RESEARCH CENTER
Paris - Rocquencourt

FIELD

Activity Report 2013

Section Partnerships and Cooperations

Edition: 2014-03-19

ABSTRACTION Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR

8.1.1.1. AbstractCell

Title: Formal abstraction of quantitative semantics for protein-protein interaction cellular network models

Instrument: ANR-Chair of Excellence (Junior, long term)

Duration: December 2009 - December 2013

Coordinator: Inria (France)

Others partners: None

See also: http://www.di.ens.fr/ feret/abstractcell

Abstract: The overall goal of this project is to investigate formal foundations and computational aspects of both the stochastic and differential approximate semantics for rule-based models. We want to relate these semantics formally, then we want to design sound approximations for each of these semantics (by abstract interpretation) and investigate scalable algorithms to compute the properties of both the stochastic and the differential semantics. Jérôme Feret is the principal investigator for this project.

8.1.1.2. AstréeA

Title: Static Analysis of Embedded Asynchronous Real-Time Software

Type: ANR Ingénierie Numérique Sécurité 2011

Instrument: ANR grant

Duration: January 2012 - December 2015

Coordinator: Airbus France (France)

Others partners: École normale supérieure (France)

See also: http://www.astreea.ens.fr

Abstract: The focus of the ASTRÉEA project is on the development of static analysis by abstract interpretation to check the safety of large-scale asynchronous embedded software. During the THÉSÉE ANR project (2006–2010), we developed a concrete and abstract models of the ARINC 653 operating system and its scheduler, and a first analyzer prototype. The gist of the ASTRÉEA project is the continuation of this effort, following the recipe that made the success of ASTRÉE: an incremental refinement of the analyzer until reaching the zero false alarm goal. The refinement concerns: the abstraction of process interactions (relational and history-sensitive abstractions), the scheduler model (supporting more synchronisation primitives and taking priorities into account), the memory model (supporting volatile variables), and the abstraction of dynamical data-structures (linked lists). Patrick Cousot is the principal investigator for this project.

8.1.1.3. Verasco

Title: Formally-verified static analyzers and compilers

Type: ANR Ingénierie Numérique Sécurité 2011

Instrument: ANR grant

Duration: Septembre 2011 - September 2015

Coordinator: Inria (France)

Others partners: Airbus France (France), IRISA (France), Inria Saclay (France)

See also: http://www.systematic-paris-region.org/fr/projets/verasco

Abstract: The usefulness of verification tools in the development and certification of critical software is limited by the amount of trust one can have in their results. A first potential issue is *unsoundness* of a verification tool: if a verification tool fails (by mistake or by design) to account for all possible executions of the program under verification, it can conclude that the program is correct while it actually misbehaves when executed. A second, more insidious, issue is *miscompilation*: verification tools generally operate at the level of source code or executable model; a bug in the compilers and code generators that produce the executable code that actually runs can lead to a wrong executable being generated from a correct program.

The project VERASCO advocates a mathematically-grounded solution to the issues of formal verifying compilers and verification tools. We set out to develop a generic static analyzer based on abstract interpretation for the C language, along with a number of advanced abstract domains and domain combination operators, and prove the soundness of this analyzer using the Coq proof assistant. Likewise, we will continue our work on the CompCert C formally-verified compiler, the first realistic C compiler that has been mechanically proved to be free of any miscompilation will be continued. Finally, the tool qualification issues that must be addressed before formally-verified tools can be used in the aircraft industry, will be investigated.

8.2. European Initiatives

8.2.1. FP7 Projects

8.2.1.1. MemCad

Type: IDEAS

Defi: Design Composite Memory Abstract Domains

Instrument: ERC Starting Grant

Objectif: Design Composite Memory Abstract Domains

Duration: October 2011 - September 2016

Coordinator: Inria (France)

Partner: None

Inria contact: Xavier Rival

Abstract: The MemCAD project aims at setting up a library of abstract domains in order to express and infer complex memory properties. It is based on the abstract interpretation frameworks, which allows to combine simple abstract domains into complex, composite abstract domains and static analyzers. While other families of abstract domains (such as numeric abstract domains) can be easily combined (making the design of very powerful static analyses for numeric intensive applications possible), current tools for the analysis of programs manipulating complex abstract domains usually rely on a monolithic design, which makes their design harder, and limits their efficiency. The purpose of the MemCAD project is to overcome this limitation.

Our proposal is based on the observation that the complex memory properties that need to be reasoned about should be decomposed in combinations of simpler properties. Therefore, in static analysis, a complex memory abstract domain could be designed by combining many simpler domains, specific to common memory usage patterns. The benefit of this approach is twofold: first it would make it possible to simplify drastically the design of complex abstract domains required to reason about complex softwares, hereby allowing certification of complex memory intensive softwares by automatic static analysis; second, it would enable to split down and better control the cost of the analyses, thus significantly helping scalability. As part of this project, we propose to build a static analysis framework for reasoning about memory properties, and put it to work on important classes of applications, including large softwares.

8.3. International Initiatives

8.3.1. Informal International Partners

Research on Kappa and its applications involves several close international partners:

- Vincent Danos (University of Edinburgh, UK);
- Walter Fontana (Harvard Medical School, US);
- Hein Koeppl and Tatjana Petrov (ETH Zürich, SW);
- Jonathan Hayman and Glynn Winskel (Cambridge, UK).

Research on abstract domains for memory states involves the group of Bor-Yuh Evan Chang (University of Colorado at Boulder, Colorado, USA).

8.4. International Research Visitors

8.4.1. Visits of International Scientists

Bor-Yuh Evan Chang visited the team from June to August 2013, as part of his collaboration with Xavier Rival.

8.4.1.1. Internships

Abdellatif Atki is a student at École Polytechnique (Palaiseau, France). He performed his M1 internship from April 2013 to July 2013 under the supervision of Antoine Miné on the Two variables per inequality abstract domain [27].

Matthias Bry is a student at École Polytechnique (Palaiseau, France). He performed his M1 internship from April 2013 to July 2013 under the supervision of Antoine Miné on analysis of concurrent programs [28].

Huisong Li is a master student at the Institute of Software, at the Chinese Accademy of Sciences (Beijing, China) and is doing a research internship under the supervision of Xavier Rival.

8.4.2. Visits to International Teams

Xavier Rival visited the ROSAEC Team in Seoul National University (team of Professor Kwangkeun Yi).

ALPAGE Project-Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

8.1.1. LabEx EFL (Empirical Foundations of Linguistics) (2011 – 2021)

Participants: Laurence Danlos, Benoît Sagot, Chloé Braud, Marie-Hélène Candito, Benoît Crabbé, Pascal Denis, Charlotte Roze, Pierre Magistry, Djamé Seddah, Juliette Thuilier, Éric Villemonte de La Clergerie.

Linguistics and related disciplines addressing language have achieved much progress in the last two decades but improved interdisciplinary communication and interaction can significantly boost this positive trend. The LabEx (excellency cluster) EFL (Empirical Foundations of Linguistics), launched in 2011 and headed by Jacqueline Vaissière, opens new perspectives by adopting an integrative approach. It groups together some of the French leading research teams in theoretical and applied linguistics, in computational linguistics, and in psycholinguistics. Through collaborations with prestigious multidisciplinary institutions (CSLI, MIT, Max Planck Institute, SOAS...) the project aims at contributing to the creation of a Paris School of Linguistics, a novel and innovative interdisciplinary site where dialog among the language sciences can be fostered, with a special focus on empirical foundations and experimental methods and a valuable expertise on technology transfer and applications.

Alpage is a very active member of the LabEx EFL together with other linguistic teams we have been increasingly collaborating with: LLF (University Paris 7 & CNRS) for formal linguistics, LIPN (University Paris 13 & CNRS) for NLP, LPNCog (University Paris 5 & CNRS) LSCP (ENS, EHESS & CNRS) for psycholinguistics, MII (University Paris 4 & CNRS) for Iranian and Indian studies. Alpage resources and tools have already proven relevant for research at the junction of all these areas of linguistics, thus drawing a preview of what the LabEx is about: experimental linguistics (see Section 4.6). Moreover, the LabEx provides Alpage with opportunities for collaborating with new teams, e.g., on language resource development with descriptive linguists (see 6.5 for example). In 2013, two post-docs funded by Labex EFL have worked at Alpage (Yves Scherrer) or jointly at Alpage and LLF (Margaret Grant).

Benoît Sagot is the head one of the 7 autonomous scientific "strands" of the LabEx EFL, namely the strand 6 on "Language Resources". Marie-Hélène Candito and Benoît Crabbé are respectively deputy-head of strands 5 on "Computational semantic analysis" and 2 on "Experimental grammar from a cross-linguistic perspective". Several project members are in charge of research operations within these 3 strands.

8.2. National Initiatives

8.2.1. ANR

8.2.1.1. ANR project ASFALDA (2012 – 2015)

Participants: Marie-Hélène Candito [principal investigator], Marianne Djemaa, Benoît Sagot, Éric Villemonte de La Clergerie, Laurence Danlos.

Alpage is principal investigator team for the ANR project ASFALDA, lead by Marie-Hélène Candito. The other partners are the Laboratoire d'Informatique Fondamentale de Marseille (LIF), the CEA-List, the MELODI team (IRIT, Toulouse), the Laboratoire de Linguistique Formelle (LLF, Paris Diderot) and the Ant'inno society.

The project aims to provide both a French corpus with semantic annotations and automatic tools for shallow semantic analysis, using machine learning techniques to train analyzers on this corpus. The target semantic annotations are structured following the FrameNet framework [47] and can be characterized roughly as an explicitation of "who does what when and where", that abstracts away from word order / syntactic variation, and to some of the lexical variation found in natural language.

The project relies on an existing standard for semantic annotation of predicates and roles (FrameNet), and on existing previous effort of linguistic annotation for French (the French Treebank). The original FrameNet project provides a structured set of prototypical situations, called frames, along with a semantic characterization of the participants of these situations (called *roles*). We propose to take advantage of this semantic database, which has proved largely portable across languages, to build a French FrameNet, meaning both a lexicon listing which French lexemes can express which frames, and an annotated corpus in which occurrences of frames and roles played by participants are made explicit. The addition of semantic annotations to the French Treebank, which already contains morphological and syntactic annotations, will boost its usefulness both for linguistic studies and for machine-learning-based Natural Language Processing applications for French, such as content semantic annotation, text mining or information extraction.

To cope with the intrinsic coverage difficulty of such a project, we adopt a hybrid strategy to obtain both exhaustive annotation for some specific selected concepts (commercial transaction, communication, causality, sentiment and emotion, time), and exhaustive annotation for some highly frequent verbs. Pre-annotation of roles will be tested, using linking information between deep grammatical functions and semantic roles.

The project is structured as follows:

- Task 1 concerns the delimitation of the focused FrameNet substructure, and its coherence verification, in order to make the resulting structure more easily usable for inference and for automatic enrichment (with compatibility with the original model);
- Task 2 concerns all the lexical aspects: which lexemes can express the selected frames, how they map to external resources, and how their semantic argument can be syntactically expressed, an information usable for automatic pre-annotation on the corpus;
- Task 3 is devoted to the manual annotation of corpus occurrences (we target 20000 annotated occurrences);
- In Task 4 we will design a semantic analyzer, able to automatically make explicit the semantic annotation (frames and roles) on new sentences, using machine learning on the annotated corpus;
- Task 5 consists in testing the integration of the semantic analysis in an industrial search engine, and to measure its usefulness in terms of user satisfaction.

The scientific key aspects of the project are:

- an emphasis on the diversity of ways to express the same frame, including expression (such as discourse connectors) that cross sentence boundaries;
- an emphasis on semi-supervised techniques for semantic analysis, to generalize over the available annotated data.

8.2.1.2. ANR project EDyLex (2010 – 2013)

Participants: Benoît Sagot [principal investigator], Rosa Stern, Damien Nouvel, Virginie Mouilleron, Marion Baranes, Sarah Beniamine, Laurence Danlos.

EDyLex was an ANR project (STIC/CONTINT) headed by Benoît Sagot, which came to an end on June 30, 2013. The focus of the project was the dynamic acquisition of new entries in existing lexical resources that are used in syntactic and semantic parsing systems: how to detect and qualify an unknown word or a new named entity in a text? How to associate it with phonetic, morphosyntactic, syntactic, semantic properties and information? Various complementary techniques will be explored and crossed (probabilistic and symbolic, corpus-based and rule-based...). Their application to the contents produced by the AFP news agency (Agence France-Presse) constitutes a context that is representative for the problems of incompleteness and lexical creativity: indexing, creation and maintenance of ontologies (location and person names, topics), both necessary for handling and organizing a massive information flow (over 4,000 news wires per day).

The participants of the project, besides Alpage, were the LIF (Université de Méditerranée), the LIMSI (CNRS team), two small companies, Syllabs and Vecsys Research, and the AFP.

In 2013, several important developments have been achieved:

- Finalization of a beta version of the first non-alpha release of the WOLF (Free French WordNet)
- Improvement or development of modules for automatic detection, classification and morphological analysis of unknown words (neologisms, new named entities) in French corpora and integration within a full-featured processing pipeline (see 6.2);
- Collaboration with Vocapia for interfacing the results of this pipeline with Vocapia's language models, in order to improve speech recognition systems used at AFP;
- Use of an EDyLex-specific version of the NewsProcess architecture, previously developed at Alpage, for meeting the expectations of the EDyLex project in terms of lexicon extension from dynamic corpora, here AFP news wires.

8.2.1.3. ANR project Polymnie (2012-2015)

Participants: Laurence Danlos, Éric Villemonte de La Clergerie.

Polymnie is an ANR research project headed by Sylvain Podogolla (Sémagramme, Inria Lorraine) with Melodi (INRIT, CNRS), Signes (LABRI, CNRS) and Alpage as partners. This project relies on the grammatical framework of Abstract Categorial Grammars (ACG). A feature of this formalism is to provide the same mathematical perspective both on the surface forms and on the more abstract forms the latter correspond to. As a consequence:

- ACG allows for the encoding of a large variety of grammatical formalisms such as context-free grammars, Tree Adjoining grammars (TAG), etc.
- ACG define two languages: an abstract language for the abstract forms, and an object language for the surface forms.

The role of Alpage in this project is to develop sentential or discursive grammars written in TAG so as to study their conversion in ACG. First results achieved in 2013 are described in 6.14 .

8.2.2. Other national initiatives

8.2.2.1. "Investissements d'Avenir" project PACTE (2012 – 2014)

Participants: Benoît Sagot, Kata Gábor.

PACTE (*Projet d'Amélioration de la Capture TExtuelle*) is an "Investissements d'Avenir" project sumbitted within the call "Technologies de numérisation et de valorisation des contenus culturels, scientifiques et éducatifs". It started in November 2012, although the associated fundings only arrived at Alpage in July 2013.

PACTE aims at improving the performance of textual capture processes (OCR, manual script recognition, manual capture, direct typing), using NLP tools relying on both statistical (n-gram-based, with scalability issues) and hybrid techniques (involving lexical knowledge and POS-tagging models). It addresses specifically the application domain of written heritage. The project takes place in a multilingual context, and therefore aims at developing as language-independant techniques as possible.

PACTE involves 3 companies (Numen, formerly Diadeis, main partner, as well as A2IA and Isako) as well as Alpage and the LIUM (University of Le Mans). It brings together business specialists, large-scale corpora, lexical resources, as well as the scientific and technical expertise required.

The results obtained at Alpage in 2013 within PACTE are described in 6.7

8.2.3. Consortium Corpus Écrits within the TGIR Huma-Num

Participants: Benoît Sagot, Djamé Seddah.

Huma-Num is a TGIR (Very Large Research Infrastructure) dedicated to digital humanities. Among Huma-Num initiatives are a dozen of consortia, which bring together most members of various research communities. Among them is the *Corpus Écrits* consortium, which is dedicated to all aspects related to written corpora, from NLP to corpus development, corpus specification, standardization, and others. All types of written corpora are covered (French, other languages, contemprorary language, medieval language, specialized text, non-standard text, etc.). The consortium Corpus Écrits is managed by the Institut de Linguistique Française, a CNRS federation of which Alpage is a member since June 2013, under the supervision of Franck Neveu.

Alpage is involved in various projects within this consortium, and especially in the development of corpora for CMC texts (blogs, forum posts, SMSs, textchat...) and shallow corpus annotation, especially with MElt.

8.3. European Initiatives

8.3.1. Collaborations in European Programs, except FP7

Program: COST

Project acronym: PARSEME

Project title: Parsing and multi-word expressions. Towards linguistic precision and computational efficiency in natural language processing

Duration: 03/2013- 03/2017

Coordinator: Agata SAVARY

Other partners: 24 participating countries

Abstract: This Action aims at increasing and enhancing the support of the European multilingual heritage from Information and Communication Technologies (ICT). This general aim is addressed through improving linguistic representativeness, precision and computational efficiency of Natural Language Processing (NLP) applications. The Action focuses on the major bottleneck of these applications: Multi-Word Expressions (MWEs), i.e. sequences of words with unpredictable properties such as “to count somebody in” or “to take a haircut.” A breakthrough in their modelling and processing can only result from a coordinated effort of multidisciplinary experts in different languages. COST is the most adequate framework answering this need. Fourteen European languages will be addressed from a cross-theoretical and cross-methodological perspective, necessary for coping with current fragmentation issues. Expected deliverables include enhanced language resources and tools, as well as recommendations of best practices for cutting-edge MWE-aware language models. The Action will lead to a better understanding of the nature of MWEs. It will establish a long-lasting collaboration within a multilingual network of MWE specialists. It will pave the way towards competitive next generation text processing tools which will pay greater attention to language phenomena.

8.4. International Initiatives

8.4.1. Inria International Partners

8.4.1.1. Informal International Partners

Alpage has active collaborations with several international teams. The most active in 2013 have been:

- collaboration with Columbia University (United States), in particular on discourse modeling (Laurence Danlos, with Owen Rambow) and on computational morphology (Benoît Sagot, with Owen Rambow and Nizar Habash)
- collaboration with the Weizmann Institute of Science (Israel) on parsing morphologically rich languages (Djamé Seddah, with Reut Tsarfaty)
- collaboration with the Indiana University (United States) on parsing morphologically rich languages (Djamé Seddah, with Sandra Kubler)
- collaboration with the Uppsala University (Sweden) on statistical parsing (Marie-Hélène Candito and sDjamé Seddah, with Joakim Nivre)

ALPINES Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR

8.1.1.1. PETALh

ANR Cosinus project - *PETascale ALgorithms for preconditioning for scientific applications* January 2011 - September 2013 (http://petal.saclay.inria.fr/). The global cost of the project is $1,350,910$, the funding from ANR is $304,232$. The total personne.mois is 140. Collaboration with Laboratoire Lions - UPMC, IFPEN, Inria Bordeaux and CEA, UC Berkeley. This project can be seen as a continuation of ANR funded PETAL project, the goal is to design parallel algorithms for the preconditioning techniques proposed during PETAL suitable for heterogeneous architectures based on multicore processors and accelerators.

8.1.1.2. Medimax

ANR-MN (Modèles Numériques) October 2013 - September 2017

The main goal is the methodological and numerical development of a new robust inversion tool, associated with the numerical solution of the electromagnetic forward problem, including the benchmarking of different other existing approaches (Time Reverse Absorbing Condition, Method of Small-Volume Expansions, Level Set Method). This project involves the development of a general parallel open source simulation code, based on the high-level integrated development environment of FreeFEm++, for modeling an electromagnetic direct problem, the scattering of arbitrary electromagnetic waves in highly heterogeneous media, over a wide frequency range in the microwave domain. The first applications considered here will be medical applications: microwave tomographic images of brain stroke, brain injuries, from both synthetic and experimental data in collaboration with EMTensor GmbH, Vienna (Austria), an Electromagnetic Medical Imaging company.

8.2. European Initiatives

8.2.1. FP7 Projects

8.2.1.1. EXA2CT

Type: COOPERATION

Instrument: Specific Targeted Research Project

Objectif: NC

Duration: September 2013 - August 2016

Coordinator: Imec, Belgium

Partner: UA Belgium, USI Switzerland, Intel France, NAG England, UVSQ France, T-Systems SfR Germany, IT4Inovations Czech Republic.

Inria contact: Luc Giraud

Abstract: The goal of this project is to develop novel algorithms and programming models to tackle what will otherwise be a series of major obstacles to using a crucial component of many scientific codes at exascale, namely solvers and their constituents. The results of this work will be combined in running programs that demonstrate the application-targeted use of these algorithms and programming models in the form of proto-applications. The application targeting will be done by an analysis of a representative selection of scientific applications using solvers and/or the constituent parts that we target. The results of the project will be disseminated to the reference application owners through a scientific and industrial board (SIB), and board-partner specific code targeting

activities, to help generate momentum behind our approach in the HPC community. The proto-applications will serve as a proof-of-concept, a benchmark for doing machine/software co-design, and as a basis for constructing future exascale full applications. In addition, the use of the SIB is a means to extract the commonalities of a range of HPC problems from different scientific domains and different industrial sectors to be able to concentrate on maximising the impact of the project by improving precisely those parts that are common across different simulation needs.

Alpines role: in charge of the Task "Preconditioners" in the working group focusing on numerical algorithms.

8.3. International Initiatives

8.3.1. Inria Associate Teams

8.3.1.1. COALA Inria associated team, Alpines and UC Berkeley

COALA associated team https://who.rocq.inria.fr/Laura.Grigori/COALA2010/coala.html focuses on communication optimal algorithms for linear algebra. We have a long term collaboration with Prof. J. Demmel, which focuses currently on communication avoiding algorithms. Since 2010, this collaboration takes place in the context of COALA Inria Associated team, and every year students visit our groups in both directions.

8.3.2. Inria International Partners

8.3.2.1. Informal International Partners

A collaboration focused on the theoretical and numerical analysis for the simulation of wave scattering by means of boundary integral formulation has been in place for several years between Xavier Claeys and the group of Ralf Hiptmair from the Seminar of Applied Mathematics at ETH Zürich.

8.3.3. Inria International Labs

Joint Laboratory for Petascale Computing, JLPC Etats-Unis. We take part in this joint effort, in the numerical libraries aspects of the joint laboratory. We collaborate and interact in particular with B. Gropp, UIUC, and J. Brown and M. Knepley, Argonne.

8.4. International Research Visitors

8.4.1. Visits of International Scientists

- Euan Spence from the University of Bath visited Xavier Claeys for one week to discuss about his work on high frequency wave scatering, and to see wether this work could apply to the formulations developed by Xavier Claeys.
- Grey Ballard from U.C. Berkeley, USA, visit of 2 weeks in January 2013. In the context of COALA Inria associated team, Grey has visited us to finalize our joint work on the publication [6].

8.4.1.1. Internships

- Sebastien Cayrols, Master 2 student Paris 11 University, March - August 2013, supervisor L. Grigori. Sebastien worked on communication avoiding ILU0 preconditioner.
- Antoine Liandrat, Ecole Centrale Lyon 2nd year, June-July 2013, supervisor L. Grigori. Antoine has worked in the context of Petalh project.
- Clement Guerin, ENS Lyon, L3 student, Mai-Juin 2013, supervisor L. Grigori. Clement's objective was to understand some of the numerical problems in communication avoiding algorithms.

8.4.2. Visits to International Teams

- L. Grigori, visit to U.C. Berkeley for 1 month (August 2013) in the context of COALA Inria associated team.

ANGE Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

8.1.1. Instabilities in Hydrodynamics (2011–2015)

Participant: Nicolas Seguin.

The Emergence project (Ville de Paris and FSMP) "Instabilities in Hydrodynamics" is related to theoretical, applied, and numerical mathematics for the study of hydrodynamical turbulence phenomena. The postdoc of Aude Bernard-Champmartin is held within this project.

8.1.2. Plasticity of geophysical flows and seismic emissions (2013–2016)

Participant: Anne Mangeney.

This project is funded by Sorbonne Paris Cité (80.000 euros) and is a collaboration between IPGP and Univ. Paris 13.

8.2. National Initiatives

8.2.1. GdR EGRIN (2013–2017)

Participant: Jacques Sainte-Marie.

EGRIN stands for Gravity-driven flows and natural hazards. J. Sainte-Marie is the head of the scientific committee of this CNRS research group. As such, J. Sainte-Marie participated to the consortium of the prospective think tank "Mathematics and the complexity of the system Earth" launched by the French agency for research in the framework of the UNESCO year "Mathematics of Planet Earth".

8.2.2. Inria Project Lab "Algae in Silico"

Participants: Anne-Céline Boulanger, Marie-Odile Bristeau, Raouf Hamouda, Jacques Sainte-Marie.

The team is involved in the GreenStars project ("Investissement d'avenir") which is a collaboration between academic institutions (INRA, Inria, Univ. Pierre et Marie Curie Paris 6, ...) and the industrial world. [2] The main purpose of GreenStars is to lay the foundations for the entire sector, from energy generation to waste recycling and production of compounds of interest. GreenStars also plans to play a long-term role in this field by training technicians, engineers and researchers. In order to structure and support the contributions of Inria in this domain, an Inria Project Lab called "Algae in Silico" has been funded.

The PhD thesis of A.-C. Boulanger was a part of this project. Likewise, the ADT In@lgae was launched in this framework in collaboration with the BIOCORE Inria project-team and enabled the recruitment of R. Hamouda as a young engineer.

8.2.3. ANR LANDQUAKE (2012–2016)

Participant: Anne Mangeney.

Within the ANR domain "Mathematics and Interfaces", this ANR project (between Univ. Paris-Est – LAMA, Univ. Denis Diderot Paris 7 – IPGP, Univ. Nantes – LPGN, Univ. Strasbourg EOST, 180.000 euros) deals with the mathematical and numerical modelling of landslides and generated seismic waves.

[2] among which are: Air Liquide, ACRI, Alfa Laval, Algaestream, Algenics, Algu'Innov, Bioalgostral, EADS, Eco-Solution, Envolure, Fermentalg, Greensea, IDEE Aquaculture, La Compagnie du Vent-GDF Suez, Microphyt, Naskeo Environnement, Ondalys, Peugeot Citroën Automobiles, Rhodia, Roquette, Sofiprotéol, Soliance, Solvay, Suez Environnement, TIA, TOTAL, Véolia Environnement.

8.2.4. LRC Manon (2010–2014)

Participants: Edwige Godlewski, Yohan Penel, Nicolas Seguin.

CEA and Laboratory Jacques-Louis Lions launched a collaboration 4 years ago. Studies are carried out about compressible two-phase flows and model coupling, for instance in the case of an asymptotic hierarchy of models.

8.2.5. Structure Health Monitoring

Participant: Nicolas Seguin.

This collaboration with the Ifsttar also comprises Inria researchers from the I4S team. The goal is to provide efficient numerical tools to take into account the impact of the flows around the structures. The most challenging part of this project concerns the off-shore wind turbines and the understanding of the ice formation on the structure.

8.2.6. ANR project HJnet (2013–2015)

Participant: Edwige Godlewski.

This research project consists in studying Hamilton-Jacobi equations on networks, and more generally on heterogeneous structures. This theoretical problem has several potential applications, in particular to traffic flow theory.

8.2.7. Hydraulics for environment and sustainable development (HED^2)

The scienfitic group (GIS in French), to which Inria is a partner, brings together scientists and engineers involved in hydraulics, risk management and sustainable development. ANGE belongs to this group. On the one hand, the team can be provided with experimental measurements (erosion, long waves, fluid structure interactions,...) thanks to this collaboration; on the other hand, the GIS can favor the transfer of numerical tools and scientific results.

8.3. European Initiatives

8.3.1. ERC Consolidator Grant (2013–2018)

Participant: Anne Mangeney.

The project SLIDEQUAKES about detection and understanding of landslides by observing and modelling gravitational flows and generated earthquakes has been funded by the European Research Council (2.000.000 euros).

8.4. International Initiatives

8.4.1. Informal International Partners

The team has developed strong relations with researchers from spanish universities, in particular with Carlos Pares (Malaga), Enrique Fernandez-Nieto and Tomas Chacon Rebollo (Sevilla). They have an expertise in complex flows, including variable density flows, erosion, non-hydrostatic effects, ...

8.5. International Research Visitors

Enrique Fernandez-Nieto and Gladys Narbona-Reina (Univ. Sevilla) were hosted for 1 month by A. Mangeney's team at IPGP.

AOSTE Project-Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

8.1.1. CIM PACA Design Platform

Participants: Robert de Simone, Ameni Khecharem, Carlos Gomez Cardenas, Emilien Kofman.

This ambitious regional initiative is intended to foster collaborations between local PACA industry and academia partners on the topics of microelectronic design, though mutualization of equipments, resources and R&D concerns. We are active in the Design Platform (one of three platforms), of which Inria is a founding member. This provides opportunities for interactions with local companies, leading indirectly to more formal collaborations at times. Phase 3 of the CIM PACA programme should be launched in 2014, and was subject of extensible preparation at the end of 2013.

The ANR HOPE project 8.2.1.2 is conducted under the auspices of the CIM PACA Design Platform, which also hosts prototype and commercial software products contributed by project members (Synopsys, Docea Power, and Magillem, see 8.2.1.2). Similarly, the CLISTINE FUI project was recently accepted, and supported by the platform.

8.2. National Initiatives

8.2.1. ANR

8.2.1.1. HeLP

Participants: Carlos Gomez Cardenas, Ameni Khecharem, Robert de Simone, Jean-Vivien Millo.

The ANR HeLP project dealt with joint modeling of functional behavior and energy consumption for the design of low-power heterogeneous SoCs. Partners were ST Microelectronics and Docea Power (SME) as industrial; Inria, UNS (UMR LEAT), and VERIMAG (coordinator) as academics. Our goal in this project was twofold: first, combine SoC modeling with temporal behavior and logical time with energy/power modeling as extra annotations on MARTE models; second, link the modeling abilities of MARTE with those of the domain-specific standard IP-XACT.

The project ended in April 2013, with some of its findings taken up and extended in the more recent ANR project HOPE.

8.2.1.2. HOPE

Participants: Carlos Gomez Cardenas, Ameni Khecharem, Emilien Kofman, Robert de Simone.

The ANR HOPE project focuses on hierarchical aspects for the high-level modeling and early estimation of power management techniques, with potential synthesis in the end if feasible.
The PhD defense of Carlos Gomez Cardenas was held in Dec 2013 [16], in strong connection with the project (as a follow-up of HeLP).
Although this project was officially started in November, it was in part postponed due to the replacement of a major partner (Texas Instruments) by another one (Intel). Current partners are CNRS/UNS UMR LEAT, Intel, Synopsys, Docea Power, Magillem, and ourselves.

8.2.1.3. GeMoC

Participants: Matias Vara Larsen, Julien Deantoni, Frédéric Mallet.

This project is admistratively handled by CNRS for our joint team, on the UMR I3S side. Partners are Inria (Triskell EPI), ENSTA-Bretagne, IRIT, Obeo, Thales TRT.

The project focuses on the modeling of heterogeneous systems using Models of Computation and Communication for embedded and real-time systems, described using generic means of MDE techniques (and in our case the MARTE profile, and most specifically its Time Model, which allows to specify precise timely constraints for operational semantic definition).

8.2.2. FUI

8.2.2.1. FUI P

Participants: Abderraouf Benyahia, Dumitru Potop Butucaru, Yves Sorel.

The goal of project P is to support the model-driven engineering of high-integrity embedded real-time systems by providing an open code generation framework able to verify the semantic consistency of systems described using safe subsets of heterogeneous modeling languages, then to generate optimized source code for multiple programming (Ada, C/C++) and synthesis (VHDL, SystemC) languages, and finally to support a multi-domain (avionics, space, and automotive) certification process by providing open qualification material. Modeling languages range from behavioural to architectural languages and present a synchronous and asynchronous semantics (Simulink/Matlab, Scicos, Xcos, SysML, MARTE, UML),
See also: http://www.open-do.org/projects/p/
Partners of the project are: industrial partners (Airbus, Astrium, Continental, Rockwell Collins, Safran, Thales), SMEs (AdaCore, Altair, Scilab Enterprise, STI), service companies (ACG, Aboard Engineering, Atos Origins) and research centers (CNRS, ENPC, Inria, ONERA).

8.2.2.2. FUI PARSEC

Participants: Dumitru Potop Butucaru, Thomas Carle, Zhen Zhang, Yves Sorel.

The PARSEC Project aims at providing development tools for critical real-time distributed systems requiring certification according to the most stringent standards such as DO-178B (avionics), IEC 61508 (transportation) or Common Criteria for Information Technology Security Evaluation. The approach proposed by PARSEC provides an integrated toolset that helps software engineers to meet the requirements associated to the certification of critical embedded software. Partners of the project are: Alstom, Thales, Ellidiss, OpenWide, Systerel, CEA, InriaS, Telecom ParisTech.
See also: http://www.systematic-paris-region.org/sites/default/files/exports/projets/fichiers/ProjetPARSEC_BookSystematic2012.pdf.

8.2.2.3. FUI CLISTINE

Participants: Robert de Simone, Amin Oueslati, Emilien Kofman.

This contract has just been accepted, with a kick-off meeting in Dec 2013. Partners are SynergieCAD (coordinator), Avantis, Optis, and the two EPIs Aoste and Nachos. The goal is to study the feasibility of building a low-cost, low-power "supercomputer", reusing ideas from SoC design, but this time with out-of-chip network "on-board", and out-of-the-shelf processor elements organized as an array. The network itself should be time predictable and highly parallel (far more than PCI-e for instance).

8.2.3. Investissements d'Avenir

8.2.3.1. DEPARTS

Participants: Liliana Cucu-Grosjean, Adriana Gogonel, Codé Lo, Cristian Maxim.

This project is funded by the BGLE Call (*Briques Logicielles pour le Logiciel Embarqué* of the national support programme *Investissements d'Avenir*. Formally started on October 1st, 2012, but the kick-off meeting was only held on April, 2013 for administrative reasons. Initially this contract was handled by the TRIO team in Nancy, but at this end of TRIO moved to Aoste Rocquencourt with the people involved. Research will target solutions for probabilistic component-based models, and a Ph.D. thesis will start early 2014 on this topic. The goal is to allow designers to unify in a common framework probabilistic scheduling techniques with compositional assume/guarantee contracts that have different levels of criticality. Our contribution is based on the schedulability analysis presented in [39].

8.3. European Initiatives

8.3.1. FP7 Projects

8.3.1.1. PROXIMA

Participants: Liliana Cucu-Grosjean, Adriana Gogonel, Codé Lo, Cristian Maxim.

Type: COOPERATION
Defi: Mixed-Criticality Systems
Instrument: Integrated Project
Objectif: Development of probabilistic approaches for mixed-criticality systems on multi-core and many-core platforms
Duration: October 2013 - September 2016
Coordinator: Barcelona Supercomputing Center (Spain)
Inria contact: Liliana Cucu-Grosjean PROXIMA started on October 1st, 2013 with a kick-off meeting in November 2013.

The project claims that probabilistic analysis techniques can provide efficient (tractable) and effective (tight) analysis of the temporal behaviour of complex mixed-criticality applications, while running on novel multicore and manycore platforms. Solid research results from the former FP7 STREP PROARTIS project sustain this claim. The concept is based on using probabilistic analysis techniques to derive safe and tight bounds on the temporal behaviour of applications,. Such bounds should reflect requirements on failure rates commensurate with their criticality.
PROXIMA defines architectural paradigms that break causal dependence in the timing behaviour of execution components at hardware and software level that can give rise to pathological cases. The risk is then reduced to quantifiably small levels. The changes needed in the hardware and software components beneath the application (processing cores, interconnects, memory hierarchies and controllers, real-time operating system, middleware, compilers) remain modest.

8.3.2. Collaborations in European Programs, except FP7

8.3.2.1. ARTEMIS PRESTO

Participants: Frédéric Mallet, Arda Goknil, Julien Deantoni, Marie-Agnès Peraldi Frati, Robert de Simone, Jean-Vivien Millo.

Type: ARTEMIS
Project title: PRESTO
Duration: April 2011 - March 2014
Coordinator: Miltech (Greece)
Others partners: TELETEL S.A. (Greece), THALES Communications (France), Rapita Systems Ltd. (United Kingdom), VTT (Finland), Softeam (France), THALES (Italy), MetaCase (Finland), Inria (France), University of LâAquila (Italy), MILTECH HELLAS S.A (Greece), PragmaDev (France), Prismtech (United Kingdom), Sarokal Solutions (Finland).
See also: http://www.cesarproject.eu/
Abstract: The PRESTO project aims at improving test-based embedded systems development and validation, while considering the constraints of industrial development processes. This project is based on the integration of test traces exploitation, along with platform models and design space exploration techniques. Such traces are obtained by execution of test patterns, during the software integration design phase, meant to validate system requirements. The expected result of the project is to establish functional and performance analysis and platform optimisation at early stage of the design development. The approach of PRESTO is to model the software/hardware allocation, by the use of modelling frameworks, such as the UML profile for model-driven development of Real Time and Embedded Systems (MARTE). The analysis tools, among them timing analysis including Worst Case Execution Time (WCET) analysis, scheduling analysis and possibly more abstract system-level timing analysis techniques will receive as inputs on the one hand information from the performance modelling of the HW/SW-platform, and on the other hand behavioural information of the software design from tests results of the integration test execution.

8.4. International Initiatives

8.4.1. Inria Associate Teams

8.4.1.1. DAESD

Title: Distributed/Asynchronous and Embedded/synchronous Systems Development

Inria principal investigator: Robert de Simone (Aoste) / Eric Madelaine (Oasis)

International Partner (Institution - Laboratory - Researcher):

East China Normal University (China) - SEI-Shone - Robert De Simone

Duration: 2012 - 2014

See also: https://team.inria.fr/DAESD/

The development of concurrent and parallel systems has traditionally been clearly split in two different families: distributed and asynchronous systems on one hand, now growing very fast with the recent progress of the Internet towards large scale services and clouds; embedded, reactive, or hybrid systems on the other hand, mostly of synchronous behaviour. The frontier between these families has attracted less attention, but recent trends, e.g. in industrial systems, in Cyber-Physical systems (CPS), or in the emerging Internet of Things, give a new importance to research combining them.
The aim of the DAESD associate team is to combine the expertise of the Oasis and Aoste teams at Inria, the SEI-Shone team at ECNU-Shanghai, and to build models, methods, and prototype software tools inheriting from synchronous and asynchronous models. We plan to address modelling formalisms and tools, for this combined model; to establish a method to analyze temporal and spatial consistency of embedded distributed real-time systems; to develop scheduling strategies for multiple tasks in embedded and distributed systems with mixed constraints.
A dedicated Spring School was organized this year in Shanghai (April 27-30th), with participation of Robert de Simone and Frédéric Mallet from Aoste.

8.4.2. Inria International Labs

8.4.2.1. LIAMA

The DAESD associated-team goals have been extended to a LIAMA project named HADES (Heterogeneous Asynchronous Distributed / Embedded Synchronous), again with the SEI-Shone lab of ECNU Shanghai. The kick-off meeting was held next to the thematic Spring School (see 8.4.1.1), in presence of Chinese and French officials.

8.5. International Research Visitors

8.5.1. Visits of International Scientists

8.5.1.1. Internships

Franco Pestarini

Subject: Threads scheduling on multicore processors

Date: from Feb 2013 until Jul 2013

Institution: Universidad National de Rosario (Argentina)

ARAMIS Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR

8.1.1.1. ANR HM-TC

Participants: Olivier Colliot [Correspondant], Marie Chupin, Didier Dormont, Denis Schwartz, Dominique Hasboun, Linda Marrakchi-Kacem, Yohan Attal, Claire Cury.

Project acronym: HM-TC

Project title: Model of the hippocampo-cortical connectivity in "temporal consciousness" in normal and pathological memory derived from multimodal anatomical and functional brain imaging (aMRI, DT-MRI, MEG, fMRI)

Duration: Nov 2009- Nov 2014

Amount: 2M€

Coordinator: Olivier Colliot (ARAMIS) and Gianfranco Dalla Barba

Other partners: CENIR, ENS Cachan, Neurospin, Grenoble Institut des Neurosciences

Abstract: The aim of this project is to evaluate the role of the medial temporal lobe and its connections with various cortical regions in temporal consciousness related tasks and to derive a neuro-computational model of memory processing from multimodal imaging data. Temporal consciousness is defined as the ability to specify one's own time-location with respect to past, present and future, and is thus a more general framework than episodic memory. Based on an original cognitive model and relying on memory dysfunctions called confabulations, different groups of participants (controls, patients with Alzheimer's disease, patients with several memory disorders) will be evaluated through behavioural tests, MEG, anatomical, functional and diffusion-tensor MRI. New signal and image processing methods will be developed for all these modalities, in order to describe in a more robust and precise way both the anatomy and the function of the medial temporal lobe. First, using in vivo ultra high field MRI acquisitions (7 Tesla), we will build a precise anatomical atlas of the hippocampus and its inner structure. This model will allow designing efficient MEG source reconstruction in these regions, and new methods to analyse anatomical and functional connectivity. Using the most recent mathematical achievements in the theory of diffeomorphic deformations, we will propose new registration and morphometry methods in order to analyze very precisely the structural alterations of the medial temporal lobe. These new methods will be applied to the neuroimaging data acquired for the project in order to analyse extensively the relationships between memory disorders and structural and functional brain alterations revealed by neuroimaging.

8.1.2. IHU

Participants: Olivier Colliot, Mario Chavez, Stanley Durrleman, Marie Chupin, Didier Dormont, Dominique Hasboun, Damien Galanaud, Fabrizio de Vico Fallani.

Project acronym: IHU-A-ICM

Project title: Institute of Translational Neuroscience

Founded in 2011

General Director: Bertrand Fontaine

The IHU-A-ICM program was selected, in 2011, in a highly competitive national call for projects. A 10-year, 55M€ program, has been implemented by a recently created foundation for scientific cooperation. Based on the clinical and scientific strenghts of the ICM and the hospital Department of Nervous System Diseases, it mainly supports neuroscience research, but is also invested in improving care and teaching. ARAMIS is strongly involved in the IHU-A-ICM project, in particular in WP6 (neuroimaging and electrophysiology), WP7 (biostatistics), WP2 (Alzheimer) and WP5 (epilepsy). We have started collaborations with the new bioinformatics/biostatistics platform (IHU WP7, head: Ivan Moszer), in particular through a joint project on the integration of imaging and genomics data.

8.1.3. CATI (Alzheimer Plan)

Participants: Olivier Colliot [Correspondant], Marie Chupin [Correspondant], Stanley Durrleman, Didier Dormont, Chabha Azouani, Ali Bouyahia, Johanne Germain, Xavier Badé, Hugo Dary, Ludovic Fillon, Takoua Kaaouana, Alexandre Routier, Sophie Lecomte.

Project acronym: CATI

Project title: Centre d'Acquisition et de Traitement des Images

Founded in 2011

Amount: 9M€

Coordinator: Jean-François Mangin

Other partners: Neurospin, CENIR, Inserm U678, IM2A

Abstract: The CATI project (funded by the National Alzheimer Plan for 9M€, 2.1M€ for ARAMIS) aims at creating a national platform for multicenter neuroimaging studies. CATI aims to be a national resource for the scientific, medical and industrial research community and will provide a wide range of services: access to a national acquisition network, standardization of acquisitions, image quality control, image analysis, databasing/archiving, meta-analyses. Through CATI, our team coordinates a large network composed of over 30 image acquisition centers. CATI already supports over 15 multicenter projects including the national cohort MEMENTO (2300 subjects). CATI is integrated with France Life Imaging (PI: F. Lethimonnier) and the Neugrid for you (N4U, PI: G. Frisoni) network.

8.1.4. Institut Carnot

Participant: Mario Chavez [Correspondant].

ARAMIS is supported by the "Programme de Maturation Carnot" for the following projects:

Etude des interactions cortex-respiration. (Coordinators: P. Pouget and M. Chavez)

Evaluating anesthetic depth using electroencephalographical recording in human and non-human primates. (Coordinators: P. Pouget and M. Chavez)

8.1.5. Other National Programs

Participants: Olivier Colliot, Marie Chupin, Stanley Durrleman, Didier Dormont, Damien Galanaud.

ARAMIS is a partner of the following national projects :

- PHRC (Programme Hospitalier de Recherche Clinique) PredictPGRN, co-funding by Alzheimer Plan, *Caractérisation multimodale prospective de la démence frontotemporale dûe à des mutations du gène PGRN à un stade symptomatique et présymptomatique*. (Coordinator : A. Brice)
- PHRC (Programme Hospitalier de Recherche Clinique) ImaBio3, co-funding by Roche (pharmaceutical industry), *Rôle des réactions cellulaires sanguines, inflammatoires et immunitaires anti-amyloïde centrales et périphériques dans la maladie d'Alzheimer débutante*. (Coordinator : M. Sarazin)
- PHRC (Programme Hospitalier de Recherche Clinique) CAPP, *Caractérisation linguistique, anatomique/métabolique et biologique des différentes formes d'aphasie primaire progressive : vers le rationnel pour des essais pharmacologiques et des rééducations du langage ciblées*. (Coordinator: M. Teichmann)

8.2. European Initiatives

8.2.1. FP7 Projects

Participants: Stefan Thurner, Vito Latora, Albert Diaz-Guilera, Maxi San Miguel, Cecilia Mascolo, Mirco Murolesi, Mario Chavez [Correspondant].

Project acronym: LASAGNE

Project title: multi-LAyer SpAtiotemporal Generalized NEtworks

Founded in 2012

Amount: 1.6M€

Coordinator: Stefan Thurner

Other partners: Medical University of Vienna, Queen Mary University of London, Universitat de Barcelona, Universitat de les Illes Balears,University of Cambridge, University of Birmingham.

Abstract: The aim of the LASAGNE project is to provide a novel and coherent theoretical framework for analysing and modelling dynamic and multi-layer networks in terms of multi-graphs embedded in space and time. To do this, we will treat time, space and the nature of interactions not as additional dimensions of the problem, but as natural, inherent components of the very same generalised network description. The theory will be validated on real-world applications involving large and heterogeneous data sets of brain networks, on- and off-line social systems, healthcare systems, and transportation flows in cities. The LASAGNE project will provide new quantitative opportunities in different fields, ranging from the prediction of pathologies to the diffusion of ideas and trends in societies, and for the management of socio-technological systems.

8.3. International Initiatives

8.3.1. Informal International Partners

S. Durrleman has an enduring collaboration with the Scientific Computing and Imaging (SCI) Institute at the University of Utah (USA). He is consultant for NIH Grant "4D shape analysis for modeling spatiotemporal change trajectories in Huntington's Disease "predict-HD". He is part of the PhD committees of J. Fishbaugh and A. Sharma supervised by professor Guido Gerig.

M. Chupin and O. Colliot have an enduring collaboration with the Center for Magnetic Resonance Research, University of Minnesota, USA (P-F Van de Moortele, T. Henry, M. Marjanska, K. Ugurbil) a leading center in 7T MRI.

D. Galanaud has an enduring collaboration with the Massachusetts General Hospital, Harvard University, USA (R. Gupta).

M. Chavez has enduring collaborations with the Center for Applied Medical Research, Pampelune, Spain (M. Valencia), the Departement of Physics, Queen Mary University of London, UK (V. Latora) and the Anatomical Neuropharmacology Unit, University of Oxford, UK (J. Mena-Segovia).

8.4. International Research Visitors

8.4.1. Visits of International Scientists

In September 2013, the team welcome James Fishbaugh, as part of its training as PhD candidate at the University of Utah under the supervision of professor Guido Gerig.

ARLES Project-Team

7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. ANR

7.1.1.1. ANR MURPHY

Participant: Animesh Pathak [correspondent].

- **Name:** MURPHY – *Dependability-focused Evaluation of Sensor Networks*
- **URL:** http://cedric.cnam.fr/~sailhanf/murphy/
- **Related activities:** § 6.5
- **Period:** [January 2011 – September 2014]
- **Partners:** CNAM (**Coordinator**), Inria ARLES, LAAS - CNRS, SmartGrains, Univ. Valenciennes.

Murphy aims at easing the development of dependable and pervasive applications built on top of robust wireless sensor networks, thus providing a mean for early detection of possible failures, by estimating dependability metrics. This endeavor is undertaken by providing:

- Fault detection based on in-network event processing;
- Fault injection that attempts to accelerate the occurrence of faults so as to judge the quality of the error handling and hence, facilitate the evaluation of dependability;
- Advanced code dissemination across sensor networks, which is intended to enable the dynamic and distributed insertion of faults and hide from the end user the complexity related to this task; and
- Suitable abstractions to reason on faults, wireless sensor networks, data-centric and event-driven applications.

The aforementioned components enable to detect faults, diagnose possible causes and select appropriate corrective actions, and therefore to consolidate the dependability of sensor applications.

7.1.2. Inria Support

7.1.2.1. Inria ADT iConnect

Participant: Valérie Issarny [correspondent].

- **Name:** iConnect – *Emergent Middleware Enablers*
- **Related activities:** § 6.2 and 6.3
- **Period:** [October 2013 – September 2015]
- **Partners:** Inria ARLES.

The pervasive computing vision is hampered by the extreme level of heterogeneity in the underlying infrastructure, which impacts on the ability to seamlessly interoperate. Further, the fast pace at which technology evolves at all abstraction layers increasingly challenges the lifetime of networked systems in the digital environment.

Overcoming the interoperability challenge in pervasive computing systems has been at the heart of the FP7 FET IP CONNECT project (http://www.connect-forever.eu/), which ran from 2009 to 2012, and was coordinated by Inria ARLES. Specifically, CONNECT has been investigating the paradigm of *Emergent middleware*, where protocol mediators are dynamically synthesized so as to allow networked systems that provide complementary functionalities to successfully coordinate. The CONNECT project has in particular delivered prototype implementation of key enablers for emergent middleware, spanning discovery, protocol learning, and mediator synthesis and deployment. Further, while CONNECT focused on learning and reconciling interaction protocols at the application layer, the FP7 project CHOReOS (http://www.choreos.eu) to which ARLES contributed as well, investigated a complementary enabler that supports interoperability across systems implementing heterogeneous interaction paradigms (i.e., client-service, event-based and shared memory). The proposed enabler introduces the concept of XSB - eXtensible Service Bus, which revisits the notion of Enterprise Service Bus and features an end-to-end interaction protocol that preserves the interaction paradigms of the individual components, while still allowing interoperability.

The objective of the Inria iConnect ADT is to leverage and integrate the above complementary results, packaging and further enhancing enabler prototypes, for take-up of the results by the relevant open source community. The work will involve development effort focused on the following core enablers:

- Universal discovery of resources composing legacy discovery protocols,
- Dynamic synthesis and deployment of mediators specified as enhanced labelled transition systems,
- XSB as underlying run-time support for mediators so as to support interoperability across systems based on heterogeneous interaction paradigms,
- Experiment in the area of federated social networking.

We intend to release the software prototypes through the newly created OW2 open source initiative FISSi (Future Internet Software and Services initiative – http://www.ow2.org/view/Future_Internet/) as our solutions are of direct relevance to sustaining interoperability in the future Internet.

7.1.2.2. Inria ADT Yarta

Participant: Animesh Pathak [correspondent].

- **Name:** Yarta – *Middleware for mobile social ecosystems*
- **Period:** [October 2012 – September 2014]
- **Partners:** Inria ARLES.

Yarta is a middleware for managing mobile social ecosystems, which builds upon existing research in context-awareness in the pervasive computing domain. The work involves development effort in the multi-layer middleware architecture of Yarta, providing the needed functionalities, including: (*i*) Storage of social data in an interoperable format, using semantic technologies such as RDF; (*ii*) Extraction of social ties from context (both physical and virtual); (*iii*) Enforcement of access control to protect social data from arbitrary access; and (*iv*) A rich set of mobile social ecosystem (MSE) management functionalities, using which mobile social applications can be developed. Specifically, the ADT supports the public open source release and evolution of the Yarta middleware, which is currently a research prototype.

7.2. European Initiatives

7.2.1. FP7 Projects

7.2.1.1. FP7 ICT IP CHOReOS

Participants: Nikolaos Georgantas [correspondent], Valérie Issarny [correspondent].

Name: CHOReOS – *Large Scale Choreographies for the Future Internet*

URL: http://www.choreos.eu/

Type: COOPERATION (ICT)

Defi: Internet of Services, Software & Virtualisation

Instrument: Integrated Project (IP)

Related activities: § 6.3

Period: [October 2010 - September 2013]

Partners: NoMagic Europe (Lithuania), CEFRIEL (Italy), CNR (Italy), Linagora (France), Inria ARLES [**scientific leader**], MLS Multimedia A.E. (Greece), OW2 Consortium, Thales Communications S.A. (France) [**coordinator**], The City University, London (UK), Università degli Studi dell'Aquila (Italy), Universidade de São Paulo (Brazil), University of Ioannina (Greece), SSII VIA (Latvia), Virtual Trip Ltd. (Greece), Wind Telecommunicazioni S.p.A (Italy).

CHOReOS aims at assisting the engineering of software service composition in the revolutionary networking environment created by the Future Internet. Indeed, sustaining service composition and moving it closer to the end users in the Future Internet is a prime requirement to ensure that the wealth of networked services will get appropriately leveraged and reused. This stresses the required move from static to dynamic development, effectively calling for adequate support for service reuse; much like software reuse has been a central concern in software engineering over the last two decades. This is why CHOReOS adopts the Service Oriented Computing (SOC) paradigm, where networked resources are abstracted as services so as to ease their discovery, access and composition, and thus reuse. However, although latest advances in the SOC domain enable facing (at least partly) the requirements of today's Internet and related networking capabilities, engineering service compositions in the light of the Future Internet challenges — in particular the ultra large scale (ULS) on all imaginable dimensions as well as the evolution of the development process from a mostly static process to a dynamic user-centric one — is far from adequately addressed. Therefore, the CHOReOS goal is to address these challenges by devising a dynamic development process, and associated methods, tools and middleware, to sustain the composition of services in the Future Internet.

7.2.1.2. FP7 ICT NoE NESSoS

Participants: Valérie Issarny [correspondent], Animesh Pathak [correspondent].

Name: NESSoS – *Network of Excellence on Engineering Secure Future Internet Software Services and Systems*

URL: http://www.nessos-project.eu

Type: COOPERATION (ICT)

Defi: Trustworthy ICT

Instrument: Network of Excellence (NoE)

Related activities: § 6

Period: [October 2010 - March 2014]

Partners: Atos Origin (Spain), CNR (Italy) [**coordinator**], ETH Zürich (Switzerland), IMDEA Software (Spain), Inria (EPIs ARLES, CASSIS, and TRISKELL), KU Leuven (Belgium), LMU München (Germany), Siemens AG (Germany), SINTEF (Norway), University Duisburg-Essen (Germany), Universidad de Malaga (Spain), Università degli studi di Trento (Italy).

The Network of Excellence NESSoS on "Engineering Secure Future Internet Software Services and Systems" aims at constituting and integrating a long lasting research community on engineering secure software-based services and systems. The NESSoS engineering of secure software services is based on the principle of addressing security concerns from the very beginning in system analysis and design, thus contributing to reduce the amount of system and service vulnerabilities and enabling the systematic treatment of security needs through the engineering process. In light of the unique security requirements exposed by the Future Internet, new results are achieved by means of an integrated research, as to improve the necessary assurance level and to address risk and cost during the software development cycle in order to prioritize and manage investments.

7.2.1.3. FP7 ICT CA EternalS

Participant: Valérie Issarny [correspondent].

Name: EternalS – *Trustworthy Eternal Systems via Evolving Software, Data and Knowledge*

URL: http://www.eternals.eu

Type: CAPACITIES (ICT)

Defi: FET - Proactive

Instrument: Coordination and Support Action (CSA)

Related activities: § 6.2

Period: [March 2010 - February 2013]

Partners: Inria (CRI Paris-Rocquencourt), KU Leuven (Belgium), Queen Mary University (UK), University of Chalmers (Sweden), University of Trento (Italy) [**coordinator**], Waterford Institute of Technology (Ireland).

Latest research work within ICT has allowed to pinpoint the most important and urgently required features that future systems should possess to meet users' needs. Accordingly, methods making systems capable of adapting to changes in user requirements and application domains have been pointed out as key research areas. Adaptation and evolution depend on several dimensions, e.g., time, location, and security conditions, expressing the diversity of the context in which systems operate. A design based on an effective management of these dimensions constitutes a remarkable step toward the realization of Trustworthy Eternal Systems. The EternalS Coordination Action (CA) specifically aims at coordinating research in that area based on a researcher Task Force together with community building activities, where the organization of large workshops and conferences is just one of the tools that are used to conduct a successful CA.

7.2.1.4. FP7 PEOPLE Requirements@run.time

Participant: Nelly Bencomo [correspondent].

Name: Requirements@run.time – *Requirements-aware systems*

URL: https://www-roc.inria.fr/arles/index.php/members/220-marie-curie-project-requirements-aware-systems-requirementsruntime

Type: PEOPLE

Instrument: Marie Curie Intra-European Fellowships for Career Development (IEF)

Related activities: § 6.7

Period: [May 2011 - May 2013]

Partners: Inria ARLES.

This project uses the novel notion of requirements reflection, that is, the ability of a system to dynamically observe and reason about its requirements. It aims to address the need of having systems requirements-aware by reifying requirements as run-time objects (i.e., requirements@run.time). These systems provide a runtime model of their requirements that allow them to reason, evaluate and report on their conformance to their requirements during execution. This project contributes towards development of conceptual foundations, engineering techniques, and computing infrastructure for the systematic development of dynamically-adaptive systems based on the principle of requirements reflection.

7.2.2. Collaborations in European Programs, except FP7

7.2.2.1. EIT ICT Labs TravelDashboard

Participant: Animesh Pathak [correspondent].

Name: TravelDashboard – *Personalized Mobility to Urban Travelers*

URL: https://www.rocq.inria.fr/arles/traveldashboard/

Period: [January 2013 - December 2013]

Partners: Alcatel/Lucent (Ir and Be), Ambientic (F), Inria (CRI Paris-Rocquencourt), Systḿeatic (F), Thales [**coordinator**], Transport for London (UK), UC London (UK).

With over 70% of the world's entire population expected to be living in cities by 2050, supporting citizens' mobility within the urban environment is a priority for municipalities worldwide. Although public multi-modal transit systems, coupled with integrated fare management and road user charging, are necessary to better manage mobility, they are not sufficient. Citizens must be offered personalized travel information, where and when such information is needed to take decisions that will make their journeys more efficient and enjoyable. Notably, such information is not purely qualitative (e.g., bus timetable, live bus tracking), but crucially subjective (e.g., crowdedness of trains, heat of tube platforms, sociability of the coaches). The perception and value attached to this information varies substantially, not only across people (e.g., different tolerance to delays, different perception of crowdedness, different taste in the social environment), but also for the same person in different contexts (e.g., work commute, leisure trip with the family). Thanks to the increased abundance of smart phones (equipped with various types of physical sensors, as well as enabling the users to easily report phenomena), the field of mobile participatory sensing has emerged recently, and can be leveraged towards providing a more fine-grain and up-to-date view of the city's transportation system. In that direction, the TravelDashboard project works towards an open source middleware platform, enriched with personalized mobility services for urban travelers, evaluated via real-life demonstrators assessment, and accompanied by novel business models.

7.3. International Initiatives

7.3.1. Inria International Labs

Valérie Issarny acts as scientific manager of the Inria@Silicon Valley program (https://project.inria.fr/inria-siliconvalley/) for the academic year 2013-14, and is on leave at UC Berkeley since August 2013.

7.3.2. Participation in other International Programs

7.3.2.1. International scientific cooperation program Inria/Brazil – Project M@TURE

Participant: Nikolaos Georgantas [correspondent].

Name: M@TURE – *Models @ runtime for self-adaptive pervasive systems*

Instrument: Inria-Brazil cooperation programme

Period: [October 2012 - September 2014]

Partners: Institute of Informatics of Federal University of Goias (Brazil), Inria ARLES.

The overall goal of the M@TURE project is to design, implement and evaluate a novel approach and architecture - comprising conceptual foundations, engineering techniques, and supporting middleware infrastructure - for self-adaptive pervasive systems by building on the notion of Models@run.time. Models@run.time extends the applicability of models and abstractions to the runtime environment. In contrast to design-time models, runtime models are used to reason about the running system taking into account its operating environment, and thus these models enable automating runtime decisions and actions regarding the creation, configuration, and evolution of the system. We in particular focus on the following dimensions and related models: (i) Requirements models making a system requirements-aware at runtime; (ii) Application- and middleware-level interoperability models exposing to an external observer the technological and business features of a system; and (iii) End-user and system engineer models modeling the internal elements of a system at two different abstraction levels. These models are considered both independently and, more importantly, in synergy in order to introduce a comprehensive conceptual and architectural solution for self-adaptive pervasive systems.

7.4. International Research Visitors

7.4.1. Visits of International Scientists

Prof. Peter Sawyer from Lancaster University (UK), visited the ARLES team during Q1 2013, where he investigated how to leverage requirements engineering in the context of distributed software systems, with a special emphasis on the exploitation of requirements@runtime.

7.4.1.1. Internships

Aness Bajia (from Feb. 2013 until Jul. 2013)

Subject: *Fault Tolerance in Sensor Network Macroprogramming*

Institution: Faculté des sciences de Tunis (Tunisia)

Amel Belaggoun (from Jan. 2013 until Aug. 2013)

Subject: *Runtime and Representation of Requirements in Self-Adaptive Systems*

Institution: Université de Versailles Saint-Quentin-en-Yvelines (France)

Ankur Gautam (from Jan. 2013 until Feb. 2013)

Subject: *Semantic Composition of Services in the Internet of Things*

Institution: Indian Institute of Technology, Banaras Hindu University, Varanasi (India)

Yijun Liu (from Jun. 2013 until Sep. 2013)

Subject: *Smartphone-supported Indoor Location System*

Institution: Stanford University (USA)

Akash Nawani (from Jan. 2013 until Mar. 2013)

Subject: *Middleware Support for Federated Social Networking*

Institution: Indian Institute of Technology, Banaras Hindu University, Varanasi (India)

Dimitrios Soukaras (from Feb. 2013 until Apr. 2013)

Subject: *Enabling High-level Application Development in the Internet of Things*

Institution: University of Peloponnese (Greece)

AXIS Project-Team

7. Partnerships and Cooperations

7.1. Regional Initiatives

7.1.1. CPER Telius - FocusLab Platform (2010 - 2013)

Participant: Brigitte Trousse [correspondent].

This grant, funded by Regional and European support, covers several areas. AxIS is being funded through the experimental platform on the usage of information systems called Focus (and renamed FocusLab). Our goal is to support the observation and analysis of user behaviors within ICT-based experimental projects adoptng a user driven approach. Hardware, software and documentation are proposed within this platform (http://focuslab.inria.fr).

Let us cite AxIS projects which used FocusLab platform: TIC TAC, ECOFFICES, ECOFAMILIES and ELLIOT. In addition to AxIS, others Inria teams (WIMMICS,REVES,MAESTRO,PLANETE) and external organisations or teams (I3M laboratory from University of Nice Sophia Antipolis, CSTB Sophia Antipolis, the Ergonauts Association, two Elliot partners) have used elements of FocusLab.

7.1.2. Labex UCN@Sophia

Participant: Brigitte Trousse [correspondent].

Title: User-Centered Network

URL: http://www.ucnlab.eu/node/5

Instrument: Labex

Coordinator: University of Nice - Sophia Antipolis

Others partners: I3S (UNS / CNRS), LEAT (UNS / CNRS), Inria, EURECOM

Abstract: The Labex UCN@Sophia proposes a research program for researchers of the ICT Campus at Sophia Antipolis, program motivated by a vision which positions the user at the centre of the network. Five scientific and strategic directions are proposed: a) Data Centric Networking, b) Distributed and Ubiquitous Computing, c) Security, privacy and network neutrality, d) Infrastructures: Heterogeneity and Efficiency and e) Energy Efficiency. Two application domains have been selected: Homecare services for persons with reduced autonomy and Intelligent Transport Systems.

See : http://www.ucnlab.eu/

AxIS research aimed mainly several of the addressed domains and research of user-centred design and co-creation with users (cf. Sections 4.2 and 4.4).

7.1.3. ICT Usage Lab: collaboration with University of Nice Sophia Antipolis

Participants: Brigitte Trousse [correspondent], Céline Lacroix.

In 2013 we had many activities.

First ICT Usage Lab started its involvement in **EIT KIC Labs** via three funded tasks (see Sections 7.3.3 , 7.3.5 and 7.3.4). We describe the Experience & living labs facilities and services offered by EIT partners of ICT Usage Lab based on the EIT ICT Labs template elaborated by E&LL research catalyst (cf. Section 7.3.3).

This year was the occasion for Inria to collaborate for **the first time in the context of EIT KIC Labs** with researchers from **University of Nice - Sophia Antipolis**:

- **I3S laboratory** - University of Nice Sophia Antipolis: F. Baude (EIT contact) from OASIS research-team project on one KIC ICT Labs task (cf. Section 7.3.4),
- **I3M laboratory** - University of Nice Sophia Antipolis: C. Lacroix (ICT Usage lab contact), F. Debos and P. Rasse (leader) related to two KIC ICT labs Call 2013 submissions: TravelDashBoard2 leaded by Thales including Arles Inria research-team and CityCrowdSource2 leaded by Loria (Madynes Inria research team-project) following the 2013 activity we have supported (cf. Section ell).

Secondly as supporting partner of the European IDeALL project, we prepared a presentation of Ecofamilies and ELLIoT projects for a France Living Labs talk at the last IDeALL meeting (Barcelona) in January 2014.

Inria and ICT Usage Lab are official partners of the Innovative City Convention event from 2012 (Nice Côte d'Azur): http://www.innovative-city.fr/partenaires/partners/. In this context we invited three speakers: in 2012 Michael Nilsson (CDT, Lulea, Finland) and Khaldoun El Agha (ICT Labs - EIT, Paris) and in 2013 Jarmo Eskelinen (Forium Virium Helsinki, ENoLL).
Thirdly the EllIoT project via Green Services Use case (2011-2013) was rich in a lot of new assets for ICT Usage Lab (cf. Section 7.3.1):

- IoT: Constitution of a pollution IoT database from ICT Usage Lab citizen mobile and fixed sensors with around 4 millions of pollution measures,
- IoT: Interesting ideas (issued from co-creation workshops) of new smart objects (mainly for asthmatic people) and user feedback on the green watch,
- IoT: Acquisition of four types of pollution stations,
- IoT: Three improved IoT user guides of our ICT Usage Lab stations,
- IoT: A first validation of our prototype of a new low cost dust (PM10) station (with Rasburry and Arduino),
- Citizen Sensing: MyGreenServices platform (cf. Section 6.5.1),
- User production: Qualitative database based on User productions,
- User production: Usage database issued from logs of MyGreenServices portal,
- Knowledge: Improved know-how in modeling and measuring user experience of an IoT-based service based on KSB UX model and FocusLab advanced data analysis methods (cf. Section 6.5.3 ,
- Knowledge: Development of a new version (v1.3) of Focuslab server (cf. Section 6.6),
- Knowledge: Elaboration and test of two new Ideation methods (Aloha!, GenIoT).

We pursued our informal contacts with Noel Conryut from the living lab "UR.LL.TL" for Teaching and Learning (Island of the Reunion) and with the urban community CINOR related to the deployment of LL projects on this territory.

Finally various tutorials related to Focuslab hardware and software (cf. Section 6.6) have been organised and proposed to Inria members and collaborators (I3S and I3M laboratories from University of Nice Sophia Antipolis, CSTB, CHU Nice). B. Senach took contact with C. Tallec from Utilisacteur in order to plan in the future a workshop about Participative Service Design in Sophia Antipolis.

7.1.4. Collaboration Agorantic-Inria

Participants: Guillaume Pilot, Bernard Senach, Brigitte Trousse.

As the craze for culture and exhibition is increasing, museums have to deal with crowds, stronger expectations about information quality and quantity and requirements for planned personalized visits.

A collaboration began this year between ICT and HSS teams from Agorantic and Inria Sophia Antipolis, including AxIS, Maestro and Wimmics, conducting interdisciplinary ICT-HSS research. This initial collaboration resulted in setting up a ANR proposal of a project for analyzing, designing, and evaluating a recommendation system helping visitors (or groups of visitors) to follow through a museum a tailored path within an exhibition, according to their specific profile. In this ANR proposal called SyReMuse ("Système de recommandation pour la visite des musées et des expositions"), AxIS researchers were involved in the modelling of the visitors (or group of visitors)' cultural experience which will support the design and evaluation of the recommender system and in specifying recommendation computation. A preliminary study of the logs from the Web site of Grenoble Museum (France) providing recommendations according to types of user profiles (families, professionals, students, scholars and groups) has been made in order to better evaluate the research problem to be addressed.

A Inria collaborative project (named "Color") proposal for 2014 is under preparation as a first step of our collaboration.

7.1.5. Involvement in Regions

PACA Region

- B. Trousse was invited at the strategical orientation committee of the PACALABS instrument (PACA Region, Marseille, June 12th) about the evaluation of the 4 past yeras of Pacalabs and to prepare the programme of the next PACALABS
- B. Trousse for ICT Usage lab has increased contacts with University of Nice Sophia Antipolis (mainly the laboratories I3M via Céline Lacroix and Paul Rasse et I3S via Françoise Baude) disseminating the living lab approach and involving them as ICTUL partners for two KIC ICT Labs 2013 Call submissions (TraveldashBoard2, CityCrowdSource2).
- Green Services use case from the European Elliot project was deployed in Nice Côte d'Azur with several experiments
- Participation in the organisation of invited talks of the Innovative City Convention (Nice, 2012).

Midi Pyrénées Region

- AxIS (C. Detraux and D. L. Scapin) are involved in ANR-PIMI project (cf. Sections 7.2.1 and 6.4.1) where the Midi-Pyrénées region and IUT Tarbes are pilot-partners.

7.2. National Initiatives

7.2.1. ANR PIMI (2010 - 2013)

Participants: Claudia Detraux, Dominique Scapin [correspondent].

Title: PIMI

Type: ANR

Defi: Personal Information Space

Instrument: Verso 2010

Duration: 2010 - 2013

Coordinator: Genigraph

Others partners: LRI, IRIT, Institut Telecom, Montimage, The Grand Duchy of Luxembourg

Abstract: PIMI Project aims at the definition of a design environment and a deployment platform for Personal Information Management system (PIM). The future PIM must provide the end-user personal data access with services that are relevant to his needs. In order to take mobility into account, the PIM will be accessed both by mobile devices (smartphone) and personal computers.

The main contributions this year are described in Section 6.4.1 .

7.2.2. FIU FIORA (2012-2015)

Participants: Yves Lechevallier [correspondent], Thierry Despeyroux.

Program: FIU (14th call)

Project acronym: FIORA

Project title: Moteur d'inférences pour la personnalisation

Duration: 2012-2015

Coordinator: Michel Manago (SME KIOLIS)

Other partners: Editions SOLAR, Mondeca, Inria (AxIS), ISEP, UNiversity of Paris XIII

Abstract: This project aims the design and the development of FIORA an engine offering personnalised content. Personalisation will be based on context parameters related to the user and available semantic information. The main result will be to develop an engine merging case-based reasoning technics, recommandation technics based on collaborative filtering and data mining. The proof concept will be experimented in two domains: a) Nutrition and b) tourism and Health (use of the cohort Nutrinet with more than 200 users) and b) e-tourism.

This project starts at the end of 2012. See our work in Section 6.2.9 .

7.2.3. LIMOS, University of Clermont-Ferrand

A collaboration has been initiated during 2013 with the LIMOS laboratory managed by Enjelbert Mephu Nguifo and Olivier Raynaud in the context of the supervision committee of Dia Diyé 's PhD thesis on the topics security/trust, usage mining and recommender systems. B. Trousse participated in two PhD Thesis meetings: September 27 (working meeting) and October 9th (annual PhD thesis supervision committee meeting).

7.2.4. Lorraine Smart Cities Living Lab and ERPI - University of Lorraine Living

B. Trousse as President of France Living Labs and Inria representative of ICT Usage lab had various collaborations this year with the ERPI laboratory of the University of Lorraine:

- Common Work with Laurent Dupont on a template describing a living Lab;
- Workshop on Co-creation with Users at Innovative City Convention (Nice, June): Claudine Guidat and Laure Morel both Professors at ERPI lab gave a talk on the Lorraine Smart Cities Living Lab;
- Study of an interdisciplinary approach of the Accelerated Citizen Co-Creation in the context of Living Labs : from usage scenarios to 3D representations (including PhD thesis subjects).

7.2.5. Living Lab of Cité du Design - St Etienne

B. Trousse as President of France Living Labs had various collaborations this year with "Cité du Design"

- Participation as supporting partner of the European project called IDeALL managed by Isabelle Verihlac from "the Cité du Design". Preparation of a presentation related to the French supporting partners as Living labs at the last meeting of the project (January 2014, Barcelona);
- F2L Support of an ANR proposal related to silver economy called DECMA: this proposal is on "the design in the context of the day life of Alzheimer patients and help people" (leader Cité du design St Etienne) - "Sociétés innovantes, intégrantes et adaptatives. Axe : Innovations".

7.2.6. France Living Labs

URL: http://www.france-livinglabs.fr/

In 2013 our activities were multiple.
First ENoLL and France Living Labs signed a formal cooperation agreement (MoU - Memorandum of Understanding) on February 24th in order to have closer communication and cooperation in their activities and initiatives through meetings, exchanging of information, knowledge, experiences and best practice. See the video on http://www.youtube.com/watch?v=EJNXQ2VUtFU.

Secondly three working groups started:

- Design & Living labs with more than 13 living labs (cf. our presentation at the last IDeALL project Slides)
- Living Labs for Silver Economy and
- Cartography and evaluation of living lab projects inside F2L members on two aspects (co-creation methods and territory role).

Thirdly France Living Labs supported two proposal submissions of the 2013 ANR Call: one with University of Lorraine and "Cité du Design" and another proposal with "Cité du design".

Finally some F2L members were involved various working groups in order to make proposals for the contract "Economy Silver". This contract was signed on December 12th and France Living Labs is mentioned at the page 86 as a key actor for the action 6.2 (Support to the development of living labs in Silver Economy both a t the national and international levels). See the contract here

7.3. European Initiatives

7.3.1. FP7 ICT ELLIOT project (2010-2013)

Participants: Xavier Augros, Florian Bonacina, Mylène Leitzelman, Anne-Laure Negri, Guillaume Pilot, Bernard Senach, Caroline Tiffon, Brigitte Trousse [correspondent].

Type: COOPERATION

Challenge: Internet of Things (IoT) and enterprise environments

Instrument: Specific Targeted Research Project

Objective: Internet of Things and Enterprise environments

Duration: September 2010 - June 2013

Coordinator: TXT Polymemia (Italy)

Partners: University of Nottingham (UK), University of Readings (UK), BIBA (Germany), Hospital San Rafael (Italy), CENG (Italy), Fing (France), Vulog SME(France)

Inria contact: Brigitte Trousse

See also: http://www.elliot-project.eu/

Abstract: The ELLIOT project (Experiential Living Labs for the Internet of Things) aims at developing an IoT experiential platform where users/citizen are directly involved in co-creating, exploring and experimenting new ideas, concepts and technological artifacts related to IOT applications and services. Based on a three levels experiential model issued from previous European projects, the study will capitalize on existing practices of co-creation in IoT contexts. It will allow the exploration of the potential impact of IOT and of the Future Internet in the context of the Open User Centered Innovation paradigm followed in the Living Lab approach.

This year we conducted various tasks related to the Green Services Use case:

- Implementation of MyGreenServices application which collects IoT data from electric cars and citizens sensors. stored usage data for sending to the ELLIOT platform (cf. Section 6.5.1
- Specification of the methodology for user experience measurement for Green Services Use case (cf. Section 6.5.3).
- Two experiments of MyGreenServices (February and June).
- Dissemination at Innovative City Convention with Special ELLIOT Citizen Awards.

Inria hosted two ELLIOT meetings on user experience measurement (KSB model and use cases) as weel as general meetings. We contributed in the various deliverables including the two public ones [38] and [37]. See also our results in Section 6.5 .

Finally the Elliot project (2011-2013) was very rich in terms of new assets for Inria and for ICT Usage Lab (cf. 7.1.3).

MyGreenServices was evaluated as Good Practice by the international Design for All foundation (for the 2014 awards).

7.3.2. COST TwinTide (2010-2013)

Participant: Dominique Scapin [correspondent].

Program: COST IC0904

Project acronym: TwinTide

Project title: Towards the Integration of Transectorial IT Design and Evaluation

Duration: 2010 - 2013

Coordinator: Effie Lai-Chong Law - Swiss Federal Institute of Technology (ETH Zà¼rich), Switzerland (CH) / University of Leicester, UK

Other partners: see http://www.irit.fr/recherches/ICS/projects/twintide

Abstract: Towards the Integration of Transectorial IT Design and Evaluation is a usability and user experience research community running under the auspices of COST (http://www.cost.esf.org/). The main objective is to harmonize research and practice on design and evaluation methodologies for computing artefacts, across sectors and disciplines, bringing together researchers and D&E professionals.

7.3.3. EIT KIC ICT Labs (2013) : Experience & Living Labs Research Catalyst

Participants: Brigitte Trousse [correspondent], Caroline Tiffon, Florian Bonacina.

Program: EIT ICT Labs

Project acronym: Activity E&LL Catalyst Coordination activity from Research Catalysts, included for 2014 in Technology EXperimentation Catalyst.

Project title: E&LL Catalyst Coordination Activity

Duration: 2013

Coordinator: F. Pianiesi (Trento Rise, Italy)

Other partners: Inria, (Hungary), TUBerlin, U. Bologna, Telecom Italia, Siemens/VMZ (Germany), DFKI (Germany)

Abstract: The Catalyst Coordination Activity will boost the usage of the E&LLs Catalyst by means of a set of service provision programs. Tasks and Activities from the Action Lines represent the customers of the Catalyst Coordination Activity. The catalyst involves a Team of Experts and leverage assets from available "Open E&LLs", as a set of accessible facilities. "Open E&LLs" function as a one-stop-shop for user-centered research services, as well as hosts of experimentation activities by customers.

This year, we were involved in various works:

- Support to Loria (mainly Madynes research-project team - Thomas Siverston and Abdelkader Lahmadi) related to the CityCrowdSource activity and within the context of the *crowdout* application (with targeted users such city administrators and citizen). Our support relied mainly on the improvement of the ergonomics aspects of the application and pre-tests with users of the first prototype. Redaction of deliverable (17 pages);
- Dissemination of E&LL research catalyst to the Management Committee of the French EIT node and to the Smart Cities action line;
- Support to EIT partners during EIT 2013 Call event (April, Paris), mainly those interested by the two action lines , Smart Cities and Cloud Computing, which are lead by the french EIT KIC labs node;
- Contribution to the elaboration of a Service Provisioning template for Open Living Labs.
- Collectinf data from EIT E&LL facilities from the French EIT node in order to make them visible on an internal EIT Web site (developed by ELL catalyst - Trento);

7.3.4. EIT KIC ICT Labs (2013) : CityCrowdSource Activity - Urban Life and Mobility

Participants: Brigitte Trousse [correspondent], Guillaume Pilot.

Program: EIT ICTLabs

Project acronym: Activity 13 052 from Intelligent Mobility and Transportation Systems action line - Allocation 7396 (IMS), renamed Future Urban Life and Mobility (ULM) mid 2013

Project title: Multimodal Mobility

Duration: 2013, from June to December

Coordinator: F. Baude (OASIS Inria-UNS) and B. Kwella (Fraunhofer Gesellschaft)

Other partners: Inria, BME (Hungary), TUBerlin, U. Bologna, Telecom Italia, Siemens/VMZ (Germany), DFKI (Germany)

Abstract: The activity seeks to specify the building blocks, a platform and a prototype for the provision of multimodal mobility. The main motivation is to facilitate the use of ICT to support the efficient organization of Accessible Mobility (support for people with special needs, economical optimization of mobility and transportation, trip planning, information on available transport modes, etc). It therefore provides the basis for sustainable future mobility.

AxIS was involved in the implementation of a Play-based demonstrator and implements, in collaboration with OASIS Inria research-project an interface between MyGreenServices platform and the PLAY platform for elaborating a use case based on our environmental sensors.

7.3.5. EIT KIC ICT Labs (2013) : Q&A - Doctoral School

Participants: Brigitte Trousse [correspondent], Caroline Tiffon.

Program: EIT ICT Labs

Project acronym: DSL

Project title: Activité DSL 13108-Support Evaluation

Duration: 2013, from March to December

Coordinator: C. Queinnec (UMPC, Paris, France)

Other partners: Inria, University of Turku, etc.

Abstract: EIT Doctortal School

Inria (ICT Usage lab) for its expertise in usage analysis was requested by the DSL leader to support the University of Turku to managae the Q/A tasks for the doctoral school. We made some recommendation for improving questionnaires and anticipating future analysis in terms of data coding. We analysed (with Sphinx IQ) students questionnaires from EIT Doctoral school, and reported results in an internal EIT KIC Labs document. A preliminary study on how to measure the main I&E outcomes of I&E courses based on Bloom'experential learning [56] has been started.

7.4. International Initiatives

7.4.1. Participation in other International Programs

7.4.1.1. FACEPE CM2ID, Brazil 2003-2013

Participants: Yves Lechevallier, Marc Csernel.

During 2013 we continued a collaboration on social network data analysis with F.A.T. De Carvalho from Federal University of Pernambuco (Recife) and Orpailleur (Inria Nancy Grand Es -LORIA).

A scientific project **Combining Numerical and Symbolical Methods for the Classification of Multi-valued and Interval Data (CM2ID)** submitted by Francisco de Carvalho and A. Napoli has been accepted for 2013 by FACEPE and Inria. The project started on January and will end on 12/2013. Researchers and students are concerned by this project from Orpailleur, AxIS and CIn-UFPE side. It aims at developing Numerical and Symbolical methods of clustering on Multi-valued and Interval Data.

This project aims at developing and comparing clustering algorithms for interval and multi-valued data. Two families of algorithms are studied, namely clustering algorithms based on the use of a similarity or a distance for comparing the objects, and classification algorithms in Formal Concept Analysis (FCA) based on attribute sharing between objects. The objectives here are to combine the facilities of both families of algorithms for improving the potential of each family in dealing with more complex and voluminous datasets, in order to push the complexity barrier farther in the mining of complex data. Biological data, namely gene expression data, are used for test and evaluation of the combination of algorithms. The project involves three teams, one Brazilian team and two French Inria teams (AxIS and Orpailleur), including specialists of clustering and classification methods. Thus the complementarity of the teams is ensured and, in addition, close contacts exist with experts of the domain of data for carrying on a complete evaluation of the results obtained by the combined algorithms expected to be designed during the project.

7.4.2. Informal International Partners

B. Trousse maintained collaborations with Morocco (cf. Section 6.2.10):

- ENSAM - Meknès (E.L. Moukthar Zemmouri [75]),
- National High School of Electrical and Mechanical engineering (ENSEM)Casablanca (H. Behja).

7.4.3. Participation to Standards in Ergonomics

Participant: Dominique Scapin [correspondent].

Standardization in ergonomics is increasingly important due to the application of the European directives about the introduction of measures to encourage improvements in the safety and health of workers (e.g., 2006/42CE on security of machinery); as well as taking into consideration national and international legislation, including accessibility. Standardization in ergonomics covers many issues. The contributions from AxIS (D. L. Scapin) at Inria concern mainly software ergonomics, in the context of AFNOR X35A, X35E, as well as ISO mirror groups:

- National: AFNOR X35A ("Ergonomie") (expert); AFNOR X35E ("Ergonomie des Logiciels Interactifs"), AFNOR groupe de travail "Normes de processus ergonomiques" (chair) [71].
- International: ISO/TC 159/SC4/WG5 (Software ergonomics and human-computer dialogues) (expert); ISO/TC 159/SC4/WG6 (Human-centred design processes for interactive systems) (expert); ISO/TC 159/SC4/WG9 (Tactile and Haptic Interactions) (expert); ISO/TC 159/SC4/WG28 (System and software product Quality Requirements and Evaluation - Common industry Format) (expert); ISO/TC 159/SC1/WG1 (Ergonomic principles) (expert).

7.5. International Research Visitors

7.5.1. Visits of International Scientists

AxIS Rocquencourt welcomed various international scientists from Brazil:

- Francisco de Carvalho (UFPE, Brazil) [20],
- Sergio Queiroz (UFPE, Brazil) [19],

BANG Project-Team

7. Partnerships and Cooperations

7.1. Regional Initiatives

7.1.1. CIRB-Collège de France

Jonathan Touboul is leading the team "Mathematical Neuroscience Laboratory" in the Centre for Interdisciplinary Research in Biology of the Collège de France. Several collaborations have been initiated, two postdocs have been recruited (Jérôme Ribot and Alberto Romagnoni), student scholarships have been provided and 3 PhD students have started their research in the laboratory (C. Quiñinao and L. C. García del Molino in 2012, Tanguy Cabana in 2013).

7.1.2. DIGITEO and Cancéropôle IdF

The DIGITEO IdF LSC *ALMA* and *ALMA2* programs, coordinated by C. Bonnet (DISCO team, Inria Saclay IdF) studies a model of leukaemia based on previous works by M. Adimy and F. Crauste (Lyon), with theoretical model design adjustments and analysis in J. L. Avila Alonso's Ph D thesis (supervised by C. Bonnet, S. Niculescu and J. Clairambault) and experimental parameter identification initiated by F. Merhi, Bang postdoc (Dec. 2010-Nov. 2011), then continued by A. Ballesta (Sep. 2011-Feb. 2013), Bang postdoc detached at INSERM, working at St. Antoine Hospital (Paris), under the supervision of J. Clairambault and C. Bonnet to link experimental and theoretical aspects and of J.-P. Marie and R.P. Tang (INSERM-UPMC) to supervise biological experiments on leukaemic cells. ALMA has been granted for 3 years, beginning in December 2010.

A. Ballesta's postdoc at St. Antoine Hospital, granted by Cancéropôle IdF *ALMA2* has led to increased collaboration of the same with the Commands Inria team (F. Bonnans, X. Dupuis, Saclay) with the aim to design optimisation procedures for anti-leukaemic therapies by cytosine arabinoside and by an anti-Flt3 targeted agent (see above "Optimisation of cancer chemotherapy").

7.2. National Initiatives

7.2.1. ANR and other national projects

7.2.1.1. ANR program Bimod

This ANR program, coordinated by V. Volpert (Lyon), involves 3 partners: CNRS (Institut Camille Jordan) in Lyon (V. Volpert), University Bordeaux II (P. Magal) and Inria (Bang project-team and DISCO team, Saclay IdF). It associates PDE models, both spatial and physiologically structured, with individual-based models in *hybrid models* to represent cancer growth (leukaemia and colorectal cancer) and therapy. It has been granted for 4 years, beginning in December 2010.

7.2.1.2. ANR Sine2Arti

Participation in the ANR project Sine2Arti. The project considers tissue homeostasis and cell reprogramming. The project is coordinated by Gregory Batt (coordinator, Contraintes research team, Inria), PIs are Oded Maler (Univ. of Grenoble) and Dirk Drasdo, an external collaborator is Ron Weiss (MIT)

7.2.1.3. GDR DarEvCan

The GDR DarEvCan, for Darwinian Evolution and Cancer, is a interdisciplinary consortium which associates 10 teams in France around the theme of evolution and cancer, in particular evolution of cancer cell populations towards drug resistance [18]. It has held its first national meeting in December 2011 in Paris, another one in April 2012 in Montpellier, and has organised an international conference in Roscoff in November 2013 http://www.cnrs.fr/insb/cjm/archives/2013/Hochberg_e.html, to which J. Clairambault presented an invited talk on behalf of the Bang team. The Bang team takes an active part in its development, which relies mainly on applying methods from evolutionary theory to cancer biology [22] (http:///www.darevcan.univ-montp2.fr/).

7.2.1.4. PEPS PTI 'Ondes de concentration en bactéries'

People of the BANG team are involved in this project funded by the CNRS. This is a collaboration with biophysicists of the Institut Curie dedicated to the description of the collective motion of bacteria by chemotaxis.

7.2.1.5. PEPS PTI 'Neuro-Info' (Jonathan Touboul)

Jonathan Touboul obtained a support of the CNRS for a collaboration with Princeton University on the information in biological systems, including neuronal networks and quorum sensing.

7.2.1.6. PEPS PTI 'NeuroGauge' (Jonathan Touboul and Alberto Romagnoni)

Alberto Romagnoni (Postdoc in the Mathematical Neuroscience Team) and Jonathan Touboul obtained a support from the CNRS program PEPS PTI in order to use tools from the non-abelian gauge theory for the modeling of the visual cortex. This is a collaboration with theoretical physicists from U. Autonoma of Madrid (Carlos Pena).

7.2.1.7. ITMO-Cancer grant PhysCancer

Participation in the ITMO-Cancer (Aviesan) project Physics of Cancer. The project studies the impact of a constraining extracellular material on the growth and division of cells and cellular aggregates. The project is coordinated by Pierre Nassoy (Institut Curie), collaborators are Dirk Drasdo and Christophe Lamaze (INSERM).

7.2.1.8. INVADE

Participation in the project INVADE (INSERM). The project studies invasion patterns of breast cancer cells. The project is coordinated by Emmanuel Barillot (Inst. Curie), collaborators include Dirk Drasdo and other groups from Institut Curie.

7.3. European Initiatives

7.3.1. FP7 Projects

7.3.1.1. ERASysbio+ C5Sys European network.

This European program (http://www.erasysbio.net/index.php?index=272) has begun in April 2010 to end up in June 2013, with the title "Circadian and cell cycle clock systems in cancer". Coordinated by F. Lévi (Villejuif) and D. Rand (Warwick), it studied both from a theoretical and from an experimental viewpoint the relationships between molecular circadian clocks and the cell division cycle, in cancer and in healthy tissues. A postdoctoral fellow (F. Billy) has been hired at Inria-Bang until November 2012 on this funding, giving rise to various publications in 2013 [7], [8], [9], [27].

7.3.1.2. NOTOX

Type: COOPERATION

Instrument: Integrated Project

Objective: NC

Duration: January 2011 - December 2015

Coordinator: Elmar Heinzle, Universität des Saarlandes, Saarbrücken

Partner: Centre National de la Recherche Scientifique, Strasbourg

Partner: Stichting Het Nederlands Kanker Instituut - Antoni Van Leeuwenhoek Ziekenhuis, Amsterdam

Partner: Karolinska Institutet, Stockholm

Partner: Insilico Biotechnology AG, Stuttgart

Partner: Institut National de Recherche en Informatique et en Automatique, Rocquencourt

Partner: Deutsches Forschungszentrum für Künstliche Intelligenz GmbH, Saarbrücken

Partner: Forschungsgesellschaft für Arbeitsphysiologie und Arbeitsschutz e.V, Dortmund

Partner: Biopredic International, F35760 St. Grégoire

Partner: Weizmann Institute of Science, Rehovot, Israel

Partner: Cambridge Cell Networks Ltd, Cambridge, UK

Partner: European Research and Project Office GmbH, Saarbrücken

Inria contact: Dirk Drasdo

Abstract: NOTOX will develop and establish a spectrum of systems biological tools including experimental and computational methods for (i) organotypic human cell cultures suitable for long term toxicity testing and (ii) the identification and analysis of pathways of toxicological relevance. NOTOX will initially use available human HepaRG and primary liver cells as well as mouse small intestine cultures in 3D systems to generate own experimental data to develop and validate predictive mathematical and bioinformatic models characterizing long term toxicity responses. Cellular activities will be monitored continuously by comprehensive analysis of released metabolites, peptides and proteins and by estimation of metabolic fluxes using 13C labelling techniques (fluxomics). At selected time points a part of the cells will be removed for in-depth structural (3D-optical and electron microscopy tomography), transcriptomic, epigenomic, metabolomic, proteomic and fluxomic characterisations. When applicable, cells derived from human stem cells (hESC or iPS) and available human organ simulating systems or even a multi-organ platform developed in SCREEN-TOX and HEMIBIO will be investigated using developed methods. Together with curated literature and genomic data these toxicological data will be organised in a toxicological database (cooperation with DETECTIVE, COSMOS and TOXBANK). Physiological data including metabolism of test compounds will be incorporated into large-scale computer models that are based on material balancing and kinetics. Various omics, data and 3D structural information from organotypic cultures will be integrated using correlative bioinformatic tools. These data also serve as a basis for large scale mathematical models. The overall objectives are to identify cellular and molecular signatures allowing prediction of long term toxicity, to design experimental systems for the identification of predictive endpoints and to integrate these into causal computer models.
Webpage: http://notox-sb.eu/fp7-cosmetics-europe/

7.3.1.3. ERC Starting Grant SKIPPER^{AD}

Type: IDEAS

Instrument: ERC Starting Grant

Duration: December 2012 - November 2017

Coordinator: Marie Doumic

Partner: INRA Jouy-en-Josas, France

Inria contact: Marie Doumic

Abstract: Amyloid diseases are of increasing concern in our aging society. These diseases all involve the aggregation of misfolded proteins, called amyloid, which are specific for each disease (PrP for Prion, Abeta for Alzheimer's). When misfolded these proteins propagate the abnormal configuration and aggregate to others, forming very long polymers also called fibrils. Elucidating the intrinsic mechanisms of these chain reactions is a major challenge of molecular biology: do polymers break or coalesce? Do specific sizes polymerize faster? What is the size of the so-called nucleus, i.e., the minimum stable size for polymers? On which part of the reactions should a treatment focus to arrest the disease ? Up to now, only very partial and partially justified answers have been provided. This is mainly due to the extremely high complexity of the considered processes, which may possibly involve an infinite number of species and reactions (and thus, an infinite system of equations).

The great challenge of this project is to design new mathematical methods in order to model fibril reactions, analyse experimental data, help the biologists to discover the key mechanisms of polymerization in these diseases, predict the effects of new therapies. Our approach is based on

a new mathematical model which consists in the nonlinear coupling of a size-structured Partial Differential Equation (PDE) of fragmentation-coalescence type, with a small number of Ordinary Differential Equations. On the one hand, we shall solve new and broad mathematical issues, in the fields of PDE analysis, numerical analysis and statistics. These problems are mathematically challenging and have a wide field of applications. On the other hand we want to test their efficacy on real data, thanks to an already well-established collaboration with a team of biophysicists. With such a continuing comparison with experiments, we aim at constantly aligning our mathematical problems to biological concerns.

7.4. International Initiatives

7.4.1. ECOS-CONICYT

B. Perthame and K. Vilches take part in the Franco-Chilean project 'Functional analysis, asymptotics and dynamics of fronts' headed by J. Dolbeault (University Paris-Dauphine) funded by ECOS-CONICYT.

7.4.2. EuroMed 3+3

M3CD, *Mathematical Models and Methods in Cell Dynamics*, a transmediterranean EuroMed3+3 program, has begun in January 2012 for 4 years, under the coordination of J. Clairambault. It associates 2 Inria teams: Bang and Dracula (Mostafa Adimy, Lyon) with the IAC-CNR in Rome (Roberto Natalini), the LMDP team in Marrakech (Hassan Hbid) and the MoMinBi team at Institut Pasteur, Tunis (Slimane BenMiled, Amira Kebir) to work on the general theme "Mathematical Models and Methods in Cell Dynamics". It has fostered in 2013 visits of students to Paris and Lyon, for Y. Bourfia, PhD student at Marrakech and UPMC, who works under the supervision of H. Hbid, M. Adimy and J. Clairambault and for Rym Jaroudi, M2 student at the University of Tunis, who works under the supervision of Slimane BenMiled and Amira Kebir.

A 2-day M3CD workshop, organised by Hassan Hbid, following a first one organised in November 2012 in Tunis, will take place in January 2014 (27-28) in Marrakech. Newcomers, researchers from the Northern side, who will be present in this workshop, will join the network in 2014: Marcello Delitala (Polito, Turin) and Oscar Angulo (University of Valladolid).

7.4.3. Xuguang Qi-Hubert Curien program

C. Emako-Kazianou and N. Vauchelet take part in a Xuguang Qi-Hubert Curien program funded by Campus-France in collaboration with Shanghai Jiao Tong university. This program no 30043VM entitled "PDE models for cell self-organization" is headed by N. Vauchelet and allows visits for both parts of the project. The chinese researchers involved in this program are Min Tang and Jie Lao.

7.4.4. Inria International Partners

1. **German Research Ministry (BMBF) funded project on the systems biology of lung cancer.** The major aim is to better understand the early metastasis formation and invasion of lung cancer, including therapeutical options. Data on all levels ranging from intracellular up to organ level will be used to establish successively an integrated multiscale model of cellular and migration decisions in lung cancer. A particular focus will be on dissecting how cellular organisation and communication in spheroid cultures and co-cultures of lung cancer cell lines with selected endothelial cells affects information processing and the proliferation and migration decisions downstream. To reveal the inhomogeneous spatio-temporal organisation in these tumour growth models, specific probes for medical imaging, quantify extracellular cytokine concentrations will be used, and the effects of pharmacological inhibitors be monitored. By data and model integration, parameters should be identified that critically determine early spread and facilitate to predict possibilities for improved therapeutic options.
   The project coordinator is Ursula Klingmueller, German Cancer Research Centre (DKFZ), Heidelberg (http://www.lungsys.de/)

2. **German Research Ministry (BMBF) funded project on the systems biology of liver (Virtual Liver Network).** The aim of the VLN project is to set up multiscale models of liver. The Virtual Liver will be a dynamic model that represents, rather than fully replicates, human liver physiology morphology and function, integrating quantitive data from all levels of organisation. Our part ranges from the intracellular up to the level of groups of liver lobules. A liver lobule is the basic repetitive functional unit of liver. Applications are explained in the text. The networks has 69 Principle Investigators organised in about 10 work packages, each of which have a number of sub-projects (http://www.virtual-liver.de/about/).

7.5. International Research Visitors

7.5.1. Visits of International Scientists

- H.T. Banks (North Carolina State University), 2 weeks at UPMC (SKIPPER^{AD} project)
- Bard Ermentrout (University of Pittsburgh), 1 week at the Mathematical Neuroscience Team
- Miguel Escobedo (University of Bilbao, BECAM), 2 weeks at UPMC (SKIPPER^{AD} project)
- Thibaud Taillefumier (University of Princeton), 2 weeks at the Mathematical Neuroscience Team
- Jonathan Rubin (University of Pittsburgh), 3 days at the Mathematical Neuroscience Team
- Justyna Signerska (Polish Academy of Mathematics), 10 days at the Mathematical Neuroscience Team
- Suzanne Sindi (University of California MERCED), 1 week at UPMC (SKIPPER^{AD} project)
- Wei-Feng Xue (University of Canterbury), 2 days at UPMC (SKIPPER^{AD} project)
- Min Tang (Shanghai Jiaotong Univ.) , 1 month at BANG (Xu GuangQi Hubert Curien program no30043V M PDE models for cell self-organization, N. Vauchelet)

7.5.1.1. Internships

- Rym Jaroudi (University of Tunis) on the subject “Applying evolutionary game theory and adaptive dynamics to modelling cancer treatments”, supervised by S. Ben Miled, A. Kebir (Tunis) and J. Clairambault: October

7.5.2. Visits to International Teams

- 10 days at the University of Pittsburgh (J. Touboul)
- 1 week at the North Carolina State University (M. Doumic and C. Kruse)
- 3 weeks at the Biophysics Lab in Princeton (J. Touboul)
- 2 days at the Courant Institute (New-York) (J. Touboul)
- 3 days at BECAM Center (Bilbao) (M. Doumic)
- 4 weeks at the CEDOC center at Gulbenkian Science Institute (L. Almeida)
- 10 days at the CMM, University of Chile (B. Perthame)
- 10 days at MIT, USA (F. Bertaux)

CAD Team

7. Partnerships and Cooperations

7.1. Regional Initiatives

Our Join Inria Tsinghua Project is located from 2004 at Tsinghua University (Beijing – China). CAD is a LIAMA Project.

CASCADE Project-Team

5. Partnerships and Cooperations

5.1. ANR Projects with Industrials

- **SAPHIR-II** *(Sécurité et Analyse des Primitives de Hachage Innovantes et Récentes)*
  Security and analysis of innovating and recent hashing primitives.
  Participants: Patrick Derbez, Jérémy Jean.

  From April 2009 to March 2013.
  Partners: France Telecom R&D, Gemalto, EADS, SAGEM, DCSSI, Cryptolog, Inria/Secret, UVSQ, XLIM, CryptoExperts.
- **BEST: Broadcast Encryption for Secure Telecommunications.**
  Participants: David Pointcheval, Elizabeth Quaglia, Mario Strefler, Damien Vergnaud, Aurore Guillevic, Sorina Ionica.

  From December 2009 to December 2013.
  Partners: Thales, Nagra, CryptoExperts, Univ. Paris 8.
  This project aims at studying broadcast encryption and traitor tracing, with applications to the Pay-TV and geolocalisation services.
- **PRINCE: Proven Resilience against Information leakage in Cryptographic Engineering.**
  Participants: Fabrice Ben Hamouda, Sonia Belaid, Alain Passelègue, Michel Ferreira Abdalla, David Pointcheval.

  From December 2010 to December 2014.
  Partners: UVSQ, Oberthur Technologies, Ingenico, Gemalto, Tranef.
  We aim to undertake research in the field of leakage-resilient cryptography with a practical point of view. Our goal is to design efficient leakage-resilient cryptographic algorithms and invent new countermeasures for non-leakage-resilient cryptographic standards. These outcomes shall realize a provable level of security against side-channel attacks and come with a formally verified implementation. For this every practical aspect of the secure implementation of cryptographic schemes must be taken into account, ranging from the high-level security protocols to the cryptographic algorithms and from these algorithms to their implementation on specific devices which hardware design may feature different leakage models.
- **SIMPATIC: SIM and PAiring Theory for Information and Communications security.**
  Participants: Damien Vergnaud, Olivier Sanders, David Pointcheval.

  From February 2013 to August 2016.
  Partners: Orange Labs,INVIA, Oberthur Technologies, STMicroelectronics, Université Bordeaux 1, Université de Caen Basse-Normandie, Université de Paris VIII
  We aim at providing the most possible efficient and secure hardware/software implementation of a bilinear pairing in a SIM card.

5.2. ANR Projects within Academics

- **ProSe: Security protocols : formal model, computational model, and implementations.**
  Participant: David Pointcheval.

  From December 2010 to November 2014.
  Partners: ENS Cachan-Inria/Secsi, LORIA-Inria/Cassis, Inria/Prosecco, Verimag.
  The goal of the project is to increase the confidence in security protocols, and in order to reach this goal, provide security proofs at three levels: the symbolic level, in which messages are terms; the computational level, in which messages are bitstrings; the implementation level: the program itself.

- **ROMAnTIC: Randomness in Mathematical Cryptography.**
  Participants: Damien Vergnaud, David Pointcheval, Adrian Thillard, Sylvain Ruhault.

  From October 2012 to September 2016.
  Partners: ANSSI, Univ. Paris 7, Univ. Paris 8.
  The goal of this project is to get a better understanding of the interplay between randomness and cryptography and to study the security of various cryptographic protocols at different levels (information-theoretic and computational security, number-theoretic assumptions, design and provable security of new and existing constructions).
- **CLE: Cryptography from Learning with Errors.**
  Participant: Vadim Lyubashevsky.

  From October 2013 to September 2017.
  Partners: UVSQ, Univ. Paris 8, Inria/SECRET.
  The main objective of this project is to explore the potential practical implications of the Learning with Errors problem and its variants. The plan is to focus on the constructions of essential primitives whose use is prevalent in the real world. Toward the end of the project, the hope is to propose and standardize several public key and symmetric key schemes that have specific advantages over ones that are currently deployed.

5.3. European Initiatives

- **ECRYPT-II: Network of Excellence in Cryptology.**
  From August 2008 to July 2013.
  There are three virtual labs that focus on the following core research areas: symmetric key algorithms (STVL), public key algorithms and protocols (MAYA), and secure and efficient implementations (VAMPIRE).
  ENS/Inria/CASCADE leads the MAYA virtual lab.
- **SecFuNet: Security for Future Networks.**
  From July 2011 to April 2014.
  The goal of the SECFUNET project is to design and develop a coherent security architecture for virtual networks and cloud accesses.

5.4. International Research Visitors

- Mario Cornejo (Ms student) – Chile
- Nuttapong Attrapadung – The National Institute of Advanced Industrial Science and Technology, Japan
- Yu Long – Shanghai Jiao Tong University, China

CLASSIC Project-Team

7. Partnerships and Cooperations

7.1. National Initiatives

- ANR project in the blank program: Calibration (2012–2015; involves Vincent Rivoirard, who is the coordinator; see https://sites.google.com/site/anrcalibration/home)
- ANR project in the blank program: Banhdits (2010–2013; involves Vincent Rivoirard; see https://sites.google.com/site/anrcalibration/home)
- PEPS Bio-Maths ("Estimation de graphes de dépendance entre neurones thalamiques et cortico-thalamiques via des modèles de Hawkes multivariés; 2012–2013; involves Vincent Rivoirard)

7.2. International Initiatives

We have one formal international collaboration, with

- Karine Bertin, University of Valparaiso, Chile (International cooperation CONICYT project, Andes Foundation project);

and other informal ones:

- Luc Devroye, McGill University, Canada;
- David Mason, Delaware University, USA;
- Shie Mannor, Technion, Israel.

CLIME Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR

- The ANR project Estimair aims at quantifying the uncertainties of air quality simulations at urban scale. The propagation of uncertainties requires the use of model reduction and emulation. A key uncertainty source lies in the traffic emissions, which will be generated using a dynamic trafic assignment model. Ensembles of traffic assignments will be calibrated and used in the uncertainty quantification. Estimair is led by Clime.
- Clime is one partner of the ANR project GeoFluids. It focuses on the specification of tools to analyse geophysical fluid flows from image sequences. Clime objectives concern the definition of reduced models from image data.
- Clime takes part to the ANR project IDEA that addresses the propagation of wildland fires. Clime is in charge of the estimation of the uncertainties, based on sensitivity studies and ensemble simulations.

8.1.2. PRIMEQUAL (ADEME)

- Clime takes part to the PRIMEQUAL project PREQUALIF, “Programme Pluridisciplinaire de REcherche sur la QUALité de l’air en Île-de-France” (i.e., “Multidisciplinary Program on Air quality research in Île-de-France”). The objective is to investigate the impact of low emission zones. The project aims at designing a new generation of diagnostic tools for assessment of health and analysis of economic benefits attributed to traffic restrictions. Clime brings data assimilation expertise which allows to compute the most accurate air pollution maps.

8.2. European Initiatives

8.2.1. Collaborations in European Programs, except FP7

Program: COST Action ES104.

Project acronym: EuMetChem.

Project title: European framework for online integrated air quality and meteorology modeling.

Duration: January 2011 - December 2014.

Coordinator: Alexander Baklanov, Danish Meteorological Institute (DMI) Danemark.

Other partners: around 14 european laboratories, experts from United States, ECMWF.

Abstract: European framework for online integrated air quality and meteorology modeling (EuMetChem) focuses on a new generation of online integrated Atmospheric Chemical Transport (ACT) and Meteorology (Numerical Weather Prediction and Climate) modeling with two-way interactions between different atmospheric processes including chemistry (both gases and aerosols), clouds, radiation, boundary layer, emissions, meteorology and climate. Two application areas of the integrated modeling are considered: (i) improved numerical weather prediction (NWP) and chemical weather forecasting (CWF) with short-term feedbacks of aerosols and chemistry on meteorological variables, and (ii) two-way interactions between atmospheric pollution/ composition and climate variability/change. The framework consists of four working groups namely: 1) Strategy and framework for online integrated modeling; 2) Interactions, parameterizations and feedback mechanisms; 3) Chemical data assimilation in integrated models; and finally 4) Evaluation, validation, and applications. Establishment of such a European framework (involving also key American experts) enables the EU to develop world class capabilities in integrated ACT/NWP-Climate modeling systems, including research, forecasting and education.

8.2.2. Collaborations with Major European Organizations

Partner: ERCIM working group “Environmental Modeling”.

The working group gathers laboratories working on developing models, processing environmental data or data assimilation.

8.3. International Initiatives

8.3.1. Inria International Partners

8.3.1.1. Informal International Partners

Partner: Chilean meteorological office (Dirección Meteorológica de Chile)

The partner produces its operational air quality forecasts with Polyphemus. The 3-day forecasts essentially cover Santiago. The forecasts are accessible online in the form of maps, time series and video (http://www.meteochile.gob.cl/modeloPOLYPHEMUS.php).

Partner: Marine Hydrophysical Institute http://mhi.nas.gov.ua/eng/, Ukraine.

The collaboration concerns the study of the Black Sea surface circulation and the issue of image assimilation in forecasting models.

Partner: IBM Research, Dublin, Ireland

The collaboration addresses the assimilation of classical observations as well as images, with application to geophysics. New assimilation methods are developed, mainly based on minimax filtering.

8.4. International Research Visitors

8.4.1. Visits of International Scientists

- Sergiy Zhuk, IBM, Dublin Research Lab, Ireland, September 2013.

CONTRAINTES Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

- The OSEO BioIntelligence coordinated by Dassault-Systèmes, with EPI Orpailleur, Sobios, Aureus pharma, Ipsen, Pierre Fabre, Sanofi-Aventis, Servier, Bayer CropScience, INSERM, Genopole Evry (2009-2014).
- ANR Investissement Avenir Iceberg project (2011-2016) "From population models to model populations", coordinated by Grégory Batt, with Pascal Hersen (MSC lab, Paris Diderot Univ./CNRS), Reiner Veitia (Institut Jacques Monod, Paris Diderot Univ./CNRS), Olivier Gandrillon (BM2A lab, Lyon Univ./CNRS), Cedric Lhoussaine (LIFL/CNRS), and Jean Krivine (PPS lab, Paris Diderot Univ./CNRS).
- ANR Blanc Net-WMS-2 (2011-2015) on "constraint optimization in Wharehouse Management Systems", coordinated by F. Fages, with N. Beldiceanu, Ecole des Mines de Nantes, EPI TASC, and Abder Aggoun, KLS optim.
- ANR Cosinus Syne2arti project (2010-2013) coordinated by Grégory Batt, with Oded Maler, CNRS Verimag, Dirk Drasdo, EPI Bang, and Ron Weiss, MIT.
- ANR Blanc BioTempo project (2010-2014) coordinated by Anne Siegel, CNRS IRISA Rennes, with Ovidiu Radulescu, U. Montpellier, Irina Rusu, U. Nantes.
- AE REGATE (2008-2013) on the "REgulation of the GonAdoTropE axis", coordinated by Frédérique Clément, SISYPHE, with E. Reiter, INRA Tours, J.P. Françoise, Univ. Paris 6, B. Laroche Orsay, P. Michel Centrale Lyon, N. Ayache ASCLEPIOS, A. Goldbeter, ULB Bruxelles.
- AE COLAGE (2008-2013) on the "control of growth and aging in *E. coli* using synthetic biology approaches", coordinated by H. Berry, COMBINING, with F. Taddei, A. Lindner, INSERM Necker, H. de Jong, D. Ropers, IBIS, H. Geiselmann, Grenoble Univ., J.-L. Gouzé, and M. Chaves, COMORE.
- GENCI (2009-) attribution of 300000 computation hours per year on the Jade cluster of 10000 processors of GENCI at CINES, Montpellier.

8.2. European Initiatives

8.2.1. Collaborations in European Programs, except FP7

Program: EraNet SysBio

Project acronym: C5Sys

Project title: Circadian and cell cycle clock systems in cancer

Duration: march 2010 - march 2013

Coordinator: Francis Lévi, INSERM Hopital Paul Brousse, Villejuif, France and David Rand, Warwick Systems Biology, UK,

Other partners: EPI BANG, Erasmus University Medical Center, Rotterdam, University College London, UK, CNRS Nice, and L2S, Orsay.

Abstract: Mammalian cells are endowed with biological oscillators which time their activities. The circadian clock (circa, about; dies, day) generates a 24-hour rhythm which controls both cellular metabolism and cell division. The cell division cycle is an oscillator which times DNA synthesis, mitosis, and related apoptosis and DNA repair. Our understanding of the molecular mechanisms at work in both oscillators has greatly improved. In sharp contrast, little is known about how these two crucial oscillators interact, and how these interactions affect cellular proliferation in normal or cancer cells. On the one hand, the disruption of circadian clocks impairs cell physiology and quality of life. On the other hand, disruption of cell cycle, DNA repair or apoptosis impacts on cell and organism survival. Experimental and clinical data show that circadian disruption accelerates malignant proliferation, and that DNA damage can reset the circadian clock. The central question addressed is how interactions between the circadian clock and cell cycle affect cellular proliferation and genotoxic sensitivity in normal and cancer cells, and how this knowledge translates into new prevention or therapeutic applications. Seven teams in France, Netherlands and United Kingdom integrate experimental, mathematical and bioinformatic approaches, so as to develop novel cell lines, biomarker monitoring methods and mathematical tools. C5Sys triggers innovative chronotherapeutic research for human cancers and advances systems medicine for improving patient care.

8.3. International Initiatives

8.3.1. Inria Associate Teams

8.3.1.1. TISHOM

Title: Artificial tissue homeostasis: combining synthetic and computational biology approaches

Inria principal investigator: Grégory Batt

International Partner (Institution - Laboratory - Researcher):

Massachusetts Institute of Technology (United States) - Weiss Lab

Duration: 2012 - 2014

See also: TISHOM

Cell-based gene therapy aims at creating and transplanting genetically-modified cells into a patient in order to treat an illness. Ideally, actively-growing cells are used to form a self-maintaining tissue in the patient, thus permanently curing the disease. Propelled forward by the development of stem cell biology, this research domain has recently attracted significant interest. Still, before any real therapeutic use, many important issues need to be addressed. In particular, one should guarantee tissue homeostasis, that is, that the size of the newly-introduced tissue remains within admissible bounds.

Using a synthetic biology approach, we propose to reprogram mammalian cells so as to enforce tissue homeostasis. The proposed design relies on growth control and cell-cell communication mechanisms. The design and tuning of such engineered tissues are particularly challenging. Indeed, the correct functioning of the system depends on its specific molecular implementation. To relate cell population behavior with molecular details, extensive modelling work and in-depth in silico analysis are needed. Therefore, a tight integration between dry lab and wet lab efforts will be essential for the success of the project.

8.4. International Research Visitors

8.4.1. Internships

Hui-Ju Katherine Chiang (from Jul 13 until Sep 13) on program compilation in biochemical reaction networks.

8.4.2. Visits to International Teams

Grégory Batt: one week with the Weiss lab at MIT

François Bertaux: two weeks with the Weiss lab at MIT

Xavier Duportet: 3 months and 1 week with the Weiss lab at MIT

CRYPT Team

5. Partnerships and Cooperations

5.1. National Initiatives

5.1.1. MOST's 973 Grant

Grant 2013CB834205

PIs Phong Nguyen and Xiaoyun Wang

Duration 2013-17

MOST is China's Ministry of Science and Technology.

5.1.2. NSFC Grant

Grant NSFC Key Project 61133013

PIs Phong Nguyen and Xiaoyun Wang

Duration 2013-16

NSFC is the National Natural Science Foundation of China.

5.2. European Initiatives

5.2.1. FP7 Projects

Phong Nguyen was leader of the Virtual Lab MAYA of FP7's ECRYPT-II Network of Excellence, which finished in 2013.

5.2.2. Collaborations with Major European Organizations

CWI: Ronald Cramer's crypto team (Netherlands). In December 2013, Cramer's crypto team officially became a partner of LIAMA's CRYPT international project: in particular, Marc Stevens expects to do joint work on the cryptanalysis of hash functions.

5.3. International Initiatives

5.3.1. Inria International Labs

- CRYPT is an international project from LIAMA in China, located at Tsinghua University in Beijing. It is a joint project between Inria, Tsinghua University and CAS Academy of Mathematics and System Sciences.
- Phong Nguyen is the new European director of LIAMA, since December 2013: previously, he was the scientific coordinator of LIAMA in 2013.

5.4. International Research Visitors

5.4.1. Visits of International Scientists

Shi Bai (Univ. of Auckland, New-Zealand)

Nicolas Gama (UVSQ and CNRS, France)

Ming-Deh Huang (Univ. Southern California, USA)

Gaëtan Leurent (UCL, Belgium)

Cheng Qi (Univ. Oklahoma, USA)

Marc Stevens (CWI, Netherlands)

Guangwu Xu (Univ. Wisconsin, USA)

DEDUCTEAM Exploratory Action

7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. ANR Locali

We are coordinators of the ANR-NFSC contract Locali with the Chinese Academy of Sciences. This year we organized the first Locali workshop in Beijing.

7.1.2. ANR BWare

We are members of the ANR *BWare*, which started on September 2012 (David Delahaye is the national leader of this project). The aim of this project is to provide a mechanized framework to support the automated verification of proof obligations coming from the development of industrial applications using the *B* method. The methodology used in this project consists in building a generic platform of verification relying on different theorem provers, such as first order provers and SMT solvers. We are in particular involved in the introduction of Deduction modulo in the first order theorem provers of the project, i.e. *Zenon* and *iProver*, as well as in the backend for these provers with the use of *Dedukti*.

7.1.3. ANR Tarmac

We are members of the ANR Tarmac, coordinated by Pierre Valarcher, on models of computation.

7.2. International Initiatives

7.2.1. Informal International Partners

Deducteam and the KWARC research group (Jacobs University, Germany), led by Michael Kohlhase, have organized a common workshop in Paris on the 12 of April. This workshop has led to the two tools dk2MMT and MMT2dk, and another workshop is planned on the 2014 year. See the program at http://www.cri.ensmp.fr/people/hermant/deducteam/2013/kwarc-dedukti.html or the webpage of the seminars.

7.3. International Research Visitors

7.3.1. Visits of International Scientists

Hermann Haeusler, Bruno Bruno Lopes and Cecilia Englander, from the University PUC Rio have visited Deducteam.

Ying Jiang from the Institute of software of the Chinese Academy of Sciences has visited Deducteam.

7.3.2. Visits to International Teams

Gilles Dowek has visited the University PUC Rio and the Institute of software of the Chinese Academy of Sciences.

DYOGENE Project-Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

DYOGENE participates in the Laboratory of Information, Networking and Communication Sciences (LINCS) http://www.lincs.fr/ created on October 28th, 2010, by three French institutions of higher education and research: Inria, Institut Télécom and UPMC. Alcatel-Lucent joined the LINCS in February 2011 as a strategic partner.

8.2. National Initiatives

8.2.1. GdR GeoSto

Members of Dyogene participate in Research Group GeoSto (Groupement de recherche, GdR 3477) http://gdr-geostoch.math.cnrs.fr/ on Stochastic Geometry led by Pierre Calka [Université de Rouen]. This is a collaboration framework for all French research teams working in the domain of spatial stochastic modeling, both on theory development and in applications.

8.2.2. ANR

8.2.2.1. ANR GAP

Graphs, Algorithms and Probability - PI: Marc Lelarge; started in Jan 2012 - 48 months. http://www.di.ens.fr/~lelarge/ANR-GAP.html

Over the last few years, several research areas have witnessed important progress through the fruitful collaboration of mathematicians, theoretical physicists and computer scientists. One of them is the cavity method. Originating from the theory of mean field spin glasses, it is key to understanding the structure of Gibbs measures on diluted random graphs, which play a key role in many applications, ranging from statistical inference to optimization, coding and social sciences.

The objective of this project is to develop mathematical tools in order to contribute to a rigorous formalization of the cavity method:

- From local to global, the cavity method on diluted graphs. We will study the extent to which the global properties of a random process defined on some graph are determined by the local properties of interactions on this graph. To this end, we will relate the cavity method to the analysis of the complex zeros of the partition function, an approach that also comes from statistical mechanics. This will allow us to apply new techniques to the study of random processes on large diluted graphs and associated random matrices.
- Combinatorial optimization, network algorithms, statistical inference and social sciences. Motivated by combinatorial optimization problems, we will attack long-standing open questions in theoretical computer science with the new tools developed in the first project. We expect to design new distributed algorithms for communication networks and new algorithms for inference in graphical models. We will also analyze networks from an economic perspective by studying games on complex networks.

8.2.2.2. ANR MARMOTE

Markovian Modeling Tools and Environments - coordinator: Alain Jean-Marie (Inria Maestro); local coordinator (partner Inria Paris-Rocquencourt): A. Bušić; 48 months; partners: Inria Paris-Rocquencourt (EPI DYOGENE), Inria Sophia Antipolis Méditerranée (EPI MAESTRO), Inria Grenoble Rhône-Alpes (EPI MESCAL), Université Versaillese-St Quentin, Telecom SudParis, Université Paris-Est Creteil, Université Pierre et Marie Curie.

The aim of the project is to realize a modeling environment dedicated to Markov models. One part will develop the Perfect Simulation techniques, which allow to sample from the stationary distribution of the process. A second one will develop parallelization techniques for Monte Carlo simulation. A third one will develop numerical computation techniques for a wide class of Markov models. All these developments will be integrated into a programming environment allowing the specification of models and their solution strategy. Several applications will be studied in various scientific disciplines: physics, biology, economics, network engineering.

8.2.2.3. ANR MAGNUM

A. Bušić is a participant (within partner LIP6) of the national project ANR MAGNUM (Methodes Algorithmiques pour la Generation aleatoire Non Uniforme: Modeles et applications) (2010–2014), partners: LIP6, LIAFA, IGM. http://www-apr.lip6.fr/anrMagnum/.

8.3. International Initiatives

8.3.1. Inria Associate Teams

The third and last year of the Associate Team "IT-SG-WN" with the EECS department of UC Berkeley in the USA, funded from 2011 to 2014, was completed by a one month visit of Prof. Anantharam in Paris in June 2013 and a visit of F. Baccelli in Berkeley in November 2013. This Associate Team participated in the Inria@SiliconValley initiative. It led to several joint publications on Information Theory: http://www.di.ens.fr/~baccelli/IT_SG_WN_web_site.htm

8.3.2. Microsoft Research-Inria Joint Centre

DYOGENE is involved in two projetcs.

- Structured Large-Scale Machine Learning
  Project summary: Machine learning is now ubiquitous in industry, science, engineering, and personal life. While early successes were obtained by applying off-the-shelf techniques, there are two main challeges faced by machine learning in the « big data » era : structure and scale. The project proposes to explore three axes, from theoretical, algorithmic and practical perspectives: (1) large-scale convex optimization, (2) large-scale combinatorial optimization and (3) sequential decision making for structured data. The project involves two Inria sites and four MSR sites.
  As part of this project Florian Bourse (student at ENS) did an internship supervised by Marc Lelarge and Milan Vojnovic. Marc Lelarge visited MSR Cambridge and Milan Vojnovic visited Inria.
- Social information networks
  Project summary: Online Social networks provide a new way of accessing and collectively treating information. Their efficiency is critically predicated on the quality of information provided, the ability of users to assess such quality, and to connect to like-minded users to exchange useful content. To improve this efficiency, we develop mechanisms for assessing users' expertise and recommending suitable content. We further develop algorithms for identifying latent user communities and recommending potential contacts to users.
  As part of this project Rui Wu (student at UIUC) did an internship supervised by Marc Lelarge and Laurent Massoulié.

8.3.3. Participation In other International Programs

Anne Bouillard is participating in the joint lab Inria-Alcatel-Lucent and collaborated with B. Ronot [18].

Anne Bouillard is collaborating with Giovanni Stea from the University of Pisa, Italy.

Marc Lelarge is part of the IFCAM project: Application of optimal control and game theory in communication networks (PIs: Rajesh Sundaresan (Indian Institute of Science) and Eitan Altman (Inria))

8.4. International Research Visitors

8.4.1. Visits of International Scientists

- Vijay Subramanian (Northwestern University), April 8-12, 2013.
- Venkatachalam Anantharam (UC Berkeley), June 2013.
- Moez Draief (Imperial College London), July 2013.
- Hermann Thorisson (University of Iceland), September-October 2013.
- Sean Meyn (University of Florida), November 24-30, 2013.
- Rajesh Sundaresan (Indian Institute of Science), December 1-5, 2013.

8.4.1.1. Internships

- Asma Ghorbel (EURECOM), August 2013 to January 2014; Subject: *LTE/LTE-A Network Optimization by Distributed Fast Algorithms*; co-advised with Chung Shue (Calvin) Chen (Alcatel-Lucent Bell Labs).
- Rémi Varloot (ENS), MPRI internship, March-August 2013; Subject: *Coupling From the Past with Oracle Skipping*.
- Rui Wu (UIUC), September-December 2013.
- Jiaming Xu (UIUC), September 16-20, 2013.

8.4.2. Visits to International Teams

Anne Bouillard was invited at Tokyo institute of Technology, Japan from March to September 2013.

B. Błaszczyszyn visited Probability and Stochastic Processes team at the University of Wroclaw.

FORMES Team

7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. Tsinghua Grant

contract: Tsinghua National Laboratory for Information Science and Technology, Cross-discipline Foundation grant 2011-9

title: An Intensional Logical Framework and Its Implementation

Participants: Jean-Pierre Jouannaud, Jianqi Li

duration: 2011 - 2012

Amount: 100,000 RMB

7.1.2. NSFC Grant

contract: National Science Foundation of China grant 61272002

title: The meta-theories of higher-order rewriting and their proof automation: toward the next generation theorem prover

PIs: Jean-Pierre Jouannaud, Jianqi Li

duration: 2013-2016

Amount: 600,000 RMB

7.2. International Initiatives

7.2.1. Inria International Partners

7.2.1.1. Declared Inria International Partners

The FORMES project has been held since the beginning at Tsinghua University, Beijing, China. Tsinghua University is a founding member of LIAMA laboratory.

7.2.1.2. Informal International Partners

The FORMES project has also collaborated with:

- Pr John Koo at Shenzhen Institute of Advanced Technology, until August 2013.
- the Institute of Software of the Chinese Academy of Science where Frédéric Blanqui has been kindly hosted between July 2012 and August 2013.

7.2.2. Inria International Labs

FORMES is one of the LIAMA projects.

7.2.3. Participation In other International Programs

LIAMA is a member of the AURA network: Association of Units of Research in Asia.

7.3. International Research Visitors

7.3.1. Visits of International Scientists

FORMES project member Jean-Pierre Jouannaud organized jointly with Pr Ming Gu the LIAMA-Tsinghua Software Day, where the following scientists reported on their research:

- Pr Edmund Clarke, from Carnegie Mellon.
- Erik Hagersten from University of Uppsala.
- Marc Pouzet from University Pierre et Marie Curie.

7.3.1.1. Internships

- *Jiaxiang Liu*
  - Subject: Diagramatic Confluence,
  - Date: from Jul 2013 to Dec 2013,
  - Institution: Ecole Polytechnique
- *Antoine Rouquette*
  - Subject: Upgrade of SimSoC simulator,
  - Date: from September 2012 to August 2013,
  - Institution: Shenzhen Institutes of Advanced Technology
- *Shenpeng Wang*
  - Subject: Approximately Timed Simulation of PowerPC e200z,
  - Date: from March 2012 to May 2013,
  - Institutions: Tsinghua University and Shenzhen Institutes of Advanced Technology

GALLIUM Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR projects

8.1.1.1. BWare

Participants: Damien Doligez, Fabrice Le Fessant, Luca Saiu.

The "BWare" project (2012-2016) is coordinated by David Delahaye at Conservatoire National des Arts et Métiers and funded by the *Ingénierie Numérique et Sécurité* programme of *Agence Nationale de la Recherche*. BWare is an industrial research project that aims to provide a mechanized framework to support the automated verification of proof obligations coming from the development of industrial applications using the B method and requiring high guarantees of confidence.

8.1.1.2. Paral-ITP

Participant: Damien Doligez.

The "Paral-ITP" project (2011-2014) is coordinated by Burkhart Wolff at Université Paris Sud and funded by the *Ingénierie Numérique et Sécurité* programme of *Agence Nationale de la Recherche*. The objective of Paral-ITP is to investigate the parallelization of interactive theorem provers such as Coq and Isabelle.

8.1.1.3. Verasco

Participants: Jacques-Henri Jourdan, Xavier Leroy.

The "Verasco" project (2012-2015) is coordinated by Xavier Leroy and funded by the *Ingéniérie Numérique et Sécurité* programme of *Agence Nationale de la Recherche*. The objective of this 4-year project is to develop and formally verify a static analyzer based on abstract interpretation, and interface it with the CompCert C verified compiler.

8.1.2. FSN BGLE projects

8.1.2.1. ADN4SE

Participants: Damien Doligez, Jael Kriener.

The "ADN4SE" project (2012-2016) is coordinated by the Sherpa Engineering company and funded by the *Briques Génériques du Logiciel Embarqué* programme of *Fonds national pour la Société Numérique*. The aim of this project is to develop a process and a set of tools to support the rapid development of embedded software with strong safety constraints. Gallium is involved in this project to provide tools and help for the formal verification in TLA+ of some important aspects of the PharOS real-time kernel, on which the whole project is based.

8.1.2.2. CEEC

Participants: Thomas Braibant, Xavier Leroy.

The "CEEC" project (2011-2014) is coordinated by the Prove & Run company and also involves Esterel Technologies and Trusted Labs. It is funded by the *Briques Génériques du Logiciel Embarqué* programme of *Fonds national pour la Société Numérique*. The CEEC project develops an environment for the development and certification of high-security software, centered on a new domain-specific language designed by Prove & Run. Our involvement in this project focuses on the formal verification of a C code generator for this domain-specific language, and its interface with the CompCert C verified compiler.

8.1.3. FUI projects

8.1.3.1. Richelieu (FUI)

Participants: Michael Laporte, Fabrice Le Fessant.

The "Richelieu" project (2012-2014) is funded by the *Fonds unique interministériel* (FUI). It involves Scilab Enterprises, U. Pierre et Marie Curie, Dassault Aviation, ArcelorMittal, CNES, Silkan, OCamlPro, and Inria. The objective of the project is to improve the performance of scientific programming languages such as Scilab's through the use of VMKit and LLVM.

8.2. European Initiatives

8.2.1. FP7 Projects

8.2.1.1. DEEPSEA

Type: IDEAS

Instrument: ERC Starting Grant

Duration: June 2013 - May 2018

Coordinator: Umut Acar

Partner: Inria

Inria contact: Umut Acar

Abstract: the objective of project DEEPSEA is to develop abstractions, algorithms and languages for parallelism and dynamic parallelism, with applications to problems on large data sets.

8.3. International Initiatives

8.3.1. Inria International Labs

Fabrice Le Fessant visited CIRIC (Center of Excellence on TIC, created by Inria in Chile) during two weeks. He gave several lectures on OCaml: a presentation at StarTechConf'2013, a presentation at University Adolfo Ibañez, and a presentation and a lecture at University of Chile.

8.4. International Research Visitors

8.4.1. Visits of International Scientists

Olin Shivers, professor at Northeastern University (Boston), visited the Gallium team from July 2013 to December 2013. He worked on static analysis and intermediate representations for functional programming languages.

8.4.1.1. Internships

Robbert Krebbers

Subject: formal semantics for the C language

Date: from Jan 2013 until Mar 2013

Institution: Radboud University (Netherlands)

GAMMA3 Project-Team

6. Partnerships and Cooperations

6.1. National Initiatives

6.1.1. ANR

F. Alauzet, N. Barral, V. Menier and A. Loseille are part of the MAIDESC ANR (2013-2015) on mesh adaptation for moving interfaces in CFD.

6.1.2. Autres sections...

P. Laug participated in the Inria collaboration program GEOFRAC: *Large-scale computation of flow in complex 3D geological fractured porous media*. Its coordinator is J. Erhel, SAGE team, Inria Rennes (January 2012 - June 2013). The teams involved are GAMMA3, POMDAPI, SAGE (Inria) and UMR Géosciences Rennes.

6.2. European Initiatives

6.2.1. FP7 Projects

F. Alauzet, N. Barral, V. Menier and A. Loseille are part of the UMRIDA FP7 program (2013-2017) devoted to the control of uncertainties in CFD.

GANG Project-Team

7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. ANR Prose

Participants: Pierre Fraigniaud, Amos Korman, Laurent Viennot.

Managed by University Paris Diderot, P. Fraigniaud.

Online social networks are among the most popular sites on the Web and continue to grow rapidly. They provide mechanisms to establish identities, share content and information, and create relationships. With the emergence of a new generation of powerful mobile devices that enable wireless ad hoc communication, it is time to extend social networking to the mobile world. Such an ad hoc social networking environment is full of opportunities. As opposed to the use of personal computers, a mobile phone is a strictly personal device, always on, with several wireless interfaces that include a short range communication with nearby nodes. Applications such as notification of status updates, sharing of user generated content, documents tagging, rating/recommendation and bookkeeping can be deployed "on the move" on top of contacts established through short range communication. It requires to deploy social networking applications in a delay tolerant manner using opportunistic social contacts as in a peer to peer network, as well as new advanced content recommendation engines.

The Prose project is a collective and multi-disciplinary effort to design opportunistic contact sharing schemes, and characterizes the environmental conditions, the usage constraint, as well as the algorithmic and architecture principles that let them operate. The partners of the Prose project will engage in this exploration through various expertise: network measurement, traffic monitoring from a real application, system design, behavioral study, analysis of distributed algorithms, theory of dynamic graph, networking modeling, and performance evaluation. As part of this project, the partners will be involved in the analysis of the content received and accessed by users of a real commercial application (PlayAdz), and will participate to the design of a new promotion advertisement service.

7.1.2. ANR Displexity

Participants: Carole Delporte-Gallet, Hugues Fauconnier, Pierre Fraigniaud, Arfoui Heger, Amos Korman, Hung Tran-The, Laurent Viennot.

Managed by University Paris Diderot, C. Delporte and H. Fauconnier lead this project that grants 1 Ph. D.

Distributed computation keep raising new questions concerning computability and complexity. For instance, as far as fault-tolerant distributed computing is concerned, impossibility results do not depend on the computational power of the processes, demonstrating a form of undecidability which is significantly different from the one encountered in sequential computing. In the same way, as far as network computing is concerned, the impossibility of solving certain tasks locally does not depend on the computational power of the individual processes.

The main goal of DISPLEXITY (for DIStributed computing: computability and ComPLEXITY) is to establish the scientific foundations for building up a consistent theory of computability and complexity for distributed computing.

One difficulty to be faced by DISPLEXITY is to reconcile the different sub-communities corresponding to a variety of classes of distributed computing models. The current distributed computing community may indeed be viewed as two not necessarily disjoint sub-communities, one focusing on the impact of temporal issues, while the other focusing on the impact of spatial issues. The different working frameworks tackled by these two communities induce different objectives: computability is the main concern of the former, while complexity is the main concern of the latter.

Within DISPLEXITY, the reconciliation between the two communities will be achieved by focusing on the same class of problems, those for which the distributed outputs are interpreted as a single binary output: yes or no. Those are known as the yes/no-problems. The strength of DISPLEXITY is to gather specialists of the two main streams of distributed computing. Hence, DISPLEXITY will take advantage of the experience gained over the last decade by both communities concerning the challenges to be faced when building up a complexity theory encompassing more than a fragment of the field.

In order to reach its objectives, DISPLEXITY aims at achieving the following tasks:

- Formalizing yes/no-problems (decision problems) in the context of distributed computing. Such problems are expected to play an analogous role in the field of distributed computing as that played by decision problems in the context of sequential computing.
- Formalizing decision problems (yes/no-problems) in the context of distributed computing. Such problems are expected to play an analogous role in the field of distributed computing as that played by decision problems in the context of sequential computing.
- Revisiting the various explicit (e.g., failure-detectors) or implicit (e.g., a priori information) notions of oracles used in the context of distributed computing allowing us to express them in terms of decidability/complexity classes based on oracles.
- Identifying the impact of non-determinism on complexity in distributed computing. In particular, DISPLEXITY aims at a better understanding of the apparent lack of impact of non-determinism in the context of fault-tolerant computing, to be contrasted with the apparent huge impact of non-determinism in the context of network computing. Also, it is foreseen that non-determinism will enable the comparison of complexity classes defined in the context of fault-tolerance with complexity classes defined in the context of network computing.
- Last but not least, DISPLEXITY will focus on new computational paradigms and frameworks, including, but not limited to distributed quantum computing and algorithmic game theory (e.g., network formation games).

The project will have to face and solve a number of challenging problems. Hence, we have built the DISPLEXITY consortium so as to coordinate the efforts of those worldwide leaders in Distributed Computing who are working in our country. A successful execution of the project will result in a tremendous increase in the current knowledge and understanding of decentralized computing and place us in a unique position in the field.

7.1.3. Alcatel-Lucent Bell Labs and Inria Joint Research Lab

Participants: The-Dang Huynh, Leonardo Linguaglossa, Fabien Mathieu, Laurent Viennot.

Gang is participating to the joint laboratory between Alcatel-Lucent and Inria and contributes mainly in the ADR (joint research action) on content centric networking.

7.1.4. Laboratory of Information, Networking and Communication Sciences (LINCS)

Participants: The-Dang Huynh, Leonardo Linguaglossa, Fabien Mathieu, Laurent Viennot.

Gang is participating to the LINCS, a research centre co-founded by Inria, Institut Mines-Télécom, UPMC and Alcatel-Lucent Bell Labs, dedicated to research and innovation in the domains of future information and communication networks, systems and services. Most of the collaboration with Alcatel-Lucent is carried through this structure.

7.2. European Initiatives

7.2.1. FP7 Projects

7.2.1.1. EULER

Title: EULER (Experimental UpdateLess Evolutive Routing)

Type: COOPERATION (ICT)

Defi: Future Internet Experimental Facility and Experimentally-driven Research

Instrument: Specific Targeted Research Project (STREP)

Duration: October 2010 - September 2013

Coordinator: ALCATEL-LUCENT (Belgium)

Others partners:

Alcatel-Lucent Bell, Antwerpen, Belgium

3 projects from Inria: CEPAGE, GANG and MASCOTTE, France

Interdisciplinary Institute for Broadband Technology (IBBT),Belgium

Laboratoire d'Informatique de Paris 6 (LIP6), Université Pierre Marie Curie (UPMC), France

Department of Mathematical Engineering (INMA) Université Catholique de Louvain, Belgium

RACTI, Research Academic Computer Technology Institute University of Patras, Greece

CAT, Catalan Consortium: Universitat PolitÃ¨cnica de Catalunya, Barcelona and University of Girona, Spain

See also: http://www-sop.inria.fr/mascotte/EULER/wiki/

Abstract: The title of this study is "Dynamic Compact Routing Scheme". The aim of this projet is to develop new routing schemes achieving better performances than current BGP protocols. The problems faced by the inter-domain routing protocol of the Internet are numerous:

The underlying network is dynamic: many observations of bad configurations show the instability of BGP;

BGP does not scale well: the convergence time toward a legal configuration is too long, the size of routing tables is proportional to the number of nodes of network (the network size is multiplied by 1.25 each year);

The impact of the policies is so important that the many packets can oscillated between two Autonomous Systems.

Description: In this collaboration, we mainly investigate new routing paradigms so as to design, develop, and validate experimentally a distributed and dynamic routing scheme suitable for the future Internet and its evolution. The resulting routing scheme(s) is/are intended to address the fundamental limits of current stretch-1 shortest-path routing in terms of routing table scalability but also topology and policy dynamics (perform efficiently under dynamic network conditions). Therefore, this project will investigate trade-offs between routing table size (to enhance scalability), routing scheme stretch (to ensure routing quality) and communication cost (to efficiently and timely react to various failures). The driving idea of this research project is to make use of the structural and statistical properties of the Internet topology (some of which are hidden) as well as the stability and convergence properties of the Internet policy in order to specialize the design of a distributed routing scheme known to perform efficiently under dynamic network and policy conditions when these properties are met. The project will develop new models and tools to exhaustively analyse the Internet topology, to accurately and reliably measure its properties, and to precisely characterize its evolution. These models, that will better reflect the network and its policy dynamics, will be used to derive useful properties and metrics for the routing schemes and provide relevant experimental scenarios. The project will develop appropriate tools to evaluate the performance of the proposed routing schemes on large-scale topologies (order of 10k nodes). Prototype of the routing protocols as well as their functional validation and performance benchmarking on the iLAB experimental facility and/or virtual experimental facilities such as PlanetLab/OneLab will allow validating under realistic conditions the overall behaviour of the proposed routing schemes.

7.3. International Initiatives

7.3.1. Internet Technologies and Architectures

Participant: Fabien Mathieu.

The aim of this project is to build a community of researchers focusing on fundamental theoretical issues of future networking, including such topics as communication theory, network information theory, distributed algorithms, self-organization and game theory, modeling of large random and complex networks and structures. Partners Inria, VTT, Aalto University, Eindhoven University are gathered under EIT ICT Labs Project Fundamentals of Networking (FUN).

7.3.2. Inria International Partners

7.3.2.1. Informal International Partners

Participants: Carole Delporte, Hugues Fauconnier.

- distributed computing and synchronization: regular visits by Sam Toueg (Toronto), Rachid Guerraoui (EPFL) and Luis Rodriguez (U. Lisboa).
- consensus agreement: Last year we have shown that $(n-1)$-set consensus can be solved obstruction-free with 2 MWMR registers and this bound is tight. We have tried to generalize this result to the $(n-k)$-set consensus with $k+1$ registers; our regular cooperation with Eli Gafni (UCLA) is still ongoing.

HIPERCOM2 Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR

8.1.1.1. GETRF

Participants: Paul Muhlethaler, Pascale Minet, Cédric Adjih, Emmanuel Baccelli, Philippe Jacquet.

Period: 2012 - 2014.

Partners: DGA/MI, Inria (coordinator), Alcatel-Lucent.

The GETRF project aims at improving the effectiveness of communications mechanisms and technologies capable of functioning in extreme conditions and GETRF also aims at opening ways for solutions that are close to the optimum. The following areas will be addressed:

- Compromise time / maximum efficiency for coloring (TDMA), which can be used to take into account the asymmetry of traffic delays to optimize routing.
- Significant energy savings for opportunistic routing (in power saving mode) even where traffic control is limited and where the nodes are idle most of the time ("low-duty cycle")
- From a completely different point of view, the finding optimal network capacity for opportunistic routing variants when designed for mobile networks
- Robustness to mobility and to changes in network conditions (difficult connectivity, foes, ...) extreme network coding - which is moreover an innovative technology in itself applied here in MANETs, at the network and/or application layer, rather than at the physical/or theoretical level as in other proposals.

The project focuses on four technical approaches which are:

- Coloring for the development of a TDMA system for energy saving and delay control,
- Cross-layer (MAC/routing) mechanism for "low-duty-cycle" mode
- Network coding,
- Opportunistic routing and mobile mobility to use relays to minimize retransmissions of packets with a target time.

The first two approaches are intended to provide energy efficient sensor networks. The second two approaches try to provide mechanisms for building ad hoc networks capable of handling high node mobility.

8.1.2. Competitivity Clusters

8.1.2.1. SAHARA

Participants: Pascale Minet, Ridha Soua, Erwan Livolant.

Period: 2011 - 2014.

Partners: EADS (coordinator), Astrium, BeanAir, CNES, ECE, EPMI, Eurocopter, GlobalSys, Inria, LIMOS, Oktal SE, Reflex CES, Safran Engineering Systems.

SAHARA is a FUI project, labelled by ASTECH and PEGASE, which aims at designing a wireless sensor network embedded in an aircraft. The proposed solution should improve the embedded mass, the end-to-end delays, the cost and performance in the transfers of non critical data. Inria is in charge of coordinating the academic partners. During year 2013, we specified the protocols for layer 3. We organized demonstrations in March at Rocquencourt and in July 2013 at Suresnes to prove our concepts.

8.1.2.2. CONNEXION

Participants: Pascale Minet, Saoucene Ridene, Ines Khoufi, Erwan Livolant.

Period: 2012 - 2016.

Partners: EDF (coordinator), All4Tec, ALSTOM, AREVA, Atos WorldGrid, CEA, CNRS / CRAN, Corys TESS, ENS Cachan, Esterel Technologies, Inria, LIG, Predict, Rolls-Royce Civil Nuclear, Telecom ParisTech.

The Cluster CONNECTION (Digital Command Control for Nuclear EXport and renovation) project aims to propose and validate an innovative architecture platforms suitable control systems for nuclear power plants in France and abroad. This architecture integrates a set of technological components developed by the academic partners (CEA, Inria, CNRS / CRAN, ENS Cachan, LIG, Telecom ParisTech) and based on collaborations between major integrators such as ALSTOM and AREVA, the operator EDF in France and "techno-providers" of embedded software (Atos WorldGrid, Rolls-Royce Civil Nuclear, Corys TESS, Esterel Technologies, All4Tec, Predict). With the support of the competitiveness clusters System@tic, Minalogic and Burgundy Nuclear Partnership,the project started in April 2012. The key deliverables of the project covered several topics related demonstration concern-driven engineering models for the design and validation of large technical systems, design environments and evaluation of HMI, the implementation of Wireless Sensor Network context-nuclear, buses business object or real-time middleware facilitating the exchange of heterogeneous data and distributed data models standardized to ensure consistency of digital systems.

The HIPERCOM2 team is involved in wireless sensor networks coping with node mobility. We focused on deployment and redeployment algorithms for mobile wireless sensor networks after a disaster. We began with a state of the art. Many works in the literatures deal with this issue. We distinguish:

- Grid based approach: sensors will redeploy according to a predetermined grid.
- The computational geometry based approach uses the Voronoi diagram and the Delaunay triangulation.
- The virtual force based approach is based on virtual forces to move sensors.

The virtual force based approach presents many advantages such as simplicity and fast coverage. That is why we adopt this approach. However, the distributed version is prone to node oscillations that consume energy. We proposed two distributed algorithms to reduce node oscillations: ADVFA that adapts to the effective number of operational sensor nodes and GDVFA that takes advantage of grid to avoid these oscillations and to easily detect redundant nodes that can sleep to save energy.

8.1.2.3. SMARTMESH

Participants: Cédric Adjih, Alaeddine Weslati.

This is a joint work with Emmanuel Baccelli from Inria Saclay.

Period: 2010 - 2013.

Partners: SAGEM, CEA, Telecom SudParis, Ineo Defense, IEF, Orelia, Prodomo, Reflex CES, Evitech, Accuwatt.

SMARTMESH is a System@tic project, focused on the design of intelligent wireless sensor mesh networking for video surveillance and intrusion alarm systems.

In 2013, Inria finalized the communication subsystem comprising the following elements:

- Communication hardware using Senslab nodes (WSN430), directly connected to “SMARTMESH” nodes, with 802.15.4 radio.
- Communication software based on an extended version of the Contiki-OS
- Extensions of RPL routing protocol: P2P-RPL and MLN-RPL (Multi-Level Neighborhood RPL, for filtering appropriate links).

- Adaptation of the Contiki-OS 802.15.4 MAC layer for enabling better performance.
- Development of a cross-layering transport layer, to allow the efficient transport of large burst of data (images), on top of the 6lowpan/802.15.4 layer: a "burst-mode" communication protocol.

During the year 2013, the different components of the SMARTMESH project have been integrated to develop a specific application of area surveillance, with an easily deployable system. The system comprises a number of sensors: audio sensors, PIR sensors, infrared cameras, standard camera; a number of sophisticated signal processing algorithms (audio, video, distributed fusion and tracking, energy management); the communication susbsystem itself; and a control/supervising terminal (displaying alarms, and tracks in real time).

Ten SMARTMESH prototype nodes have been created, integrating the different components. They have been tested in deployments in the military camp of Beynes (mostly from december 2012 to february 2013). The deployments had been planned with a map describing orientation and positions of the sensors of the nodes.

A demonstration of the entire SMARTMESH project was successfully conducted on 22 february, with the following application: detection of human "intruders", and of vehicles, and tracking of their motion.

8.1.2.4. ACRON

Participant: Cédric Adjih.

Period: 2011 - 2013

Partners: Supélec (Télécommunications), Inria, ENS TREC, Inria HIPERCOM, Université Paris-Sud, IEF.

ACRON is a DIMLSC DIGITEO project. It deals with analysis and design of self-organized wireless networks. The HIPERCOM team project will study the theoretical limits of wireless networking.

In 2013, we finalized a protocol for diffusion in Vehicular Networks (VANETs) using network coding: the "DONC" diffusion protocol (joint work with Anthony Busson and Farhan Mirani in particular). The protocol is combining network coding with delay-based broadcast.

8.1.2.5. SWAN

Participants: Cédric Adjih, Claudio Greco.

Period: 2011 - 2014

Partners: CNRS, Supélec, Université Paris-Sud (L2S), LTCI, LRI, Inria and IEF.

SWAN, Source-aWAre Network coding, is a DIMLSC DIGITEO project. It deals with network coding for multimedia.

8.1.2.6. MOBSIM

Participants: Cédric Adjih, Paul Muhlethaler, Hana Baccouch.

Period: 2011 - 2013

Partners: Inria Sophia, Inria Genoble.

MOBSIM is an ADT, Action of Technology Development. It aims at developping the NS3 simulation tool. The HIPERCOM team focuses on routing protocols and MAC protocol (namely the EY-NPMA protocol Elimination Yield Non-Preemptive Multiple Access). An engineer has been recruited for this project.

Thanks to the ADT, a module for the simulator ns-3 has been released: Ey-Wifi. It is available, along with a detailed tutorial explaining how to use it, at: http://hipercom.inria.fr/Ey-Wifi

8.2. International Initiatives

8.2.1. Participation In other International Programs

8.2.1.1. AWSN 2013

Program: Euromediterranean 3+3

Title: Auto-adaptivity in Wireless Sensor Networks

Inria principal investigator: Pascale Minet

International Partners:

University of Catania (Italy) - DIEEI - Lucia Lo Bello

Ecole Nationale Supérieure d'Informatique et d'Analyse des Systèmes (Morocco) - ND-SRG - Mohamed Erradi

Ecole Nationale des Sciences de l'Informatique (Tunisia) - CRISTAL - Leila Azouz Saidane

Duration: Jan 2012 - Dec 2015

See also: http://hipercom.inria.fr/euromed/

Wireless sensor networks (WSNs) allow the development of numerous applications in various domains, such as security and surveillance, environment protection, precision agriculture, intelligent transportation, homecare of elderly and disabled people...

Communication in such WSNs has to cope with limited capacity resources, energy depletion of sensor nodes, important fluctuations of traffic in the network, changes in the network topology (radio link breakage, interferences ...) or new application requirements. In the AWSN project, we focus on the different techniques to be introduced in the WSNs to make them auto-adaptive with regard to these various changes, while meeting the application requirements. Thus, we address:

- network deployment and redeployment in order to fulfill the application requirements,
- QoS (Quality of Service) optimization taking into account real-time traffic and dynamic bandwidth allocation,
- energy efficiency and replacement of failed sensor node,
- component generation and dynamic adaptation of the application.

In 2013, the AWSN project organized two workshops reserved to AWSN teams:

- Workshop in Rocquencourt in September 2013.
- Workshop in Catania in December 2013.

The AWSN project organized also two open workshops:

- RAWSN 2013 in Marrakech in May 2013 organized by the Moroccan team: see the program on http://www.netys.net/rawsn2013/, workshop held in conjunction with NETYS 2013.
- PEMWN 2013 workshop in Hammamet in November 2013, organized by the Tunisian and French teams, see the program on https://sites.google.com/site/pemwn2013/final-program

8.3. International Research Visitors

8.3.1. Visits of International Scientists

- **Leila Saidane**, ENSI, Tunis, Tunisia, February and September 2013,
- **Mohammed Erradi**, ENSIAS, Rabat, Morocco, September 2013,
- **Abdellatif Kobbane**, ENSIAS, Rabat, Morocco, September 2013.

IMARA Project-Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

The Yvelines General Council has designated the winners of its second call for projects "Intelligent Car - City of the Future". Following a selection made by a jury, the winners were four consortia. IMARA was involved in two of the four winning projects: TRANS'YVES, coordinated by ADM Concept, and Link & Go coordinated by AKKA Technologies (with Controlsys, Inria and DBT) project. The Yvelines department wanted to promote the emergence of projects on sustainable development and automated driving with electric vehicles. On four projects selected, two of them are just referring to a concept of automatic parking, the vehicle comes to park all alone with no one on board. The call for proposals with a budget of 3 million Euros has been used to finance demonstrators that were exhibited at the Geneva Motor Show in 2013 as part of the Green Pavilion.
Link & Go was coordinated has been awarded the prestigious *2013 Grand National Engineering Award.*

8.2. National Initiatives

8.2.1. ANR

8.2.1.1. ABV

Title: Automatisation basse vitesse

Instrument: ANR

Duration: January 2009 - April 2013

Coordinator: IFFSTAR

Others partners: Continental, IBISC, IEF, Induct, Inria, LAMIH, Vismetris, UHA-MIPS, Veolia Environnement

See also: http://www.projet-abv.fr/

Abstract: This ambitious project aims at demonstrating automated driving at low speed in urban areas and on peri-urban roads. The aim is to demonstrate the technical feasibility of automating driving at low speeds, typically in situations of congestion or heavy traffic.

8.2.1.2. SCORE@F

Title: Système COopératif Routier Expérimental Français

Instrument: FUI

Duration: 2010-2013

Coordinator: Renault-REGIENOV

Others partners: UTAC, LAB, EURECOM, IFSTTAR, Inria, Télécom Ecole de Management

See also: http://www.scoref.fr/

Abstract: SCORE@F (French Experimental Road Cooperative System) is a collaborative research project, experimental road cooperative systems as part of a European framework for experimentation. The SCORE@F is intended to prepare the deployment of "road cooperative systems" on motorways and other road environments through the implementation of operational tests in an open environment. Road cooperative systems are based on wireless local communication between vehicles and road infrastructure (V2I - I2V) and between vehicles (V2V). The deployment of cooperative systems will be strongly influenced by road Framework Directive of the European Commission ITS.

8.2.1.3. COCOVEA

Title: Coopération Conducteur-Véhicule Automatisé

Instrument: ANR

Duration: 01/11/2013 – 30/04/2017

Coordinator: Jean-Christophe Popieul (LAMIH - University of Valenciennes)

Partners: LAMIH, IFSTTAR, Inria, University of Caen, COMETE, PSA, CONTINENTAL, VALEO, AKKA Technologies, SPIROPS

Inria contact: Fawzi Nashashibi

Abstract: CoCoVeA project aims at demonstrating the need to integrate from the design of the system, the problem of interaction with the driver in resolving the problems of sharing the driving process and the degree of freedom, authority, level of automation, prioritizing information and managing the operation of the various systems. This approach requires the ability to know at any moment the state of the driver, the driving situation in which he finds himself, the operating limits of the various assistance systems and from these data, a decision regarding activation or not the arbitration system and the level of response.

8.2.2. Competitivity Clusters

IMARA team is a very active partner in the competitivity clusters, especially MOV'EO and System@tic. We are involved in several technical committees like the DAS SUR of MOV'EO for example. IMARA is also the main Inria contributor in the VeDeCoM institute (IEED). VeDeCoM is financing a PhD thesis of Pierre Merdrignac; his scientific research topic is on the fusion of perception and communication for pedestrian assistance, monitoring and tracking.

8.3. European Initiatives

8.3.1. FP7 Projects

8.3.1.1. DRIVE C2X

Type: COOPERATION

Defi: Driving implementation of car 2 x communication technology

Instrument: Integrated Project

Objectif: ICT for Mobility of the Future

Duration: January 2011 - December 2013

Coordinator: DAIMLER AG (Germany)

Partner: 31 partners from automotive industry, electronic and supplier industry, software development, traffic engineering, research institutes and road operators.

Inria contact: Thierry Ernst

Abstract: With 31 partners, 15 support partners and 18.8 million Euro budget, DRIVE C2X will lay the foundation for rolling out cooperative systems in Europe. Hence, lead to a safer, more economical and more ecological driving.

8.3.1.2. ITSSV6

Type: COOPERATION

Defi: IPV6 ITS Station Stack for Cooperative Systems FOTs

Instrument: Specific Targeted Research Project

Objectif: ICT for Mobility of the Future

Duration: February 2011 - January 2014

Coordinator: Inria (France)

Partner: Universidad de Murcia (Spain), Institut Télécom (France), Mines ParisTech (france), Inria (France), Lesswire (Germany), SZTAKI (Hungary), IPTE (Austria), BlueTechnix (Austria).

Inria contact: Thierry Ernst

Abstract: ITSSv6 builds on the base of existing standards from ETSI, ISO and IETF and IPv6 software available from CVIS and GeoNet projects. Its main objective is to deliver an optimized IPv6.

See also: http://itssv6.inria.fr/

8.3.1.3. SANDRA

Type: COOPERATION

Instrument: Integrated Project

Objectif: NC

Duration: October 2009 - September 2013

Coordinator: SELEX ES SPA (Italy)

Partner: Acreo (Sweden), Airtel ATN (Ireland), Alenia Aermacchi (Italy), Altys (France), Bradford University (United Kingdom), Cyner (Netherlands), Dassault Aviation (France), Deutsche Flugsicherung GmbH (Germany), Deutsches Zentrum fur Luft- und Raumfahrt e.V. (Germany), EADS Innovation Works (France), Gatehouse (Denmark), IMST GmbH (Germany), Inria (France), Intecs (Italy), LionixBV (Netherlands), Monitorsoft (Russian Federation), Nationaal Lucht- en Ruimtevaartlaboratorium - NLR (Netherlands), Paris Lodron Universitat (Salzburg), RadioLabs (Italy), SITA (Switzerland), Slot Consulting (Hungary), Thales Aerospace (United Kingdom), Thales Alenia Space (France), Thales Avionics(France), Thales TRT-UK (United Kingdom), TriaGnoSys GmbH (Germany), University of Pisa (Italy), University of Twente (Netherlands).

Inria contact: Thierry Ernst

Abstract: The SANDRA concept consists of the integration of complex and disparate communication media into a lean and coherent architecture for aeronautical networking.

See also: http://sandra.aero/2013/

8.3.1.4. CATS

Title: City Alternative Transport System

Type: COOPERATION (TRANSPORTS)

Instrument: Specific Targeted Research Project (STREP)

Objectif: NC

Duration: January 2010 - December 2013

Coordinator: Lohr Industrie (France)

Partner: Inria (France), CTL (Italy), EPFL (Switzerland), TECHNION (Israel), GEA (Switzerland), ERT (France), and the cities of Formello (Italy), Strasbourg (France) and Ploiesti (Romania).

Inria contact: Michel Parent

Abstract: CATS' aim is the full development and experimentation of a new urban transport service based on a new generation of vehicle. Its major innovation is the utilization of a single type of vehicle for two different uses: individual use or semi collective transport. This new transport service is aimed at filling the gap between public mass transport and private individual vehicles.

See also: http://www.cats-project.org

8.3.1.5. FURBOT

Title:Architectures of Light Duty Vehicles for urban freight transport

Type: COOPERATION (TRANSPORTS)

Instrument: Specific Targeted Research Project (STREP)

Objectif: NC

Duration: November 2011 - October 2014

Coordinator: Genova University (Italy)

Partner: Bremach (Italy), ZTS (Slovakia), Universite di Pisa (Italy), Persico (Italy), Mazel (Spain), TCB (Portugal), Inria (France).

Inria contact: Fawzi Nashashibi

Abstract: The project proposes novel concept architectures of light-duty, full-electrical vehicles for efficient sustainable urban freight transport and will develop FURBOT, a vehicle prototype, to factually demonstrate the performance expected.

8.3.1.6. CityMobil2

Type: COOPERATION (TRANSPORTS)

Instrument: Large-scale integrating project

Objectif: NC

Duration: September 2012 - August 2016

Coordinator: University of Rome La Sapienza, CTL (Italy)

Partner: Inria (France), DLR (germany), GEA Chanard (Switzerland), POLIS (Belgium), ERT (Belgium), EPFL (Switzerland),...(45 partners!)

Inria contact: Fawzi Nashashibi

Abstract: The CityMobil2 goal is to address and to remove three barriers to the deployment of automated road vehicles: the implementation framework, the legal framework and the unknown wider economic effect. CityMobil2 features 12 cities which will revise their mobility plans and adopt wherever they will prove effective automated transport systems. Then CityMobil2 will select the best 5 cases (among the 12 cities) to organize demonstrators. The project will procure two sets of automated vehicles and deliver them to the five most motivated cities for a 6 to 8 months demonstration in each city. CityMobil2 will establish a workgroup that will deliver a proposal for a European Directive to set a common legal framework to certify automated transport systems.

See also: http://www.citymobil2.eu/en/

8.3.1.7. DESERVE

Title: DEvelopment platform for Safe and Efficient dRiVE

Objectif: NC

Duration: September 2012 - August 2015

Coordinator: VTT (Finland)

Partner: CRF (Italy), Armines (France), CONTINENTAL AUTOMOTIVE FRANCE SAS (France), FICOSA (Italy), Inria (France), TRW (Great Britain), AVL (Austria), BOSCH (Germany), DAIMLER (Germany), VOLVO (Sweden),...(26 partners)

Inria contact: Fawzi Nashashibi

Abstract: To manage the expected increase of function complexity together with the required reduction of costs (fixed and variable) DESERVE will design and build an ARTEMIS Tool Platform based on the standardization of the interfaces, software (SW) reuse, development of common non-competitive SW modules, and easy and safety-compliant integration of standardized hardware (HW) or SW from different suppliers. With innovative design space exploration (DSE) methods system design costs can be reduced by more than 15%. Hence, DESERVE will build an innovation ecosystem for European leadership in ADAS embedded systems, based on the automotive R&D actors, with possible applications in other industrial domains.

See also: http://www.artemis-ia.eu/project/index/view/?project=38

8.3.1.8. Mobility2.0

Title: Co-operative ITS systems for enhanced electric vehicle mobility
Type: COOPERATION (TRANSPORTS)
Objectif: NC
Duration: September 2012 - February 2015
Coordinator: Broadbit (Slovakia)
Partner: ETRA (Spain), Barcelona Digital (Spain), ICCS (Greece), MRE (Italy), Armines (France), University of Twente (Netherlands), Privé (Italy), NEC (United Kingdom)
Inria contact: Jean-Marc Lasgouttes
Abstract: Mobility2.0 will develop and test an in-vehicle commuting assistant for FEV mobility, resulting in more reliable and energy-efficient electro-mobility. In order to achieve a maximum impact, Mobility2.0 takes an integrated approach of addressing the main bottlenecks of urban FEV mobility: "range anxiety" related to the limited FEV range, scarcity of parking spaces with public recharging spots, and the congestion of urban roads. Our integrated approach means the application developed by Mobility2.0 will utilize co-operative systems to simultaneously consider these bottlenecks, so that such an optimization can be achieved which still guarantees reliable transportation for each FEV owner. Mobility2.0 will focus on assisting the daily urban commute, which represents the bulk of urban mobility.
See also: http://mobility2.eu/

8.3.2. Collaborations with Major European Organizations

- IMARA is a full partner of VRA:
  VRA – Vehicle and Road Automation is a support action funded by the European Union to create a collaboration network of experts and stakeholders working on deployment of automated vehicles and its related infrastructure. VRA project is considered as the cooperation interface between EC funded projects, international relations and national activities on the topic of vehicle and road automation. It is financed by the European Commission DG CONNECT and coordinated by ERTICO – ITS Europe.
- IMARA is member of the Working Group on Automation. This group has been created and is animated by ERTICO ITS Europe. The Automation Working Group was formed under the iMobility Forum, with the initial high level aims of exploring and promoting the potential of highly automated vehicles and applications and working towards the development of a roadmap for the deployment of automated systems.

8.4. International Initiatives

8.4.1. Inria International Partners

8.4.1.1. Declared Inria International Partners

IMARA has developed a wide collaboration network with international partners from both academia and industry.

- **NAIST :** IMARA has signed a MoU with the Nara Institute of Science and Technology (NAIST). The research themes of cooperation are in the area of *advanced intelligent transportation systems (ITS)*.
- **YAMAHA :** IMARA has signed a MoU with YAMAHA to conduct joint research on the *New Generation of AGV projects* (Autonomous Ground Vehicles).
- **AXTER Technologies :** IMARA has signed a MoU with AXTER Technologies for the cooperation on the *autonomous navigation in indoor environments for automated industrial vehicles*.
- **Simon Bolìvar University :** IMARA and University Simon Bolivar (Venezuela) have started a privileged cooperation thanks to the ECOS Nord Program. The collaboration will start effectively in 2014. Researchers and PhD from both institutes will visit each other and conduct common research on the benefits of ITS solutions for an enhanced mobility in congested cities. IMARA has already hosted in the past 3 engineers as trainees working in the field of intelligent control.

8.4.1.2. Informal International Partners

CITRIS : IMARA has been part of Inria's teams involved in the cooperation with the CITRIS (Center for Information Technology Research in the Interest of Society, California), as a key actor of the joint research between Inria and the University of Berkeley around the smart city.

8.4.2. Participation In other International Programs

ECOS Nord : Since December 4th (2013), Inria and the University of Simon Bolivar (Venezuela) are partners of a project financed by the ECOS Nord Program (ECOS Nord No. V14M01). This project is co-financed by the Ministries of Foreign Affairs of Venezuela and France.

8.5. International Research Visitors

8.5.1. Visits of International Scientists

- ***Prof. Plamen PETROV*** : professor at the Technical University of Sofia (Bulgaria). He has been an invited professor at Inria from June to September 2013. During this period he made joint research on intelligent adaptive control applied to vehicle manoeuvring (automated parking and assisted overtaking).
- ***Satoshi MATSUURA*** : He has been a Visiting Professor from NAIST (Nara Institute of Science and Technology, Japan). Until March 2013, he has been working in the area of telecommunications applied to ITS. He was also the initiator of the signed MoU between NAIST and IMARA.

8.5.1.1. Internships

- M. Kenta Mori : he was an intern from NAIST, working in the field of telecommunications applied to ITS applications, under the supervision of Mrs. Oyunchimeg Shagdar.
- M. José Javier Anaya Catala : he was an intern from the Technical University of Madrid (UPM, Spain). He developed a vehicle-to-pedestrian communication protocole using WiFi devices.
- Miss Oriana Rojas-Michelena : she was an intern from Simón Bolìvar University and she developed an on-board vehicle controller dedicated to the management of the approach of traffic lights.
- M. Ray Lattarulo Arias : he was an intern from Simón Bolìvar University (Venezuela). He developed a fuzzy controller to follow Bezier-like trajectories executed by a cybercar.
- Ernest Creiser : he was an intern from ENSAE ParisTech / Univ. Paris Dauphine. He worked on the development of man-machine interfaces dedicated to the EU-FURBOT project.
- Mohamed Maddouri : he was intern from Télécom SudParis and he developed a tool dedicated to the calibration of a laser-camera set used in a moving vehicle.

MATHRISK Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR

B. Jourdain is involved in the ANR Stab (2013/2016). Partners: Lyon1 and Paris-Dauphine.

8.1.2. Competitivity Clusters

Pôle Finance Innovation.

8.2. International Initiatives

8.2.1. Inria International Partners

8.2.1.1. Informal International Partners

- Center of Excellence program in Mathematics and Life Sciences at the Department of Mathematics, University of Oslo, Norway, (with B. Øksendal).
- Department of Mathematics, University of Manchester (with Tusheng Zhang, currently in charge of an EU-ITN program on BSDEs and Applications).
- Mannheim University (with Alexander Schied, Chair of Mathematics in Business and Economics, Department of Mathematics)
- Roma Tor Vergata University (Lucia Caramellino)
- Amsterdam University (Michel Velekoop)
- Delft University (Kees Oosterlee)
- Mexico University and CIMAT (Begonia Fernandez)
- Osaka and Ritsumeikan University (A. Kohatsu-Higa).
- Shandong University, China (Z. Chen)

8.3. International Research Visitors

8.3.1. Visits of International Scientists

- Alexander Schied, Mannheim University,
- Andreea Minca, Cornell University,
- Xin Guo, Berkeley University,
- Arturo Kohatsu Higa, Ritsumeikan University,
- Luis Ortiz Gracia, CWI - Centrum voor Wiskunde en Informatica, Amsterdam,
- Karel in ’t Hout, University of Antwerpern,
- Lucia Caramellino, Tor Vergata University, Roma.

MICMAC Project-Team

7. Partnerships and Cooperations

7.1. International Initiatives

T. Lelièvre, G. Stoltz and F. Legoll participate to the Laboratoire International Associé (LIA) CNRS / University of Illinois at Urbana-Champaign on complex biological systems and their simulation by high performance computers. This LIA involves on the french side research teams from Université Nancy, Université de Lyon and Inria Rennes.

7.2. International Research Visitors

7.2.1. Visits of International Scientists

We have invited the following researchers to visit our team:

- U. Hetmaniuk (University of Washington in Seattle), April 8-12, 2013, and Dec 16-20, 2013.

MOKAPLAN Exploratory Action

7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. ANR

Jean-David Benamou is the coordinator of the ANR ISOTACE (Interacting Systems and Optimal Transportation, Applications to Computational Economics) ANR-12-MONU-0013 (2012-2016). The consortium explores new numerical methods in Optimal Transportation AND Mean Field Game theory with applications in Economics and congested crowd motion. Four extended seminars have been organized/co-organized by Mokaplan. Check https://project.inria.fr/isotace/news.
Christophe Duquesne (Aurigetech) is a software and mobility consultant hired on the ANR budget. He helps the consortium to develop its industrial partnerships.

7.2. International Initiatives

7.2.1. Informal International Partners

Mokaplan has strong links with several Canadian researchers (Oberman, Froese, Agueh, Pass). In July 2013, Oudet, Carlier, Agueh, Pass, Oberman, Froese and Benamou gathered in Banff for a "focussed research group" week :
http://www.birs.ca/events/2013/focussed-research-groups/13frg167. The meeting was productive and several new collaborations were started on the occasion which are listed in the objectives of this proposal.

7.3. International Research Visitors

7.3.1. Visits of International Scientists

- Brendan Pass (U. of Alberta).
- Brittany Froese (U. Texas at Austin).
- Giuseppe Buttazzo (U. Pisa).

7.3.1.1. Internships

- Nicolas Bonne extended the ALG2 used in the CFD approch to Optimal Mass Transportation to build a numerical method for Mean Field Games models.

MUTANT Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR

8.1.1.1. INEDIT

Title: Interactivity in the Authoring of Time and Interactions

Project acronym: INEDIT

Type: ANR Contenu et Interaction 2012 (CONTINT)

Instrument: ANR Grant

Duration: September 2012 - September 2015

Coordinator: IRCAM (France)

Other partners: Grame (Lyon, France), LaBRI (Bordeaux, France).

Abstract: The INEDIT project aims to provide a scientific view of the interoperability between common tools for music and audio productions, in order to open new creative dimensions coupling *authoring of time* and *authoring of interaction*. This coupling allows the development of novel dimensions in interacting with new media. Our approach lies within a formal language paradigm: An interactive piece can be seen as a virtual interpreter articulating locally synchronous temporal flows (audio signals) within globally asynchronous event sequence (discrete timed actions in interactive composition). Process evaluation is then to respond reactively to signals and events from an environment with heterogeneous actions coordinated in time and space by the interpreter. This coordination is specified by the composer who should be able to express and visualize time constraints and complex interactive scenarios between mediums. To achieve this, the project focuses on the development of novel technologies: dedicated multimedia schedulers, runtime compilation, innovative visualization and tangible interfaces based on augmented paper, allowing the specification and realtime control of authored processes. Among posed scientific challenges within the INEDIT project is the formalization of temporal relations within a musical context, and in particular the development of a GALS (Globally Asynchronous, Locally Synchronous) approach to computing that would bridge in the gap between synchronous and asynchronous constraints with multiple scales of time, a common challenge to existing multimedia frameworks.

8.1.2. Other National Initiatives

The team participated to the CLASYCO network on DSL for simulation, supported by the RNSC (réseau national des systèmes complexes).

Jean-Louis Giavitto participates to the SynBioTIC ANR Blanc project (with IBISC, University of Evry, LAC University of Paris-Est, ISC - Ecole Polytechnique).

8.2. International Initiatives

8.2.1. Inria International Partners

8.2.1.1. Informal International Partners

Miller Puckette (UCSD), David Wessel (UC Berkeley), Edward Lee (UC Berkeley), Shlomo Dubnov (UCSD).

8.3. International Research Visitors

Dr. Roger Dannenberg (Carnegie Mellon University) was invited by MuTant in May 2013, where he took part in Arshia Cont's HDR defense, José Echeveste's mid-term PhD defense, and gave a public seminar in the MuTant Seminars in Real-time Multimedia Computing series.

Dr. Shlomo Dubnoc (University of California San Diego) was invited by MuTant in August 2013 for ongoing collaborative work and to take part in the International Conference on Geometric Science of Information 2013, Special Session on *Audio and Music* organized by MuTant member Arshia Cont.

Masahiko Sakai visited MuTant for two weeks in August 2013. He is a professor at the University of Nagoya and director of the Sakabe/Sakai computer science laboratory of the department of computer science and mathematical informatics of Nagoya University.

Dr. Edward Lee and Dr. David Wessel (UC Berkeley) visited MuTant for discussions on future collaborations with MuTant around Cyber-Physical Systems.

PARKAS Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR

ANR WMC project (program “jeunes chercheuses, jeunes chercheurs”), 2012–2016, 200 Keuros. F. Zappa Nardelli is the main investigator.

ANR Boole project (program “action blanche”), 2009-2014.

ANR Partout (program “defis”), 2009-2012. Louis Mandel and Marc Pouzet.

ANR CAFEIN, 2013-2015. Marc Pouzet.

Action d’envergure Synchronics, 2008-2012. The action was driven by Alain Girault (Inria, PopArt, Grenoble) and Marc Pouzet (Inria, Parkas, Paris-Rocquencourt), to focus on “langages for embedded systems”. This has been instrumental in driving our new research on hybrid system modelers.

8.1.2. Competitivity Clusters

FUI project OpenGPU, 2008–2012.

8.1.3. Investissements d’avenir

Sys2Soft contract (Briques Génériques du Logiciel Embarqué). Partenaire principal: Dassault-Systèmes, etc. Inria contacts are Benoit Caillaud (HYCOMES, Rennes) and Marc Pouzet (PARKAS, Paris).

ManycoreLabs contract (Briques Génériques du Logiciel Embarqué). Partenaire principal: Kalray. Inria contacts are Albert Cohen (PARKAS, Paris) and Alain Darte (COMPSYS, Lyon).

8.1.4. Others

Marc Pouzet is scientific advisor for the Esterel-Technologies/ANSYS company.

8.2. European Initiatives

8.2.1. FP7 Projects

8.2.1.1. TETRACOM

Type: CAPACITIES

Defi: Alternative Paths to Components and Systems

Instrument: Coordination and Support Action

Objectif: Advanced Computing, embedded and Control systems

Duration: September 2013 – August 2016

Coordinator: Rainer Leupers

Partner: RWTH Aachen (Germany)

Inria contact: Albert Cohen

Abstract: coordination action to support bilateral technology transfer partnerships (TTPs); prototype of future H2020 transfer instruments.

8.2.1.2. COPCAMS

Type: ARTEMIS

Defi: Alternative Paths to Components and Systems

Instrument: ASP

Objectif: NC

Duration: April 2013 – March 2016

Coordinator: Christian Fabre

Partner: CEA Leti (Grenoble)

Inria contact: Albert Cohen

Abstract: cognitive/smart cameras enabled by hardware accelerators, including manycore processors (STHORM platform of ST) and GPUs.

8.2.2. Collaborations in European Programs, except FP7

8.2.2.1. MODRIO

Duration: December 2012 - December 2014

Coordinator: EDF

Partner: Dassault-Systèmes, EDF, Institut Francais du Pétrole, DLR (Munich, Germany), LMS-Imagine, Inria.

Inria contact: Benoit Caillaud (HYCOMES, Rennes); Marc Pouzet (PARKAS, Paris)

8.3. International Initiatives

8.3.1. Inria Associate Teams

8.3.1.1. POLYFLOW

Title: Polyhedral Compilation for Data-Flow Programming Languages

Inria principal investigator: Albert Cohen

International Partner (Institution - Laboratory - Researcher):

IISc Bangalore (India) - Department of Computer Science and Automation - Albert Cohen

Duration: 2013 - 2016

See also: http://polyflow.gforge.inria.fr

Polyhedral techniques for program transformation are now used in several proprietary and open source compilers. However, most of the research on polyhedral compilation has focused on imperative languages such as C, where computation is specified in terms of statements with zero or more nested loops and other control structures around them. Graphical data-flow languages, where there is no notion of statements or a schedule specifying their relative execution order, have so far not been studied using a powerful transformation or optimization approach. These languages are extremely popular in system analysis, modeling and design, in embedded reactive control. They also underline the construction of many domain-specific languages and compiler intermediate representations. The copy and execution semantics of data-flow languages impose a different set of challenges. We plan to bridge this gap by studying techniques that could enable extraction of a polyhedral representation from data-flow programs, transform them, and synthesize them from their equivalent polyhedral representation.

8.4. International Research Visitors

8.4.1. Visits of International Scientists

We have regular invited professors in the PARKAS team:

- In 2012, one month (June/July), Prof. Stephen Edwards (Columbia Univ., New York, USA).
- In 2013, one month (June), Prof. Mary Sheeran from (Chalmers Univ., Sweden).

8.4.1.1. Internships

Pankaj Prateek, Anirudh Kumar, and Pankaj More, students at IIT Kanpur, India, worked in the Parkas team under the supervision of Francesco Zappa Nardelli from 4th May, 2013 to 23 July, 2013.

Guillaume Chelfi, student at Telecom Paris and the MPRI program, under the supervision of Francesco Zappa Nardelli and Marc Pouzet, from 1st of March, 2013, to 31st July, 2013. Guillaume Chelfi worked on the formal verification of the translation of synchronous programs to sequential code.

Louis Mandel supervised the 5-months MPRI Internship of Louis Jachiet from April to August. Louis Jachiet worked on the static scheduling of ReactiveML programs.

Albert Cohen supervised the 3-months Internship of Vincent Thiberville, 3rd year student at École Polytechnique, from April to June. Vincent conducted experimental studies and proposed enhanced methods to support array-based computations in the Heptagon synchronous language.

8.4.2. Visits to International Teams

October, Louis Mandel spent 2 weeks in the team of Vijay Saraswat at IBM T.J. Watson. He worked on the type system of the X10 language.

PI.R2 Project-Team

6. Partnerships and Cooperations

6.1. National Initiatives

Pierre-Louis Curien (coordinator), Yves Guiraud and Philippe Malbos are members of the three-years Focal project of the IDEX Sorbonne-Paris-Cité, started in June 2013. This project, giving the support for the PhD grant of Cyrille Chenavier, concerns the interactions between higher-dimensional rewriting and combinatorial algebra with researchers from LAGA (Univ. Paris 13)

Pierre-Louis Curien (coordinator), Yves Guiraud and Philippe Malbos are members of the four-years Cathre ANR project, accepted in 2013, to begin in January 2014. This project will investigate the general theory of higher-dimensional rewriting, the development of a general-purpose library for higher-dimensional rewriting, and applications in the fields of combinatorial algebra, combinatorial group theory and theoretical computer science.

Matthieu Sozeau, Hugo Herbelin, Lourdes del Carmen González Huesca and Yann Régis-Gianas are members of the ANR Paral-ITP started November 2011. Paral-ITP is about preparing the Coq and Isabelle interactive theorem provers to a new generation of user interfaces thanks to massive parallelism and incremental type-checking.

Hugo Herbelin is the coordinator of the PPS site for the ANR Récré accepted in 2011, which started in January 2012. Récré is about realisability and rewriting, with applications to proving with side-effects and concurrency.

Matthieu Sozeau is member of the ANR Typex project (Types and certification for XML) and is coordinator of one of the tasks of the project on formalisation and certification of XML tools. The project kicked-off on January 8th, 2012 and is a joint project with LRI, PPS and Inria Grenoble.

6.2. European Initiatives

6.2.1. FP7 Projects

Yann Régis-Gianas is a participant of the EU-FP7 Certified Complexity project (CerCo). This European project started in February 2010 as a collaboration between Bologna university (Asperti, Sacerdoti Coen), Edinburgh university (Pollack) and Paris Diderot university (Amadio, Régis-Gianas). The CerCo project aims at the construction of a formally verified complexity preserving compiler from a large subset of the C programming language to some typical micro-controller assembly language, of the kind traditionally used in embedded systems.

6.2.2. Collaborations in European Programs, except FP7

Pierre-Louis Curien, Yves Guiraud and Philippe Malbos are collaborators of the Applied and Computational Algebraic Topology (ACAT) networking programme of the European Science Foundation.

6.3. International Initiatives

6.3.1. Inria Associate Teams

Title: Proof theory and functional programming languages (SEMACODE)

Inria principal investigator: Alexis SAURIN

International Partner:

Institution: University of Oregon (United States)

Laboratory: Computer and Information Science Department

Researcher: Zena ARIOLA

International Partner:

Institution: University of Novi Sad

Laboratory: Faculty of Engineering

Researcher: Silvia GHILEZAN

Duration: 2011 - 2013

See: http://www.pps.univ-paris-diderot.fr/~saurin/EA-SEMACODE

6.3.2. Inria International Partners

We are setting up a partnershiop with the University of Wroclaw (our interlocutors are D. Biernacki and M. Biernacka).

6.3.3. Participation In other International Programs

Pierre-Louis Curien participates to the ANR International French-Chinese project LOCALI (coordinated by Gilles Dowek), and to a MathAmSud project in algebraic operads with the university of Talca (Chile).

6.3.4. Other international cooperations

MIT (Adam Chlipala, Jason Gross).

6.4. International Research Visitors

6.4.1. Visits of International Scientists

Beta Ziliani (MPI, Saarbrücken) visited πr^2 and PPS for a week in January to collaborate with Yann Régis-Gianas and Matthieu Sozeau.

Zena Ariola visited πr^2 and PPS for the whole academic year 2012-2013 with SEMACODE associate team to collaborate with Pierre-Louis Curien, Hugo Herbelin and Alexis Saurin. Her two PhD students joined for shorter terms (Paul Downen from November 2012 to July 2013 and Luke Maurer, being funded by the INTERNSHIP program – see below – from March 2013 to July 2013).

Marco Gaboardi visited πr^2 and PPS in for 10 days in may and again in december 2013 to collaborate with Alexis Saurin.

Olivier Danvy visited πr^2 and PPS in the fall 2013.

Fernando Ferreira (Univ. of Lisbon) and Ulrich Kohlenbach visited πr^2, hosted by Jaime Gaspar.

6.4.2. Internships

Participant: Luke Maurer.

Subject: Foundation for lazy languages

Date: from Mar 2013 until Jul 2013

Institution: University of Oregon (United States)

6.4.3. Visits to International Teams

Pierre Boutillier visited MSP group at the university of Strathclyde for a month in March 2013.

Hugo Herbelin visited Thomas Streicher at the University of Darmstadt in May 2013.

Hugo Herbelin visited the Institute of Cybernetics in Tallinn, Estonia in September and October 2013.

Pierre-Louis Curien visited IAS for 3 weeks in March, towards the end of the Special Year on Univalent Foundations. Matthieu Sozeau visited Vladimir Voevodsky at the IAS in Princeton for 15 days in May 2013.

POLSYS Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR

- **ANR Jeunes Chercheurs CAC Computer Algebra and Cryptography (2009-2013).** The contract CAC "Computer Algebra and Cryptography started in October 2009 for a period of 4 years. This project investigates the areas of cryptography and computer algebra, and their influence on the security and integrity of digital data. In CAC, we plan to use basic tools of computer algebra to evaluate the security of cryptographic schemes. CAC will focus on three new challenging applications of algebraic techniques in cryptography; namely block ciphers, hash functions, and factorization with known bits. To this hand, we will use Gröbner bases techniques but also lattice tools. In this proposal, we will explore non-conventional approaches in the algebraic cryptanalysis of these problems (Participants: L. Perret [contact], J.-C. Faugère, G. Renault).
- **ANR Grant (international program) EXACTA (2010-2013): Exact/Certified Algorithms with Algebraic Systems.**
  The main objective of this project is to study and compute the solutions of nonlinear algebraic systems and their structures and properties with selected target applications using exact or certified computation. The project consists of one main task of basic research on the design and implementation of fundamental algorithms and four tasks of applied research on computational geometry, algebraic cryptanalysis, global optimization, and algebraic biology. It will last for three years (2010-2013) with 300 person-months of workforce. Its consortium is composed of strong research teams from France and China (KLMM, SKLOIS, and LMIB) in the area of solving algebraic systems with applications.
- **ANR Grant HPAC: High Performance Algebraic Computing (2012-2016).** The pervasive ubiquity of parallel architectures and memory hierarchy has led to a new quest for parallel mathematical algorithms and software capable of exploiting the various levels of parallelism: from hardware acceleration technologies (multi-core and multi-processor system on chip, GPGPU, FPGA) to cluster and global computing platforms. For giving a greater scope to symbolic and algebraic computing, beyond the optimization of the application itself, the effective use of a large number of resources (memory and specialized computing units) is expected to enhance the performance multi-criteria objectives: time, resource usage, reliability, even energy consumption. The design and the implementation of mathematical algorithms with provable, adaptive and sustainable performance is a major challenge. In this context, this project is devoted to fundamental and practical research specifically in exact linear algebra and system solving that are two essential "dwarfs" (or "killer kernels") in scientific and algebraic computing. The project should lead to progress in matrix algorithms and challenge solving in cryptology, and should provide new insights into high performance programming and library design problems (J.-C. Faugère [contact], L. Perret, G. Renault, M. Safey El Din).
- **ANR Grant GeoLMI: Geometry of Linear Matrix Inequalities (2011-2015).** he GeoLMI project aims at developing an algebraic and geometric study of linear matrix inequalities (LMI) for systems control theory. It is an interdisciplinary project at the border between information sciences (systems control), pure mathematics (algebraic geometry) and applied mathematics (optimisation). The project focuses on the geometry of determinantal varieties, on decision problems involving positive polynomials, on computational algorithms for algebraic geometry, on computational algorithms for semi-definite programming, and on applications of algebraic geometry techniques in systems control theory, namely for robust control of linear systems and polynomial optimal control (Participants: J.-C. Faugère, M. Safey El Din [contact], E. Tsigaridas).

8.2. European Initiatives

8.2.1. FP7 Projects

8.2.1.1. A3

Type: PEOPLE

Defi:

Instrument: Career Integration Grant

Objectif: NC

Duration: May 2013 - April 2017

Coordinator: Jean-Charles Faugère

Partner: Institut National de Recherche en Informatique et en Automatique (Inria), France

Inria contact: Elias Tsigaridas

Abstract: The project Algebraic Algorithms and Applications (A3) is an interdisciplinary and multidisciplinary project, with strong international synergy. It consists of four work packages The first (Algebraic Algorithms) focuses on fundamental problems of computational (real) algebraic geometry: effective zero bounds, that is estimations for the minimum distance of the roots of a polynomial system from zero, algorithms for solving polynomials and polynomial systems, derivation of non-asymptotic bounds for basic algorithms of real algebraic geometry and application of polynomial system solving techniques in optimization. We propose a novel approach that exploits structure and symmetry, combinatorial properties of high dimensional polytopes and tools from mathematical physics. Despite the great potential of the modern tools from algebraic algorithms, their use requires a combined effort to transfer this technology to specific problems. In the second package (Stochastic Games) we aim to derive optimal algorithms for computing the values of stochastic games, using techniques from real algebraic geometry, and to introduce a whole new arsenal of algebraic tools to computational game theory. The third work package (Non-linear Computational Geometry), we focus on exact computations with implicitly defined plane and space curves. These are challenging problems that commonly arise in geometric modeling and computer aided design, but they also have applications in polynomial optimization. The final work package (Efficient Implementations) describes our plans for complete, robust and efficient implementations of algebraic algorithms.

8.3. International Initiatives

8.3.1. Inria Associate Teams

The POLSYS Team and ARIC at ENS Lyon are part of the QOLAPS (Quantifier Elimination, Optimization, Linear Algebra and Polynomial Systems) Associate Team with the Symbolic Computation Group at North Carolina State University. Activities of this associate team are described at the following url:

http://www-polsys.lip6.fr/QOLAPS/index.html

8.3.1.1. Informal International Partners

- Crypto team at Royal Holloway, University of London, UK.
- Prof. Victor Y. Pan, Department of Mathematics and Computer Science Lehman College, City University of New York, USA.

8.3.2. Inria International Labs

The POLSYS Team is involved in the ECCA (Exact Certified Computation with Algebraic Systems) at LIAMA in China.

8.4. International Research Visitors

8.4.1. Visits of International Scientists

Prof. K. Yokoyama (Japan) visited the POLSYS team during January 2013.

Prof. C. Yap (Courant Institute, New-York, USA) was an Inria invited professor and visited the POLSYS team during June and July 2013.

Prof. B. Sturmfels (Univ. Berkeley, USA) visited the POLSYS team during July 2013.

Prof. I. Bomze (Univ. of Vienna, Austria) visited the POLSYS team during October 2013.

Prof. J. Guttierez (Univ. Santander, Spain) visited the POLSYS team during November 2013.

Prof. J. Hauenstein (North Carolina State Univ., USA) visited the POLSYS team during November 2013.

J. Rohal (North Carolina State Univ., USA) visited the POLSYS team during November 2013.

8.4.1.1. Internships

- T. Verron (Internship M2 and ENS Paris): Computation of Gröbner bases for quasi-homogeneous systems.

POMDAPI Project-Team

6. Partnerships and Cooperations

6.1. National Initiatives

ANR GEOPOR: "Geometrical approach for porous media flows: theory and numerics", with LJLL (Université de Paris 6).

ANR MANIF: "Mathematical and numerical issues in first-principle molecular simulation", with Cermics (École Nationale des Ponts et Chaussées), and LJLL (Université de Paris 6).

ARC Geofrac: (*Action de Recherche Coopérative*, Inria) "Large-scale computation of flow in complex 3D geological fractured porous media" with Inria project-teams Sage and Gamma3. From 2011.

C2S@Exa (Computer and Computational Sciences at Exascale) is an Inria Porject Lab (IPL). This national initiative aims at the development of numerical modeling methodologies that fully exploit the processing capabilities of modern massively parallel architectures in the context of a number of selected applications related to important scientific and technological challenges for the quality and the security of life in our society. This project supports in particular the PhD of N. Birgle (supervised by. J. Jaffré) which is part of an Inria-Andra collaboration.

Projet P: Project P is a four-year research project funded by the French FUI (*Fonds Unique Interministériel*) that started in 2011. Project P aims at supporting the model-driven engineering of high-integrity embedded real-time systems by providing an open code generation framework. The contribution of project-team Pomdapi is in the domain of language translation and block-schema modelisation semantics. This project supports the work of C. Franchini (under the supervision of P. Weis).

6.2. European Initiatives

6.2.1. FP7 Projects

Program: ERC Czech Republic

Project acronym: MORE

Project title: Implicitly constituted material models: from theory through model reduction to efficient numerical methods

Duration: September, 2012–August, 2017

Coordinator: Josef Málek, Charles University in Prague

Other partners: Charles University in Prague, Czech Republic; Institute of Mathematics, Academy of Sciences of the Czech Republic, Czech Republic; Oxford Centre for Nonlinear Partial Differential Equations, United Kingdom

www: http://more.karlin.mff.cuni.cz/

6.3. International Initiatives

Pomdapi is associated with LIRNE-Équipe d'Ingéniérie Mathématiques, Université Ibn Tofaïl (Kenitra, Morocco) (PHC Volubilis) in the project "Techniques multi-échelles adaptatives pour la résolution des problèmes d'écoulement et de transport en milieux poreux hétérogènes". From 2010.

Pomdapi is part of the EuroMediterranean 3+3 program with the project HYDRINV (Direct and inverse problems in subsurface flow and transport). Besides Inria institutions participating in this project are: Universitat Politècnica de Catalunya (Barcelona, Spain), Universidad de Sevilla (Spain), École Mohamedia d'Ingénieurs (Rabat, Morocco), Université Ibn Tofaïl (Kenitra, Morocco), University Centre of Khemis Miliana (Algeria), École Nationale d'Ingénieurs de Tunis (Tunisia). From 2012.

6.4. International Research Visitors

6.4.1. Visits of International Scientists

Laïla Amir, professor at FSTG in Marrakech, Morocco, was invited for one week.

H. Ben Ameur, professor at IPEST and member of the ENIT-Lamsin laboratory, Tunis, Tunisia, was invited for three months.

Lamia Guellouz, associate professor at Ecole Nationale d'Ingénieurs de Tunis, Tunisia, was invited for two weeks.

Z. Mghazli, professor at university Ibn Tofaïl, Kenitra, Morocco, was invited for one week.

6.4.2. Internships

E. Ahmed, from École Nationale d'Ingénieurs de Tunis (Tunisia), has visited Pomdapi for nine months on the subject *Modélisation d'écoulements diphasiques dans un milieu poreux fracturé*.

F. Cheikh, from École Nationale d'Ingénieurs de Tunis (Tunisia), has visited pomdapi for six months on the subject *Identification de failles dans un milieu poreux par une méthode d'indicateurs*.

M. H. Riahi, from École Nationale d'Ingénieurs de Tunis (Tunisia), has visited Pomdapi for six months on the subject *Identification de paramètres hydrogéologiques dans un milieu poreux*.

6.4.3. Visits to International Teams

M. Vohralík has visited from March 29th till May 15th Charles University in Prague, Czech Republic, Departement of Numerical Analysis (collaboration on the project MORE, teaching a Master 2nd year course).

PROSECCO Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR

8.1.1.1. ProSe

Title: ProSe: Security protocols : formal model, computational model, and implementations (ANR VERSO 2010.)

Other partners: Inria/Cascade, ENS Cachan-Inria/Secsi, LORIA-Inria/Cassis, Verimag.

Duration: December 2010 - December 2014.

Coordinator: Bruno Blanchet, Inria (France)

Abstract: The goal of the project is to increase the confidence in security protocols, and in order to reach this goal, provide security proofs at three levels: the symbolic level, in which messages are terms; the computational level, in which messages are bitstrings; the implementation level: the program itself.

8.1.2. FUI

8.1.2.1. Pisco

Title: PISCO

Partners: Bull, Cassadian, CEA, CS, Saferiver, Serpikom, Telecom Paristech

Duration: January 2013 - December 2014.

Coordinator: Liliana Calabanti, Bull (France)

Abstract: The goal of the project is to develop a prototype of a new secure applicance based on a virtual machine architecture accessing an HSM. The role of PROSECCO is to contribute to the analysis of security http://www.systematic-paris-region.org/en/projets/pisco

8.2. European Initiatives

8.2.1. FP7 Projects

8.2.1.1. CRYSP

Title: CRYSP: A Novel Framework for Collaboratively Building Cryptographically Secure Programs and their Proofs

Type: IDEAS ()

Instrument: ERC Starting Grant (Starting)

Duration: November 2010 - October 2015

Coordinator: Karthikeyan Bhargavan, Inria (France)

Abstract: The goal of this grant is to develop a collaborative specification framework and to build incremental, modular, scalable verification techniques that enable a group of collaborating programmers to build an application and its security proof side-by-side. We propose to validate this framework by developing the first large-scale web application and full-featured cryptographic protocol libraries with formal proofs of security.

8.3. International Initiatives

8.3.1. Inria International Partners

8.3.1.1. Informal International Partners

- K. Bhargavan, A. Pironti, and A. Delignat-Lavaud work closely with Microsoft Research in Cambridge, Redmond, Silicon Valley, and Bangalore (C. Fournet, N. Swamy, M. Abadi, P. Naldurg)
- G. Steel and R. Bardou work closely with University of Venice, Italy (R. Foccardi).
- G. Bana works closely with Keio University Japan
- E-I. Bartzia works closely with IMDEA Madrid (P-Y. Strub)

8.4. International Research Visitors

8.4.1. Visits of International Scientists

- Pierre-Malo Denielou (Lecturer, Royal Holloway, University of London) visited us for two months as professeur invité.
- Sergio Maffeis (Imperial College, London) visited us as part of an ongoing collaboration.
- Cédric Fournet (Researcher, Microsoft Researcher) visited us as part of an ongoing collaboration.

8.4.2. Visits to International Teams

- Alfredo Pironti visited Microsoft Research Cambridge (UK) several times, as part of a long-term collaboration
- Gergely Bana visited Keio University (Japan), ICT Lisbok (Portugal), and Queen Mary University of London in Nov 2013
- Benjamin Smyth visited Toshiba, Japan and Univesity of Birmingham (UK)

RAP Project-Team

6. Partnerships and Cooperations

6.1. International Research Visitors

RAP team has received the following people:

- Louigi Addario-Berry (McGill)
- Jit Bose (Carleton)
- Vida Dujmovic (Carleton)
- Christina Goldschmidt (Oxford)
- Stefan Langerman (UL Bruxelles)
- Gabor Lugosi (Pompeu Fabra)
- Cecile Mailler (UVSQ)
- Kavita Ramanan (Brown)
- Yuting Wen (McGill)

6.2. National Research Visitors

RAP team has received the following people:

- Thomas Bonald (Telecom ParisTech, Paris)
- Fabrice Guillemin (Orange Labs)
- Esther le Rouzic (Orange Labs)

REGAL Project-Team

7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. InfraJVM - (2012–2015)

Members: LIP6 (Regal), Ecole des Mines de Nanes (Constraint), IRISA (Triskell), LaBRI (LSR).

Funding: ANR Infra.

Objectives: The design of the Java Virtual Machine (JVM) was last revised in 1999, at a time when a single program running on a uniprocessor desktop machine was the norm. Today's computing environment, however, is radically different, being characterized by many different kinds of computing devices, which are often mobile and which need to interact within the context of a single application. Supporting such applications, involving multiple mutually untrusted devices, requires resource management and scheduling strategies that were not planned for in the 1999 JVM design. The goal of InfraJVM is to design strategies that can meet the needs of such applications and that provide the good performance that is required in an MRE.

The coordinator of InfraJVM is Gaël Thomas. Infra-JVM brings a grant of 202 000 euros from the ANR to UPMC over three years.

7.1.2. Nuage - (2012–2014)

Members: Non Stop Systems (NSS), Oodrive, Alphalink (Init SYS), CELESTE, DotRiver, NewGeneration, LIP6 (Regal et Phare)

Funding: Fonds National pour la Société Numérique, CDC

Objectives: The Nuage project aims at designing and building an open source, energy-aware, cloud based on OpenStack. In this project, the Regal group contributes on the storage axis. In clouds, virtualization forms the basis to ensure flexibility, portability and isolation. However, the price to pay for flexibility and isolation is memory fragmentation. We thus propose to pool unused memory by allowing nodes to use memory of other nodes to extend their cache, at the kernel level.

It involves a grant of 153 000 euros over 2,5 years.

7.1.3. ODISEA - (2011–2014)

Members: Orange, LIP6 (Regal), UbiStorage, Technicolor, Institut Telecom

Funding: FUI project, Ile de France Region

Objectives: ODISEA aims at designing new on-line data storage and data sharing solutions. Current solutions rely on big data centers, which induce many drawbacks: (i) a high cost, (ii) proprietary solutions, (iii) inefficiency (one single location, not necessarily close to the user). The goal is to tackle these issues by designing a distributed/decentralized solution that leverage edge resources like set-top boxes.

It involves a grant of 159 000 euros from Region Ile de France over three years.

7.1.4. Richelieu - (2012–2014)

Members: LIP6 (Regal), Scilab Entreprise, Silkan, OCaml Pro, Inria Saclay, Arcelor Mittal, CNES, Dassault Aviation.

Funding: FUI.

Objectives: The goal of Richelieu is to design a new runtime for the Scilab language based on VMKit. Scilab is a scientific language and its runtime relies on a costly interpretation loop. In the Richelieu project, we propose to replace the interpretation loop by VMKit, which provides both an efficient Just In Time Compiler and advanced memory management techniques.

It involves a grant of 135 000 euros from Region Ile de France over two years.

7.1.5. MyCloud (2011–2014)

Members: Inria Rhones-Alpes (SARDES), LIP6 (REGAL), EMN, WeAreCloud, Elastic Cloud.

Funding: MyCloud project is funded by ANR Arpège.

Objectives: Cloud Computing is a paradigm for enabling remote, on-demand access to a set of configurable computing resources. The objective of the MyCloud project is to define and implement a novel cloud model: SLAaaS (SLA aware Service). Novel models, control laws, distributed algorithms and languages will be proposed for automated provisioning, configuration and deployment of cloud services to meet SLA requirements, while tackling scalability and dynamics issues. It involves a grant of 155 000 euros from ANR to LIP6 over three years.

7.1.6. ConcoRDanT (2010–2014)

Members: Inria Regal, project leader; LORIA, Universdide Nova de Lisboa

Funding: ConcoRDanT is funded by ANR Blanc.

Objectives: CRDTs for consistency without concurrency control in Cloud and Peer-To-Peer systems. Massive computing systems and their applications suffer from a fundamental tension between scalability and data consistency. Avoiding the synchronisation bottleneck requires highly skilled programmers, makes applications complex and brittle, and is error-prone. The ConcoRDanT project investigates a promising new approach that is simple, scales indefinitely, and provably ensures eventual consistency. A Commutative Replicated Data Type (CRDT) is a data type where all concurrent operations commute. If all replicas execute all operations, they converge; no complex concurrency control is required. We have shown in the past that CRDTs can replace existing techniques in a number of tasks where distributed users can update concurrently, such as co-operative editing, wikis, and version control. However CRDTs are not a universal solution and raise their own issues (e.g., growth of meta-data). The ConcoRDanT project engages in a systematic and principled study of CRDTs, to discover their power and limitations, both theoretical and practical. Its outcome will be a body of knowledge about CRDTs and a library of CRDT designs, and applications using them. We are hopeful that significant distributed applications can be designed using CRDTs, a radical simplification of software, elegantly reconciling scalability and consistency. ConcoRDanT involves a grant of 192 637 euros from ANR to Inria over three and a half years.

7.1.7. STREAMS (2010–2014)

Members: LORIA (Score, Cassis), Inria (Regal, ASAP), Xwiki.

Funding: STREAMS is funded by ANR Arpège.

Objectives: Solutions for a peer-To-peer REAl-tiMe Social web The STREAMS project proposes to design peer-to-peer solutions that offer underlying services required by real-time social web applications and that eliminate the disadvantages of centralised architectures. These solutions are meant to replace a central authority-based collaboration with a distributed collaboration that offers support for decentralisation of services. The project aims to advance the state of the art on peer-to-peer networks for social and real-time applications. Scalability is generally considered as an inherent characteristic of peer-to-peer systems. It is traditionally achieved using replication techniques. Unfortunately, the current state of the art in peer-to-peer networks does not address replication of continuously updated content due to real-time user changes. Moreover, there exists a tension between sharing data with friends in a social network deployed in an open peer-to-peer network and ensuring privacy. One of the most challenging issues in social applications is how to balance collaboration

with access control to shared objects. Interaction is aimed at making shared objects available to all who need them, whereas access control seeks to ensure this availability only to users with proper authorisation. STREAMS project aims at providing theoretical solutions to these challenges as well as practical experimentation. It involves a grant of 57 000 euros from ANR to Inria over three and a half years.

7.1.8. ABL - (2009–2013)

Members: Gilles Muller, Julia Lawall, Gaël Thomas, Suman Saha.

Funding: ANR Blanc.

Objectives: The goal of the "A Bug's Life" (ABL) project is to develop a comprehensive solution to the problem of finding bugs in API usage in open source infrastructure software. The ABL project has grown out of our experience in using the Coccinelle code matching and transformation tool, which we have developed as part of the former ANR project Blanc Coccinelle, and our interactions with the Linux community. Coccinelle targets the problem of documenting and automating collateral evolutions in C code, specifically Linux code. A collateral evolution is a change that is needed in the clients of an API when the API changes in some way that affects its interface. Coccinelle provides a language for expressing collateral evolutions by means of Semantic Patches, and a transformation tool for performing them automatically.

ABL concluded in 2013 with the defense of the PhD thesis of Suman Saha in March and the publication of Saha's PhD work at the IEEE conference Dependable Systems and Networks (DSN) in June. At DSN, Saha received the William C. Carter Award for best student paper. This is the only best paper award given at DSN and was the first time that the recipient was from a French university. Saha has since taken a postdoc position jointly at Harvard and Lehigh Universities.

7.2. European Initiatives

7.2.1. FP7 Projects

7.2.1.1. SyncFree

Type: COOPERATION

Challenge: Pervasive and Trusted Network and Service Infrastructures

Instrument: Specific Targeted Research Project

Objectives: ICT-2013.1.2 "Software Engineering, Services and Cloud Computing," ICT-2013.1.6 "Connected and Social Media"

Duration: October 2013 - September 2016

Coordinator: Marc Shapiro (Inria)

Partners: Inria (Regal & Score), Basho Technologies Inc., Trifork A/S, Rovio Entertainment Oy, U. Nova de Lisboa, U. Catholique de Louvain, Koç U., Technische U. Kaiserslautern.

Inria contact: Marc Shapiro

Abstract: The goal of SyncFree is to enable large-scale distributed applications *without global synchronisation*, by exploiting the recent concept of *Conflict-free Replicated Data Types* (CRDTs). CRDTs allow unsynchronised concurrent updates, yet ensure data consistency. This radical new approach maximises responsiveness and availability; it enables locating data near its users, in decentralised clouds.

Global-scale applications, such as virtual wallets, advertising platforms, social networks, online games, or collaboration networks, require consistency across distributed data items. As networked users, objects, devices, and sensors proliferate, the consistency issue is increasingly acute for the software industry. Current alternatives are both unsatisfactory: either to rely on synchronisation

to ensure strong consistency, or to forfeit synchronisation and consistency altogether with ad-hoc eventual consistency. The former approach does not scale beyond a single data centre and is expensive. The latter is extremely difficult to understand, and remains error-prone, even for highly-skilled programmers.

SyncFree avoids both global synchronisation and the complexities of ad-hoc eventual consistency by leveraging the formal properties of CRDTs. CRDTs are designed so that unsynchronised concurrent updates do not conflict and have well-defined semantics. By combining CRDT objects from a standard library of proven datatypes (counters, sets, graphs, sequences, etc.), large-scale distributed programming is simpler and less error-prone. CRDTs are a practical and cost-effective approach.

The SyncFree project will develop both theoretical and practical understanding of large-scale synchronisation-free programming based on CRDTs. Project results will be new industrial applications, new application architectures, large-scale evaluation of both, programming models and algorithms for large-scale applications, and advanced scientific understanding.

7.2.2. Collaborations in European Programs, except FP7

Program: COST Action IC1001

Project acronym: Euro-TM

Project title: Transactional Memories: Foundations, Algorithms, Tools, and Applications

Duration: 2011–2014

Coordinator: Dr. Paolo Romano (INESC)

Other partners: Austria, Czech Republic, Denmark, France, Germany, Greece, Israel, Italy, Norway, Poland, Portugal, Serbia, Spain, Sweden, Switzerland, Turkey, United Kingdom.

Inria contact: Marc Shapiro

Abstract: Parallel programming (PP) used to be an area once confined to a few niches, such as scientific and high-performance computing applications. However, with the proliferation of multicore processors, and the emergence of new, inherently parallel and distributed deployment platforms, such as those provided by cloud computing, parallel programming has definitely become a mainstream concern. Transactional Memories (TMs) answer the need to find a better programming model for PP, capable of boosting developers' productivity and allowing ordinary programmers to unleash the power of parallel and distributed architectures avoiding the pitfalls of manual, lock based synchronization. It is therefore no surprise that TM has been subject to intense research in the last years. This Action aims at consolidating European research on this important field, by coordinating the European research groups working on the development of complementary, interdisciplinary aspects of Transactional Memories, including theoretical foundations, algorithms, hardware and operating system support, language integration and development tools, and applications.

7.2.3. Collaborations with Major European Organizations

Center for Informatics and Information Technologies (CITI) of Universidade Nova de Lisboa

Commutative Replicated Data Type (CRDT)

7.3. International Initiatives

7.3.1. Inria International Partners

7.3.1.1. Declared Inria International Partners

7.3.1.1.1. Dependability of dynamic distributed systems for ad-hoc networks and desktop grid (ONDINA) (2011-2013)

Members: Inria Paris Rocquencourt (REGAL), Inria Rhone-Alpes (Avalon), UFBA (Bahia, Brazil))

Funding: Inria

Objectives: Modern distributed systems deployed over ad-hoc networks, such as MANETs (wireless mobile ad-hoc networks), WSNs (wireless sensor networks) or Desktop Grid are inherently dynamic and the issue of designing reliable services which can cope with the high dynamics of these systems is a challenge. This project studies the necessary conditions, models and algorithms able to implement reliable services in these dynamic environments.

7.3.1.1.2. Enabling Collaborative Applications For Desktop Grids (ECADeG) (2011–2013)

Members: Inria Paris Rocquencourt (REGAL), USP (Sao Paulo, Brazil))

Funding: Inria

Objectives: The overall objective of the ECADeG research project is the design and implementation of a desktop grid middleware infrastructure for supporting the development of collaborative applications and its evaluation through a case study of a particular application in the health care domain.

7.3.2. Participation in other International Programs

7.3.2.1. Improving Clone Detection for Systems Software, Merlion Project - (2013)

Members: Julia Lawall, Gilles Muller, Lisong Guo, Peter Senna Tschudin.

Funding: Institut Français de Singapour.

Objectives: Clone detection is a technique for finding similar code fragments scattered across a code base. Clone detection is potentially very relevant to operating systems code, as many operating system services, such as drivers for related devices, have similar functionalities, and thus similar implementations. Nevertheless, the application of clone detection to systems code has achieved only moderate success, finding clone rates of only 10-20% in Linux kernel code. The purpose of this project is to consider how clone detection can be more effectively used in systems code development, for *e.g.*, code understanding or bug finding.

7.4. International Research Visitors

7.4.1. Visits of International Scientists

- Rachid Guerraoui, Professor, 1 month from EPFL, Switzerland.
- Kenji Kono, Professor, 3 months from University Keio, Japan.
- David Lo, Assistant Professor, 1 week, and Yuan Tian, PhD student, 1 month, both from Singapore Management University, in the context of a Merlion France-Singapore collaboration grant.
- Luis R. Rodriguez, 2 months, from Qualcomm, USA.

7.4.2. Internships

Participant: Dang Nhan Nguyen.
Subject: Scalable old-generation garbage collection for NUMA multicores.
Date: from Jan 2013 until Jun 2013
Institution: Chalmers U. (Sweden)

Participant: Mudit Verma.
Subject: Relaxed synchronization for library datatypes in NUMA multicores.
Date: from Jan 2013 until Jun 2013
Institution: Int. Masters in Distr. Computing / KTH (Sweden)

Participant: Burcu Külahçioglu Özkan.
Subject: Verifying distributed systems based on CRDTs
Date: from Jan 2013 until Jun 2013
Institution: Koç U., Turquie.

7.4.3. Visits to International Teams

- Julia Lawall, 2 weeks, to Singapore Management University, in the context of a Merlion France-Singapore collaboration grant.

REO Project-Team

7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. ANR

7.1.1.1. ANR Project "M3RS"

Participants: Laurent Boudin, Muriel Boulakia, Céline Grandmont [Principal Investigator], Irène Vignon-Clementel.

Period: 2008-2013.
This project, coordinated by C. Grandmont, aims at studying mathematical and numerical issues raised by the modeling of the lungs.

7.1.1.2. ANR Project "Epsilon"

Participant: Marina Vidrascu [local coordinator].

Period: 2009-2013
This project, coordinated by Jean-Jacques Marigo (LMS-Ecole polytechnique) aims to study Domain decomposition and multi-scale computations of singularities in mechanical structures.

7.1.1.3. ANR Project "EXIFSI"

Participants: Benoit Fabrèges, Miguel Ángel Fernández Varela [Principal Investigator], Mikel Landajuela Larma, Marina Vidrascu.

Period: 2012-2016
The aim of this project, coordinated by Miguel Àngel Fernández Varela, is to study mathematically and numerically new numerical methods for incompressible fluid-sructure interaction.

7.1.1.4. ANR Project "CARDIOXCOMP"

Participants: Muriel Boulakia, Jean-Frédéric Gerbeau [Principal Investigator], Fabien Raphel.

Period: 2013-2013.
This project, coordinated by Jean-Frédéric Gerbeau, is carried out in the framework of a joint laboratory ("LabCom" call of ANR) with the software company NOTOCORD. The focus is the mathematical modeling of a device measuring the electrical activity of cardiomyocytes. The overall objective of CardioXcomp is to enrich NOTOCORD's software with modelling and simulation solutions and provide to pharmacology research a completely new set incorporating state of the art signal processing and numerical simulation.

7.1.1.5. ANR Project "iFLOW"

Participants: Chloé Audebert, Jean-Frédéric Gerbeau, Irène Vignon-Clementel [co-Principal Investigator].

Period: 2013-2017.
This ANR-tecsan, co-managed by Eric Vibert (Paul Brousse Hospital) and Irene Vignon-Clementel, aims at developing an Intraoperative Fluorescent Liver Optimization Workflow to better understand the relationship between architecture, perfusion and function in hepatectomy.

7.2. European Initiatives

7.2.1. FP7 Projects

7.2.1.1. REVAMMAD

Type: PEOPLE

Instrument: Marie Curie Initial Training Network

Duration: April 2013 - March 2017

Coordinator: Andrew Hunter, University of Lincoln (UK)

Partners: See the web site

Inria contact: J-F Gerbeau

Abstract: REVAMMAD is a European Union project aimed at combatting some of the EU's most prevalent chronic medical conditions using retinal imaging. The project aims to train a new generation of interdisciplinary scientists for the academic, clinical and industrial sectors, and to trigger a new wave of biomedical interventions. The role of REO team within this consortium is to propose a mathematical model and a simulation tool for the retina hemodynamics.

7.3. International Initiatives

7.3.1. Inria Associate Teams

Participants: Grégory Arbia, Miguel Ángel Fernández Varela, Jean-Frédéric Gerbeau, Céline Grandmont, Jessica Oakes, Irène Vignon-Clementel [coordinator].

Period: 2008-2013

CARDIO: The aim of this project is to foster the collaboration between the Cardiovascular Biomechanics Research Laboratory (CVBRL) of C.A. Taylor (Stanford University, USA) and colleagues such as Dr. Feinstein, and the project-team REO, through research on cardiovascular and respiratory related topics (boundary conditions for complex flow, patient-specific modeling of congenital heart disease, image-based fluid solid interaction, postprocessing of numerical simulations). The associated team has been extended to other partners: team-project MACS at Inria, the Marsden group at University of California in San Diego and the and the Shadden group at University of California in Berkeley.. CA Figueroa is now at KCL, UK.

7.3.2. Trans-Atlantic Network of Excellence for Cardiovascular Research

Participants: Grégory Arbia, Jean-Frédéric Gerbeau, Irène Vignon-Clementel [correspondant].

Period: 2010-2015

This network, funded by the Leducq fondation, is working on the multi-scale modeling of single ventricle hearts for clinical decision support [3].

7.3.3. German BMBF national project Lungsys II

Participant: Irène Vignon-Clementel.

Period: 2012-2015 "Systems Biology of Lung Cancer "Dynamic Properties of Early Spread and Therapeutic Options". In collaboration with Dirk Drasdo EPI Bang, Inria & Paris 6 UPMC

7.4. International Research Visitors

7.4.1. Internships

- Stephanie Lindsey, PhD student at Cornell University, Aug 2013 - February 2014

[3] http://modelingventricle.clemson.edu/home

SECRET Project-Team

7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. ANR

- **ANR SAPHIR-2** (03/09 → 03/13)
  Security and Analysis of Primitives of Hashing Innovatory and Recent 2
  http://www.saphir2.fr/
  ANR program: VERSO (Reseaux du Futur et Services)
  Partners: France Telecom, Gemalto, Cryptolog international, EADS SN, Sagem Securite, ENS/LIENS, UVSQ/PRISM, Inria (project-team SECRET), ANSSI
  153 kEuros
  This industrial research project aims at participating to the NIST competition (cryptanalysis, implementations, optimizations, etc.), and in supporting the SHA-3 candidates proposed by its partners.
- **ANR BLOC** (10/11 → 09/15)
  Conception et analyse de chiffrements par blocs efficaces pour les environnements contraints
  ANR program: Ingénierie numérique et sécurité
  Partners: INSA Lyon, Inria (project-team SECRET), University of Limoges (XLIM), CryptoExperts
  446 kEuros
  The BLOC project aims at providing strong theoretical and practical results in the domain of cryptanalyses and design of block ciphers.
- **ANR KISS** (12/11 → 12/15)
  Keep your personal Information Safe and Secure
  ANR program: Ingénierie numérique et sécurité
  Partners: Inria (project-teams SMIS and SECRET), LIRIS, Gemalto, UVSQ (Prism), Conseil Général des Yvelines
  64 kEuros
  The KISS project builds upon the emergence of new portable and secure devices known as Secure Portable Tokens (e.g., mass storage SIM cards, secure USB sticks, smart sensors) combining the security of smart cards and the storage capacity of NAND Flash chips. The idea promoted in KISS is to embed, in such devices, software components capable of acquiring, storing and managing securely personal data.
- **ANR CLE** (10/13 → 10/17)
  Cryptography from learning with errors
  ANR program: Jeunes Chercheurs, SIMI2
  Coordinator: Vadim Lyubashevsky (Inria, EPI Cascade)
  The aim of this project is to combine algorithmic and algebraic techniques coming from asymmetric and symmetric cryptology in order to improve some attacks and to design some symmetric primitives which have a good resistance to side-channel attacks.

7.1.2. Others

- **French Ministry of Defense** (01/11 → 12/13)
  Funding for the supervision of Marion Bellard's PhD.
  30 kEuros.
- **French Ministry of Defense** (10/12 → 09/15)
  Funding for the supervision of Audrey Tixier's PhD.
  30 kEuros.

- **DGA-MI** $(12/11 \rightarrow 02/13)$
  Analysis of binary streams.
  20 kEuros.
- **PEPS IQC 2013** $(04/13 \rightarrow 03/14)$
  Topology and quantum codes
  coordinated by G. Zémor, Institut de Mathématiques de Bordeaux.
  http://www.cnrs.fr/mi/spip.php?article301
- **PEPS IQC 2013** $(04/13 \rightarrow 03/14)$
  Quantum Cryptography and distributed computing
  coordinated by Frédéric Grosshans, Laboratoire Aimé Cotton.
  http://www.cnrs.fr/mi/spip.php?article301

7.2. European Initiatives

7.2.1. Collaborations in European Programs, except FP7

Program: COST
Project acronym: ICT COST Action IC1306
Project title: Cryptography for Secure Digital Interaction
Duration: January 2014 - November 2017
Coordinator: Claudio Orlandi, Aarhus University, Denmark
Other partners: see http://www.cost.eu/domains_actions/ict/Actions/IC1306
Abstract: The aim of this COST action is to stimulate interaction between the different national efforts in order to develop new cryptographic solutions and to evaluate the security of deployed algorithms with applications to the secure digital interactions between citizens, companies and governments.

7.3. International Initiatives

7.3.1. Inria International Partners

7.3.1.1. Informal International Partners

- Otto-von-Guericke Universität Magdeburg, Institut für Algebra und Geometrie (Germany):
  Study of Boolean functions for cryptographic applications
- DTU - Danmarks Tekniske Universitet, Department of Mathematics:
  Lightweight symmetric crytography and code-based cryptography
- Indian Statistical Institute, Kolkata, India:
  Symmetric cryptography

7.4. International Research Visitors

7.4.1. Visits of International Scientists

- Grigory Kabatianskiy, Institute for Problems of Information Transmission, Moscow, Russia, November 23-30
- Paulo Barreto, University of Sao Paulo, Brazil, November 22-30
- Dimitrios Simos, SBA Research, Vienna, Austria, June 30-July 6
- Bimal Roy, Indian Statistical Institute, Kolkata, India, June 15-23

7.4.2. Visits to International Teams

- University of Sherbrooke, Canada, July 14-21 (J.P. Tillich)
- Newton Institute for Mathematical Sciences, Cambridge, United Kingdom, November 6-8, invitation to the *Mathematical Challenges in Quantum Information* Program, (A. Leverrier)
- CWI, Amsterdam, Netherlands, November 26-27, collaboration with Christian Schaffner, (A. Leverrier)
- FHNW, Windisch, Switzerland, May 27-31, visiting Willi Meier (M. Naya-Plasencia)

SIERRA Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR: Calibration

Participant: Sylvain Arlot.

S. Arlot, Membre du projet ANR Calibration
Titre: Statistical calibration
Coordinator: University Paris Dauphine
Leader: Vincent Rivoirard
Other members: 34 members, mostly among CEREMADE (Paris Dauphine), Laboratoire Jean-Alexandre Dieudonné (Université de Nice) and Laboratoire de Mathématiques de l'Université Paris Sud
Instrument: ANR Blanc
Duration: Jan 2012 - Dec 2015
Total funding: 240 000 euros
Webpage: https://sites.google.com/site/anrcalibration/

8.1.2. CNRS: Gargantua

Participants: Sylvain Arlot, Francis Bach.

S. Arlot, F. Bach, membres du projet "Gargantua"
Titre: Big data; apprentissage automatique et optimisation mathématique pour les données gigantesques
Coordinator: Laboratoire Jean Kuntzmann (UMR 5224)
Leader: Zaid Harchaoui
Other members: 13 members: S. Arlot, F. Bach and researchers from Laboratoire Jean Kuntzmann, Laboratoire d'Informatique de Grenoble (Universite Joseph Fourier) and Laboratoire Paul Painleve (Universite Lille 1).
Instrument: défi MASTODONS du CNRS
Duration: May 2013-Dec 2013 (may be reconducted for 2014)
Total funding: 30 000 euros for 2013
Webpage: http://lear.inrialpes.fr/people/harchaoui/projects/gargantua/index.html

8.2. European Initiatives

8.2.1. SIERRA

Participants: Francis Bach [correspondent], Simon Lacoste-Julien, Augustin Lefèvre, Nicolas Le Roux, Mark Schmidt.

Type: IDEAS
Instrument: ERC Starting Grant
Duration: December 2009 - November 2014
Coordinator: Inria (France)
Abstract: Machine learning is now a core part of many research domains, where the abundance of data has forced researchers to rely on automated processing of information. The main current paradigm of application of machine learning techniques consists in two sequential stages: in the representation phase, practitioners first build a large set of features and potential responses for model building or prediction. Then, in the learning phase, off-the-shelf algorithms are used to solve the appropriate data processing tasks. While this has led to significant advances in many domains, the potential of machine learning techniques is far from being reached.

8.2.2. SIPA

Participants: Alexandre d'Aspremont [correspondent], Fajwel Fogel.

Type: IDEAS
Instrument: ERC Starting Grant
Duration: May 2011 - May 2016
Coordinator: CNRS
Abstract: Interior point algorithms and a dramatic growth in computing power have revolutionized optimization in the last two decades. Highly nonlinear problems which were previously thought intractable are now routinely solved at reasonable scales. Semidefinite programs (i.e. linear programs on the cone of positive semidefinite matrices) are a perfect example of this trend: reasonably large, highly nonlinear but convex eigenvalue optimization problems are now solved efficiently by reliable numerical packages. This in turn means that a wide array of new applications for semidefinite programming have been discovered, mimicking the early development of linear programming. To cite only a few examples, semidefinite programs have been used to solve collaborative filtering problems (e.g. make personalized movie recommendations), approximate the solution of combinatorial programs, optimize the mixing rate of Markov chains over networks, infer dependence patterns from multivariate time series or produce optimal kernels in classification problems. These new applications also come with radically different algorithmic requirements. While interior point methods solve relatively small problems with a high precision, most recent applications of semidefinite programming in statistical learning for example form very large-scale problems with comparatively low precision targets, programs for which current algorithms cannot form even a single iteration. This proposal seeks to break this limit on problem size by deriving reliable first-order algorithms for solving large-scale semidefinite programs with a significantly lower cost per iteration, using for example subsampling techniques to considerably reduce the cost of forming gradients. Beyond these algorithmic challenges, the proposed research will focus heavily on applications of convex programming to statistical learning and signal processing theory where optimization and duality results quantify the statistical performance of coding or variable selection algorithms for example. Finally, another central goal of this work will be to produce efficient, customized algorithms for some key problems arising in machine learning and statistics.

8.3. International Initiatives

8.3.1. Inria Associate Team STATWEB

Title: Fast Statistical Analysis of Web Data via Sparse Learning
Inria principal investigator: Francis Bach
International Partner (Institution - Laboratory - Researcher):

University of California Berkeley (United States) - EECS and IEOR Departments - Francis Bach

Duration: 2011 - 2013
See also: http://www.di.ens.fr/~fbach/statweb.html
The goal of the proposed research is to provide web-based tools for the analysis and visualization of large corpora of text documents, with a focus on databases of news articles. We intend to use advanced algorithms, drawing from recent progresses in machine learning and statistics, to allow a user to quickly produce a short summary and associated timeline showing how a certain topic is described in news media. We are also interested in unsupervised learning techniques that allow a user to understand the difference between several different news sources, topics or documents.

8.4. International Research Visitors

8.4.1. Visits of International Scientists

Michael Jordan (U.C. Berkeley), spent one year in our team, until the summer 2013, financed by the Fondation de Sciences Mathématiques de Paris and Inria.

SISYPHE Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR project EBONSI: Extended Block-Oriented Nonlinear System Identification

Participants: Boyi Ni, Michel Sorine, Qinghua Zhang.

The main idea of block-oriented nonlinear system identification is to model complex systems with interconnected simple blocks. Such models cover many industrial applications and are simple enough for theoretic studies. In EBONSI we extend classical block-oriented nonlinear models to new model structures motivated by applications, and relax some traditional restrictions on experimental conditions. This international project is jointly funded by the French ANR and the Chinese National Natural Science Foundation (NSFC) from 2011 to 2014. The partners are SISYPHE (project leader), the Centre de Recherche en Automatique de Nancy (CRAN), and the Laboratory of Industrial Process Monitoring and Optimization of Peking University.

8.1.2. ANR project 0DEFECT: On-board fault diagnosis for wired networks

Participants: Mohamed Oumri, Michel Sorine, Qinghua Zhang.

Due to the increasing number of electric and electronic equipments in automotive vehicles, the reliability of electric connections is becoming more and more important. The project 0DEFECT aims at developing tools for on-board diagnosis of failures in electric wire connections in automotive systems. The project is funded by Agence Nationale de la Recherche (ANR) from 2009 to Jan 2013. The partners are CEA LIST (project leader), Renault Trucks, Freescale, PSA, Delphi, Supelec LGEP and Inria.

8.1.3. ANR project SODDA: Soft Defects Diagnosis in wired networks

Participants: Michel Sorine, Qinghua Zhang.

The need for detection, localization and characterization of defects in a cable network has led to the ANR projects SEEDS followed by 0-DEFECT in the automotive domain, INSCAN for cables along railways. These projects provide the foundations of diagnosis methods for cables – with a proof of feasibility in the case of hard defects (short-circuit, open circuit) - and some theoretical results on the associated inverse problems in the case of soft faults. They also made it possible to identify their limits. One of the principal limits of these methods, based on the principles of reflectometry, is the difficulty of detecting soft defects. If it was possible to detect and locate precisely these defects, that would help for preventive maintenance or prognosis. The objective of SODDA is to study the signatures of the soft defects, by combining theory and experiment, and to design and test innovative methods adapted to these signatures which are very difficult to detect. The project is run by an academic consortium, in close connection with an industrial board, responsible for keeping the work in realistic and relevant use cases. The Inria teams involved are POEMS and Sisyphe.

8.1.4. ANR project EPOQ2: Estimation PrOblems for Quantum & Quantumlike systems

Participants: Mazyar Mirrahimi, Pierre Rouchon, Michel Sorine.

The project EPOQ2 is an ANR "Young researcher" project led by Mazyar Mirrahimi (Sisyphe). Its goal is to address a class of inverse problems arising from either the emerging application domain of "quantum engineering" or from some classical applications where a natural quantization lead to quantum-like systems, as it is the case in particular for inverse scattering for transmission lines. This research is in collaboration with the Pierre Aigrain laboratory at ENS Paris, Michel Devoret and Rob Schoelkopf at Yale University and Pierre Rouchon from Ecole Nationale Supérieure des Mines de Paris.

8.1.5. Inria Large Scale Initiative Action REGATE

REGATE (REgulation of the GonAdoTropE axis) has been a 4-year Large Scale Initiative Action funded by Inria in May 2009 dedicated to the modeling, simulation and control of the gonadotrope axis. The action is coordinated by Frédérique Clément. The Inria participants to this action are researchers of 2 Inria research teams, Contraintes and Sisyphe. There are also participants from INRA, Université Libre de Bruxelles (Unité de Chronobiologie théorique), Université Paris 6 (Laboratoire Jacques-Louis Lions) and the Florida State University.

The closing meeting of REGATE has hold this year on April 9th. Beyond its academic achievements (see more details on the publication page of the website), REGATE has played a significant role on the national level, in the constitution of the transversal research group "Integrative and translational approaches of human and animal reproduction" (GdR REPRO), that was initiated by ITMO (Multi OrganizationThematic Institute)) BCDE (Cell Biology, Development and Evolution).

8.2. European Initiatives

8.2.1. Collaborations in European Programs, except FP7

MODRIO: Model Driven Physical Systems Operation. This ITEA 2 (Information Technology for European Advancement) project is joined by partners from Austria, Belgium, Finland, France, Germany, Italy and Sweden. See the complete list on the MODRIO page of the ITEA 2 call 6 website. The involved Inria project-teams are PARKAS, S4 and SISYPHE. It is coordinated by EDF, France.

To meet the evermore stringent safety and environmental regulations for power plants and transportation vehicles, system operators need new techniques to improve system diagnosis and operation. Open standards are necessary for different teams to cooperate by sharing compatible information and data. The objective of the MODRIO project is to extend modeling and simulation tools based on open standards from system design to system diagnosis and operation.

ERNSI: European Research Network System Identification. The SISYPHE project-team is involved in the activities of the European Research Network on System Identification (ERNSI) federating major European research teams on system identification. See the website of ERNSI. Funded as a SCIENCE project (1992 - 1995), HCM Project (1993-1996), TMR Project (1998 - 2003), this network, currently coordinated by Bo Wahlberg, Automatic Control, KTH, Stockholm, is still very active.
Partners: KTH (Sweden), Inria (France), TUD (Technische Universität Darmstadt), TUW (Vienna University of Technology), UCAM-DENG (University of Cambridge), ELEC (Vrije Universiteit Brussel), ULIN (Sweden), UNIPD (Italy).

8.3. International Initiatives

8.3.1. Inria International Partners

8.3.1.1. Declared Inria International Partners

Collaborations in Neuroscience & Neuroendocrinology:

- Boston University: joint publications [87], [92] (with John Burke, Tasso Kaper and Mark Kramer).
- University of Sevilla (Spain): joint publications [43] (with Emilio Freire and Enrique Ponce), participation in PhD examination boards (Mathieu Desroches).
- Joint publications with individual collaborators: Thomas Stiehl (IWR Heidelberg) [39] ; David Avitabile (School of Mathematical Sciences, University of Notthingham) [83] and Serafim Rodrigues (Centre for Robotics and Neural Systems, Plymouth University) [83], [7].
- Florida State University: joint work on GnRH decoding, with Richard Bertram and Joël Tabak, in the framework of the doctoral committee of Patrick Fletcher.

Collaborations in Quantum engineering:

The collaborations with the teams of Michel Devoret and Robert Schoelkopf, enforced through a two-year sabbatical visit of Mazyar Mirrahimi at Yale university, have led to a set of contributions ranging from the theoretical analysis and performance optimization of ongoing experiments on weak quantum measurements [47] and preparation of non-classical field states through single photon Kerr effect [49] to the design of new experiments on single qubit cooling by reservoir engineering techniques [46] and development of new quantum gates allowing the transfer of quantum information from a superconducting qubit to a cavity mode [111].

Collaborations in Classical engineering:

Long-term collaboration of Qinghua Zhang with Lennart Ljung (Linköping University, Sweden) and Peter Lindskog (NIRA Dynamics, Sweden) that led to the development of the System Identification ToolBox (SITB) is one of the main Matlab toolboxes commercialized by The Mathworks and several papers.

8.4. International Research Visitors

8.4.1. Visits of International Scientists

Koen TIELS, Vrije Universiteit Brussel, Department of Fundamental Electricity and Instrumentation, from the group of Johan SCHOUKENS, has visited us during October 2013.

8.4.2. Visits to International Teams

Mazyar Mirrahimi spent four months in the Quantronics Laboratory of Michel Devoret and in the Rob Schoelkopf Lab at Yale University.

SMIS Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR KISS (Dec. 2011 - Dec. 2015)

Partners: Inria-SMIS (coordinator), Inria-SECRET, LIRIS, Univ. of Versailles, CryptoExperts, Gemalto, Yvelines district.
SMIS funding: 230k€.

The idea promoted in KISS is to embed, in trusted devices, software components capable of acquiring, storing and managing securely various forms of personal data (e.g., salary forms, invoices, banking statements, geolocation data, depending on the applications). These software components form a Personal Data Server which can remain under the holder's control. The scientific challenges include: embedded data management issues tackling regular, streaming and spatio-temporal data (e.g., geolocation data), data provenance-based privacy models, crypto-protected distributed protocols to implement private communications and secure global computations.

8.1.2. ARC CAPPRIS (Dec. 2011 - Dec. 2015)

Inria Large Scale Initiative.
Inria Partners: PRIVATICS (coordinator), SMIS, PLANETE, CIDRE, COMETE.
External partners: Univ. of Namur, Eurecom, LAAS.
Funding: not associated to individual project-teams.

An ARC is a long-term multi-disciplinary project launched by Inria to sustain large scale risky research actions in line with its own strategic plan. CAPPRIS stands for "Collaborative Action on the Protection of Privacy Rights in the Information Society". The key issues that will be addressed are: (1) the identification of existing and future threats to privacy, (2) the definition of formally grounded measures to assess and quantify privacy, (3) the definition of the fundamental principles underlying privacy by design and methods to apply them in concrete situations and (4) The integration of the social and legal dimensions. To assess the relevance and significance of the research results, they will be confronted to three classes of case studies CAPPRIS partners are involved in: namely Online Social Networks, Location Based Services and Electronic Health Record Systems.

8.1.3. PEPS PAIP (Pour une Approche Interdisciplinaire de la Privacy) (Sept. 2013 - Sept. 2014)

Partners: ADIS and SMIS (co-organizers), CERDI, DANTE, COMETE, GRACE, TPT, LIMSI.
Funding: 30K€ from CNRS, not associated to individual project-teams.

The Digital Society Institute (DSI) will be the UPSa IDEX catalyst for multidisciplinary research on societal challenges inherent to eLife/life digitization. DSI plans to be one of the European leading institutes fostering multidisciplinary research across ICTS and SHES. In 2013 DSI already hosts two kick-off major research projects : (1) Human and Machine Coevolution and (2) Privacy/digital identities. ADIS and SMIS are co-organizing project (2) on data privacy. The PEPS PAIP is part of project (2) and aims at fostering the cooperation between lawyers, economists and computer scientists on privacy issues, through the organization of brainstorming days and workshops and a study of possible joint experiments of privacy preserving applications.

8.1.4. Digiteo LETEVONE chair (2010-2013)

Partners: LIX (Ecole Polytechnique), PRiSM (UVSQ), DBWeb (Telecom ParisTech), Exalead S.A..

Funding: Grant covers the expenses of Pr. Vazirgiannis' visits to France (hosted by LIX) and of 2 PHD students.

Participant in the DIGITEO Learning Techniques for Evolving Networks chair, held by Pr. Michalis Vazirgiannis (Athens University of Economics and Business) from 2010 to 2013. The overall objective of the proposed project is mining and learning from the large scale and dynamically evolving data and graphs generated in the Web 2.0 context. Our particular collaboration has delt with privacy protection of users' data in this context.

8.2. European Initiatives

8.2.1. FP7 Projects

8.2.1.1. PDS4NRJ (Aug. 2013 - Aug. 2014)

Instrument: Marie Curie Intra-European Fellowships for Career Development
Duration: 2013 Aug. - 2014 Aug.
Inria contact: Philippe Bonnet
This project, called PDS4NRJ, is based on the insights that (a) secure personal data management can be radically improved with the advent of secure hardware embedded on personal devices at the edges of the Internet, and (b) that a secure personal data management infrastructure should be applied in the context of smart buildings. Our overall objective is to define a new form of decentralized infrastructure for sharing smart meter data with access and usage control guarantees. The PDS4NRJ project is a unique opportunity for Philippe Bonnet, currently associate professor at ITU (Denmark), to become a leading expert in the field of secure personal data management thanks to a tight cooperation with SMIS members.

8.2.2. Collaborations in European Programs, except FP7

Program: Danish Council for Independent Research (FTP call)
Project acronym: CLyDE
Project title: Cross-LaYer optimized Database Engine
Duration: 10/2011 - 10/2014
Coordinator: Philippe Bonnet (ITU of Copenhagen)
Other partners: IT University of Copenhagen (Denmark), SMIS
Abstract: The goal is to explore how flash devices, operating system and database system can be designed together to improve overall performance. Such a co-design is particularly important for the next generation database appliances, or cloud-based relational database systems for which wellsuited flash components must be specified. More generally, our goal is to influence the evolution of flash devices and commodity database systems for the benefit of data intensive applications. The project should result in two complementary open-source software systems: (i) a bimodal flash device software component based on the idea from [6], and (ii) a database system optimized for bimodal flash devices. The project funding is managed by the IT University of Copenhagen and covers the expenses for two co-supervised PhD students (including regular visits to and from Denmark).

8.2.3. Collaborations with Major European Organizations

The SMIS members have developed tight European cooperations with the following persons/teams:

Philippe Bonnet (Associate Professor at the University of Copenhagen, Denmark)
Collaboration on Flash-based data management for high-end servers. The study of flash devices started during a short sabbatical of Luc Bouganim (from April to August 2008) in Copenhagen. The uFLIP study has been conducted in close cooperation with Philippe Bonnet from IT University of Copenhagen and Björn Þór Jónsson from Reykjavík University. The cooperation with Copenhagen is very active and led to new studies on flash devices and on the Trusted Cell architecture Two PhD students are currently co-supervised by Luc Bouganim and Philippe Bonnet. Philippe Bonnet got a Marie-Curie IEF grant and will visit SMIS for one year in 2013-2014.
Michalis Vazirgiannis (Athens University of Economics and Business)
Collaboration on Minimal Exposure in the context of Michalis' Digiteo Chair at LIX (Ecole Polytechnique).

8.3. International Research Visitors

See Section 8.2.1 .

WILLOW Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. Agence Nationale de la Recherche (ANR): SEMAPOLIS

Participants: Mathieu Aubry, Josef Sivic.

The goal of the SEMAPOLIS project is to develop advanced large-scale image analysis and learning techniques to semantize city images and produce semantized 3D reconstructions of urban environments, including proper rendering. Geometric 3D models of existing cities have a wide range of applications, such as navigation in virtual environments and realistic sceneries for video games and movies. A number of players (Google, Microsoft, Apple) have started to produce such data. However, the models feature only plain surfaces, textured from available pictures. This limits their use in urban studies and in the construction industry, excluding in practice applications to diagnosis and simulation. Besides, geometry and texturing are often wrong when there are invisible or discontinuous parts, e.g., with occluding foreground objects such as trees, cars or lampposts, which are pervasive in urban scenes. This project will go beyond the plain geometric models by producing semantized 3D models, i.e., models which are not bare surfaces but which identify architectural elements such as windows, walls, roofs, doors, etc. Semantic information is useful in a larger number of scenarios, including diagnosis and simulation for building renovation projects, accurate shadow impact taking into account actual window location, and more general urban planning and studies such as solar cell deployment. Another line of applications concerns improved virtual cities for navigation, with object-specific rendering, e.g., specular surfaces for windows. Models can also be made more compact, encoding object repetition (e.g., windows) rather than instances and replacing actual textures with more generic ones according to semantics; it allows cheap and fast transmission over low- bandwidth mobile phone networks, and efficient storage in GPS navigation devices.

This is a collaborative effort with LIGM / ENPC (R. Marlet), University of Caen (F. Jurie), Inria Sophia Antipolis (G. Drettakis) and Acute3D (R. Keriven).

8.2. European Initiatives

8.2.1. QUAERO (Inria)

Participant: Ivan Laptev.

QUAERO (AII) is a European collaborative research and development program with the goal of developing multimedia and multi-lingual indexing and management tools for professional and public applications. Quaero consortium involves 24 academic and industrial partners leaded by Technicolor (previously Thomson). Willow participates in work package 9 “Video Processing” and leads work on motion recognition and event recognition tasks.

8.2.2. EIT-ICT labs: Mobile visual content analysis (Inria)

Participants: Ivan Laptev, Josef Sivic.

The goal of this project within the European EIT-ICT activity is to mature developed technology towards real-world applications as well as transfer technology to industrial partners. Particular focus of this project is on computer vision technology for novel applications with wearable devices. The next generation mobile phones may not be in the pocket but worn by users as glasses continuously capturing audio-video data, providing visual feedback to the user and storing data for future access. Automatic answers to “Where did I leave my keys yesterday?" or “How did this place look like 100 years ago?" enabled by such devices could change our daily life while creating numerous new business opportunities. The output of this activity is new computer vision technology to enable a range of innovative mobile wearable applications.

This is a collaborative effort with S. Carlsson (KTH Stockholm) and J. Laaksonen (Aalto University).

8.2.3. European Research Council (ERC) Advanced Grant: "VideoWorld" - Jean Ponce

Participants: Jean Ponce, Ivan Laptev, Josef Sivic.

WILLOW will be funded in part from 2011 to 2015 by the ERC Advanced Grant "VideoWorld" awarded to Jean Ponce by the European Research Council.
This project is concerned with the automated computer analysis of video streams: Digital video is everywhere, at home, at work, and on the Internet. Yet, effective technology for organizing, retrieving, improving, and editing its content is nowhere to be found. Models for video content, interpretation and manipulation inherited from still imagery are obsolete, and new ones must be invented. With a new convergence between computer vision, machine learning, and signal processing, the time is right for such an endeavor. Concretely, we will develop novel spatio-temporal models of video content learned from training data and capturing both the local appearance and nonrigid motion of the elements—persons and their surroundings—that make up a dynamic scene. We will also develop formal models of the video interpretation process that leave behind the architectures inherited from the world of still images to capture the complex interactions between these elements, yet can be learned effectively despite the sparse annotations typical of video understanding scenarios. Finally, we will propose a unified model for video restoration and editing that builds on recent advances in sparse coding and dictionary learning, and will allow for unprecedented control of the video stream. This project addresses fundamental research issues, but its results are expected to serve as a basis for groundbreaking technological advances for applications as varied as film post-production, video archival, and smart camera phones.

8.2.4. European Research Council (ERC) Starting Grant: "Activia" - Ivan Laptev

Participant: Ivan Laptev.

WILLOW will be funded in part from 2013 to 2017 by the ERC Starting Grant "Activia" awarded to Ivan Laptev by the European Research Council.
Computer vision is concerned with the automated interpretation of images and video streams. Today's research is (mostly) aimed at answering queries such as "Is this a picture of a dog?", "Is the person walking in this video?" (image and video categorisation) or sometimes "Find the dog in this photo" (object detection). While categorisation and detection are useful for many tasks, inferring correct class labels is not the final answer to visual recognition. The categories and locations of objects do not provide direct understanding of their function, i.e., how things work, what they can be used for, or how they can act and react. Neither do action categories provide direct understanding of subject's intention, i.e., the purpose of his/her activity. Such an understanding, however, would be highly desirable to answer currently unsolvable queries such as "Am I in danger?" or "What can happen in this scene?". Answering such queries is the aim of this project.

The main challenge is to uncover the functional properties of objects and the purpose of actions by addressing visual recognition from a different and yet unexplored perspective. The major novelty of this proposal is to leverage observations of people, i.e., their actions and interactions to automatically learn the use, the purpose and the function of objects and scenes from visual data. This approach is timely as it builds upon two key recent technological advances: (a) the immense progress in visual object, scene and human action recognition achieved in the last ten years, and (b) the emergence of massive amounts of image and video data readily available for training visual models. My leading expertise in human action recognition and video understanding puts me in a strong position to realise this project. ACTIVIA addresses fundamental research issues in automated interpretation of dynamic visual scenes, but its results are expected to serve as a basis for ground-breaking technological advances in practical applications. The recognition of functional properties and intentions as explored in this project will directly support high-impact applications such as prediction and alert of abnormal events and automated personal assistance, which are likely to revolutionise today's approaches to crime protection, hazard prevention, elderly care, and many others.

8.2.5. European Research Council (ERC) Starting Grant: "Leap" - Josef Sivic

Participant: Josef Sivic.

The contract is to be signed and will begin during 2014. WILLOW will be funded in part from 2014 to 2018 by the ERC Starting Grant "Leap" awarded to Josef Sivic by the European Research Council.
People constantly draw on past visual experiences to anticipate future events and better understand, navigate, and interact with their environment, for example, when seeing an angry dog or a quickly approaching car. Currently there is no artificial system with a similar level of visual analysis and prediction capabilities. LEAP is a first step in that direction, leveraging the emerging collective visual memory formed by the unprecedented amount of visual data available in public archives, on the Internet and from surveillance or personal cameras - a complex evolving net of dynamic scenes, distributed across many different data sources, and equipped with plentiful but noisy and incomplete metadata. The goal of this project is to analyze dynamic patterns in this shared visual experience in order (i) to find and quantify their trends; and (ii) learn to predict future events in dynamic scenes. With ever expanding computational resources and this extraordinary data, the main scientific challenge is now to invent new and powerful models adapted to its scale and its spatio-temporal, distributed and dynamic nature. To address this challenge, we will first design new models that generalize across different data sources, where scenes are captured under vastly different imaging conditions such as camera viewpoint, temporal sampling, illumination or resolution. Next, we will develop a framework for finding, describing and quantifying trends that involve measuring long-term changes in many related scenes. Finally, we will develop a methodology and tools for synthesizing complex future predictions from aligned past visual experiences. Our models will be automatically learnt from large-scale, distributed, and asynchronous visual data, coming from different sources and with different forms of readily-available but noisy and incomplete metadata such as text, speech, geotags, scene depth (stereo sensors), or gaze and body motion (wearable sensors). Breakthrough progress on these problems would have profound implications on our everyday lives as well as science and commerce, with safer cars that anticipate the behavior of pedestrians on streets; tools that help doctors monitor, diagnose and predict patients' health; and smart glasses that help people react in unfamiliar situations enabled by the advances from this project.

8.3. International Initiatives

8.3.1. IARPA FINDER Visual geo-localization (Inria)

Participants: Josef Sivic, Petr Gronat, Nicolas Maisonneuve.

Finder is an IARPA funded project aiming to develop technology to geo-localize images and videos that do not have geolocation tag. It is common today for even consumer-grade cameras to tag the images that they capture with the location of the image on the earth's surface ("geolocation"). However, some imagery does not have a geolocation tag and it can be important to know the location of the camera, image, or objects in the scene. Finder aims to develop technology to automatically or semi-automatically geo-localize images and video that do not have the geolocation tag using reference data from many sources, including overhead and ground-based images, digital elevation data, existing well-understood image collections, surface geology, geography, and cultural information.

Partners: ObjectVideo, DigitalGlobe, UC Berkeley, CMU, Brown Univ., Cornell Univ., Univ. of Kentucky, GMU, Indiana Univ., and Washington Univ.

8.3.2. Inria Associate Team VIP

Participants: Ivan Laptev, Josef Sivic.

This project brings together three internationally recognized research groups with complementary expertise in human action recognition (Inria), qualitative and geometric scene interpretation (CMU) and large scale object recognition and human visual perception (MIT). The goal of VIP (Visual Interpretation of functional Properties) is to discover, model and learn functional properties of objects and scenes from image and video data.

Partners: Aude Oliva (MIT) and Alexei Efros (CMU). The project will be funded during 2012-2014.

8.3.3. Inria International Chair - Prof. John Canny (UC Berkeley)

Participants: John Canny [UC Berkeley], Jean Ponce, Ivan Laptev, Josef Sivic.

Prof. John Canny (UC Berkeley) has been awarded the Inria International chair in 2013. He has visited Willow in November 2013 for a week to begin a lasting collaboration.

8.3.4. Inria CityLab initiative

Participants: Josef Sivic, Jean Ponce, Ivan Laptev, Alyosha Efros [UC Berkeley].

Willow participates in the ongoing CityLab@Inria initiative (co-ordinated by V. Issarny), which aims to leverage Inria research results towards developing “smart cities" by enabling radically new ways of living in, regulating, operating and managing cities. The activity of Willow focuses on urban-scale quantitative visual analysis and is pursued in collaboration with A. Efros (UC Berkeley).

Currently, map-based street-level imagery, such as Google Street-view provides a comprehensive visual record of many cities worldwide. Additional visual sensors are likely to be wide-spread in near future: cameras will be built in most manufactured cars and (some) people will continuously capture their daily visual experience using wearable mobile devices such as Google Glass. All this data will provide large-scale, comprehensive and dynamically updated visual record of urban environments.

The goal of this project is to develop automatic data analytic tools for large-scale quantitative analysis of such dynamic visual data. The aim is to provide quantitative answers to questions like: What are the typical architectural elements (e.g., different types of windows or balconies) characterizing a visual style of a city district? What is their geo-spatial distribution (see figure 1)? How does the visual style of a geo-spatial area evolve over time? What are the boundaries between visually coherent areas in a city? Other types of interesting questions concern distribution of people and their activities: How do the number of people and their activities at particular places evolve during a day, over different seasons or years? Are there tourists sightseeing, urban dwellers shopping, elderly walking dogs, or children playing on the street? What are the major causes for bicycle accidents?

Break-through progress on these goals would open-up completely new ways smart cities are visualized, modeled, planned and simulated, taking into account large-scale dynamic visual input from a range of visual sensors (e.g., cameras on cars, visual data from citizens, or static surveillance cameras).

8.4. International Research Visitors

8.4.1. Visits of International Scientists

Prof. Alexei Efros (UC Berkeley) has visited WIllow for six months in 2013. Aude Oliva (Principal investigator, Massachuesetts Institute of Technology) visited Willow for three months in 2013. Prof. John Canny (UC Berkeley) has visited Willow for a week in fall 2013 to begin a long term collaboration.

8.4.2. Visits to International Teams

Vincent Delaitre has visited the Robotics Institute, Carnegie Mellon University during November 2012 — January 2013, within the scope of the Inria associate team VIP. Maxime Oquab has done a 3 months internship at Microsoft Research in New York City, U.S.A.