when the company must do some maintenance operations on the network. The difficulties are the number of constraints, the size of the network, the quantity of trains and many other features related to the Belgian railway system. These difficulties imply that some choices have to be made to balance the quantity of work feasible in the 3 years project. After developing an interface between the INFRABEL database and the framework used in this project, a first model (MIP) will be implemented and then tested.

6.2.2. Collaborations in European Programs, except FP7 & H2020

Program: JPI Urban Europe

Project acronym: e4-share

Project title: Models for Ecological, Economical, Efficient, Electric Car-Sharing

Duration: 11/2014 - 10/2017

Coordinator: Markus Leitner (U. Vienna, Austria)

Other partners:

- AIT, Vienna, Austria
- GOM, Université Libre de Bruxelles (Inria/INOCS)
- Department of Electrical, Electronics and information Engineering, Alma Mater University of Bologna, Italy
- iC consulenten Ziviltechniker GesmbH, Vienna, Austria

Abstract: Car-sharing systems and the usage of electric cars become increasingly popular among urban citizens. Thus, providing vast opportunities to meet todays challenges in terms of environmental objectives, sustainability and living quality. Our society needs to manage a transformation process that ultimately shall lead to fewer emissions and less energy consumption while increasing the quality of public space available.

In e4-share, the team will lay the foundations for efficient and economically viable electric car-sharing systems by studying and solving the optimization problems arising in their design and operations. A main goal is to derive generic methods and strategies for optimized planning and operating in particular for flexible variants which best meet preferences of customers but impose nontrivial challenges to operators. This project will develop novel, exact and heuristic, numerical methods for finding suitable solutions to the optimization problems arising at the various planning levels as well as new, innovative approaches considering these levels simultaneously.

The project e4-share (Models for Ecological, Economical, Efficient, Electric Car-Sharing) runs from October 2014 to October 2017 and is funded by FFG, INNOVIRIS and MIUR via Joint Programme Initiative Urban Europe. The project comprises an interdisciplinary team of five partners from Austria, Belgium and Italy.

6.3. International Initiatives

6.3.1. Informal International Partners

- CIRRELT, GERAD, Montreal (P. Marcotte, G. Savard, M. Gendreau, G. Laporte, B. Gendron, ..)
- University of Maastricht (Stan Van Hoesel)
- Politecnico di Milano (Edouardo Amaldi)
- University of Lisbon (Luis Gouveia)
- University of Aveiro (Cristina Requejo)
- University of Sevilla (Justo Puerto)
- University of Chile (Fernando Ordonez)

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

9. Partnerships and Cooperations

9.1. Regional Initiatives

Links participates in the CPER DATA (2015-19)

9.2. National Initiatives

ANR Aggreg (2014-19): Aggregation Queries.

- Particpants: J. Niehren [correspondent], P. Bourhis, A. Lemay, A. Boiret
- The coordinator is J. Niehren and the parteners are the University Paris 7 (A. Durand) including members of the Inria project DAHU (L. Ségoufin), the University of Marseille (N. Creignou) and University of Caen (E. Grandjean).
- Objective: the main goal of the Aggreg project is to develop efficient algorithms and to study the complexity of answering aggregate queries for databases and data streams of various kinds.

ANR Colis (2015-20): Correctness of Linux Scripts.

- Participants: J. Niehren [correspondent], A. Lemay, S. Tison, A. Boiret, V. Hugot.
- The coordinator is R. Treinen from the University of Paris 7 and the other partner is the Tocata project of Inria Saclay (C. Marché).
- Objective: This project aims at verifying the correctness of transformations on data trees defined by shell scripts for Linux software installation. The data trees here are the instance of the file system which are changed by installation scripts.

ANR DataCert (2015-20):

- Participants: I. Boneva [correspondent], A. Bonifati, S. Tison.
- Parteners: The coordinator is E. Contejean from the University of Paris Sud and the other partner is the University of Lyon.
- Objective: the main goals of the Datacert project are to provide deep specification in Coq of algorithms for data integration and exchange and of algorithms for enforcing security policies, as well as to design data integration methods for data models beyond the relational data model.

9.2.1. Competitivity Cluster Picom

FUI Hermes (2012-15): The future of shopping

- We participate in the Hermes project of the Pôle de compétitivité PICOM, a regional research cluster on the industy of commerce.
- Participants: I. Boneva [correspondent], A. Bonifati, J. Niehren
- Objective: Here we work on filtering publicity offers by newspaper arriving on complex event streams in real time.
- Parteners: Norsys, Auchan, etc

9.3. International Initiatives

9.3.1. Inria Associate Teams not involved in an Inria International Labs

Associated Team "Integrating Linked Data" with the Datbase group of the University of Oxford (2013-15).

9.3.2. Inria International Partners

9.3.2.1. Declared Inria International Partners

AMSud project "Foundations of Graph Databases" (2016-17)

Partners: Santiago de Chili (C. Riveros), Buenos Airos (S. Figuera), Bordeaux (G. Puppis).

9.4. International Research Visitors

9.4.1. Visits of International Scientists

George Fletcher, Eindhoven University of Technology, Belgium, Apr 2015

Martin Musicante, Federal University of Rio Grande do Norte, Bresil, Sep 2014- Oct 2015.

9.4.1.1. Internships

M. Linardi, University of Trento. On Web Data Integration, from Feb 2015 until Sep 2015.

9.4.2. Visits to International Teams

9.4.2.1. Research stays abroad

Slawek Staworko, University of Edinburgh, 2014-16.

MAGNET Team

9. Partnerships and Cooperations

9.1. Regional Initiatives

MIKAELA KELLER participated in the joint Inria Campus-Institut Pasteur workshop whose goal was to reinforce the collaboration between both institutes.

MARC TOMMASI belongs to the drafting committee of the Lille IDEX project, and is a representative for the COMUE in the DAS commission "Ubiquitaire et Internet des Objets".

MARC TOMMASI and PASCAL DENIS supervise the PhD thesis of DAVID CHATEL on semi-supervised spectral clustering. The PhD is funded by Inria and the "Région Nord - Pas de Calais".

9.2. National Initiatives

9.2.1. *Competitivity Clusters*

We are part of FUI HERMES (2012-2015), a joint project in collaboration with many companies (Auchan, KeyneSoft, Cylande, ...). The main objective is to develop a platform for contextual customer relation management. The project started in November 2012.

9.2.2. *EFL*

PASCAL DENIS is an associate member of the Laboratoire d'Excellence *Empirical Foundations of Linguistics* (EFL), http://www.labex-efl.org/.

9.2.3. *SCAGLIA*

The project SCAGLIA (Scalable Graph Algorithms for Learning in Networked Data) of FABIO VITALE was accepted at the JCJC INS2I 2015 call.

9.3. European Initiatives

9.3.1. *Collaborations in European Programs, except FP7 & H2020*

Program: ERC Advanced Grant

Project acronym: STAC

Project title: Strategic conversation

Duration: Sep. 2011 - Aug. 2016

Coordinator: Nicholas Asher, CNRS, Université Paul Sabatier, IRIT (France)

Other partners: School of Informatics, Edinburgh University; Heriot Watt University, Edinburgh

Abstract: STAC is a five year interdisciplinary project that aims to develop a new, formal and robust model of conversation, drawing from ideas in linguistics, philosophy, computer science and economics. The project brings a state of the art, linguistic theory of discourse interpretation together with a sophisticated view of agent interaction and strategic decision making, taking advantage of work on game theory.

Program: COST Action

Project acronym: TextLink

Project title: Structuring Discourse in Multilingual Europe

Duration: Apr. 2014 - Apr. 2018

Coordinator: Prof. Liesbeth Degand, Université Catholique de Louvain, Belgium

Other partners: 26 EU countries and 3 international partner countries (Argentina, Brazil, Canada)

Abstract: Effective discourse in any language is characterized by clear relations between sentences and coherent structure. But languages vary in how relations and structure are signaled. While monolingual dictionaries and grammars can characterize the words and sentences of a language and bilingual dictionaries can do the same between languages, there is nothing similar for discourse. For discourse, however, discourse-annotated corpora are becoming available in individual languages. The Action will facilitate European multilingualism by (1) identifying and creating a portal into such resources within Europe - including annotation tools, search tools, and discourse-annotated corpora; (2) delineating the dimensions and properties of discourse annotation across corpora; (3) organizing these properties into a sharable taxonomy; (4) encouraging the use of this taxonomy in subsequent discourse annotation and in cross-lingual search and studies of devices that relate and structure discourse; and (5) promoting use of the portal, its resources and sharable taxonomy. With partners from across Europe, TextLink will unify numerous but scattered linguistic resources on discourse structure. With its resources searchable by form and/or meaning and a source of valuable correspondences, TextLink will enhance the experience and performance of human translators, lexicographers, language technology and language learners alike.

9.4. International Initiatives

9.4.1. Inria Associate Teams not involved in an Inria International Labs

Program: Inria North-European Labs

Project acronym: RSS

Project title: Rankings and Similarities in Signed graphs

Duration: late 2015 to late 2017

Partners: Aristides Gionis (Data Mining Group, Aalto University, Finland) and Mark Herbster (Centre for Computational Statistics and Machine Learning, University College London, UK)

Abstract: The project focuses on predictive analysis of networked data represented as signed graphs, where connections can carry either a positive or a negative semantic. The goal of this associate team is to derive novel formal methods and machine learning algorithms towards link classification and link ranking in signed graphs and assess their performance in both theoretical and practical terms.

9.4.2. Inria International Partners

9.4.2.1. Informal International Partners

We have started a collaboration with Fei Sha (University of California, Los Angeles) on the topic of representation learning for Natural Language Processing, materialized by the submission of a proposal to the 2016 call of the Inria Associate Teams program.

9.5. International Research Visitors

9.5.1. Visits of International Scientists

We invited Prof. Claudio Gentile (Università dell'Insubria, Italy) in July, collaborating with MARC TOMMASI and FABIO VITALE on contextual node classification and bipartite graph matching problems on social network with user binary feedback.

Prof. Mark Herbster (University College London, UK) was invited for the PhD dissertation defense of THOMAS RICATTE in January and for Amir Sani's thesis in May 2015. He also collaborated with FABIO VITALE.

Several international researchers have also been invited to give a talk at the MAGNET seminar:

- Jan Ramon (KU Leuven, Belgium): "Learning theory for network-structured data" (January)
- Borja Balle (University of McGill, Canada): "A General Framework for Learning Weighted Automata" (February)
- Tiago P. Peixoto (Universität Bremen, Germany): "Inferring the large-scale structure of networks" (April)
- Dan Roth (University of Illinois at Urbana/Champaign, USA): "Learning, Inference and Supervision for Structured Prediction Tasks" (May)
- Michael Mathioudakis (Helsinki Institute for Information Technology, Finland): "Absorbing random-walk centrality – theory and algorithms" (June)
- Andre Martins (Priberam Labs and Instituto Superior Técnico Lisbon, Portugal): "Advances in Structured Regularization" (December)

9.5.2. *Visits to International Teams*

In July and in August, FABIO VITALE visited Aalto University (Helsinki, Finland), collaborating with Prof. Aristides Gionis on learning influence processes in social networks and graph reconstruction with queries.

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

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR BECASIM

G. Dujardin and I. Lacroix are members of the ANR BECASIM project (http://becasim.math.cnrs.fr/). This ANR project gathers mathematicians with theoretical and numerical backgrounds together with engineers. The objective is to develop numerical methods to accurately simulate the behavior of Bose-Einstein condensates.

Title: Simulation numérique avancée pour les condensats de Bose-Einstein.

Type: Modèles Numériques - 2012

ANR reference: ANR-12-MONU-0007

Coordinator: Ionut DANAILA, Université de Rouen.

Duration: January 2013 - December 2016.

Partners: Université Lille 1, UPMC, Ecole des Ponts ParisTech, Inria-Nancy Grand-Est, Université Montpellier 2, Université Toulouse 3.

8.1.2. Labex CEMPI

Title: Centre Européen pour les Mathématiques, la Physique et leurs interactions

Coordinator: Stephan De Bièvre.

Duration: January 2012 - December 2019.

Partners: Laboratoire Paul Painlevé and Laser physics department (PhLAM), Université Lille 1.

The "Laboratoire d'Excellence" Centre Européen pour les Mathématiques, la Physique et leurs interactions (CEMPI), a project of the Laboratoire de Mathématiques Paul Painlevé and the Laboratoire de Physique des Lasers, Atomes et Molécules (PhLAM), was created in the context of the "Programme d'Investissements d'Avenir" in February 2012.

The association Painlevé-PhLAM creates in Lille a research unit for fundamental and applied research and for training and technological development that covers a wide spectrum of knowledge stretching from pure and applied mathematics to experimental and applied physics.

One of the three focus areas of CEMPI research is the interface between mathematics and physics. This focus area encompasses three themes. The first is concerned with key problems of a mathematical, physical and technological nature coming from the study of complex behaviour in cold atoms physics and non-linear optics, in particular fibre optics. The two other themes deal with fields of mathematics such as algebraic geometry, modular forms, operator algebras, harmonic analysis and quantum groups that have promising interactions with several branches of theoretical physics.

8.1.3. MIS

Incentive Grant for Scientific Research (MIS) of the Fonds National de la Recherche Scientifique (Belgium)

Title: Patterns, Phase Transitions, 4NLS & BIon.

Coordinator: Denis Bonheure.

Duration: January 2014 - December 2016.

Partner: Université libre de Bruxelles.

8.1.4. PDR

Research Project (PDR) of the Fonds National de la Recherche Scientifique (Belgium).

D. Bonheure is co-investigator of this PDR.

Title: Asymptotic properties of semilinear systems.

Coordinator: Christophe Troestler (UMons).

Duration: July 2014 - June 2018.

Partner: Université de Mons, Université catholique de Louvain, Université libre de Bruxelles.

8.2. European Initiatives

8.2.1. FP7 & H2020 Projects

8.2.1.1. QUANTHOM

Title: Quantitative methods in stochastic homogenization

Programm: FP7

Duration: February 2014 - January 2019

Coordinator: Unibersité Libre de Bruxelles (Belgium)

Partner: Inria

Inria contact: Antoine Gloria

'This proposal deals with the development of quantitative tools in stochastic homogenization, and their applications to materials science. Three main challenges will be addressed. First, a complete quantitative theory of stochastic homogenization of linear elliptic equations will be developed starting from results I recently obtained on the subject combining tools originally introduced for statistical physics, such as spectral gap and logarithmic Sobolev inequalities, with elliptic regularity theory. The ultimate goal is to prove a central limit theorem for solutions to elliptic PDEs with random coefficients. The second challenge consists in developing an adaptive multiscale numerical method for diffusion in inhomogeneous media. Many powerful numerical methods were introduced in the last few years, and analyzed in the case of periodic coefficients. Relying on my recent results on quantitative stochastic homogenization, I have made a sharp numerical analysis of these methods, and introduced more efficient variants, so that the three academic examples of periodic, quasi-periodic, and random stationary diffusion coefficients can be dealt with efficiently. The emphasis of this challenge is put on the adaptivity with respect to the local structure of the diffusion coefficients, in order to deal with more complex examples of interest to practitioners. The last and larger objective is to make a rigorous connection between the continuum theory of nonlinear elastic materials and polymer-chain physics through stochastic homogenization of nonlinear problems and random graphs. Analytic and numerical preliminary results show the potential of this approach. I plan to derive explicit constitutive laws for rubber from polymer chain properties, using the insight of the first two challenges. This requires a good understanding of polymer physics in addition to qualitative and quantitative stochastic homogenization.'

8.3. International Initiatives

8.3.1. Informal International Partners

Felix Otto's group at Max Planck Institute for Mathematics in the Sciences.

8.4. International Research Visitors

8.4.1. Visits of International Scientists

8.4.1.1. Internships

Louis Huguet, MA1 internship from ENS Cachan, 3 months.

8.4.2. *Visits to International Teams*

8.4.2.1. Sabbatical programme

Denis Bonheure was awarded a "Mission scientifique du FNRS" (sabbatical).

8.4.2.2. Research stays abroad

Denis Bonheure was visiting professor (in the frame of his sabbatical year) at

- USP Sao Carlos, ICMC, Departamento de matematica
- Karlsruher Institut fuer Technologie (KIT), Institut fuer Analysis
- Pontificia Universidad Católica de Chile, Facultad de Matemáticas
- Instituto Superior Tecnico de Lisboa, Departamento de Matemática
- Université Aix-Marseille, Laboratoire d'Analyse, Topologie et Probabilités
- Universidad de Buenos Aires, Departamento de Matemática
- Università degli studi di Torino, Dipartimento di Matematica

Antoine Gloria spent two months at IHES (February–March 2015), as a guest of the Schlumberger chair of Felix Otto.

Christopher Shirley was invited by Pr. Nariyuki Minami and Pr. Fumihiko Nakano to Japan, from Nov. 26 to Dec. 13.

MINT Project-Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

8.1.1. MATRICE

24 month project. lead: Lille school of architecture. Partners: Telecom Lille, Ecole des mines de douai, Centrale Lille, Lille school of design. Subject: 3D printing for construction industry. Funding for MINT: 12 months engineer, 12 months post-doc.

8.1.2. Iconographie Numérique (Sept. 2015-Dec. 2018)

From sept. 2015 to dec. 2018.
Funding from MEL, 24 months for post-doctoral position.
Subject: Design of a digital tool for historians and archaeologists.

8.1.3. Art/science projects

Pauline de Chalendar (FreeHands project). Shown at Panorama exposition sept-dec. 2015, Fresnoy (Tourcoing). Also shown at VISAP, IEEE Infoviz ArtTrack, august 2015, Chicago.
Pauline Delwaulle
Out of space: Mirror Lake Station Pictanovo project 2013-2015 in collaboration with Mathilde Lavesnne. Shown at "Portes ouvertes, La Malterie, October 17th to 19th 2014; "Expériences interactives" de Pictanovo, l'Hospice d'Havré, May 28th to July 10th 2015; La cartographie, Espace Culture de l'Université de Lille 1, October 6th to December 11th 2015; "Hyper-archéologie", Centre Arc-en-ciel de Liévin, January 29th to February 29th 2016

8.2. National Initiatives

8.2.1. Touchit (13th FUI, May 2012-2015)

Participants: Michel Amberg, Frédéric Giraud, Betty Lemaire-Semail [correspondant].

The purpose of this project is twofold. It aims at designing and implementing hardware solutions for tactile feedback based on programmable friction. It also aims at developing the knowledge and software tools required to use these new technologies for human-computer interaction. Grant for MINT is balanced on 272 keuro handled at University for L2EP, and 220 Keuros for Inria.

Partners: STMicroelectronics, CEA/LETI, Orange Labs, CNRS, EASii IC, MENAPIC and ALPHAUI.

Competitive clusters involved: Minalogic, Cap Digital and MAUD.

8.2.2. Smart-Store (12th FUI, 2011-2014, extended to 2015)

Participants: Samuel Degrande [correspondant], Laurent Grisoni, Fabrice Aubert.

The aim of this project is to set up, in the context of retail, some middleware and hardware setup for retail interactive terminal, that allows customer to connect with their own smart-phone on a system that includes a large screen, and allows to browse some store offer, as well as pre-order and/or link to further reconsulting. SME Ides-3com leads this FUI, which also includes Immochan, Oxylane, and VisioNord. Grant for MINT is 301 Keuros. This project started on September 2012 (start of this project has been delayed due to administrative problems), for a duration of 36 months.

Associated competitivity cluster: PICOM (retail)

8.2.3. Equipex IRDIVE (ANR project 2012-2020)

3 Meuros project, co-funded by ERDF for the developpement of a pluri-disciplinary project on ICT-based tools for understanding human perception of visual contents. Laurent Grisoni is member of the lead group of this project, and animates an axis devoted to art-sciences and technologies collaborations.

8.2.4. MAUVE CPER ("Contrat de Plan État-Région") 2016-2020 project

Funds: 4 Meuros (validated at national level, funded by Region), and 1 Meuro additional funding provided by ERDF.
Subject: ICT tools for mediation and access to knowledge.
Lead: University of Lille, University of Artois. Laurent Grisoni is co-lead of this project.

8.2.5. Projet FUI HID: lead Holusion (2016-2018)

Participants: Laurent Grisoni [correspondant], Samuel Degrande, Fabrice Aubert.

290 Keuros for MINT. Funding for two 18 months contracts and 24 months of post-doc.
Subject: rationalized process for industrial use of holographic displays.
MINT contribution: anamorphic software tools for holographics displays, and study of interactive aspects, including collaborative activities.

8.2.6. InriaRT

Participants: Laurent Grisoni [correspondant], Samuel Degrande, Francesco de Comité.

Art/science Inria internal network gathering projects interested in collaborating with artists.
Inria teams involved: MuTANT (paris), Imagine (grenoble), Flowers, Potioc (Bordeaux), Hybrid, MimeTic (Rennes).

8.3. International Initiatives

8.3.1. Participation In other International Programs

8.3.1.1. Mac Gill University, Canada, (CIRRMT, Marcelo Wanderley)

Technological tool for an Opera, Two years project, Planned for January 2017. Composed by Arnaud Petit, written by Alain Fleischer.

8.3.1.2. Université de Liège

Application for project C-SHADE

8.3.1.3. Institut Superior Technico, Lisbon (Joaquim jorge)

Application for project C-SHADE

<div align="center">

Mjolnir Team

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8. Partnerships and Cooperations

8.1. National initiatives

8.1.1. Turbotouch (ANR, 2014-2018)

Participants: Géry Casiez [correspondent], Nicolas Roussel, Thomas Pietrzak.

Touch-based interactions with computing systems are greatly affected by two interrelated factors: the transfer functions applied on finger movements, and latency. This project aims at transforming the design of touch transfer functions from black art to science to support high-performance interactions. We are working on the precise characterization of the functions used and the latency observed in current touch systems. We are developing a testbed environment to support multidisciplinary research on touch transfer functions and will use this testbed to design latency reduction and compensation techniques, and new transfer functions.

Partners: Inria Lille's NON-A team and the "Perceptual-motor behavior group" from the Institute of Movement Sciences.

Web site: http://mjolnir.lille.inria.fr/turbotouch/

Related 2015 publications: [23], [18], [27].

8.1.2. ParkEvolution (Carnot Inria - Carnot STAR, 2015-2016)

Participants: Géry Casiez [correspondent], Sébastien Poulmane.

This project studies the fine motor control of patients with Parkinson disease in an ecological environment, at home, without the presence of experimenters. Through longitudinal studies, we collect raw information from pointing devices to create a large database of pointing behavior data. From the analysis of this big dataset, the project aims at inferring the individual's disease progression and influence of treatments.

Partners: the "Perceptual-motor behavior group" from the Institute of Movement Sciences and Hôpital de la Timone.

Web site: http://parkevolution.org/

8.1.3. BCI-LIFT (Inria Project Lab, 2015-2019)

Participants: Géry Casiez, Nicolas Roussel [correspondent].

The goal of this large-scale initiative is to design a new generation of non-invasive Brain-Computer Interfaces (BCI) that are easier to appropriate, more efficient, and suited for a larger number of people.

Partners: Inria's ATHENA, NEUROSYS, POTIOC, HYBRID & DEMAR teams, *Centre de Recherche en Neurosciences de Lyon* (INSERM) and INSA Rouen.

Web site: https://bci-lift.inria.fr/

8.2. European initiatives

8.2.1. Happiness (H2020-ICT-2014-1/ICT-03-2014/RIA, 2015-2018)

Participants: Thomas Pietrzak, Nicolas Roussel [correspondent].

The main objective of this project is to develop and evaluate new types of haptic actuators based on Advanced Thin, Organic and Large Area Electronics (TOLAE) technologies for use in car dashboards.

Partners: CEA (coordinator), Inria Rennes' HYBRID team, Arkema, Bosch, Glasgow University, ISD, Walter Pack, Fundacion Gaiker.

Web site: http://happiness-project.eu/

8.2.2. Mjolnir/UCLIC associate team (Inria Lille, 2015-2017)

Participants: Sylvain Malacria [correspondent], Nicolas Roussel.

The goal of this project is the design and implementation of novel cross-device systems and interaction techniques that minimize the cost of divided attention. Of particular interest are notification systems on smart watches and in distributed computing systems.

Partner: University College London Interaction Centre (United Kingdom).

8.3. International initiatives

8.3.1. MIDWAY (Inria associate team, 2014-2016)

Participants: Fanny Chevalier, Stéphane Huot [correspondent], Justin Mathew.

The goal of the project is the design and implementation of a musical interaction design workbench to facilitate the exploration and definition of new interactive technologies for both musical creation and performance.

Partner: Inria Saclay's EXSITU team and the Input Devices and Music Interaction Laboratory (IDMIL) from the Centre for Interdisciplinary Research in Music Media and Technology (CIRMMT) at McGill University, Canada.

Web site: http://insitu.lri.fr/MIDWAY/

Related 2015 publications: [16].

8.4. International research visitors

8.4.1. Visits of international scientists

Visiting scholars:

- Marcelo Wanderley, 4 one week visits, Professor at McGill University, Canada
- Edward Lank, November 24-25th, Associate Professor at the University of Waterloo, Canada
- Mathieu Nancel, March-April, Postdoctoral researcher at the University of Waterloo, Canada

Internships:

- Jeronimo Barbosa, November-December, PhD student at McGill University, Canada
- Aakar Gupta, February-May, PhD student at University of Toronto, Canada

8.4.2. Visits to international teams

Two internships sponsored by Mitacs — Inria research awards:

- Alix Goguey: 4 months (June-September) at the University of Waterloo with Daniel Vogel
- Justin Mathew: 3 months (June-August) at McGill University with Catherine Guastavino and Marcelo Wanderley

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

9. Partnerships and Cooperations

9.1. Regional Initiatives

Christophe Biernacki has some contracts and/or PhD theses with regional companies: Arcelor-Mittal (thesis), Auchan (contract), PIXEO (contract and thesis), Cylande (contract).

9.1.1. Collaborations within PSo-Innov

Participant: Sophie Dabo.

Sophie Dabo is a member of the regional emergent project *Précarité, Solidarité, vers un accompagnement innovant des personnes en difficultés d'une association spécialisée* with the LGI2A, CRIL, Discontinuité, LEM, APSA-Pas-de-Calais and coordinator: Issam Nouaouri (issam.nouaouri@univ-artois.fr).

9.1.2. MPAGenomics2

Participants: Samuel Blanck, Guillemette Marot.

During the 'Plan Cancer 2' period, eight SIRICs ('Site de Recherche Intégrée sur le Cancer') were created in France, including the SIRIC ONCOLille. This last one financed the project MPAGenomics2, coordinated by Guillemette Marot, to biologically validate on cohorts of patients suffering from leukaemia the tools developed by the Development Technological Action MPAGenomics. The project lasted five months and other partners were Functional Genomics platform from Univ. Lille 2, INSERM UMR-S 1172 and biology pathology center of Lille hospital.

9.2. National Initiatives

9.2.1. ANR ClinMine

Participants: Julien Jacques, Cristian Preda, Vincent Vandewalle.

Modal team is member of ClinMine ANR project (http://www.lifl.fr/ClinMine/pmwiki/index.php) in charge with statistical methdology. Collaborators : LIFL, CHRU Lille, CHU Montpellier, ALICANTE, GHICL.

9.2.2. ANR Imagiweb

Participant: Julien Jacques.

Julien Jacques is member of Imagiweb ANR project (http://mediamining.univ-lyon2.fr/people/velcin/imagiweb/) as member of the ERIC laboratory (Univ. de Lyon).

9.2.3. ANR Calibration

Participant: Alain Celisse.

Alain Celisse is a member of the Calibration ANR project (https://sites.google.com/site/anrcalibration/anr-calibration) in charge with statistical methdology. Collaborators : Select, ENS Cachan, Université Paris-Sud, Université Nice, Université Paul Sabatier de Toulouse.

9.2.4. Working groups

Christophe Biernacki is the president (since 1012) of the data mining and learning group of the French statistical association (SFdS, http://www.sfds.asso.fr/)

Sophie Dabo belongs to the working groups

- STAFAV (STatistiques pour l'Afrique Francophone et Applications au Vivant),
- ERCIM Working Group on computational and Methodological Statistics, Nonparametric Statistics Team,
- Ameriska, Paris.

Guillemette Marot belongs to the StatOmique working group

Julien Jacques belongs to the Working Group on Model Based Clustering (University of Washington)

Benjamin Guedj belongs to the following GdR of CNRS: ISIS (local referee for Inria Lille - Nord Europe), MaDICS, MASCOT-NUM (local referee for Inria Lille - Nord Europe).

Alain Celisse belongs to the Statistics for Systems Biology group (SSB) in Paris.

Alain Celisse belongs to a working group on change-point detection with people from Lancaster university (UK).

9.3. International Initiatives

9.3.1. SIMERGE

Participant: Sophie Dabo.

SIMERGE is a LIRIMA project-team started in January 2015. It includes researchers from

Mistis, Inria Grenoble - Rhône-Alpes, France

LERSTAD, Laboratoire d'Etudes et de Recherches en Statistiques et Développement, Université Gaston Berger, Sénégal

IRD, Institut de Recherche pour le Développement, Unité de Recherche sur les Maladies Infectieuses et Tropicales Emergentes, Dakar, Sénégal

LEM lab, Lille Economie et Management, Université Lille 1, 2, 3

9.3.2. Inria International Partners

9.3.2.1. Informal International Partners

Benjamin Guedj regularly collaborates with Olivier Wintenberger from Københavns Universitet (KU, Denmark).

9.4. International Research Visitors

Benjamin Guedj regularly collaborates with Olivier Wintenberger from Københavns Universitet (KU, Denmark).

9.4.1. Visits of International Scientists

Sylvain Robbiano (March 2015 - University College London, UK) and Pierre Alquier (April 2015 - ENSAE ParisTech, France) have visited Benjamin Guedj. Those two visits have been followed by the submission of two research papers (Nov. 2015 and Jan. 2016, respectively).

9.4.1.1. Internships

Siddharth Sharma Siddharth

Date: Nov 2015 - May 2016

Institution: LNM Institute of Information Technology (India)

Supervisor: Guillemette Marot

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

8. Partnerships and Cooperations

8.1. Regional Initiatives

- Project ARCIR «Estimation distribuée de systèmes dynamiques en réseaux», coordinator Prof. Mihaly Petreczky, URIA – Mines de Douai, 2013–2015
- CPER CIA, "Internet of Things", 2011–2015
- CPER CISIT (becoming ELSAT 2020 in 2015), "Campus international sur la securite et inter-modalite de transport", project "CONTRAERO" with LML and IEMN, 2011–2015 (becoming CONTRATECH 2016-2020 with LML, IEMN, LAMIH and ONERA)

8.2. National Initiatives

- ANR project Finite4SoS (Finite time control and estimation for Systems of Systems), coordinator Prof. Wilfrid Perruquetti (NON-A team, Inria): 2015-2020
- ANR project WaQMoS (Coastal waters quality surveillance using bivalve mollusk-based sensors), coordinator Dr. Denis Efimov (NON-A team, Inria): 2015-2020
- ANR project TourboTouch (High-performance touch interactions), coordinator Prof. Géry Casiez (MJOLNIR team, Inria): 2014-2019
- ANR project ChaSliM (Chattering-free Sliding Modes), coordinator Prof. B. Brogliato (BIBOP team, Inria): 2012-2015
- ANR project ROCC-SYS (Robust Control of Cyber-Physical Systems), coordinator Dr. L. Hetel: 2013-2018
- ANR project MSDOC (Multidimentional System: Digression od Stability), coordinator Bachelier Olivier (Poitiers University) : 2014-2017
- We are also involved in several technical groups of the GDR MACS (CNRS, "Modélisation, Analyse de Conduite des Systèmes dynamiques", see http://www.univ-valenciennes.fr/GDR-MACS), in particular: Technical Groups "Identification", "Time Delay Systems", "Hybrid Systems", "Complex Systems, Biological Systems and Automatic Control," and "Control in Electrical Engineering".
- Model-free control: collaborations with the startup ALIEN SAS (created by C. Join and M. Fliess).

8.3. European Initiatives

8.3.1. FP7 & H2020 Projects

- UCoCoS "Understanding and Controling Complex Systems", European Joint Doctorate, starting from April 2016, partners KU Leuven (Belgium), TU/e (Netherlands) and Centrale Lille (France).

8.4. International Initiatives

8.4.1. Inria Associate Teams not involved in an Inria International Labs

- Associate team with Norwegian University of Science and Technology (Tronheim, Norway) and UMEA university (Sweden), 2013-2016
  Subject: "Dynamical precision improvement for industrial robots"

8.4.2. Inria International Partners

8.4.2.1. Informal International Partners

- Tel Aviv University, Israel
- Sliding Mode Control Lab., UNAM, Mexico
- Department Control Automatico, CINVESTAV-IPN, Mexico
- National Polytechnic Institute, Mexico
- Department of Control Systems and Informatics, Saint Petersburg State University of Information Technologies Mechanics and Optics (ITMO), Russia

8.4.3. Participation In other International Programs

- CNRS GDRI DelSys (http://www.cnrs.fr/ins2i/spip.php?article1799)

8.5. International Research Visitors

8.5.1. Visits of International Scientists

- Professor Arie Levant, Tel Aviv University, Israel (Inria, 4 months)
- Professor Emilia Fridman, Tel Aviv University, Israel (Ecole Centrale de Lille, 1 month)
- Dr. Francisco Bejarano, National Polytechnic Institute, Mexico (Ecole Centrale de Lille, 1 month)

8.5.1.1. Internships

- Ivan De Jesus Salgado Ramos, National Polytechnic Institute, Mexico, till Apr 2015
  Subject:PID control design based on the different differentiation techniques

8.5.2. Visits to International Teams

8.5.2.1. Research stays abroad

- Gang Zheng, 2 months visit to Nanjing University of Sicence and Technology

RAPSODI Team

9. Partnerships and Cooperations

9.1. Regional Initiatives

The PhD program of Ahmed Aït Hammou Oulhaj is partially supported (50%) by the Region Nord-Pas-de-Calais.

9.2. National Initiatives

9.2.1. ANR

C. Cancès is the coordinator of the ANR GEOPOR project. (https://www.ljll.math.upmc.fr/cances/ANR-GEOPOR/). This project aims to study realistic models for complex porous media flows from a variational point of view, and to take advantage of this new approach to design and analyze some efficient numerical methods.

> Title: Approche géométrique pour les écoulements en milieux poreux : théorie et numérique.
>
> Type: Jeunes Chercheuses Jeunes Chercheurs SIMI 1- 2013
>
> ANR Reference: ANR-13-JS01-0007-01
>
> Coordinator: Clément Cancès, Inria Lille - Nord Europe.
>
> Duration: January 2014 – June 2017

I. Lacroix is the local coordinator at Université Lille 1 of the ANR BECASIM project (http://becasim.math.cnrs.fr/). This ANR project gathers mathematicians with theoretical and numerical backgrounds together with engineers. The objective is to develop numerical methods to accurately simulate the behavior of Bose-Einstein condensates.

> Title: Simulation numérique avancée pour les condensats de Bose-Einstein.
>
> Type: Modèles Numériques - 2012
>
> ANR reference: ANR-12-MONU-0007
>
> Coordinator: Ionut DANAILA, Université de Rouen.
>
> Duration: January 2013 - December 2016.

C. Chainais-Hillairet is a member of the ANR MOONRISE project (http://moonrise.math.cnrs.fr/). The MOONRISE project aims at exploring modeling, mathematical and numerical issues originating from the presence of high oscillations in nonlinear PDEs mainly from the physics of nanotechnologies and from the physics of plasmas.

> Title: Modèles, Oscillations et schémas numériques.
>
> Type: Fondements du numérique (DS0705) - 2014
>
> ANR reference: ANR-14-CE23-0007
>
> Coordinator: Florian MEHATS, Université de Rennes 1.
>
> Duration: October 2014 - September 2019.

B. Merlet is a member of the ANR GEOMETRYA project

(https://www.ljll.math.upmc.fr/lemenant/GEOMETRYA/) The GEOMETRYA project addresses several problems within the framework of geometric measure theory, from both theoretical and numerical viewpoints. Most of these problems are derived from the modeling of physical phenomenons. The main topics are: the Geometric Measure Theory in singular metric spaces, the Plateau problem, the Mumford-Shah functional, irrigation and branched transport problems, the Willmore energy.

> Title: Théorie gémométrique de la mesure et applications
>
> Type: Blanc SIMI 1 - 2012
>
> ANR reference: ANR-12-BS01-0014
>
> Coordinator: Hervé Pajot, Université Joseph Fourier (Grenoble).
>
> Duration: january 2013 - december 2016.

9.2.2. *Labex CEMPI*

> Title: Centre Européen pour les Mathématiques, la Physique et leurs interactions
>
> Coordinator: Stephan De Bièvre.
>
> Duration: January 2012 - December 2019.
>
> Partners: Laboratoire Paul Painlevé and Laser physics department (PhLAM), Université Lille 1.

The "Laboratoire d'Excellence" Centre Européen pour les Mathématiques, la Physique et leurs interactions (CEMPI), a project of the Laboratoire de Mathématiques Paul Painlevé and the Laboratoire de Physique des Lasers, Atomes et Molécules (PhLAM), was created in the context of the "Programme d'Investissements d'Avenir" in February 2012.

The association Painlevé-PhLAM creates in Lille a research unit for fundamental and applied research and for training and technological development that covers a wide spectrum of knowledge stretching from pure and applied mathematics to experimental and applied physics.

One of the three focus areas of CEMPI research is the interface between mathematics and physics. This focus area encompasses three themes. The first is concerned with key problems of a mathematical, physical and technological nature coming from the study of complex behaviour in cold atoms physics and non-linear optics, in particular fibre optics. The two other themes deal with fields of mathematics such as algebraic geometry, modular forms, operator algebras, harmonic analysis and quantum groups that have promising interactions with several branches of theoretical physics.

9.2.3. *PEPS égalité*

I. Lacroix-Violet was the coordinator of the project *Theoretical and numerical study of the quantum Navier-Stokes system* supported by the Institute for Mathematical Sciences and Interaction (INSMI) of the French National Center for Research (CNRS) the in the framework of the PEPS égalité call for proposal. In this project, the members have considered the quantum Navier-Stokes equations with a linear density dependent viscosity from a numerical and a theoretical point of view. From a theoretical point of view, I. Lacroix-Violet, M. Gisclon and D. Bresch studied the limit of the system when the viscosity parameter tends to zero. This work is still en progress. From a numerical point of view, following the recent work of D. Bresch, F. Couderc, P. Noble et J.-P. Vila, I. Lacroix-Violet and A. Jüngel have tried to design some numerical methods for the simulation of the complete model.

> Title: Theoretical and numerical study of the quantum Navier-Stokes system
>
> Coordinator: I. Lacroix-Violet
>
> Members-: M. Gisclon (Université Savoie Mont-Blanc) & A. Jüngel (Technische Universität Wien)
>
> Duration: January 2015 June 2015

9.3. International Research Visitors

9.3.1. *Visits of International Scientists*

We have a long-time collaboration with Ansgar Jüngel's research group from TU Wien. We hosted several PhD students during the last years and Ansgar Jüngel came for a one week research stay in 2015.

Patrick Dular from Liège University (Belgium) was invited in Lille from May, 15 to June, 15 on a Labex CEMPI support.

Ezzeddine Zahrouni from Nabeul University (Tunisia) was invited in Lille from Mai, 27 to Juin, 10 on a Lille University support.

9.3.2. *Visits to International Teams*

Thomas Rey visited Lorenzo Pareschi (March 9-14, 2015) and Giacomo Dimarco (June 23-27, 2015) in the Department of Mathematics and Computer Science of the University of Ferrara (Italy) to work on hyperbolic balance laws and on semi-lagrangian methods for the Boltzmann equation respectively.

<div align="center">

RMOD Project-Team

</div>

9. Partnerships and Cooperations

9.1. Regional Initiatives

We have signed a convention with the CAR team led by Noury Bouraqadi of Ecole des Mines de Douai. In this context we co-supervized three PhD students (Mariano Martinez-Peck, Nick Papoylias and Guillermo Polito). The team is also an important contributor and supporting organization of the Pharo project.

9.2. European Initiatives

9.2.1. FP7 & H2020 Projects

MEALS FP7 Marie Curie Research Staff Exchange Scheme

MEALS (Mobility between Europe and Argentina applying Logics to Systems) is a mobility project financed by the 7th Framework programme under the Marie Curie International Research Staff Exchange Scheme. It involves seven academic institutions from Europe and four from Argentina, and a total of about 80 researchers to be exchanged. The project started on the 1st of October, 2011, and it has a duration of 4 years. Nr: FP7-PEOPEL-2011-IRSES

http://www.meals-project.eu

9.2.2. Collaborations in European Programs, except FP7 & H2020

9.2.2.1. ERCIM Software Evolution

We are involved in the ERCIM Software Evolution working group since its inception. We participated at his creation when we were at the University of Bern.

9.3. International Initiatives

9.3.1. Inria International Labs

Inria Chile
Associate Team involved in the International Lab:

9.3.1.1. PLOMO2

Title: Infrastructure for a new generation of development tools

International Partner (Institution - Laboratory - Researcher):

Universidad de Chile (Chile) - Computer Science Department, PLEIAD laboratory (DCC) - Alexander Bergel

Start year: 2014

See also: http://pleiad.cl/research/plomo2

Performing effective software development and maintenance are best achieved with effective tool support. Provided by a variety of tools, each one presenting a specific kinds of information supporting the task at hand. With Plomo2, we want to invent a new generation tools to navigate and profile programs by combining dynamic information with visualization to improve the development environment.

9.3.2. Inria International Partners

9.3.2.1. Declared Inria International Partners

Participants: Marcus Denker [correspondant], Stéphane Ducasse [RMoD], Nicolas Anquetil [RMoD], Diego Garbervetsky [UBA,LAFHIS], Gabriela Arevalo [Universidad Nacional de Quilmes)], Nicolas Passerini [Uqbar].

Uqbar - Argentina

Uqbar is a foundation of researchers teaching in several universities of the Buenos Aires area. Universidad Tecnologica Nacional (FRBA) Universidad Nacional de Quilmes, Universidad Nacional de San Martin,Universidad Nacional del Oeste. LAFHIS is a research laboratory from the University of Buenos Aires. More information at (http://www.uqbar-project.org).

9.3.2.2. Informal International Partners

Pharo in Research: We are building an ecosystem around Pharo with international research groups, universities and companies. Several research groups (such as Software Composition Group – Bern, and Pleaid – Santiago) are using Pharo. Many universities are teaching OOP using Pharo and its books. Several companies worldwide are deploying business solutions using Pharo.

University of Mons, Belgium Julien Delplanque is a student in the master M1 program from Mons University. He is working on SQL parsers and code critics.

9.3.3. Participation In other International Programs

9.3.3.1. STIC AmSud

Participants: Damien Cassou [correspondant], Gustavo Santos [RMoD], Martin Dias [RMoD], David Röthlisberger [UDP - Universidad Diego Portales, Santiago, Chile], Marcelo Almeida Maia [UFU - Federal University of Uberlândia, Brasil], Romain Robbes [Departamento de Ciencias de la Computación (DCC), Universidad de Chile, Santiago, Chile], Martin Monperrus [Spirals].

Project Partners: Inria RMOD, Inria Spirals, DCC Universidad de Chile, Universidad Diego Portale Chile, Federal University of Uberlândia, Brasil.

This project aims at facilitating the usage of frameworks and application programming interfaces (APIs) by mining software repositories. Our intuition is that mining reveals how existing projects instantiate these frameworks. By locating concrete framework instantiations in existing projects, we can recommend to developers the concrete procedures for how to use a particular framework for a particular task in a new system. Our project also tackles the challenge of adapting existing systems to new versions of a framework or API by seeking repositories for how other systems adapted to such changes. We plan to integrate recommendations of how to instantiate a framework and adapt to changes directly in the development environment. Those points taken together, considerably distinguish our approach from existing research in the area of framework engineering.

Nicolas Anquetil visited one week the ASERG team of Pr. Marco Tulio Valente at Federal University of Minas Gerais (Brazil), and another week the team of Pr. Alexander Bergel at University of Chile.

9.3.3.2. European Lab with Delft

We have a Lille Nord Europe European Lab with A. Bachelli from Delft University. We are working on infrastructure and tools for code reviewing. We have exchange of staff and presented a paper at SANER 2015.

9.4. International Research Visitors

9.4.1. Visits of International Scientists

In the context of the PLOMO2 associated Team with the University of Chile:

- Johan Fabry (January 2015 for Pharo Days Lille, PLEIAD funded)
- Alexandre Bergel (01/07/2015 until 27/07/2015)
- Johan Fabry (July 2015 for ESUG, PLEIAD funded)
- Pierre Chanson (July 2015 and September 2015)
- Miguel Campusano (20/09/2015-07/10/2015)
- Alexandre Bergel (Dec 2015)

In the context of MEALS:

- Guido Chari visited RMoD in March 2015.

Other visitors:

- Glenn Cavarle, Jun 2015. Pharo MOOC.
- Skip Lentz, Delft University of Technology, Delft, the Netherlands, September 2015 to January 2016. Internship/Research project.
- Matthieu Lacaton, Thales, April 2015.
- Alain Plantec, Univ. Bretagne Occidentale, until June 2015. Bloc UI Project.
- Klérisson Vinícius Ribeiro da Paixão, Federal University of Uberlândia, Uberlândia (MG), Brazil, from September, 2015 to July, 2016. Stic-Amsud MineAPI.
- Markiyan Rizun, Ivan Franko National University of Lviv, Ukraine, From 11 January 2015 to 5 February 2015 and 4 July 2015 7 August 2015. Rewrite Tool.
- Nicolás Passerini, Uqbar / Universidad Nacional de Quilmes, Buenos Aires, Argentina, 24/11/2015 to 27/11/2015.
- Pablo Tesone, Thesis Relay from August 2015.
- Abdelghani ALIDRA, University 20 Aout 55, Skikda. Algeria. One month in June-July and November 2015 to December 2016.
- Leonardo Silva, PhD student from Brazil (Federal University of Minas Gerais), did a 6 months internship within for his PhD. From January 2015 to June 2015. SticAmsud Project Dynarchi.

9.4.2. Visits to International Teams

9.4.2.1. Research stays abroad

- Guillermo Polito: 25.05.2015 SOFT Languages Lab Vrije Universiteit Brussel, Brussels. Visit to present the work of the laboratory and look for collaborations.
- Guillermo Polito: 23.07.2015 Universidad de Quilmes, Buenos Aires. Visit to present the work of the laboratory.
- Nicolas Anquetil visited one week the ASERG team of Pr. Marco Tulio Valente at Federal University of Minas Gerais (Brazil), and another week the team of Pr. Alexander Bergel at University of Chile.
- Marcus Denker: 02.11-02.12.2015 PLEIAD DCC University of Chile, Santiago de Chile. Visit in the context of the Inria Associated Team PLOMO2.
- Marcus Denker: 02.01-20.01.2015 PLEIAD DCC University of Chile, Santiago de Chile. Visit in the context of the Inria Associated Team PLOMO2.
- Damien Cassou and Gustavo Santos. 02.02.2015. Visited for one week the University of Uberlandia (Brazil). Project MineAPI (SticAmSud).
- Olivier Auverlot and Anne Etien 16.12.15. University of Namur, Belgium. Visit to present the SQL project.

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

9. Partnerships and Cooperations

9.1. Regional Initiatives

Participant: Olivier Pietquin.

- *Title*: Sniper, Guerrilla, Shark, Razor et les autres
- *Type*: PICTANOVO
- *Coordinator*: Association P.A.S. (Emmanuelle Grangier)
- *Duration*: 2015
- *Abstract*:

  "Sniper, Guerrilla, Shark et les autres" is an interactive physical setting as well as a choreographic performance for four dancers /performers and two types of robots behaving as a swarm (some of them flying, others being on the floor). The context is high frequency trading from which emerges a world where human performers and non-humanoid robots live together. Their behaviour are depending on the same basic rules working at a non-temporal scale and a macro-temporal scale of share prices fluctuation.

9.2. National Initiatives

9.2.1. ANR ExTra-Learn

Participants: Alessandro Lazaric, Jérémie Mary, Rémi Munos, Michal Valko.

- *Title*: Extraction and Transfer of Knowledge in Reinforcement Learning
- *Type*: National Research Agency (ANR-9011)
- *Coordinator*: Inria Lille (A. Lazaric)
- *Duration*: 2014-2018
- *Abstract*: ExTra-Learn is directly motivated by the evidence that one of the key features that allows humans to accomplish complicated tasks is their ability of building knowledge from past experience and transfer it while learning new tasks. We believe that integrating transfer of learning in machine learning algorithms will dramatically improve their learning performance and enable them to solve complex tasks. We identify in the reinforcement learning (RL) framework the most suitable candidate for this integration. RL formalizes the problem of learning an optimal control policy from the experience directly collected from an unknown environment. Nonetheless, practical limitations of current algorithms encouraged research to focus on how to integrate prior knowledge into the learning process. Although this improves the performance of RL algorithms, it dramatically reduces their autonomy. In this project we pursue a paradigm shift from designing RL algorithms incorporating prior knowledge, to methods able to incrementally discover, construct, and transfer "prior" knowledge in a fully automatic way. More in detail, three main elements of RL algorithms would significantly benefit from transfer of knowledge. *(i)* For every new task, RL algorithms need exploring the environment for a long time, and this corresponds to slow learning processes for large environments. Transfer learning would enable RL algorithms to dramatically reduce the exploration of each new task by exploiting its resemblance with tasks solved in the past. *(ii)* RL algorithms evaluate the quality of a policy by computing its state-value function. Whenever the number of states is too large, approximation is needed. Since approximation may cause instability, designing suitable approximation schemes is particularly critical. While this is currently done by a domain expert, we propose to perform this step automatically by constructing features that incrementally

adapt to the tasks encountered over time. This would significantly reduce human supervision and increase the accuracy and stability of RL algorithms across different tasks. *(iii)* In order to deal with complex environments, hierarchical RL solutions have been proposed, where state representations and policies are organized over a hierarchy of subtasks. This requires a careful definition of the hierarchy, which, if not properly constructed, may lead to very poor learning performance. The ambitious goal of transfer learning is to automatically construct a hierarchy of skills, which can be effectively reused over a wide range of similar tasks.

- *Activity Report*: Research in ExTra-Learn focused on how to effectively transfer knowledge from an external expert as in apprenticeship learning. This is an important step towards automatic transfer because it digs into the problem of how knowledge of an expert can be integrated into the learning process. This investigation led to the publication of two papers at IJCAI'15. In 2015 a number of activities has also started. Ronan Fruit has been recruited for a PhD started in December. The main focus of the PhD will be related to transfer in multi-armed bandit, in particular in systems which are non-stationary where the task can change multiple times. Pierre-Victor Chaumier will start a long internship on transfer in RL with focus on applications to Atari games. Romain Warlop started in July a Cifre PhD (co-supervised by A. Lazaric, J. Mary, and Ph. Preux) with focus on how to use transfer learning in recommendation systems. We expect these activities to significantly advance the research in the project within 2016.

9.2.2. ANR KEHATH

Participant: Olivier Pietquin.

- *Acronym*: KEHATH
- *Title*: Advanced Quality Methods for Post-Edition of Machine Translation
- *Type*: ANR
- *Coordinator*: Lingua & Machina
- *Duration*: 2014-2017
- *Other partners*: Univ. Lille 1, Laboratoire d'Informatique de Grenoble (LIG)
- *Abstract*: The translation community has seen a major change over the last five years. Thanks to progress in the training of statistical machine translation engines on corpora of existing translations, machine translation has become good enough so that it has become advantageous for translators to post-edit machine outputs rather than translate from scratch. However, current enhancement of machine translation (MT) systems from human post-edition (PE) are rather basic: the post-edited output is added to the training corpus and the translation model and language model are re-trained, with no clear view of how much has been improved and how much is left to be improved. Moreover, the final PE result is the only feedback used: available technologies do not take advantages of logged sequences of post-edition actions, which inform on the cognitive processes of the post-editor. The KEHATH project intends to address these issues in two ways. Firstly, we will optimise advanced machine learning techniques in the MT+PE loop. Our goal is to boost the impact of PE, that is, reach the same performance with less PE or better performance with the same amount of PE. In other words, we want to improve machine translation learning curves. For this purpose, active learning and reinforcement learning techniques will be proposed and evaluated. Along with this, we will have to face challenges such as MT systems heterogeneity (statistical and/or rule-based), and ML scalability so as to improve domain-specific MT. Secondly, since quality prediction (QP) on MT outputs is crucial for translation project managers, we will implement and evaluate in real-world conditions several confidence estimation and error detection techniques previously developed at a laboratory scale. A shared concern will be to work on continuous domain-specific data flows to improve both MT and the performance of indicators for quality prediction. The overall goal of the KEHATH project is straightforward: gain additional machine translation performance as fast as possible in each and every new industrial translation project, so that post-edition time and cost is drastically reduced. Basic research is the best way to reach this goal, for an industrial impact that is powerful and immediate.

9.2.3. *ANR MaRDi*

Participants: Olivier Pietquin, Bilal Piot.

- *Acronym*: MaRDi
- *Title*: Man-Robot Dialogue
- *Type*: ANR
- *Coordinator*: Univ. Lille 1 (Olivier Pietquin)
- *Duration*: 2012-2016
- *Other partners*: Laboratoire d'Informatique d'Avignon (LIA), CNRS - LAAS (Toulouse), Acapela group (Toulouse)
- *Abstract*: In the MaRDi project, we study the interaction between humans and machines as a situated problem in which human users and machines share the same environment. Especially, we investigate how the physical environment of robots interacting with humans can be used to improve the performance of spoken interaction which is known to be imperfect and sensible to noise. To achieve this objectif, we study three main problems. First, how to interactively build a multimodal representation of the current dialogue context from perception and proprioception signals. Second, how to automatically learn a strategy of interaction using methods such as reinforcement learning. Third, how to provide expressive feedbacks to users about how the machine is confident about its behaviour and to reflect its current state (also the physical state).

9.2.4. *National Partners*

- Inria Bordeaux - Sud-Ouest
  - B.Piot and O.Pietquin worked with T.Munzer and M.Lopes on Inverse Reinforcement Learning with Relational Domains. It led to a publication in IJCAI 2015 [24].
- CentraleSupélec
  - B.Piot and O.Pietquin worked with M.Geist on Inverse Reinforcement Learning with Relational Domains and Dialogue Management. It led to a conference publication in IJCAI 2015 [24] and a workshop publication in MLIS 2015 [29].
- Inria Nancy - Grand Est
  - J.Perolat, B.Piot and O.Pietquin worked with Bruno Scherrer on Stochastic Games. It led to a conference publication in ICML 2015 [28].
- CMLA - ENS Cachan.
  - Julien Audiffren *Collaborator*
    M. Valko, A. Lazaric, and M. Ghavamzadeh work with Julien on Semi-Supervised Apprenticeship Learning. We finalized and published a max-entropy algorithm that outperforms the approach without unlabeled data.
- LTCI, Institut Télécom-ParisTech, France.
  - Charanpal Dhanjal, Stefan Clemençon*Collaborator*
    Romaric Gaudel collaborates with Charanpal and Stefan since 2010 on topics related to *Matrix Factorization*. In the past we applied our work to sequential recommendation and to sequential clustering. This year, the collaboration has led to a publication in AAAI'15 conference [16].

9.3. European Initiatives

9.3.1. *Collaborations in European Programs, except FP7 & H2020*

9.3.1.1. *CHIST-ERA IGLU*

Participants: Olivier Pietquin, Bilal Piot, Jérémie Mary.

Program: CHIST-ERA

Project acronym: IGLU

Project title: Interactive Grounding of Language Generation

Duration: 10/2015 - 9/2018

Coordinator: Jean-Rouat (Univ. Sherbrooke)

Other partners: Univ. Lille, CRIStAL (France) - Inria, Flowers (France) - UMONS, Numédiart (Belgium) - KTH, TMH (Sweden) - Universidad de Zaragoza, I3A (Spain)

Abstract: Language is an ability that develops in young children through joint interaction with their caretakers and their physical environment. At this level, human language understanding could be referred as interpreting and expressing semantic concepts (e.g. objects, actions and relations) through what can be perceived (or inferred) from current context in the environment. Previous work in the field of artificial intelligence has failed to address the acquisition of such perceptually-grounded knowledge in virtual agents (avatars), mainly because of the lack of physical embodiment (ability to interact physically) and dialogue, communication skills (ability to interact verbally). We believe that robotic agents are more appropriate for this task, and that interaction is a so important aspect of human language learning and understanding that pragmatic knowledge (identifying or conveying intention) must be present to complement semantic knowledge. Through a developmental approach where knowledge grows in complexity while driven by multimodal experience and language interaction with a human, we propose an agent that will incorporate models of dialogues, human emotions and intentions as part of its decision-making process. This will lead anticipation and reaction not only based on its internal state (own goal and intention, perception of the environment), but also on the perceived state and intention of the human interactant. This will be possible through the development of advanced machine learning methods (combining developmental, deep and reinforcement learning) to handle large-scale multimodal inputs, besides leveraging state-of-the-art technological components involved in a language-based dialog system available within the consortium. Evaluations of learned skills and knowledge will be performed using an integrated architecture in a culinary use-case, and novel databases enabling research in grounded human language understanding will be released.

9.4. International Initiatives

9.4.1. Inria Associate Teams not involved in an Inria International Labs

9.4.1.1. CWI

In the end of 2015 SEQUEL started an Inria Associate team with CWI, Amsterdam. This project is called "Universal algorithms for sequential forecasting and bandit problems" and is led by Daniil Ryabko from the SEQUEL side, and by Peter Grunwald from the CWI side.

9.4.1.2. EduBand

Title: Educational Bandits

International Partner (Institution - Laboratory - Researcher):

Carnegie Mellon University (United States) - Department of Computer Science, Theory of computation lab - Emma Brunskill

Inria investigators: A. Lazaric, M. Valko

Start year: 2015

See also: https://project.inria.fr/eduband/

Education can transform an individual's capacity and the opportunities available to him. The proposed collaboration will build on and develop novel machine learning approaches towards enhancing (human) learning. Massive open online classes (MOOCs) are enabling many more people to access education, but mostly operate using status quo teaching methods. Even more important than access is the opportunity for online software to radically improve the efficiency, engagement and effectiveness of education. Existing intelligent tutoring systems (ITSs) have had some promising successes, but mostly rely on learning sciences research to construct hand-built strategies for automated teaching. Online systems make it possible to actively collect substantial amount of data about how people learn, and offer a huge opportunity to substantially accelerate progress in improving education. An essential aspect of teaching is providing the right learning experience for the student, but it is often unknown a priori exactly how this should be achieved. This challenge can often be cast as an instance of decision-making under uncertainty. In particular, prior work by Brunskill and colleagues demonstrated that reinforcement learning (RL) and multi-arm bandit (MAB) can be very effective approaches to solve the problem of automated teaching. The proposed collaboration is thus intended to explore the potential interactions of the fields of online education and RL and MAB. On the one hand, we will define novel RL and MAB settings and problems in online education. On the other hand, we will investigate how solutions developed in RL and MAB could be integrated in ITS and MOOCs and improve their effectiveness.

9.4.2. Inria International Partners

9.4.2.1. Declared Inria International Partners

9.4.2.1.1. Montanuniverstat Leoben

Montanuniverstat Leoben (MUL), Austria, is an international partner of SEQUEL. The work in 2015 has been mostly on representation learning in reinforcement learning. The partnership involves Ronald Ortner and Peter Auer on the MUL side.

9.4.2.2. Informal International Partners

+ University of California Irvine (USA)

> Anima Anandkumar *Collaborator*

> A. Lazaric collaborates with A. Anandkumar on the use of spectral methods for reinforcement learning.

+ Politecnico di Milano (Italy)

> Nicola Gatti *Collaborator*

> A. Lazaric finalized a work with N. Gatti on the application of MAB on sponsored search auctions and mechanism design.

+ Universität Potsdam (Germany)

> Alexandra Carpentier *Collaborator*

> M. Valko collaborates with A. Carpentier on scaling bandits to large dimensions and structures.

+ Adobe Research, California

> Branislav Kveton *Collaborator*
> M. Valko and B. Kveton collaboration for sequential learning at recommendation for the entertainment content that features diversity.

+ Boston University, USA

> Venkatesh Saligrama *Collaborator*
> M. Valko, R. Munos collaborated with V. Saligrama and M. Hanawal, on cost-effective spectral sensing, useful in radars.

9.5. International Research Visitors

9.5.1. Visits to International Teams

9.5.1.1. Sabbatical programme

Ryabko Daniil

Date: Jan 2014 - Jan 2015

Institution: CMM (Chile)

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

9. Partnerships and Cooperations

9.1. Regional Initiatives

9.1.1. Région Nord-Pas De Calais

9.1.1.1. Citizen Awareness and Contribution to Air Quality Monitoring
Participants: Daniel Romero Acero, Romain Rouvoy [correspondant], Lionel Seinturier.

This is a 3-year granted in the context of the so-called "Chercheur citoyen" program that started in 2015. The partners are LISIC/Université Côte d'Opale (leader), ATMO Nord-Pas De Calais, Association Bâtisseurs d'Economie Solidaire. This project targets the distributed monitoring of air quality with crowd-sensing solutions obtained via sensors connected to smart devices. We aim at inciting citizens to perform their own measures, and to obtain thanks to GPS geo-localisation a large-scale database and a dynamic fine-grained cartography of air quality. This project takes advantage of the APISENSE® crowdsensing platform (see Section 6.1).

9.1.2. Inria Lille - Nord Europe

9.1.2.1. ADT eSurgeon
Participants: Maxime Colmant, Loïc Huertas, Romain Rouvoy [correspondant].

ADT eSurgeon (2013–15) is a technology development initiative supported by the Inria Lille - Nord Europe Center that aims at supporting the development of the POWERAPI software library (see Section 6.2) for measuring and monitoring the energy consumption of middleware and software systems.

9.1.2.2. ADT Spoon3R
Participants: Gérard Paligot, Martin Monperrus [correspondant].

ADT Spoon3R (2014–16) is a technology development initiative supported by the Inria Lille - Nord Europe Center that aims at supporting the development of the SPOON software library. (see Section 6.4) Spoon3R aims at extending SPOON with the features defined in the context of our research activities on automated software repair.

9.1.2.3. North European Lab LLEX
Participants: Benoit Cornu, Martin Monperrus [correspondant], Lionel Seinturier.

North European Lab LLEX (2015–17) is an international initiative supported by the Inria Lille - Nord Europe Center that takes place in the context of a collaboration between Inria and University College London. LLEX deals with research on automatic diagnosis and repair of software bugs. Automatic software repair is the process of fixing software bugs automatically An automatic software repair system fixes software bugs with no human intervention. The goal of automatic software repair is to save maintenance costs and to enable systems to be more resilient to bugs and unexpected situations. This research may dramatically improve the quality of software systems. The objective of the partnership is to work on the automated diagnosis of exceptions with a focus on null pointer exceptions.

9.1.2.4. North European Lab SOCS
Participants: Maria Gomez Lacruz, Christophe Ribeiro, Romain Rouvoy [correspondant], Lionel Seinturier.

North European Lab SOCS (2013–15) is an international initiative supported by the Inria Lille - Nord Europe Center that takes place in the context of a well-established collaboration between Inria and *Universitetet i Oslo* (UiO) initiated in 2008. SOCS (Self-Optimization of Cyber-physical Systems) focuses on the self-optimization issues in cyber-physical systems. Cyber-Physical Systems (CPS) are complex systems-of-systems that blend hardware and software to fulfill specific missions. However, traditional CPS are statically configured to achieve predefined goals, which not only limit their sharing and their reuse, but also hinder their sustainability. We believe that this waste of resources stems from the lack of agility of CPS to adapt to change in their environment or objectives. The SOCS Inria Lab takes advantage of the technologies developed as part of the APISENSE® crowd-sensing platform (see Section 6.1) to leverage the development of agile CPS.

9.1.2.5. LEDA

Participant: Philippe Merle [correspondant].

LEDA (2013–16) Laboratoire d'Expérimentation et de Démonstrations Ambiantes is a demonstration space allocated by the Inria Lille - Nord Europe Center whose goal is to show the scientific results of the Spirals team in the domains of distributed systems, adaptable middleware, software product lines, green computing, and ambiant computing. These results are illustrated around the scenario of a mock digital home.

9.2. National Initiatives

9.2.1. ANR

9.2.1.1. ANR BottleNet

Participants: Romain Rouvoy [correspondant], Walter Rudametkin Ivey, Lionel Seinturier.

BottleNet is a 48-month project funded by ANR that started on October 2015. The objective of BottleNet is to deliver methods, algorithms, and software systems to measure Internet Quality of Experience (QoE) and diagnose the root cause of poor Internet QoE. Our goal calls for tools that run directly at users' devices. We plan to collect network and application performance metrics directly at users' devices and correlate it with user perception to model Internet QoE, and to correlate measurements across users and devices to diagnose poor Internet QoE. This data-driven approach is essential to address the challenging problem of modeling user perception and of diagnosing sources of bottlenecks in complex Internet services. BottleNet will lead to new solutions to assist users, network and service operators as well as regulators in understanding Internet QoE and the sources of performance bottleneck.

9.2.1.2. ANR SATAS

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

SATAS is a 48-month project funded by ANR that started on October 2015. SATAS aims to advance the state of the art in massively parallel SAT solving with a particular eye to the applications driving progress in the field. The final goal of the project is to be able to provide a "pay as you go" interface to SAT solving services, with a particular focus on its power consumption. This project will extend the reach of SAT solving technologies, daily used in many critical and industrial applications, to new application areas, which were previously considered too hard, and lower the cost of deploying massively parallel SAT solvers on the cloud.

9.2.2. Competitivity Clusters

9.2.2.1. FUI Hermes

Participants: Laurence Duchien, Romain Rouvoy, Lionel Seinturier [correspondant].

Hermes is a 41-month project funded by FUI and labelized by the PICOM (Pôle des Industries du COMmerce) competitivity cluster which has started in August 2012. The partners are Norsys (leader), Keynosoft, Numsight, Cylande, Auchan, Brand Alley, Kiabi, Leroy Merlin, Univ. Lille 1, LIPN, LITIS. The goal of the project is to define a modular and context-aware marketing platform for the retail industry. The focus is put on the interactions with customers in order to extract and mine relevant informations related to shopping habits, and on a multi-device, cross-canal, approach to better match customer usages.

9.2.3. Programme Investissement d'Avenir (PIA)

9.2.3.1. PIA Datalyse
Participants: Filip Krikava, Romain Rouvoy, Lionel Seinturier [correspondant], Bo Zhang.

Datalyse is a 42-month project of the Programme Investissement d'Avenir Cloud Computing 3rd call for projects. The project started in May 2013. The partners are Eolas (leader), Business & Decision, Groupement des Mousquetaires, Université Grenoble 1, Université Lille 1, Inria, Université Montpellier 2. The project aims at defining an elastic cloud computing infrastructure for processing big volumes of data. The originality of the project is to consider jointly data generated by users and by the infrastructure, and to correlate data at these two levels.

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

OCCIware is a 36-month project of the Programme Investissement d'Avenir Cloud Computing and Big Data 4th call for projects. The project started in December 2014. The partners are Open Wide (leader), ActiveEon SA, CSRT, Institut Mines-Télécom/Télécom SudParis, Inria, Linagora GSO, Obeo, OW2 Consortium, Pôle Numérique, and Université Joseph Fourier - Grenoble. The project aims at defining a formal framework for managing every digital resources in the clouds, based on *Open Cloud Computing Interface* (OCCI) recommendations from *Open Grid Forum* (OGF).

9.2.4. Inria National Initiatives

9.2.4.1. Inria ADT Focus CrowdLab
Participants: Clive Ferret-Canape, Julien Duribreux, Maria Gomez Lacruz, Christophe Ribeiro, Romain Rouvoy [correspondant], Antoine Veuiller.

The purpose of the ADT Focus CrowdLab (2014–2016) is to strengthen the technological part of the Metroscope consortium and to promote the APISENSE$^{®}$ crowd-sensing platform (see Section 6.1) as a reference platform fo gathering mobile data within the scientific community. The CrowdLab project focuses on three stringent goals: (1) consolidating the current technological solutions, (2) technical and logistical support of the research activities initiated in different scientific domains, and (3) the improvement of security and anonymity of collected data. In addition to the Metroscope consortium, the Inria research teams participating of the ADT Focus CrowdLab project are: Spirals (coordinator), Madynes, Diana, Muse.

9.2.5. Other National Initiatives

9.2.5.1. ADEME Web Energy Archive 2
Participants: Maxime Colmant, Loïc Huertas, Filip Krikava, Romain Rouvoy [correspondant], Lionel Seinturier.

Web Energy Archive 2 (WEA2) is a 12-month project funded in 2015 by ADEME. The purpose of the project is to define innovative solutions for measuring the energy consumption of web sites as experienced by users. The output of the project can be consulted on http://webenergyarchive.com where web sites are ranked based on their energy profile (from A to G, where A denotes web sites that are the more energy friendly). This project contributes to the development of our PowerAPI library (see Section 6.2).

9.3. European Initiatives

9.3.1. FP7 & H2020 Projects

Program: FP7 ICT.

Project acronym: PaaSage.

Project title: Model Based Cloud Platform Upperware.

Duration: October 2012–September 2016.

Coordinator: ERCIM.

Other partners: ERCIM (Fr), SINTEF (No), STFC (UK), U. of Stuttgart (De), Inria (Fr), CETIC (Be), FORTH (El), Be.Wan (Be), EVRY Solutions (No), SysFera (Fr), Flexiant (UK), Lufthansa Systems AG (De), Gesellschaft fur wissenschaftliche Datenverarbeitung mbh Gottingen (De), Automotive Simulation Center Stuttgart (De).

Abstract: Cloud computing is a popular and over-hyped concept in ICT. The concept of infinitely scalable elastic resources changing without complex systems administration and paying only for resources used is attractive. These benefits are not immediately realizable. Within organisation benefits are realizable at considerable cost. IaaS (*Infrastructure-as-a-Service*) public Clouds have different interfaces and conditions of use thus for an organisation to "scale out" requires considerable investment using skilled technical staff. The business need is to allow organisations to "scale out" from their private Cloud to public Clouds without a technical chasm between. This cannot easily be achieved. Aligned with the EU strategic direction of an open market for services, SOA (*Service-Oriented architecture*) offers a way to virtualize across heterogeneous public Clouds and organizational private Clouds. It opens a market for European SMEs to provide services to be utilized (and paid for) by business applications and for all organisations to benefit from a catalogue of services that can be used across the environment. PaaSage will deliver an open and integrated platform, to support both deployment and design of Cloud applications, together with an accompanying methodology that allows model-based development, configuration, optimisation, and deployment of existing and new applications independently of the existing underlying Cloud infrastructures. Specifically it will deliver an IDE (*Integrated Development Environment*) incorporating modules for design time and execution time optimisation of applications specified in the Cloud Modeling Language (Cloud ML), execution-level mappers and interfaces and a metadata database.

Participants: Laurence Duchien, Daniel Romero Acero [correspondant], Romain Rouvoy, Lionel Seinturier.

Program: FP7 FET.

Project acronym: DIVERSIFY.

Project title: More software diversity. More adaptivity in CAS.

Duration: 36 months (2013–16).

Coordinator: Inria.

Other partners: SINTEF (Norway), Trinity College Dublin (Ireland), University of Rennes 1 (France).

Abstract: DIVERSIFY explores diversity as the foundation for a novel software design principle and increased adaptive capacities in CASs (*Collective Adaptive Systems*). Higher levels of diversity in the system provide a pool of software solutions that can eventually be used to adapt to unforeseen situations at design time. The scientific development of DIVERSIFY is based on a strong analogy with ecological systems, biodiversity, and evolutionary ecology. DIVERSIFY brings together researchers from the domains of software-intensive distributed systems and ecology in order to translate ecological concepts and processes into software design principles.

Participants: Martin Monperrus [correspondant], Matias Martinez.

9.4. International Initiatives

9.4.1. Inria Associate Teams not involved in an Inria International Labs

9.4.1.1. SOMCA

Title: Self-Optimization of Service Oriented Architectures for Mobile and Cloud Applications

International Partner (Institution - Laboratory - Researcher):

Université du Québec À Montréal (Canada) - LATECE - Naouel MOHA

Start year: 2014

See also: http://sofa.uqam.ca/somca.php

The long-term goal of this research program is to propose a novel and innovative methodology embodied in an software platform, to support the runtime detection and correction of anti-patterns in large-scale service-oriented distributed systems in order to continuously optimize their quality of service. One originality of this program lies in the dynamic nature of the service-oriented environments and the application on emerging frameworks for embedded and distributed systems (*e.g.*, Android/iOS for mobile devices, PaaS/SaaS for Cloud environments), and in particular mobile systems interacting with remote services hosted on the Cloud.

9.4.2. Inria International Partners

9.4.2.1. Declared Inria International Partners

9.4.2.1.1. University of Los Andes, Bogota, Colombia

We have a long term collaboration since 2005 with this university. Over the years, four PhD thesis (Carlos Noguera, Carlos Parra, Daniel Romero Acero, Gabriel Tamura) have been defended in our team with students who obtained their MSc in this university. The first three were full French PhD, whereas the last one was a co-tutelle with this university. Professor Rubby Casallas from University of Los Andes is frequently visiting our team. The most recently defended PhD thesis, that of Gabriel Tamura, deals with QoS (quality-of-service) contract preservation in distributed service-oriented architectures. A formal theory to perform, in a safe way, the process of self-adaptation in response to quality-of-service (QoS) contracts violation has been proposed. The results have been published in [90], [88] and in the PhD thesis document itself [87].
Participants: Laurence Duchien [correspondant], Daniel Romero Acero, Romain Rouvoy, Lionel Seinturier.

9.4.2.1.2. University of Oslo, Norway

The scientific collaboration with this international partner deals with complex distributed systems that have to seamlessly adapt to a wide variety of deployment targets. This is due to the fact that developers cannot anticipate all the runtime conditions under which these systems are immersed. A major challenge for these software systems is to develop their capability to continuously reason about themselves and to take appropriate decisions and actions on the optimizations they can apply to improve themselves. This challenge encompasses research contributions in different areas, from environmental monitoring to real-time symptoms diagnosis, to automated decision making. The collaboration has been supported by the SEAS Inria associated team (2012-14).
Participants: Maria Gomez Lacruz, Daniel Romero Acero, Romain Rouvoy [correspondant], Lionel Seinturier.

9.4.3. Participation In other International Programs

9.4.3.1. STIC AmSud - Project MineAPI
Participants: Benoit Cornu, Maria Gomez Lacruz, Matias Martinez, Martin Monperrus [correspondant], Vincenzo Musco, Gérard Paligot, Romain Rouvoy.

MineAPI is a STIC AmSud project (2015–16) between with University Diego Portales, Santiago, Chile, and Federal University of Uberlândia, Brazil. The coordinator on the French side is Damien Cassou from the Inria/Lille1 project-team Rmod. The project aims at facilitating the usage of frameworks and application programming interfaces (APIs) by mining software repositories. Our intuition is that mining reveals how existing projects instantiate these frameworks. By locating concrete framework instantiations in existing projects, we can recommend to developers the concrete procedures for how to use a particular framework for a particular task in a new system. Our project also tackles the challenge of adapting existing systems to new versions of a framework or API by seeking repositories for how other systems adapted to such changes.

9.5. International Research Visitors

9.5.1. Visits of International Scientists

9.5.1.1. Internships

Mayank Gupta

Date: May 2015 - Jul 2015

Institution: Indian Institute of Technology Delhi (India)

Supervisor: Romain Rouvoy

Spyros Lalos

Date: August 2015 - October 2015

Institution: Technical University Munich (Germany)

Supervisor: Romain Rouvoy