Activity Report 2012

Section Partnerships and Cooperations

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

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. 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. MBAT

Title: Combined Model-based Analysis & Testing of Embedded Systems

Type: Artemis Call 10

Instrument: FP7 project

Duration: November 2011 - October 2014

Coordinator: Daimler (Germany)

Others partners: 38 partners in Austria, Denmark, Estonia, France, Germany, Italy, Sweden, and United Kingdom

See also: http://www.artemis-ia.eu/project/index/view/?project=29

Abstract: MBAT will mainly focus on providing a technology platform for effective and cost-reducing validation and verification of embedded systems, focusing primarily on transportation domain, but also to be used in further domains. The project involves thirty three European industrial (large companies and SMEs) and five academic partners. Radhia Cousot is the principal investigator for this project.

8.2.1.2. MemCad

Title: Memory Compositional Abstract Domains

Type: IDEAS ()

Instrument: ERC Starting Grant (Starting)

Duration: October 2011 - September 2016

Coordinator: Inria (France)

Others partners: none

See also: http://www.di.ens.fr/~rival/memcad.html

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

8.3. International Research Visitors

8.3.1. Visits of International Scientists

Yanjun Wen is associate professor at the Department of Computer Science and Technology, College of Computer, National University of Defense Technology, Changsha, P. R. China. He has visited the team from June 2011 to May 2012 and is interested in the static analysis of parallel software by abstract interpretation.

Roberto Giacobazzi, professor at the University of Verona, Italy, visited the Team in May 2012.

Michael Hicks is associate professor at the Department of Computer Science, University of Maryland, USA. He has visited the team in October 2012 and is interested in abstract interpretation, software security, and differential privacy.

Tatjana Petrov is a PhD student at ETH Zürich. She has visited the team in February 2012 and is interested in the model reduction of stochastic systems.

8.3.1.1. Internships

David Delmas is an engineer at Airbus France on educational leave to pursue the 2nd year of the Parisian Master of Research in Computer Science (MPRI). He has visited the team from September 2011 to August 2012.

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

8. Partnerships and Cooperations

8.1. Regional Initiatives

8.1.1. CIM PACA

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

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 so far actively participating in the Design Platform (one of the three platforms launched in this context), of which Inria is a founding member.

This year our ANR proposal HOPE was labeled by the regional SCS Cluster, through its ARCSIS/CIM PACA branch for microelectronics design. The project was consequently accepted, and will benefit from support from CIM PACA Design platform to host prototype and commercial software from project members (Synopsys, Docea Power, and Magillem, see 8.2.1.3).

8.2. National Initiatives

8.2.1. ANR

8.2.1.1. RT-Simex

Participants: Julien deAntoni, Frédéric Mallet.

The RT-Simex project is dedicated to the reverse engineering of analysis traces of simulation and execution back up to the source code, or in our case most likely into the original models in a MARTE profile representation. The prime contractor is OBEO, a software publishing company based in Nantes. The project ended in April 2012.

8.2.1.2. HeLP

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

The ANR HeLP project deals with joint modeling of functional behavior and energy consumption for the design of low-power heterogeneous SoCs. Partners are ST Microelectronics and Docea Power (SME) as industrial; Inria, UNS (UMR LEAT), and VERIMAG (coordinator) as academics. Our goal in this project is twofold: first, combine SoC modeling with temporal behavior and logical time with energy/power modeling as extra annotations on MARTE models; second, compare the capacities of high-level SystemC TLM abstraction with that of Esterel seen as a multiclock formalism based on logical abstract time.

The PhD thesis of Carlos Gomez, while not formerly funded by this project, is closely linked to its results (by providing a MDE metamodel with non-functional multiview aspects, such as performance, power and temperature. Several transformation links were realized, towards AcePlorer tool by DOCEA POWER, partner of the project, or also (as part of Ameni Khecharem internship) towards Scilab for simulation execution. Some of this work will be continued in the forthcoming ANR HOPE project.

8.2.1.3. HOPE

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

This project was only recently started, with a kick-off meeting in November. Original proponents were UMR LEAT, Texas Instruments, Synopsys, Docea Power, Magillem, and ourselves. It seems that, due to internal reorganisation, TI might withdraw from the project. Other major semiconductor industrial partners in PACA are being approched for replacement (mainly Intel). The purpose of the HOPE project is to focus on high-level modeling and early estimation of hierarchical power management techniques, with potential synthesis in the end if feasible.

8.2.1.4. GeMoC

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

This project was only recently started, with a kick-off meeting in December. It 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.

8.3. European Initiatives

8.3.1. ARTEMIS Projects

8.3.1.1. CESAR

Participant: Robert de Simone.

       Title: CESAR

       Duration: February 2009 - June 2012

       Coordinator: AVL - GmbH (Austria)

Others partners: AIRBUS Operations GbmH (Germany), AIRBUS Operations SAS (France), ABB AS (Norway), ABB AB (Sweden), AbsInt Angewandte Informatik GmbH (Germany), ACCIONA Infraestructuras S.A. (Spain), Ansaldo STS S.p.A. (Italy), ASTRIUM SAS (France), AIRBUS Operations Limited (United Kingdom), Aristotle University of Thessaloniki (Greece), Commissariat à l´Energie Atomique et aux Energies Alternatives (France), CNRS (France), Centro Ricerche Fiat S.C.p.A. (Italy), Critical Software S.A. (Poland), Danieli Automation S.p.A. (Italy), Delphi France SAS (France), Deutsches Zentrum für Luft- und Raumfahrt e.V. (Germany), Dassault Systemes (France), EADS Deutschland GmbH (Germany), Fondacion Tecnalia Research & Innovation (Italy), ESTEREL Technologies SA (France), Fraunhofer Gesellschaft zur Förderung der Angewandten Forschung e.V. (Germany)

See also: http://www.cesarproject.eu/

Abstract: CESAR stands for Cost-efficient methods and processes for safety relevant embedded systems and is a European funded project from ARTEMIS JOINT UNDERTAKING (JU). The three transportation domains automotive, aerospace, and rail, as well as the automation domain share the need to develop ultra-reliable embedded systems to meet societal demands for increased mobility and ensuring safety in a highly competitive global market. To maintain the European leading edge position in the transportation as well as automation market, CESAR aims to boost cost efficiency of embedded systems development and safety and certification processes by an order of magnitude. CESAR pursuits a multi-domain approach integrating large enterprises, suppliers, SME's and vendors of cross sectoral domains and cooperating with leading research organizations and innovative SME's.

Upon completion, CESAR was awarded an ARTEMIS honorary mention for achievement.

8.3.1.2. PRESTO

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

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.

8.3.2. Collaborations in European Programs, except FP7

8.3.2.1. ITEA2 Timmo2Use

Participants: Marie-Agnès Peraldi Frati, Julien DeAntoni, Arda Goknil, Jean-Vivien Millo, Yves Sorel.

Program: ITEA2

Project acronym: Timmo2Use

Project title: TIMing MOdel, TOols, algorithms, languages, methodology, and USE cases

Duration: October 2010 - October 2012

Coordinator: Volvo Technology AB (Sweden)

Other partners: AbsInt Angewandte Informatik GmbH (Germany), Arcticus Systems AB (Sweden), Chalmers University of Technology (Sweden), Continental Automotive GmbH (Germany), Delphi France SAS (France), dSPACE GmbH (Germany), INCHRON GmbH (Germany), Institut National de Recherche en Informatique et Automatique (France), Mälardalen University (Sweden), Rapita Systems Ltd. (United Kingdom), RealTime-at-Work (France), Robert Bosch GmbH (Germany), Symtavision GmbH (Germany), Technische Universität Braunschweig (Germany), Time Critical Networks (Sweden), Universität Paderborn (Germany).

See also: http://timmo-2-use.org/

Abstract: TIMMO develops different types of timing constraints and dynamic behaviour formalisms, to be used inside the supply chain and the complex development process in distributed real-time automotive system design. TIMMO-2-USE stands for TIMing MOdel - TOols, algorithms, languages, methodology, and USE cases which summarizes the main objectives of the project, i.e., the development of novel tools, algorithms, languages, and a methodology validated by use cases.

The project provides partial funding for the postdoctoral positions of Jean-Vivien Millo and Arda Goknil.

8.3.2.2. ITEA2 OPENPROD

Participants: Simon Nivault, Yves Sorel.

Program: ITEA2

Project acronym: OpenProd

Project title: Open Model-Driven Whole-Product Development and Simulation Environment

Duration: June 2009 - May 2012

Coordinator: Siemens Industrial TurboMachinery AB (Sweden)

Other partners: Appedge (France), Bosch Rexroth AG (Sweden), CEA LIST (France), EADS Innovation Works (France), Electricité De France (France), Equa Simulation AB (Sweden), ETH Zürich (Switzerland), Fachhochschule Bielefeld (Germany), Fraunhofer FIRST (Germany), IFP (France), Inria Rocquencourt (France), INSA Lyon (France), Linköping University (Sweden), LMS Imagine (France), MathCore Engineering AB (Sweden), Metso Automation (France), Nokia (Finland), Plexim GmbH (Germany), Pöyry Forest Industry (Finland), PSA Peugeot Citroen (France), Siemens AG, Sector Energy (Germany), SKF Sverige AB (Sweden), Technische Universität Braunschweig (Germany), TLK Thermo GmbH (Germany), VTT Technical Research Centre (Finland), XRG Simulation GmbH (Germany).

See also: http://www.ida.liu.se/~pelab/OpenProd/

Abstract: The OPENPROD project is developing an open whole-product, model-driven systems development, modelling and simulation (M&S) environment that integrates the leading open industrial software development platform Eclipse with open-source modelling and simulation tools such as OpenModelica and industrial M&S tools and applications. The project will enable a more formalised validation of production to cut time to market and ensure higher quality, using open solutions which will have a high impact, based on easy uptake and wide dissemination.

8.4. International Initiatives

8.4.1. Inria Associated Teams

8.4.1.1. DAESD

Title: Distributed/Asynchronous and Embedded/synchronous Systems Development

Inria principal investigator: Robert de Simone

International Partner (Institution - Laboratory - Researcher):

East China Normal University (China) - SEI-Shone - Yixiang Chen

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*, 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. In parallel with our research collaboration this Associate Team, the SEI-Shone lab is organizing a workshop in Shanghai, with a first edition in Nov. 2011, on "Distributed - Asynchronous and Embedded - synchronous Systems Development".

8.4.2. Participation In International Programs

8.4.2.1. LIAMA

Following the DAESD associated-team, a proposal for a LIAMA project with ECNU Shanghai, named HADES, has been presented recently at the LIAMA steering committee in December 2012. It is a joint proposal with the OASIS EPI.

8.5. International Research Visitors

8.5.1. Visits of International Scientists

Jagadish Suryadevara (IDT, Mälardalen University, Sweden) visited us for two months in May/June 2012.

8.5.1.1. Internships

Matias Ezequiel VARA LARSEN (from Mar 2012 until Jun 2012)

Subject: Study of the influence of Linux operating system on OpenMP applications performances on multicore processors

Institution: National University of La Plata (Argentina)

CASCADE Project-Team

6. Partnerships and Cooperations

6.1. 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.

- **PACE: Pairings and Advances in Cryptology for E-cash.**
  Participants: Olivier Blazy, David Pointcheval, Damien Vergnaud.

  From December 2007 to February 2012.
  Partners: France Telecom R&D, NXP, Gemalto, CNRS/LIX (Inria/TANC), Univ. Caen, Cryptolog.
  This project aims at studying new properties of groups (similar to pairings, or variants), and then to exploit them in order to achieve more practical e-cash systems.

- **BEST: Broadcast Encryption for Secure Telecommunications.**
  Participants: Duong Hieu Phan, David Pointcheval, Elizabeth Quaglia, Mario Strefler.

  From December 2009 to November 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, Michel Ferreira Abdalla, David Pointcheval.

  From December 2010 to November 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.

6.2. 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.**
  Participant: Damien Vergnaud.

  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).

6.3. European Initiatives

- **ECRYPT-II: Network of Excellence in Cryptology.**
  From August 2008 to January 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.

- **ERC Starting Grant: LATTICE.**
  From September 2010 to August 2012

- **SecFuNet: Security for Future Networks.**
  From July 2011 to December 2013

6.4. International Research Visitors

- Angelo De Caro (PhD student) – Univ. Salerno, Italy

- Karina M. Magalhães (PhD student) – University of Campinas, Brazil

- Daniel Masny (PhD student) – University of Bochum, Germany

- Nuttapong Attrapadung – The National Institute of Advanced Industrial Science and Technology, Japan

- Manuel Bernardo Barbosa – University of Minho, Portugal

- Yu Long – Shanghai Jiao Tong University, China

- Igor Shparlinski – Macquarie U., Australia

- Hoeteck Wee – George Washington University, USA

- Christian Schaffner – CWI, Amsterdam

CONTRAINTES Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

- 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 (2010-2013) coordinated by Anne Siegel, CNRS IRISA Rennes, with Ovidiu Radulescu, U. Montpellier, Irina Rusu, U. Nantes.

- AE REGATE (2008-2012) 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-) 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, 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: mars 2010 - mars 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

Title: Artificial tissue homeostasis: combining synthetic and computational biology approaches (TISHOM)

Inria principal investigator: Gregory Batt

International Partner (Institution - Laboratory - Researcher):

Massachusetts Institute of Technology (United States) - Weiss Lab - Ron Weiss

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.

8.3.2. Inria International Partners

We also have a collaboration with the Center for Systems and Control at the Delft University of Technology (The Netherlands) on developing formal probabilistic approaches for robust control of gene expression. This collaborative project is funded by the Frans/Nederlandse Academie as part of the van Gogh Programm (Coordination Alessandro Abate/Grégory Batt).

8.4. International Research Visitors

8.4.1. Visits of International Scientists

8.4.1.1. Visits of International Scientists

Prof. Fernando Buarque (from February 2012 until April 2012)

Subject: Fish School Optimization

Institution: University of Pernambuco, Brazil

8.4.1.2. Internships

Hui-Ju Katherine CHIANG (from Jul 2012 until Oct 2012)

Subject: Theory of temporal logic constraint solving

Institution: National Taiwan University (Taiwan)

Anthony LINS (from Mar 2012 until Jun 2012)

Subject: Particle swarm optimization for systems biology

Institution: Federal University of Pernambuco (Brazil)

8.4.1.3. Short visits

Andreas Weber, University of Bonn, Germany

Chris Banks, University of Edinburgh, UK

Francesco Santini, CWI, Amsterdam, Netherlands

Ron Weiss, MIT, USA

Alessandro Abate and Ilya Tkachev, TU Delft, Netherlands

Liu Bing, National University of Singapore, Singapore

8.4.2. Visits to International Teams

Xavier Duportet: 6 months with the Weiss lab at MIT

Szymon Stoma: two times two weeks with the Weiss lab at MIT

François Bertaux: two times two weeks with the Weiss lab at MIT

DEDUCTEAM Team

6. Partnerships and Cooperations

6.1. National Initiatives

6.1.1. ANR Locali

We are coordinators of the ANR-NFSC contract Locali with the Chinese Academy of Sciences. This year we mostly developed in proof in a finite structure project of this contract.

6.1.2. ANR BWare

We are members of the ANR Beware which started on last September (David Delahaye is the national leader). The objective is to provide a proof platform for B proof obligations. We are in particular involved in the introduction of Deduction modulo in the automated proved tableaux-based Zenon and also in the combination of Deduction modulo and superposition.

6.1.3. ANR Tarmac

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

6.2. International Research Visitors

6.2.1. Visits of International Scientists

Nachum Dershowitz (Tel Aviv) has been visiting our group for three months.

Cecilia Englander (Puc-Rio) has been visiting our group for four months.

6.2.2. Visits to International Teams

Pierre Néron has been visiting César Muñoz group in Nasa-Langley for three months.

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

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. 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

PIs: Jean-Pierre Jouannaud, Jianqi Li

duration: 2011 - 2012

Amount: 100,000 RMB

8.1.2. 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

8.2. International Initiatives

8.2.1. Inria International Partners

FORMES is an international project from LIAMA in China, located on two sites, Tsinghua University in Beijing, and CAS Shenzhen Institute of Advanced Technologies in Shenzhen. In addition this project has had collaborations with CAS Institute of Software and Harbin Engineering University in 2012.

8.3. International Research Visitors

8.3.1. Visits of International Scientists

FORMES received visiting Pr Nachum Dershowitz from Israel at Tsinghua for a short stay.

8.3.1.1. Internships

Rémi Nollet (L3, ENS Lyon) did an internship at Inria Rocquencourt co-supervised by Frédéric Blanqui and Pierre Weis on the certification of construction functions generated by Moca.

8.3.2. Visits to International Teams

Jean-Pierre Jouannaud, invited in Barcelone, UTC, LSI-Lab, September 2012.

Frédéric Blanqui visited the Institute of Applied Mechanics and Informatics (IAMI) of the Vietnamese Acadamy of Sciences at Ho Chi Minh City.

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

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ADN4SE (FSN)

Participant: Damien Doligez.

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. BWare (ANR)

Participant: Damien Doligez.

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.

8.1.3. CEEC (FSN)

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.

8.1.4. LaFoSec

Participant: Damien Doligez.

The LaFoSec study, commissioned by ANSSI, aims at studying the security properties of functional languages, and especially of OCaml. The study is done by a consortium led by the SafeRiver company. Last year, it produced more than 600 pages of documents, including recommendations for security-aware development in OCaml.

The study continued this year with the production of a prototype of a secure XML/XSD validator following these recommendations, and a security evaluation of the prototype by an independent company.

Most of these documents will be made available in 2013 on the ANSSI Web site (http://ssi.gouv.fr/).

8.1.5. Paral-ITP (ANR)

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.

8.1.6. U3CAT (ANR)

Participant: Xavier Leroy.

The "U3CAT" project (2009-2012) ended in August 2012. It was coordinated by Virgile Prevosto at CEA LIST and funded by the *Arpège* programme of *Agence Nationale de la Recherche*. This action focused on program verification tools for critical embedded C codes. We were involved in this project on issues related to memory models [35] and formal semantics for the C language, at the interface between compilers and verification tools.

8.1.7. Verasco (ANR)

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.

8.2. International Research Visitors

8.2.1. Visits of International Scientists

Gabriel Dos Reis, assistant professor at Texas A&M University, visited the Gallium team in July 2012, to work on the formal semantics of the C and C++ languages.

8.2.1.1. Internships

Joseph Tassarotti, undergraduate student at Harvard University, did an internship at Gallium from June to August 2012. He worked on register allocation and instruction scheduling for the CompCert verified compiler.

<h1 style="text-align: center; color: red;">MUTANT Project-Team</h1>

7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. ANR

7.1.1.1. 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.

7.1.2. 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).

7.2. International Research Visitors

7.2.1. Visits of International Scientists

Miller S. Puckette is a professor of computer music in University of California San Diego (UCSD) and author of *Max* and *PureData* real-time programming environments for interactive arts. He participated in May 2012 in the MuTant Real-time Multimedia Computing Seminars (available on the web) and contributed to the team's knowledge of multimedia real-time scheduling challenges and paradigms.

James McCartney is a senior researcher in Apple Core Audio project and author of the audio synthesis and algorithmic composition programming environment *SuperCollider*. He visited *MUTANT* in November 2012 and participated in the MuTant Real-time Multimedia Computing Seminars (available on the web). He is interested in robust scheduling of heterogeneous computing for real-time multimedia applications.

David Rizo is lecturer at the University of Alicante, Spain. He is interested in music information retrieval and classification of musical genres by combining audio and symbolic descriptors. He visited *MuTant* in March 2012 and participated in a session of the MaMux seminar dedicated to trees and hierarchical structures in computer music.

Masahiko Sakai 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. He visited *MuTant* in April 2012.

Yoshiharu Kojima is an research fellow of the Japan society for the promotion of science. He has made a two months post-doctoral visit in *MuTant* in October and November 2012 on the application of term rewriting techniques to the formalization of musical processes, under the institutional program for young researchers overseas visits of the graduate school of information science at Nagoya University.

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.

ANR CAFEIN, 2013-2015.

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.

8.2. International Research Visitors

8.2.1. Visits of International Scientists

September, 27 - October, 3, Peter Sewell (U. Cambridge) visited the Parkas team for collaboration with F. Zappa Nardelli and R. Morisset.

October, 6-13, Mike Hicks (U. Maryland) visited the Département d'informatique of the ENS.

January, 18-20, P. Sadayappan (Ohio State U.) visited the team to work with Tobias Grosser and Sven Verdoolaege. Similar visits took place in July and December.

June-July 2013. Stephen Edwards (Columbia U.) was invited by ENS to spend a month in the team.

8.2.1.1. Internships

January-July, Pankaj Pawan (IIT Kanpur) was intern student (M2) under the supervision of F. Zappa Nardelli.

May-September, Robin Morisset (ENS Ulm) was intern student (M2) under the supervision of F. Zappa Nardelli.

May-September, Fran cois Gindraud (ENS Ulm) was intern student (M2) under the supervision of A. Cohen.

December 2011-November 2012, Mehdi Dogguy was post-doc funded by the ANR Partout grant. Mehdi Dogguy worked on the static analysis of ReactiveML programs and was supervised by L. Mandel.

April-July 2012, Cyprien Lecourt (École Polytechnique) was intern student (M1) under the supervision of M. Pouzet.

April-September 2012, Guillaume Baudart (École normale supérieure de Cachan) was intern student (M2) under the supervision of M. Pouzet. Guillaume was a student from IRCAM and the supervision was joint with Florent Jacquemart (Inria Paris-Rocquencourt and IRCAM).

8.2.2. Visits to International Teams

Louis Mandel spent 7 weeks in the team of Vijay Saraswat at IBM T.J. Watson. He worked on the type system of the X10 language.

Albert Cohen and Tobias Grosser visited Prof. Uday Bondhugula at the Indian Institute of Science (IISc), CSA department, for 4 days and 2 weeks, respectively. Tobias Grosser gave a lecture/tutorial on optimizing compilation in LLVM to IISc students and AMD engineers.

<p style="text-align:center; color:red;">**PI.R2 Project-Team**</p>

7. Partnerships and Cooperations

7.1. National Initiatives

Matthieu Sozeau, Hugo Herbelin, Lourdes del Carmen Gonzalez 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.

7.2. European Initiatives

7.2.1. 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 (Stark) and Paris 7 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. François Bobot's postdoc is funded by this project.

7.2.2. Collaborations in European Programs, except FP7

Hugo Herbelin is participating to a PHC Pavle Savić with the university of Novi Sad in Serbia, the mathematical institute of Belgrade, ENS Lyon and the university of Turin. This project, called TLIT and headed by Silvia Ghilezan on the Serbian side, is about the properties of resource λGtz calculus; subject reduction for the $\overline{\lambda}\mu\widetilde{\mu}$-calculus; explicit substitutions and confluence; the diagrams and termination for $^*X$ calculus; introducing imperative features in classical logic; the $\lambda\mu$ calculus and its properties; the symmetries in classical logics.

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.

7.3. International Initiatives

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

Activity report: http://www.pps.univ-paris-diderot.fr/~saurin/EA-SEMACODE/en/activite.html

Cross-fertilisation between logic and programming languages theory is at the root of many striking developments in programming concepts as well as tools for formal analysis of programs. Our associated team project aims at gathering senior and young researchers from both sites in order to put a joint research effort on the following research themes: formalising particular evaluation strategies of functional languages based on logical techniques coming from sequent calculi. More specifically, we shall be interested in incorporating control operators directly in call-by-need and in developing a uniform framework for call-by-value and call-by-name calculi with delimited control, in particular to unveil the logical interpretation of delimited control (that is its logical counterpart with respect to Curry-Howard correspondence), and developing connections between delimited control and stream calculi; developing the logical content of realistic abstract machines and associated formal analysis tools for realistic abstract machines building on Curien-Herbelin $\overline{\lambda}$ calculi. The project will gather πr^2 expertise in proof theory and in the logical foundations of functional programming languages, the expertise of the Oregonian group on call-by-need evaluation and delimited control as well as respective crucial inputs of Gaboardi and Ghilezan on stream calculi, delimited control, semantics and type theory. The project will in particular allow to have the Inria and American students and post-docs involved in the project (7 out of 13 people involved) to travel between both sites and to organise joint workshops (one such workshop is planned in June 2011).

7.3.2. *PHC*

Hugo Herbelin started a PHC STAR with Gyesik Lee and Sungwoo Park in Korea on reverse mathematics and Coq, and on the role that polarisation can play in this respect.

7.3.3. *Inria International Partners*

πr^2 has strong relations with the following universities: Cambridge (Tim Griffin), Nottingham (Thorsten Altenkirch), Münich (Andreas Abel, Martin Hofmann), Strathclyde (Conor McBride), Chalmers in Göteborg (Thierry Coquand, Peter Dybjer), Technical University in Tallinn (Tarmo Uustalu, Keiko Nakata), Yale University (Zhong Shao), Harvard University (Greg Morrisett).

7.4. International Research Visitors

7.4.1. *Visits of International Scientists*

Thorsten Altenkirch (University of Nottingham) visited πr^2 for one month April 2012.

Conor McBride (University of Strathclyde) visited πr^2 for three weeks April-May 2012.

Keiko Nakata (University of Tallin) visited πr^2 for 4 days in September and worked with Zena Ariola and Hugo Herbelin on typing the continuation-passing-style semantics of call-by-need λ-calculus.

Tim Griffin visited πr^2 from January to June 2012 (and was funded 3 months by the Inria Paris-Rocquencourt invitation programme). He worked on the formalisation of routing protocols in Coq, and had many exchanges with Coq and ssreflect implementors.

Zena Ariola is visiting πr^2 during the whole academic year 2012-2013. She works on call-by-need, continuation-passing translations and related subjects.

Beta Ziliani (MPI Saarbrücken) visited πr^2 for one week in January 2012 and one week in July 2012 to work with Matthieu Sozeau on formalising the unification algorithm of Coq.

Jael Kriener (University of Kent) visited πr^2 for one week in January 2012 to work with Matthieu Sozeau on proof-search for Type Classes.

7.4.2. Internships

We host Paul Downen (PhD student of Zena Ariola, University of Oregon), during the entire academic year 2012/2013.

7.4.3. Visits to International Teams

Hugo Herbelin and Matthieu Sozeau have spent three months at the IAS as part of the special year on Univalent Foundations (October-December 2012).

7.4.4. Shorter International Visits Abroad

Pierre-Louis Curien visited Zena Ariola (Univ. of Oregon) for 2 weeks in May-June, and Tarmo Uustalu (Institute of Cybernetics of Technical University, Tallinn) for 2 weeks in December.

Hugo Herbelin visited Silvia Ghilezan at the University of Novi Sad in Serbia for one week in January 2012. He visited Predrag Janičić at the University of Belgrade for 2 days. He visited Danko Ilik in Skopje for one week.

Hugo Herbelin visited 4 days Gyesik Lee in Seoul and 3 days Sungwoo Park in Pohang in May as part of their joint project on Reverse Mathematics in Coq.

Guillaume Munch-Maccagnoni also visited Seoul (as part of the PHC STAR programme) 10 days in December.

Matthieu Sozeau was invited by the French Ministry of Foreign Affairs to visit Keiko Nakata and Tarmo Uustalu (IoC, Tallinn) for 4 days in June 2012. He gave a seminar on Equations there.

<h1 style="text-align:center; color:red;">POLSYS Project-Team</h1>

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]).

8.2. European Initiatives

8.2.1. FP7 Projects

ECRYPT II - European Network of Excellence for Cryptology II is a 4 1/2 year network of excellence funded within the Information & Communication Technologies (ICT) Programme of the European Commission's Seventh Framework Programme (FP7) under contract number ICT-2007-216676. It falls under the action line Secure, dependable and trusted infrastructures. ECRYPT II started on 1 August 2008. Its objective is to continue intensifying the collaboration of European researchers in information security. The ECRYPT II research roadmap is motivated by the changing environment and threat models in which cryptology is deployed, by the gradual erosion of the computational difficulty of the mathematical problems on which cryptology is based, and by the requirements of new applications and cryptographic implementations. Its main objective is to ensure a durable integration of European research in both academia and industry and to maintain and strengthen the European excellence in these areas. In order to reach this goal, 11 leading players have integrated their research capabilities within three virtual labs focusing on symmetric key algorithms (SymLab), public key algorithms and protocols (MAYA), and hardware and software implementations associate (VAMPIRE). They are joined by more than 20 adjoint members to the network who will closely collaborate with the core partners. The team joins the European Network of Excellence for Cryptology ECRYPT II this academic year as associate member (J.C. Faugère [contact], L. Perret, and G. Renault).

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.

8.3.2. Participation In International Programs

The POLSYS Team is part of the ECCA (Exact/Certified Computations with Algebraic systems) project at LIAMA in Beijing; our Chinese collaborators are from Beihang University, Peking University, the Chinese Academy of Sciences (Key Laboratory of Mathematics Mechnanization and State Key Laboratory of Information Security).

We are also part of an International Royal Society Joint Project with the Crypto team Royal Holloway, University of London, UK (2010-2012). The Royal Society Joint Project Grant Programme is designed to enable international collaboration. The main goal of the project is to investigate the viability of a wide range of new algebraic techniques in the cryptanalysis of block ciphers, and potentially other symmetric cryptographic algorithms (such as hash functions).

8.4. International Research Visitors

8.4.1. Visits of International Scientists

As part of its collaboration with Guénaël Renault, the Professor Kazuhiro Yokoyama from Rikkyo University (Japan) visited the team during December 2012.

Erich Kaltofen (Professor at North Carolina State University) visited the group in June-July 2012 in the frame of the QOLAPS Associate Team.

Xiao-Shan Gao, Lihong Zhi, Jinsan Cheng (Chinese Academy of Sciences, KLMM) visited the group in July 2012 in the frame of the ECCA project and the ANR EXACTA project.

8.4.1.1. Internships

- T. Verron (Internship M2 and ENS Paris): Computation of Gröbner bases for quasi-homogeneous systems.
- F. Martani (Internship M2): Dedicated Linear Algebra for Gröbner Bases.

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.)

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.

8.2. 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

- We work closely with Microsoft Research in Cambridge, Redmond, and Bangalore (C. Fournet, N. Swamy, P. Naldurg)
- We work closely with University of Venice, Italy (R. Foccardi).

8.4. International Research Visitors

8.4.1. Visits of International Scientists

- Michael May (Faculty Lecturer, Kinneret College on the Sea of Galilee, Israel) visited us for three months as professeur invité.

- Sergio Maffeis (Imperial College, London) visited us as part of an ongoing collaboration.

8.4.1.1. Internships

- Jean Karim Zinzindohoue did his M1 stage with Karthikeyan Bhargavan. He won the "Prix du stage de recherche dit prix d'option" for his work on "Tracking Cryptographically Masked Flows in Android Applications"

- Antoine Delignat-Lavaud did his M2 stage with Karthikeyan Bhargavan on "Security Types for Web Applications"

- Chetan Bansal did a Master's stage with Karthikeyan Bhargavan on "Analysis and Verification of Security for Web Applications"

- Avinash Thummala did a Master's stage with Karthikeyan Bhargavan on "Verifying JavaCard Applets"

- Sneha Popley did a PhD summer internship with Karthikeyan Bhargavan on "Verifying Cryptographic Applications in Java"

8.4.2. Visits to International Teams

- Visits to Imperial College, London: Karthikeyan Bhargavan, Antoine Delignat-Lavaud, Chetan Bansal

- Visits to Microsoft Research, Cambridge: Karthikeyan Bhargavan, Alfredo Pironti

- Visits to University of Birmingham: Ben Smyth, Miriam Paiola

SECRET Project-Team

7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. ANR

- **ANR DEMOTIS** ($02/09 \rightarrow 02/12$)
  Collaborative Analysis, Evaluation and Modelling of Health Information Technology
  http://www.demotis.org/
  ANR program: ARPEGE (Systèmes Embarques et Grandes Infrastructures)
  Partners: Sopinspace, Inria (project-teams SECRET and SMIS), CNRS/CECOJI
  55 kEuros.
  DEMOTIS brings together computer scientists and legal scholars. The project experiments new methods for the multidisciplinary design of large information systems that have to take in account legal, social and technical constraints. Its main field of application is personal health information systems. Most notably, work is conducted in priority on the infrastructure for the French personal medical file system (DMP) and secondarily on the data infrastructure for the research and public health networks associated with specific diseases (AIDS, cancer). The aim is to understand how the intrication between the legal and technical domains affects the design of such data infrastructures.

- **ANR SAPHIR-2** ($03/09 \rightarrow 03/13$)
  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 COCQ** ($01/09 \rightarrow 07/12$)
  Codes correcteurs quantiques
  http://www-roc.inria.fr/secret/Jean-Pierre.Tillich/COCQ.html
  ANR program: Domaines emergents
  Partners: ENSEA, Inria (project-team SECRET), Université de Bordeaux, Telecom ParisTech
  117 kEuros
  This project deals with the development of fundamental research on error correcting codes for quantum channels. In particular, we aim to suggest suitable generalizations to the quantum setting of the best known families of quantum codes (such as LDPC or turbo-codes) and to analyze their performance.

- **ANR BLOC** ($10/11 \rightarrow 09/15$)
  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.

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 → 02/13)
  Analysis of binary streams.
  20 kEuros.

7.2. European Initiatives

Associate member of the ECRYPT II European network of excellence (08/08 → 07/12) http://www.ecrypt.eu.org/

7.2.1. Collaborations with Major European Organizations

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
Symmetric crytography and code-based cryptography

7.3. International Research Visitors

7.3.1. Visits of International Scientists

- Gohar Kyureghyan, Otto-von-Guericke Universität Magdeburg, Germany, from October 2011 to June 2012
- Davide Schipani, Universität Zurich, Switzerland, February 13-17
- Sergey Abrahamyan, Institute for Informatics and Automation Problems, Yerevan, Armenia, May 20-26
- Yves Edel, Gent University, Belgium, June 3-9
- Christiane Peters, DTU, Denmark, November 19-23
- Stefan Heyse, Ingo von Maurich and Ralf Zimmermann, Ruhr-Universität Bochum, Germany, November 19-23
- Grigory Kabatyanskiy, IPIT, Moscow, Russia, December 17-21 .

7.3.2. Visits to International Teams

- DTU-Mathematics, Denmark Technical University, Denmark, January-August, 8-month sabbatical stay funded by the DGA (A. Canteaut).
- School of Informatics, University of Edinburgh, Scotland, December 3-6, invitation to the *Quantum Security Meeting*, and visit of Elham Kashefi's group (A. Leverrier).

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

8. Partnerships and Cooperations

8.1. International Initiatives

8.1.1. Inria Associate Teams

CAD is an Inria/Tsinghua University team related to LIAMA (China).

8.1.2. Participation In International Programs

We attend an international program of National Natural Science Foundation of China from 2010 to 2013.

Floating Point continuity clearly is a pioneer effort to solving a well-known unsolved problem. Up to now, almost all geometric modeling tool kits are based on traditional mathematics. They ignore the fact that computers can only represent a finite set of real numbers and simply use the formula $(a - \varepsilon < b)$ and $(b < a + \varepsilon)$ to compare whether two real numbers a and b are equal to each other or not. In the way, it becomes a very hard problem how to choose the proper value i.e., the precision is often out of control in geometric modeling tool kits although few documents report such the fact. This problem is very difficult. We also explore some formal methods and applied them to geometric algorithms. It seems to be an interesting research avenue. Finally, we also plan to study tolerances problem more carefully with CAD/CAM experts, because many of tolerances are not only directly related to the actual manufacturing process.

The central challenge with spline surfaces is to control their continuity when multiple patches join and to enable different types of sharpness. We are especially excited by a new result that addresses a central problem with spline modeling that has been open for five decades: the variation of continuity across a patch. This is needed, for example, when a crease forms in a smooth area. Because spline surfaces are modeled using a (mostly separable) tonsorial product of polynomial bases, it is hard to have a different level of continuity on two opposite edges of a patch. We proposed a particularly elegant solution to this challenge by smoothly varying the parametric location of the spline knots. This allows the curve to transition from a configuration where knots overlap (sharp C^1 discontinuity) to a configuration where they are distinct (fully continuous surface). We think that this work will have a large impact on CAD-CAM. Moreover, we speculate that our new geometric representation could be good candidates for better solving numerical simulation (PDEs) problems.

CLASSIC Project-Team

7. Partnerships and Cooperations

7.1. National Initiatives

- ANR project in the conception and simulation track: EXPLO/RA (involves Emilien Joly, Pierre Gaillard, Sébastien Gerchinovitz, Gilles Stoltz; see http://sites.google.com/site/anrexplora/);

- ANR project in the blank program: Parcimonie (involves Sébastien Gerchinovitz, Vincent Rivoirard, Gilles Stoltz; see http://www.proba.jussieu.fr/ANR/Parcimonie/);

- ANR project in the blank program: Calibration (involves Vincent Rivoirard, who is the coordinator; see https://sites.google.com/site/anrcalibration/home);

7.2. European Initiatives

Thanks to the PASCAL European network of Excellence (http://www.pascal-network.org/), we have strong links with Gábor Lugosi, Universitat Pompeu Fabra, Spain and Nicolò Cesa-Bianchi, Università degli Studi di Milano.

7.3. International Initiatives

We have some internal collaborations, with

- Karine Bertin, University of Valparaiso, Chile;

- Luc Devroye, McGill University, Canada;

- Shie Mannor, Technion, Israel.

In particular, Pierre Gaillard spent 5 months working with Shie Mannor from January to May 2012.

<h1 style="color:red; text-align:center">GAMMA3 Project-Team</h1>

5. Partnerships and Cooperations

5.1. Regional Initiatives

- Maîtrise des propriétés des fibres de chanvre (fibre / chènevotte), dans le cadre de valorisation s en agro-composites base polymère, MAPROFI CONTRAT DE PROJETS ETAT-REGION 2007-2013, INRA, UTT, USTL, AFT plasturgie, ITC
- Valorisation par recyclage de composites bio-sourcés à base de fibres de chanvre au travers de leur comportement mécanique sous sollicitations statiques et dynamiques, Projet BioComposites Incitatif Amont DRRT 2012 de la région Champagne Ardenne

5.2. European Initiatives

5.2.1. FP7 Projects

- Projet Européen : FP7 Health-F5-2009-241818 : NANOANTENNA
  Participants: Dominique Barchiesi [correspondant], Thomas Grosges, Sameh Kensentini
  Développement d'un biocapteur in vitro, ultra sensible et sélectif destiné à la détection de protéines impliquées dans les premières phases du développement de maladies. Modélisation et optimisation numériques du dispositif (taille, forme, couplage électromagnétique-matériaux).

5.3. International Research Visitors

5.3.1. Internships

- ZHANG Jie, 3D advanced remeshing procedure for numerical simulation of forming processes
- SLIMANI Faouzi, Modélisation mécanique des aptitudes de formage à chaud des tôles et des tubes minces avec remaillage adaptatif en grandes déformations

5.3.2. Visits to International Teams

- Frederic Alauzet, Septembre 2011-Septembre 2012, Mississippi State University, CAVS lab.

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

7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. ANR

ANR ANR-08-BLAN, Program: Big'MC (Issues in large scale Monte Carlo). (2009-2012).

Partners ENST, ENPC, University Paris-Dauphine.

7.1.2. Competitivity Clusters

Pôle Finance Innovation.

Project "Credinext" on credit risk derivatives (2009-2012).

Partners: Thomson Reuters, Lunalogic, Pricing Partners, Ecole Polytechnique, Inria, ENPC, Université Paris-Est Marne la Vallée.

(Several PhD and Postdoc grants)

7.2. European Initiatives

Eurostars Program "Transparency in Financial Markets" (OSEO grant) (Postdoc grants).

7.3. International Research Visitors

7.3.1. Visits of International Scientists

Emmanuella Rosazza Gianin, Bococca Milano University , January 2012

Peter Forsyth, Waterloo university Canada, July 2012

7.3.2. Internships

- Roxana Dumitrescu, Master 2 , University Paris-Dauphine
- Jiang Pu , Ecole Polytechnique, 3rd year

MICMAC Project-Team

7. Partnerships and Cooperations

7.1. Regional activities

The project-team is shared between Inria and Ecole des Ponts ParisTech.

7.2. National Initiatives

The project-team is involved in several ANR projects:

- the ANR MANIF focuses on the mathematical and numerical analysis of electronic structure models, such as, in particular, the Kohn-Sham model. It includes two research teams: researchers from the JL Lions Laboratory (Paris 6) and the Micmac team. It is coordinated by E. Cancès.

- I. Dabo is members of the ANR PANELS (Photovoltaics from Ab-initio Novel Electronic-structure Simulations).The PANELS initiative gathers three groups (CNRS, Institut Neel, France; Université de Lyon, LPMCN, France; Ecole des Ponts, Université Paris-Est, CERMICS, France) expert in methodology developments around many-body perturbation theory and a novel orbital-dependent density functional formalism, in order to study the electronic, optical and transport properties of second/third generation photovoltaic devices.

- E. Cancès is involved in the ANR BECASIM, which is concerned with the numerical simulation of Bose-Einstein condensates. This ANR has been accepted in June 2012, and is coordinated by I. Danaila (Université de Rouen).

- C. Le Bris participates to the ANR EMAQS. The scientist in charge is Karine Beauchard (CMLS, Ecole polytechnique).

- F. Legoll participates to the ANR Megas.

- T. Lelièvre is in charge of the ANR project "MEGAS".

- T. Lelièvre is member of the ANR-project "BIGMC" (PI: Gersende Fort, Telecom ParisTech) and of the ANR-project "STAB" (PI: I. Gentil, Université de Lyon).

- F. Nier is a member of ANR-NOSEVOL led by F. Hérau (Nantes) T. Ramond (Orsay) and S. Vu-Ngoc (Rennes), started in jan. 2012 for 4 years.

- F. Nier is a member of ANR-LODIQUAS led by F. Castella (Rennes) and N. Mauser (Wien), started in april 2012 for 4 years.

In addition, the team is participating in

- the GdR Quantum dynamics. This interdisciplinary research network is focused on physical and mathematical problems related to the time evolution of quantum systems (transport problems, nonequilibrium systems, etc),

- the GdR CoDFT,

- the GdR Maths et entreprise,

- the GdR correl (correlated methods in electronic structure computations),

- the GDR-CNRS 3274 Dynamique Quantique 2009-2012,

- the GDR-CNRS 2434 Analyse des Equations aux Dérivées Partielles.

The MICMAC team project is involved in two Labex, namely the Labex Bezout (started in 2011) and the Labex MMCD (started in 2012).

We have invited the following National researchers to visit our team:

- A. Lozinski (University of Toulouse and now at the University of Besançon): repeated visits during the year 2012.

7.3. International Initiatives

7.3.1. *Visits of International Scientists*

We have invited the following researchers to visit our team:

- U. Hetmaniuk (University of Washington in Seattle), March 5-16, 2012,
- B. Khoromskij and V. Khoromskaia, (Max-Planck-Institute for Mathematics in the Sciences Leipzig), December 17-20, 2012.
- G. Nguetseng (University of Yaoundé 1, Cameroon), March 19-30, 2012,

7.3.2. *Bilateral international relations*

E. Cancès is involved in a France-Berkeley project on the modelling of solvated molecules.

T. Lelièvre, G. Stoltz and F. Legoll participates 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.

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

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR

8.1.1.1. 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/

8.1.1.2. Detect

    Participants: Sylvain Arlot, Francis Bach, Rémi Lajugie.

        Title: New statistical approaches to computer vision and bioinformatics

        Coordinator: Ecole Normale Supérieure (Paris)

        Leader of the project: Sylvain Arlot

        Other members: J. Sivic (Willow project-team, ENS), A. Celisse (University Lille 1), T. Mary-Huard (AgroParisTech), E. Roquain and F. Villers (University Paris 6).

        Instrument: ANR, Young researchers Program

        Duration: Sep 2009 - Aug 2012

        Total funding: 70000 Euros

        See also: http://www.di.ens.fr/~arlot/ANR-DETECT.htm

        Abstract: The Detect project aims at providing new statistical approaches for detection problems in computer vision (in particular, detecting and recognizing human actions in videos) and bioinformatics (e.g., simultaneously segmenting CGH profiles). These problems are mainly of two different statistical nature: multiple change-point detection (i.e., partitioning a sequence of observations into homogeneous contiguous segments) and multiple tests (i.e., controlling a priori the number of false positives among a large number of tests run simultaneously).

8.2. European Initiatives

8.2.1. FP7 Projects

8.2.1.1. SIERRA

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

Title: SIERRA – Sparse structured methods for machine learning

Type: IDEAS

Instrument: ERC Starting Grant (Starting)

Duration: December 2009 - November 2014

Coordinator: Inria (France)

See also: http://www.di.ens.fr/~fbach/sierra

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: the tenet of this proposal is that to achieve the expected breakthroughs, this two-stage paradigm should be replaced by an integrated process where the

8.3. International Initiatives

8.3.1. Inria Associate Teams

8.3.1.1. STATWEB

Participants: Francis Bach [correspondant], Ronny Luss.

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 - Laurent El Ghaoui

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, http://www.cs.berkeley.edu/~jordan), is spending one year in our team, starting September 2012, financed by the Fondation de Sciences Mathématiques de Paris and Inria.

<div align="center">**BANG Project-Team**</div>

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, a postdoc has been recruited, student scholarships have been provided and 3 PhD students have started their research in the laboratory (J. Scher, C. Quininao and L. C. García del Molino).

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 RP. 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").

7.1.3. INRA

Collaboration with INRA (Isabelle Hue, Juhui Wang, Alain Trubuil) on Trophoblast development. One PhD student position in Bang has been funded within the Doctoral School *Ecole du Vivant*, Paris for Chadha Chettaoui), who has defended her thesis in July 2012.

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. ANR TOPPAZ

(url http://www-roc.inria.fr/bang/TOPPAZ/index.html)

TOPPAZ (Theory and Observations of Polymerisation processes in Prion and Alzheimer diseases) is a 3-year (2009-2012) research project financed by ANR grant "programme blanc" and headed by Marie Doumic-Jauffret.

It involves two teams, a mathematical and numerical team (B. Perthame, V. Calvez, P. Gabriel, T. Lepoutre, P. Michel, and a team in Brazil headed by J. Zubelli) and a biophysicist team headed by H. Rezaei. It has allowed to finance the post-doctoral contract of F. Charles and the 1-year grant of L. M. Tine.

The general goal is to develop new mathematical and numerical tools for polymerisation processes, in a strong link with experimentalists and with direct application to experimental data designed by the biologists' team. The achievements of ANR TOPPAZ are described in Sections 6.1.4 and 6.1.5 .

7.2.1.4. 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 [27]. It has held its first national meeting in December 2011 in Paris, and another one in April 2012 in Montpellier. The Bang team takes an active part in its development, which relies mainly on applying methods from evolutionary theory to cancer biology [33]. (url http:///www.darevcan.univ-montp2.fr/)

7.2.1.5. GdR EGRIN

The CNRS supports the creation of a "research group" called EGRIN, starting in january 2013 and devoted to the modelling, analysis and simulation of gravity driven flows. J Sainte-marie is the head of the scientific committee of this research group.

(url http://gdr-egrin.math.cnrs.fr/)

7.2.1.6. Green Stars

Participation in the Green Stars project ("Investissement d'avenir") on the production of biofuel using microalgae in collaboration with the EPI COMORE, LOCEAN, INRAA, LOV.

7.2.1.7. 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.

7.2.1.8. 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).

7.3. European Initiatives

7.3.1. FP7 Projects

7.3.1.1. ERASysbio+ C5Sys European network.

This European program (url http://www.erasysbio.net/index.php?index=272) has begun in April 2010, with the title "Circadian and cell cycle clock systems in cancer". Coordinated by F. Lévi (Villejuif) and D. Rand (Warwick), it studies 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. It has been granted for 3 years. A postdoctoral fellow (F. Billy) has been hired at Inria-Bang until November 2012 on this funding, giving rise to various publications in 2012 [10], [11], [12], [39], [42].

7.3.1.2. NOTOX

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 SCREENTOX 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. EU-project PASSPORT

Participation in the European network PASSPORT on modelling liver regeneration after partial hepatectomy (url http://www.vph-noe.eu/vph-projects/74-eu-fp7-vph-projects/50-passport-strep)

7.3.1.4. ERC Starting Grant SKIPPERAD

The ERC Starting Grant allocated to M. Doumic-Jauffret in december 2012 will last for five years. The acronym standing for *Simulation of the Kinetics and Inverse Problem for protein Polymerisation in Amyloid Diseases* (Prion, Alzheimer's), its main goal is to contribute to the design of new methods for protein polymerisation simulation and prediction, a major issue in amyloid diseases.

7.4. International Initiatives

7.4.1. Inria Associate Teams

7.4.1.1. QUANTISS, with BMBF

Title: Towards quantitative tissue simulations
Inria principal investigator: Dirk Drasdo
International Partner (Institution - Laboratory - Researcher):
        University of Liepzig (Germany) - IZBI
Duration: 2010 - 2012
See also: http://www.msysbio.com/ea

The scientific achievements addressed tissue organisation processes such as tissue regeneration, degeneration and growth. Our main contribution was the development of concepts, a process chain, and software suite to permit quantitative simulations of tissue organisation processes on histological scales. Our main applications were multiple projects on liver, lung cancer and mesenchymal stem cell differentiation. The results of the main projects for 2012 have briefly been summarised the results section (liver regeneration, multiscale liver modelling, blood flow modelling, software generation CellSys, etc. most based on the grant projects LUNGSYS and Virtual Liver network).

7.4.2. 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.

7.4.3. EuroMed 3+3

M3CD, *Mathematical Models and Methods in Cell Dynamics*, a transmediterranean EuroMed3+3 program, has begun in January 2012 for 2 [+ 2: renewal] 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) to work on the general theme "Mathematical Models and Methods in Cell Dynamics". It has fostered visits of students (in particular 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 researchers, participation in the international SM2A conference in Marrakech (June 2012, url http://sm2a-2012.ucam.ac.ma/en/), and a M3CD 2-day workshop in Tunis (Institut Pasteur, November 2012, (url http://euromedbiomaths.org/atelier-M3CD-Tunis/)) organised by Amira Kebir (MoMinBi).

7.4.4. Inria International Partners

7.4.4.1. 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 ($http://www.lungsys.de/$)

7.4.4.2. 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.

($http://www.virtual-liver.de/about/$)

CLIME Project-Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

- Clime is involved in the project PREQUALIF–IZNOGOUD–BARC, with many partners including the leading partner LSCE ("Laboratoire des Sciences du Climat et l'Environnement"), which aims at designing methods for the evaluation of the measures to be taken in the ZAPA areas ("Priority Areas for Air Quality Measures"). Clime focuses on the assimilation of observations to better evaluate the actual air quality.

8.2. National Initiatives

8.2.1. ANR

- 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.

- The MSDAG project (Multiscale Data Assimilation in Geophysics) is an ANR project. Fours partners are in the project: CEREA (Clime project-team, Marc Bocquet, PI of the whole project), Fluminance (Étienne Mémin), Moise Project-team (Laurent Debreu), LSCE (Frédéric Chevallier). It has ended the 30th of September 2012.

8.2.2. INSU

- Clime is running the project MIDAR "Inverse modeling of deposition measurements in case of a radiological release", under the framework of the LEFE-ASSIM program of INSU. This includes a cooperation with the Institute for Safety Problems of Nuclear Power Plants (National Academy of Sciences of Ukraine). This project has ended in summer 2012.

- Clime is part of the INSU/LEFE project ADOMOCA-2, with about ten French teams working in atmospheric chemistry data assimilation.

8.3. European Initiatives

8.3.1. 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 (Eu-MetChem) will focus 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. At least, two application areas of the integrated modeling are planned to be 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 will consist 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) will enable the EU to develop world class capabilities in integrated ACT/NWP-Climate modeling systems, including research, forecasting and education.

8.3.2. *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. In 2012, the working group organized sessions during IEMSs conference in Leipzig, Germany.

8.4. International Initiatives

8.4.1. *Inria 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.cl/modelos.html).

Partner: Marine Hydrophysical Institute, Ukraine.

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

Partner: Institute of Numerical Mathematics, Russia.

The collaboration concerns the estimation of uncertainty of the motion field derived from image data with data assimilation technics.

8.4.2. *Participation In International Programs*

- Clime is running a two-year project under the PHC-DNIPRO program with Taras Shevchenko University of Kyiv, Ukraine. The subject concerns a posteriori minimax motion estimation from images.

8.5. International Research Visitors

8.5.1. *Visits of International Scientists*

- Sergii Demydenko, Taras Shevchenko University of Kyiv, Ukraine,July 2012.
- Andrii Filipenkov, Taras Shevchenko University of Kyiv, December 2012.
- Takemasa Myoshi, University of Maryland, USA, June 2012.
- Oleksandr Nakonechnyi, Taras Shevchenko University of Kyiv, December 2012.
- Sergiy Zhuk, IBM, Dublin Research Lab, Ireland, December 2012.

8.5.2. *Visits to International Teams*

- Vivien Mallet took part in June to a HARVEST project, funded by Pascal2. He visited the Department of Statistical Science at University College London. The project dealt with uncertainty quantification using statistical emulation of geophysical models, mainly for climate modeling.

<div align="center">

POMDAPI Project-Team

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5. Partnerships and Cooperations

5.1. National Initiatives

ANR Fost: *Formal prOofs about Scientific compuTations*, with EPI Proval (Inria Saclay - Île-de-France), Laboratoire de Recherche en Informatique (University of Paris 11), and Laboratoire d'Informatique de l'Université Paris-Nord (University of Paris 13). Until May 31st.

ANR MANIF: *Problèmes mathématiques et numériques en simulation moléculaire ab initio*, with CER-MICS (Ecole Nationale des Ponts et Chaussées), and LJLL (Université Pierre et Marie Curie).

ARC Geofrac: Action de Recherche coopérative Inria "Large-scale computation of flow in complex 3D geological fractured porous media" rassemblant les équipes Inria Sage, Gamma3 et Pomdapi. From 2011.

5.2. European Initiatives

5.2.1. Collaborations in European Programs, except FP7

Program: ERC République tchèque

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, Université Charles à Prague

Other partners: Université Charles à Prague, République tchèque; Institut des mathématiques, Académie des Sciences de la République tchèque, République tchèque; Oxford Centre for Nonlinear Partial Differential Equations, UK.

5.3. International Initiatives

5.3.1. Participation In International Programs

- Pomdapi is associated with LIRNE-Equipe d'ingéniérie mathématiques, université Ibn Tofaïl, Kenitra, Maroc (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, Universidad de Sevilla, université Ibn Tofaïl (Kenitra, Maroc), University Centre of Khemis Miliana (Algeria), Ecole Nationale d'Ingénieurs de Tunis.

5.4. International Research Visitors

5.4.1. Internships

Mohamed Hedi Riahi (from May 2012 until Aug 2012)

Subject: Implémentation d'un algorithme d'estimation de paramètres

Institution: Ecole Nationale d'Ingénieurs de Tunis (Tunisia)

Fatma Cheikh (from Sep 2012 until Nov 2012)

Subject: Implémentation d'indicateurs de localisation de failles en milieux poreux

Institution: Ecole Nationale d'Ingénieurs de Tunis (Tunisia)

Emna Mejri (from Jun 2012 until Jul 2012)

Subject: Ecoulements eau-air en milieu poreux

Institution: Ecole Nationale d'Ingénieurs de Tunis (Tunisia)

5.4.2. Visits to International Teams

J. Jaffré and J. E. Roberts were invited by Rainer Helmig to visit the Department of Hydromechanics and Modelling of Hydrosystems (March 14 – April 6 2012).

REO Project-Team

7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. ANR

7.1.2. ANR Project "M3RS"

Participants: Laurent Boudin, Muriel Boulakia, Paul Cazeaux, Anne-Claire Egloffe, Céline Grandmont [Principal Investigator], Bérénice Grec, Sébastien Martin, 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.

7.1.3. ANR Project "Epsilon"

Participants: Marina Vidrascu, Sofiene Hendili.

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.

7.1.4. ANR Project "EXIFSI"

Participants: Miguel Ángel Fernández Varela, Mikel Landajuela Larma, Vincent Martin, Marina Vidrascu.

Period: 2012-2016

The aim of this project, coordinated by Miguel Ángel Fernández Varela is to study mathematically and numerically new semi-explicit fluid-structure interaction schemes.

7.2. European Initiatives

7.2.1. FP7 Projects

7.2.1.1. EUHEART

Title: euHeart
Type: COOPERATION (ICT)
Defi: Virtual Physiological Man
Instrument: Integrated Project (IP)
Duration: June 2008 - September 2012
Coordinator: Philips Technologie GmbH Forschungslaboratorien (Germany)
Others partners: Philips Technologie GmbH (DE), The University of Oxford (UK), Universitat Pompeu Fabra (SP), The University of Sheffield (UK), Inria, French National Research Institute in Informatics and Mathematics (FR), King's College London (UK), Academisch Medisch Centrum bij de Universiteit van Amsterdam (NL), Universität Karlsruhe (TH) (DE), Institut National de la Santé et de la Recherche Médicale, INSERM (FR), Philips Medical Systems Nederland BV (NL), Berlin Heart GmbH (DE), HemoLab BV (NL), Universitätsklinikum Heidelberg (DE), Volcano Europe SA / NV (BE), Hospital Clínico San Carlos de Madrid (SP), Philips Ibérica S.A. (SP)
See also: http://www.euheart.eu/
Abstract: The euHeart project (Ref 224495), is a 4-year integrated European project which aims at developing personalized, and clinically validated multi-physics, multi-level models of the heart and great vessels.

7.3. International Initiatives

7.3.1. Inria Associate Teams

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

Period: 2008-2014

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 USCD and the Flow physics group at IIT. CA Figueroa is now at KCL, UK.

7.3.2. *Inria International Partners*

7.3.3. *Trans-Atlantic Network of Excellence for Cardiovascular Research*

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

Period: 2010-2014

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

7.3.4. *German BMBF national project Lungsys II*

Participant: Irène Vignon-Clementel.

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

ICI Vous pouvez ecrire du texte

7.4. International Research Visitors

7.4.1. *Visits of International Scientists*

- André Garon, Département Génie Mécanique de l'Ecole Polytechnique de Montréal, 10-18 may, 2012
- Michel Delfour, Département de Mathématiques et Statistiques, Université de Montréal, 12-16 may, 2012
- C. Alberto Figueroa, KCL, London, UK, Feb 7-8th 2012
- Maxim Solovchuk, Taida Institute of Mathematical Sciences, National Taiwan University, 15–30 july, 2012
- Chang-Shou Lin, Taida Institute of Mathematical Sciences, National Taiwan University, 22-24 november, 2012
- Jessica Oakes, University of California at San Diego, USA, 17-21 december, 2012

7.4.1.1. Internships

- Frédéric Jamin, MS student, Imperial College, London, UK, May 15th-Sept 14th 2012

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

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

7. Partnerships and Cooperations

7.1. Regional Initiatives

7.1.1. Paris Region ASTech project MODIPRO: Modeling for diagnosis and prognosis
Participants: Abdouramane Moussa Ali, Qinghua Zhang.

In order to improve the safety and reliability of airplanes, the MODIPRO project (Modélisation pour le Diagnostic et le Pronostic) funded by the Pôle de Compétitivité Aérospatial ASTech of Paris Region from 2009 to 2012 aims at developing a software for deriving airplane functional models for the purpose of fault diagnosis and prognosis, by analyzing the flight data of a fleet of airplanes. The involved partners are Dassault Aviation (project leader), Snecma, IT4Control, Bayesia, KBS, UPMC, Supelec and Inria.

7.2. National Initiatives

7.2.1. ANR project DMASC: Scaling Invariance of Cardiac Signals, Dynamical Systems and Multifractal Analysis
Participants: Julien Barral, Claire Médigue, Michel Sorine.

Collaboration with Denis Chemla (Kremlin-Bicêtre Hospital), Paulo Gonçalves (Inria Rhônes-Alpes) and Stéphane Seuret (Paris 12 University).

The ANR project DMASC (Program SYSCOMM 2008) started in January 2009 under the coordination of J. Barral.

Numerical studies using ideas from statistical physics, large deviations theory and functions analysis have exhibited striking scaling invariance properties for human long-term R-R interval signals extracted from ECG (intervals between two consecutive heartbeats). These numerical studies reveal that the scaling invariance may have different forms depending upon the states of the patients in particular for certain cardiac diseases. These observations suggest that a good understanding of multifractal properties of cardiac signals might lead to new pertinent tools for diagnosis and surveillance. However, until now, neither satisfactory physiological interpretations of these properties nor mathematical models have been proposed for these signals. For medical applications we need to go beyond the previously mentioned works and achieve a deepened study of the scaling invariance structure of cardiac signals. This is the aim of DMASC.

New robust algorithms for the multifractal signals processing are required ; specifically, it seems relevant to complete the usual statistical approach with a geometric study of the scaling invariance. In addition, it is necessary to apply these tools to a number of data arising from distinct pathologies, in order to start a classification of the different features of the observed scaling invariance, and to relate them to physiology. This should contribute to develop a new flexible multifractal mathematical model whose parameters could be adjusted according to the observed pathology. This multifractal analysis can be applied to another fundamental signal, the arterial blood pressure, as well as to the couple (R-R, Blood Pressure). The main results of this project can be found in [15].

7.2.2. ANR project EBONSI: Extended Block-Oriented Nonlinear System Identification
Participants: Pierre-Alexandre Bliman, Michel Sorine, Qinghua Zhang.

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

7.2.3. ANR project 0-DEFECT: On-board fault diagnosis for wired networks in automotive systems

Participants: Mohamed Oumri, Michel Sorine, Qinghua Zhang.

The number of electric and electronic equipments is increasing rapidly in automotive vehicles. Consequently, the reliability of electric connections is becoming more and more important. The project entitled "Outil de diagnostic embarqué de faisseaux automobiles" (0-DEFECT) aims at developing tools for on-bord diagnosis of failures in electric wire connections in automotive systems. This project is funded by Agence Nationale de la Recherche (ANR) from 2009 to 2012. The involved partners are CEA LIST (project leader), Renault Trucks, Freescale, PSA, Delphi, Supelec LGEP and Inria.

7.2.4. ANR project INSCAN: Fault diagnosis for security critical long distance electric transmission lines

Participants: Leila Djaziri, Michel Sorine, Qinghua Zhang.

The wired electric networks of the French railway system cover more than 50000 km. The electric insulation of the signaling lines along the railways is monitored by regular inspections. Today these inspections are based on an expensive procedure realized by human operators located at both ends of each section of a transmission line. The service of signaling devices has to be interrupted during this procedure, and so does the railway traffic. The in situ monitoring of the transmission lines, without interruption of service, is thus an important economic issue. For this purpose, the project entitled "Diagnostic de câbles électriques sécuritaires pour grandes infrastructures" is funded by ANR from 2009 to 2012 in order to study the feasibility of in situ monitoring tools for these transmission lines. The involved partners are SNCF (project leader), CEA LIST and Inria.

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

The need for detection, localization and characterization of defects in a cables network has led to several projects, funded by the ANR: SEEDS followed by 0-DEFECT in the automotive domain, INSCAN for cables along railways. These co-operative works made it possible to 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 the SODDA project 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 will be 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.

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

Participants: Hadis Amini, Zaki Leghtas, Mazyar Mirrahimi, Pierre Rouchon, Michel Sorine.

The project EPOQ2 is an ANR "Young researcher" project led by Mazyar Mirrahimi (Sisyphe). It has for goal to address a class of inverse problems rising 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 (LPA) at ENS Paris and the Quantronics Laboratory (Qlab) of Michel Devoret and the Rob Schoelkopf Lab at Yale University and Pierre Rouchon from Ecole Nationale Supérieure des Mines de Paris.

7.2.7. *Inria Large Scale Initiative Action REGATE*

REGATE (REgulation of the GonAdoTropE axis) is 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) and Université Paris 6 (Laboratoire Jacques-Louis Lions).

7.3. European Initiatives

7.3.1. *Collaborations in European Programs, except FP7*

7.3.1.1. ERNSI

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.

- Program: Funded as a SCIENCE project (1992 - 1995), HCM Project (1993-1996), TMR Project (1998 - 2003).
- Project acronym: ERNSI
- Project title: European Research Network System Identification
- Duration: 1992 —
- Coordinator: The network ERNSI is currently coordinated by Bo Wahlberg, Automatic Control, KTH SE 100 44 Stockholm, Sweden.
- Other 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).
- Abstract: Modeling of dynamical systems is fundamental in almost all disciplines of science and engineering, ranging from life science to process control. Engineering uses models for the design and analysis of complex technical systems. System identification concerns the construction, estimation and validation of mathematical models of dynamical physical or engineering phenomena from experimental data.

7.3.1.2. MODRIO
Participants: Abdouramane Moussa Ali, Qinghua Zhang.

The SISYPHE project-team, with two other Inria project-teams (PARKAS, S4) participates in the MODRIO project regrouping partners from 7 european countries.

- Program: ITEA 2.
- Project acronym: MODRIO.
- Project title: Model Driven Physical Systems Operation.
- Duration: 2012 – 2015
- Coordinator: Daniel Bouskela, EDF, France.

- Other partners: ABB (Sweden AB), ABB AG (Germany), AIT Austrian Institute Of Technology (Austria), Ampère Laboratory-CNRS-University of Lyon (France), Bielefeld University of Applied Sciences (Germany), Dassault Aviation (France), Deutsches Zentrum für Luft- und Raumfahrt (DLR) (Germany), Digital Product Simulation (DPS) (France), DS AB (Sweden), EADS (France), Enicon Eco-Energy-Consulting GmbH (Austria), Equa Simulation AB (Sweden), IFP Energies nouvelles (France), Ilmenau University of Technology (Germany), Inria (France), ITI (Germany), Katholieke Universiteit Leuven (Belgium), Knorr-Bremse (Germany), Linkping University (Sweden), LMS Imagine (France), LMS International (Belgium), MathCore Engineering AB (Sweden), Modelon AB (Sweden), Pöyry Finland Oy (Finland), Qtronic (Germany), Scania (Sweden), Semantum Oy (Finland), Sherpa Engineering (France), Siemens AG (Germany), Siemens Industrial Turbomachinery AB Industrial Turbomachinery A.B. (Sweden), Simpack AG (Germany), Supmeca (France), Triphase (Belgium), University of Calabria (Italy), Vattenfall (Sweden), VTT Technical Research Centre of Finland Tec (Finland), Wapice Ltd (Finland).

- Abstract: 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. This project joined by partners from Austria, Belgium, Finland, France, Germany, Italy and Sweden has been selected by the board of Information Technology for European Advancement (ITEA 2). The involved Inria project-teams are PARKAS, S4 and SISYPHE.

7.4. International Initiatives

7.4.1. Inria International Partners

Mazyar Mirrahimi closely collaborates with the Quantronics Laboratory (Qlab) of Michel Devoret and the Rob Schoelkopf Lab at Yale University.

7.5. International Research Visitors

7.5.1. Visits of International Scientists

7.5.1.1. Internships

Patrick FLETCHER (two months: February and July 2012)

Subject: Regulation of hormone production by the frequency of a periodic stimulating signal

Institution: Florida State University (United States)

7.5.2. Visits to International Teams

Mazyar Mirrahimi spent one year in the Quantronics Laboratory (Qlab) of Michel Devoret and the Rob Schoelkopf Lab at Yale University.
Qingua Zhang visited the Laboratory of Industrial Process Monitoring and Optimization of Peking University, in the framework of the ANR EBONSI project.

ARLES Project-Team

7. Partnerships and Cooperations

7.1. National Grants

7.1.1. ANR

7.1.1.1. ANR MURPHY: Dependability-focused Evaluation of Sensor Networks
Participant: Animesh Pathak [correspondent].

- **Name:** MURPHY – *Dependability-focused Evaluation of Sensor Networks*
- **Related activities:** § 6.5
- **Period:** [January 2011 – December 2013]
- **Partners:** CNAM, 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 which 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 (i) enable the dynamic and distributed insertion of faults and (ii) hide from the end user the complexity related to this task,
- 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 D2T Action de Developpement Technologique MobiTools
Participants: Valérie Issarny, Bachir Moussa Tari Bako.

- **Name:** *MobiTools – Environnement de développement logiciel pour plateforme mobiles*
- **Period:** [January 2011 – December 2012]
- **Partners:** Inria (CRI Paris-Rocquencourt, EPI ARLES)

As part of the development of our software prototypes, MobiTools focuses on setting a supporting continuous integration platform (compilation, test, profiling, quality).

7.1.2.2. Inria D2T Action de Developpement Technologique Yarta
Participants: Animesh Pathak, George Rosca.

- **Name:** *Yarta – Middleware for mobile social ecosystems*
- **Period:** [October 2012 – September 2013]
- **Partners:** Inria (CRI Paris-Rocquencourt, EPI ARLES)

This project targets the development of Yarta, 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 will be used to support 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 FET IP CONNECT
Participant: Valérie Issarny [correspondent].

> **Name:**CONNECT – *Emergent Connectors for Eternal Software Intensive Networked Systems*
>
> **URL:** http://www.connect-forever.eu/
>
> **Type:** COOPERATION (ICT)
>
> **Defi:** ICT forever yours
>
> **Instrument:** Integrated Project (IP)
>
> **Related activities:** § 6.2
>
> **Period:** [February 2009 - November 2012]
>
> **Partners:** Inria (CRI Paris-Rocquencourt) [**project coordinator**], Ambientic (France), CNR (Italy), DoCoMo (Germany), Lancaster University (UK), Thales Communications SA (France), Universita degli Studi L'Aquila (Italy), Technische Universitaet Dortmund (Germany), University of Oxford (UK), Uppsala Universitet (Sweden), Peking University (China).

The CONNECT Integrated Project aims at enabling continuous composition of networked systems to respond to the evolution of functionalities provided to and required from the networked environment. At present the efficacy of integrating and composing networked systems depends on the level of interoperability of the systems's underlying technologies. However, interoperable middleware cannot cover the ever growing heterogeneity dimensions of the networked environment. CONNECT aims at dropping the interoperability barrier by adopting a revolutionary approach to the seamless networking of digital systems, that is, synthesizing on the fly the connectors via which networked systems communicate. The resulting emergent connectors are effectively synthesized according to the behavioral semantics of application- down to middleware-layer protocols run by the interacting parties. The synthesis process is based on a formal foundation for connectors, which allows learning, reasoning about and adapting the interaction behavior of networked systems at run-time. Synthesized connectors are concrete emergent system entities that are dependable, unobtrusive, and evolvable, while not compromising the quality of software applications. To reach these objectives the CONNECT project undertakes interdisciplinary research in the areas of behavior learning, formal methods, semantic services, software engineering, dependability, and middleware. Specifically, CONNECT investigates the following issues and related challenges: (i) Modeling and reasoning about peer system functionalities, (ii) Modeling and reasoning about connector behaviors, (iii) Runtime synthesis of connectors, (iv) Learning connector behaviors, (v) Dependability assurance, and (vi) System architecture. The effectiveness of CONNECT research is assessed by experimenting in the field of wide area, highly heterogeneous systems where today's solutions to interoperability already fall short (e.g., systems of systems).

7.2.1.2. 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 & § 6.4
>
> **Period:** [February October 2010 - September 2013]
>
> **Partners:** NoMagic Europe (Lithuania), CEFRIEL (Italy), CNR (Italy), Linagora (France), Inria (CRI Paris-Rocquencourt) [**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 compositions 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 again 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.

7.2.1.3. 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:** § 6.6
>
> **Period:** [May 2011 - May 2013]
>
> **Partners:** Inria (CRI Paris-Rocquencourt).

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 The researchers build upon their extensive expertise in the area of reflective middleware and reflective architectures and research projects like CONNECT.

7.2.1.4. 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 2013]

Partners: Atos Origin (Spain), CNR (Italy) [**coordinators**], ETH Zürich (Switzerland), IMDEA Software (Spain), Inria (EPI 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 on Engineering Secure Future Internet Software Services and Systems (NESSoS) 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. NESSoS integrates the research labs involved; NESSoS re-addresses, integrates, harmonizes and fosters the research activities in the necessary areas, and increases and spreads the research excellence. NESSoS also impacts training and education activities in Europe to grow a new generation of skilled researchers and practitioners in the area. NESSoS collaborates with industrial stakeholders to improve the industry best practices and support a rapid growth of software-based service systems in the Future Internet.

7.2.1.5. 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), 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 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 will be used to conduct a successful CA.

7.3. International Initiatives

7.3.1. Participation In International Programs

7.3.1.1. Project M@TURE – International scientific cooperation programme Inria/Brazil
Participant: Nikolaos Georgantas [Correspondant].

> **Name:** M@TURE – Models @ runtime for self-adaptive pervasive systems: enabling user-in-the-loop, requirement-awareness, and interoperability in ad hoc settings

> **Instrument:** Inria-Brazil cooperation programme

> **Period:** [October 2012 – September 2014]

> **Partners:** Joint project with Institute of Informatics, Federal University of Goias, Brazil.

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 will 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 will be 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

7.4.1.1. Internships

> Amel Belaggoun (from Apr 2012 until Sep 2012)

>> Subject: Exploring the Use of Dynamic Decision Networks for Self-Adaptive Systems

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

> Ajay Chhatwal (from Jan 2012 until Mar 2012)

>> Subject: Supporting Application Development for the Future Internet of Smart Things and Services

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

> Guilherme Nogueira (from Apr 2012 until Oct 2012)

>> Subject: Facilitating the Specification of Fault Tolerance Requirements in Sensor Network Macroprograms

>> Institution: University of São Paulo (Brazil)

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

6. Partnerships and Cooperations

6.1. Regional Initiatives

6.1.1. PEFICAMO

Participants: Carole Delporte-Gallet, Hugues Fauconnier, Julien Clément.

Managed by University Paris Diderot, H. Fauconnier is leading this project granting J. Clément from Région Ile de France.

6.2. National Initiatives

6.2.1. ANR SONGS

Participant: Fabien Mathieu.

The goal of the SONGS project is to extend the applicability of the SimGrid simulation framework from Grids and Peer-to-peer systems to Clouds and High Performance Computation systems. Each type of large-scale computing system will be addressed through a set of use cases and lead by researchers recognized as experts in this area.

6.2.2. 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.

6.2.3. ANR Shaman

Participants: Carole Delporte-Gallet, Hugues Fauconnier, Hung Tran-The.

SHAMAN (Self-organizing and Healing Architectures for Malicious and Adversarial Networks) is an ANR VERSO Project (2009-2012).

Managed by University Paris Diderot, H. Fauconnier leads this project that grants Ph. D. H. Tran-The.

SHAMAN focuses on the algorithmic foundations of resource-constrained autonomous large scale systems, dedicated to enabling the sustainability of network functions in spite of abrupt system evolutions, component failures, and attacks. We foresee original solutions in the general frameworks of self-stabilization, failure detection, and robust protocols. Our first objective is the design of obligate but realistic models encompassing anonymity, dynamism, and/or malicious behavior. Our second objective is to evaluate both the theoretical power, and the practical functionality, of these models, by confronting them to their ability of designing efficient algorithms and protocols for dynamic and malicious environments. This evaluation will be tackled in two complementary application domains: wireless sensor networks, and peer-to-peer systems. The primary outcome of SHAMAN should be the demonstration of reliable middleware bricks that could be integrated in real distributed platforms.

6.2.4. 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.

6.3. European Initiatives

6.3.1. FP7 Projects

6.3.1.1. 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 Politècnica 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.

6.4. International Initiatives

6.4.1. *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). http://eit.ictlabs.eu/ict-labs/all-events/article/fundamentals-of-future-networking-workshop/.

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

7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. ANR: GETRF

Participants: Paul Mühlethaler, Pascale Minet, Cédric Adjih, Emmanuel Baccelli, Salman Malik.

Period: 2012 - 2014.

Partners: DGA/MI, Inria.

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 will focus 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.

7.1.2. Competitivity Clusters

7.1.2.1. SAHARA
Participants: Pascale Minet, Cédric Adjih, Ridha Soua, Erwan Livolant.

Period: 2011 - 2014.

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

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 2012, we took part to the specification of application requirements. We also defined the functional architecture and made measurements within the plane of SAFRAN.

7.1.2.2. CONNEXION
Participants: Pascale Minet, Cédric Adjih, Saoucene Mahfoudh Ridene, Ines Khoufi.

Period: 2012 - 2016.

Partners: All4Tec, ALSTOM, AREVA, Atos WorldGrid, CEA, CNRS / CRAN, Corys TESS, EDF, 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 HIPERCOM project-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 can classify these works in several ways:

- First classification:
  - Centralized Algorithms as Practical swarm optimization (PSO), Centralized virtual forces...These algorithms minimize the moves done by nodes since each sensor moves only to its final position computed by the specific node. However, they rely on assumption that may be unrealistic (e.g. network connectivity). Furthermore, they are not scalable.
  - Distributed Algorithms as Distributed Self Spreading algorithm (DSSA), Force-based Genetic Algorithm (FGA), Mass-Sprig -Relaxation Algorithm... These algorithms are more relistic: they adapt to the knowledge progressively acquired during the redeployment. However, there are still pending issues such as nodes oscillation, coverage computation, point of interest...
- Second classification:
  - 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 latter (virtual force based approach) presents many advantages such as simplicity and fast coverage. That is why we adopt this appraoch.

7.1.2.3. SensLab and FIT
Participants: Cédric Adjih, Emmanuel Baccelli, Ala Eddin Weslati.

Period: 2011 - 2021

Partners: Inria (Lille, Sophia-Antipolis, Grenoble), INSA, UPMC, Institut Télécom Paris, Institut Télécom Evry, LSIIT Strasbourg.

The HIPERCOM team started the development of a testbed for SensLab in 2010. This testbed located in building 21 at Rocqquencourt Inria center consists now of 128 wireless SensLab nodes.

A location has been found for the new testbed of the EQUIPEX FIT: the basement of building 1 at Rocquencourt. An engineer has been recruited for this project.

7.1.2.4. ACRON

Participant: Cédric Adjih.

Period: 2011 - 2014

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.

7.1.2.5. SWAN

Participants: Cédric Adjih, Salman Malik.

Period: 2011 - 2014

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

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

7.1.2.6. MOBSIM

Participants: Cédric Adjih, Paul Mühlethaler, Hana Baccouch.

Period: 2011 - 2013

Partners: Inria Sophia, Inria Genoble.

MOBSIM is an ADT, Action of Technology Development. It aims at developing 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.

7.1.3. OCARI2

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

Partners: EDF, LIMOS, TELIT.

At the end of the OCARI (Optimization of Ad hoc Communications in Industrial networks) project, funded by ANR, started in February 2007 and ended in 2010, EDF the coordinator decided to continue the project with a restricted number of partners: TELIT, LIMOS (Clermont Ferrand university) and Inria. The goal was to prove the feasibility on commercially available cards of the OCARI stack designed during the ANR project and to make a public demonstration of this product. During the year 2011, the OCARI stack has been improved and implemented on the ZE51 module of TELIT based on the Texas Instrument CC2530 Chipset. During 2012, we made several demonstrations of the energy-efficient routing protocol EOLSR and the node coloring algorithm OSERENA to save energy.

The OCARI project deals with wireless sensor networks in an industrial environment. It aims at responding to the following requirements which are particularly important in power generation industry and in warship construction and maintenance:

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

The development of OCARI targets the following industrial applications:

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

To meet the requirements of supported applications (remote command of actuators, tele-diagnostic...), new solutions will be brought to manage several communication modes, ranging from deterministic data transfers to delay tolerant transfers. A key issue is how to adapt routing algorithms to the industrial environment, taking into account more particularly limited network resources (e.g.; bandwidth), node mobility and hostile environment reducing radio range.

The OCARI project aims at developing a wireless sensor communication module, based on IEEE 802.15.4 PHY layer and supporting EDDL and HART application layer. The Inria contribution concerns more particularly energy efficient routing and node activity scheduling.

- The energy efficient extension of OLSR, called EOLSR, is implemented on top of the MAC protocol defined by LATTIS and LIMOS. The MAC protocol is a variant of ZigBee ensuring some determinism and quality of service and allowing leave nodes (e.g. sensor, actuator) as well as router nodes to sleep. The EOLSR protocol avoids nodes with low residual energy and selects the routes minimizing the energy consumed by an end-to-end transmission.

- SERENA, the protocol used to schedule router node activity, is based on three-hop coloring. It allows any node to sleep during the slots that are attributed neither to its color nor to its one-hop neighbors. SERENA contributes to a more efficient use of energy: less energy is spent in the idle and interference states. Hence, network lifetime is considerably increased. SERENA has been optimized for the specific context of OCARI (i.e.; very limited bandwidth 250kbps, small size messages 127 bytes, limited memory and limited processing power) have been delivered.

These protocols have been implemented in the OCARI stack, operating on a ZE51 module of TELIT.

7.2. European Initiatives

7.2.1. Collaborations in European Programs, except FP7

Program: CSOSG

Project acronym: SAFEST

Project title:

Duration: May 2012-April 2015

Coordinator: Emmanuel Baccelli

Other partners: Freie Universitat Berlin, Hamburg University, Sagem, Daviko, FOS, Fraunhofer

Abstract: Public spaces, such as airports, railway stations, or stadiums bring together large numbers of people on limited space to use security-sensitive infrastructure. These spaces pose two distinct challenges to public security: (a) detecting unauthorized intrusions and (b) monitoring large crowds in order to provide guidance in case of unexpected events (e.g., mass panic). To ensure the safety of the general public as well as individuals, we thus require a flexible and intelligent method for area surveillance. One example in which current monitoring systems proved to be dangerously inefficient is the Love Parade music festival in Duisburg, Germany, July 2010. Crowd control failed to provide guidance to a large crowd, resulting in a mass panic with 21 deaths and several hundred injured. In this particular case, overloaded communication infrastructure led to a lack of information about the density and the movement of the crowd, which in turn resulted in misjudgments on appropriate strategies to resolve the situation. This incident highlights the need for more sophisticated and reliable methods for area surveillance. The SAFEST project aims to analyse the social context of area surveillance and to develop a system that can fulfill this task, both in terms of technology as well as

acceptance by the general public. The system will operate in distributed way, collect anonymised data, securely transfer this data to a central location for evaluation, and if necessary notify the operator and/or issue alerts directly to the general public. SAFEST addresses the following topics: (i) it proposes a solution for crisis management, addressing social, technical, and economic issues, (ii) it enhances the protection of the population against risks and dangers, including the evaluation of acceptance of said solution, and (iii) it addresses the protection of critical infrastructures by the means of a comprehensive technical solution.

7.3. International Initiatives

7.3.1. IT-SG-WN

Title: Information Theory, Stochastic Geometry, Wireless Networks

Inria principal investigator: Paul Muhlethaler

International Partner (Institution - Laboratory - Researcher):

Stanford University (United States) - Information Systems Laboratory, Department of Electrical Engineering - Abbas El Gamal

Duration: 2011 - 2013

See also: http://www.di.ens.fr/~baccelli/IT_SG_WN_web_site.htm

The activity of this proposal is centered on the inter-play between stochastic geometry and network information theory, whith a particular emphasis on wireless networks. In terms of research, three main lines of thought will be pursued:1. Error exponents and stochastic geometry2. Stochastic geometry and network Information Theory3. Cognitive radio and stochastic geometry

7.3.2. Participation In International Programs

7.3.2.1. AWSN2012

Program: Euromediterranean 3+3

Title: Auto-adaptivity in Wireless Sensor Networks

Inria principal investigator: Pascale Minet

International Partners (Institution - Laboratory - Researcher):

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: 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 will 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.

After a kick-off meeting in Paris in February, we organized three workshops where each team presented its works:

- a workshop in Rabat in October 2012, where each team presented its works,
- a workshop in Tunis in November 2012. This workshop was open to non-members and was preceded by a call for paper. It was held in conjunction with the IEEE NoF 2012 conference (Network of the Future).
- a workshop in Catania in December 2012, where new results have been presented.

7.4. International Research Visitors

7.4.1. Visits of International Scientists

- **Mauro Fonseca**, Pontifical Catholic University of Paraná, Curitiba, Brazil, July 2012-June 2013 (Saclay),
- **Anelise Munaretto**, Federal Technological University of Paraná, Curitiba, Brazil, July 2012-June 2013 (Saclay),
- **Leila Saidane**, ENSI, Tunis, Tunisia, February and July 2012 (Rocquencourt),
- **Lucia Lo Bello**, UniCT, Catania, Italy, February 2012 (Rocquencourt),
- **Mohammed Erradi**, ENSIAS, Rabat, Morocco, February 2012 (Rocquencourt),
- **Bernard Mans**, Macquarie University, March-August 2012 (Rocquencourt).

7.4.1.1. Internships

Kanchana Thilakarathna, NICTA/University of New South Wales, Sydney, Australia, March-September 2012 (Saclay)

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

6. Partnerships and Cooperations

6.1. International Research Visitors

RAP team has received the following people:

- Louigi Addario-Berry (McGill)
- Vida Dujmovic (Carleton)
- Matthieu Jonckheere (CONICET, Buenos Aires, Argentina)
- Liudmila Rozanova (CNR — IIT, University of Pisa)
- Iraj Saniée (Alcatel-Lucent Bell Labs)
- Hamed Amini (EPFL)
- Christina Goldschmidt (Oxford)
- Ross Kang (CWI)
- Stefan Langerman (UL Bruxelles)
- Henning Sulzbach (Frankfurt)

6.2. National Research Visitors

RAP team has received the following people:

- Bernard Arzur (Orange Labs)
- Thomas Bonald (Telecom ParisTech, Paris)
- Emilie Coupechoux (Inria, TREC)
- Davide Cuda (Orange Labs)
- Fabrice Guillemin (Orange Labs)
- Raluca Indre (Orange Labs)
- Esther le Rouzic (Orange Labs)
- Patrick Loiseau (Eurecom)

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

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. ODISEA2 - (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.

7.1.3. 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. The principal investigators for Regal are Luciana Arantes, Pierre Sens, and Julien Sopena. It involves a grant of 155 000 euros from ANR to LIP6 over three years.

7.1.4. ConcoRDanT - (2010–2013)

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. The project leader and principal investigator for Regal is Marc Shapiro. ConcoRDanT involves a grant of 192 637 euros from ANR to Inria over three years.

7.1.5. SPADES - (2009–2012)

Members: LIP, MIS (and LIP6/REGAL), Inria Rennes, Inria Saclay, LIG, LUG, CERFACS, IN2P3

Funding: ANR CONTINT

Objectives: The main goal of SPADES is to propose a non-intrusive but highly dynamic environment, able to take advantages to available resources over very large scale grids. Another challenge of SPADES is to provide a software solution for a service discovery system able to face a highly dynamic platform. This system will be deployed over volatile nodes and thus must tolerate "failures".

The principal investigator for Regal is Franck Petit. The project was initiated while he was with MIS (UPJV/Amiens) and a non-permanent researcher during 2008-2009 with Inria, within Graal Team (LIP, Lyon). The amount of the grant from ANR to MIS is 125 000 euros.

7.1.6. STREAMS - (2010–2013)

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. The principal investigators for Regal is Marc Shapiro. It involves a grant of 57 000 euros from ANR to Inria over three years.

7.1.7. PROSE - (2009–2012)

Members: Technicolor, Inria (Regal), EURECOM, PlayAdz, LIAFA.

Funding: PROSE project is funded by ANR VERSO.

Objectives: Content Shared Through Peer-to-Peer Recommendation & Opportunistic Social Environment.

The Prose project is a collective effort to design opportunistic contact sharing schemes, and characterizes the environmental conditions as well as algorithmic and architecture principles that let them operate. The partners of the Prose project will engage in this exploration through various expertise: network measurement, system design, behavioral study, analysis of distributed algorithms, theory of dynamic graph, networking modeling, and performance evaluation.

The principal investigators for Regal are Sébastien Monnet and Marc Shapiro. It involves a grant of 152 000 euros from ANR to Inria over three years.

7.1.8. ABL - (2009–2012)

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

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.

The main achievements of the ABL project in 2012 include the design of an approach to automatically generating a robust interface to the Linux kernel, which received a best paper award at ASE 2012, and the design of an approach to finding resource-release omission faults in systems software. The latter has led to over 60 patches for various systems software projects, including Linux and Python.

7.2. European Initiatives

7.2.1. FP7 Projects

7.2.2. Collaborations in European Programs, except FP7

7.2.2.1. Google European Doctoral Fellowship "A principled approach to eventual consistency based on CRDTs

Cloud computing systems 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 Commutative Replicated Data Type (CRDT) approach, based on commutativity, is a simple and principled solution to this conundrum; however, only a handful of CRDTs are known, and CRDTs are not a universal solution. This PhD research aims to expand our knowledge of CRDTs, to design and implement a re-usable library of composable CRDTs, to maintain study techniques for maintaining strong invariants above CRDTs, and to experiment with CRDTs in applications. We are hopeful that significant distributed applications can be designed using our techniques, which would radically simplify the design of cloud software, reconciling scalability and consistency. This Google European Doctoral Fellowship is awarded to Marek Zawirski, advised by Marc Shapiro. This award includes a grant of 41 000 euros yearly over three years starting September 2010.

7.3. International Initiatives

7.3.1. Participation In International Programs

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

Members: Inria Paris Rocquencourt (REGAL), Inria Rhone-Alpes (GRAAL), 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.

7.3.1.2. 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.

7.4. International Research Visitors

7.4.1. Visits of International Scientists

- Kenji Kono, Professor, University Keio, Japan, 1 year, 2012
- Nuno Preguia, Associate Professor, Universidade Nova de Lisboa; 6-month visit
- Valter Balegas, PhD Student, Universidade Nova de Lisboa; 3-month visit

7.4.2. Internships

- David Navalho, PhD Student, Universidade Nova de Lisboa; 3-month visit
- Valter Balegas, PhD Student, Universidade Nova de Lisboa; 3-month visit

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

8. Partnerships and Cooperations

8.1. Regional Initiatives

8.1.1. LINCS

TREC 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.

8.1.2. Digiteo ACRON

Participant: Bartłomiej Błaszczyszyn.

Project *Analyse et Conception de Réseaux Sans Fil Auto-Organisés* (ACRON) started in 2011. Coordinator: Supélec (Télécommunications), Partners: Inria HIPERCOM, Université Paris-Sud, IEF. Trec is associated partner.

The objective of this project is to work on characterization of the fundamental performance limits of large self-organizing wireless networks and develop distributed and self-organizing communication techniques that will approach the theoretical limits.

8.2. National Initiatives

8.2.1. ANR CMON

Participants: François Baccelli, Florence Bénézit, Darryl Veitch.

The ANR project CMON, jointly with Technicolor, LIP6, the Inria project-team Planète and the community http://wiki.grenouille.com/index.php/CMON was continued for 6 months. This project is focused on the development of end-to-end measurement for Internet that can be deployed by end-users, without any support from ISP. Our work over this period focused on wireless network tomography.

8.2.2. ANR PEGASE

Participants: Abir Benabid, Anne Bouillard.

TREC is a partner of the 3-year ANR project called PEGASE, jointly with ENS Lyon, the Inria project-team MESCAL, ONERA, Real-Time-at-Work (start-up) and Thalès. This project is focused on the analysis of critical embedded networks using algebraic tools. The aim is to apply these techniques to AFDX and Spacewire architectures. Abir Benabid was hired until January 2012.

8.2.3. ANR GAP

Participants: Marc Lelarge, Emilie Coupechoux, Mathieu Leconte.

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 (2012-2016) is to develop mathematical tools in order to contribute to a rigorous formalization of the cavity method. We intend to launch two new research lines:

- 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.

8.2.4. ANR MAGNUM

Participant: Ana Bušić.

Ana Bušić is participating (pôle de rattachement: LIP6, UPMC) in the 4-year ANR project MAGNUM (Méthodes Algorithmiques pour la Génération aléatoire Non Uniforme: Modèles et applications), 2010–2014; http://www.lix.polytechnique.fr/~rossin/ANR/Magnum/www/. The central theme of the MAGNUM project is the elaboration of complex discrete models that are of broad applicability in several areas of computer science. A major motivation for the development of such models is the design and analysis of efficient algorithms dedicated to simulation of large discrete systems and random generation of large combinatorial structures.

8.2.5. GdR Stochastic Geometry

Participants: François Baccelli, Bartłomiej Błaszczyszyn.

TREC is a member of the 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. The kickoff meeting was organized this year in March at the University of Rouen; http://gdr-geostoch.math.cnrs.fr/workshop_Rouen. It brought together more than 80 researchers from France and Europe.

8.2.6. ARC OCOQS

Participant: Ana Bušić.

Two-year Inria Collaborative action *Action de recherche collaborative (ARC)* OCOQS "Optimal threshold policies in COntrolled Queuing Systems" OCOQS started in 2011. Coordinator: Ana Bušić, Participants: Alain Jean-Marie (MAESTRO, Inria Sophia-Antipolis), Emmanuel Hyon (University of Paris Ouest and LIP6), Ingrid Vliegen (University of Twente); http://www.di.ens.fr/~busic/OCOQS. The research subject is the optimal control of stochastic processes, with applications to the control of networks and manufacturing systems. The principal aim is to widen the set of mathematical techniques that can be used to prove that optimal policies are of threshold type, thereby widening the set of classes of models that can be effectively solved exactly or numerically handled in practice. A one-day workshop on Structural Properties in Markov Decision Processes was organized this year in January at Inria, Paris; http://www.di.ens.fr/~busic/OCOQS/workshop.html.

8.3. European Initiatives

8.3.1. Collaborations in European Programs FP7
Participant: All Trec.

- European Network of Excellence (NoE), http://euronf.enst.fr/en_accueil.html;
- Project acronym: Euro-NF;
- Duration: January 2008 - June 2012;
- Coordinator: D. Kofman (Intitut Télécom);
- Partners: about 30 partners;
- Abstract: This NoE is focused on the next generation Internet. Its main target is to integrate the research effort of the partners to be a source of innovation and a think tank on possible scientific, technological and socio-economic trajectories towards the network of the future. Euro-NF is supported by the theme "Information and Communication Technologies (ICT)" under the 7th Framework Programme of the European Community for RTD. Euro-NF is a continuation of Euro-NGI

8.3.2. Collaborations in European Programs, except FP7

8.3.2.1. EIT ICT Labs
Participants: François Baccelli, Fabien Mathieu, Mir Omid Mirsadeghi, Rémi Varloot.

This grant in collaboration with Fabien Mathieu (GANG) was focused on the analysis of P2P systems, primarily in the context of wireless. Our partner Ilkka Norros (VTT) visited several times to work on the matter. We hired an Intern from ENS (Rémi Varloot). Our efforts led to a joint paper accepted at Infocom'13. In spite of the success of this collaboration, the grant will not be continued (due to the lack of proper 'Catalyst' with EIT ICT Labs).

8.4. International Initiatives

8.4.1. Inria Associate Teams

8.4.1.1. IT-SG-WN

- Title: Information Theory, Stochastic Geometry, Wireless Networks
- Inria principal investigator: François Baccelli
- International Partner:

  Institution: University of California Berkeley (United States)

  Laboratory: EECS Department

  Researcher: Venkat Anantharam, Anant Sahai, David Tse.
- International Partner:

  Institution: Stanford University (United States)

  Laboratory: EE

  Researcher: Abbas El Gamal.
- Duration: 2011 - 2013
- See also: http://www.di.ens.fr/~baccelli/IT_SG_WN_web_site.htm
- The activity of this proposal is centered on the inter-play between stochastic geometry and network information theory, whith a particular emphasis on wireless networks. In terms of research, three main lines of thought will be pursued:1. Error exponents and stochastic geometry2. Stochastic geometry and network Information Theory3. Cognitive radio and stochastic geometry

8.5. International Research Visitors

8.5.1. Visits of International Scientists

- Venkat Anantharam (University of Berkeley),
- Daryl Daley (University of Melbourne),
- Christian Hirsch (University of Ulm),
- Guenter Last (KIT Germany),
- Ravi Mazumdar (University of Waterloo, Inria visiting professor),
- Naoto Miyoshi (Tokyo Institute of Technology),
- Ilkka Norros (VTT, Finland).

8.5.2. Internships

- Julieta BOLLATI (from Apr 2012 until Jun 2012)

  Subject: Optimal threshold computation in controlled queueing systems

  Institution: National University of Rosario (Argentina)

8.5.3. Visits to International Teams

- François Baccelli is one of the two recipients of the Simons Math+X Chair (https://simonsfoundation.org/funding/funding-opportunities/mathematics-physical-sciences/mathx/mathx-encouraging-interactions-2011-chair-recipients/ and is now on the faculty at UT Austin. He keeps a part time position in TREC.

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 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 should provide Alpage with opportunities for collaborating with new teams, e.g., on language resource development with descriptive linguists (INALCO, for example).

Benoît Sagot is in charge of one of the 7 scientific "strands" of the LabEx EFL, namely the strand on Language Resources. Several other project members are in charge of research operations within 3 of these 7 strands ("Experimental grammar from a cross-linguistic perspective", "Computational semantic analysis", "Language Resources").

8.2. National Initiatives

8.2.1. ANR

8.2.1.1. ANR project ASFALDA (2012 – 2015)

Participants: Marie Candito, Benoît Sagot, Éric Villemonte de La Clergerie, Laurence Danlos, Marianne Djemaa.

Alpage is principal investigator team for the ANR project ASFALDA, lead by Marie 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 [56] 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, Marion Richard, Sarah Beniamine, Laurence Danlos.

EDYLEX is an ANR project (STIC/CONTINT) headed by Benoît Sagot. The focus of the project is 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, are the LIF (Université de Méditerranée), the LIMSI (CNRS team), two small companies, Syllabs and Vecsys Research, and the AFP.

In 2012, several important developments have been achieved:

- Large-scale improvements within the WOLF (Free French WordNet)

- Corpus-based studies targeted at qualitatively understanding and quantitatively modeling French morphological construction mechanisms (derivation, composition, borrowing and others)

- Development of modules for automatic detection, classification and morphological analysis of unknown words in French corpora [45];

- Adaptation and extension 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.

8.2.1.4. "Investissements d'Avenir" project PACTE (2012 – 2014)
Participants: Benoît Sagot, Éric Villemonte de La Clergerie, Laurence Danlos.

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 early 2012.

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 (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.

In 2012, the results obtained within PACTE are mostly related to SxPipe and to DeLex, the new Alexina lexicon for German (as well as the German instance of MElt trained among other on DeLex). These results are described in more details in the corresponding "software" sections.

8.3. International Initiatives

8.3.1. Participation In International Programs

8.3.1.1. ISO subcommittee TC37 SC4 on "Language Resources Management"
Participant: Éric Villemonte de La Clergerie.

The participation of ALPAGE to French Technolangue action Normalangue has resulted in a strong implication in ISO subcommittee TC37 SC4 on "Language Resources Management" Éric de La Clergerie has participated to an ISO meeting in Madrid (June 2012) and has played a role of expert (in particular on morpho-syntactic annotations [MAF], feature structures [FSR & new FSD], and syntactic annotations [SynAF]). MAF has finally reached the level of an ISO standard (ISO/FDIS 24611, oct. 2012). A paper [21] promoting both SynAF and MAF was presented at TLT'11 (Lisbon, Dec. 2012).

8.4. International Research Visitors

8.4.1. *Visits of International Scientists*

Roser Sauri, research scientist at Media-Lab in Barcelonea (Spain), has been "professeur invitée" at Alpage between the 1st of april and the 15th of May 2012. Roser Sauri is well known for her work on event factuality for which she developed a formal model and an annotated corpus. During her stay in Paris, she has been working with Alpage members to extend her model to discourse. Moreover, she helped Alpage in launching the FDTB (French Discourse Tree Bank), a project to annotate the French Tree Bank for discourse. Her experience in annotating similar copora for Catalan and Spanish was very fruitful and collaboration with her is going on.

8.4.1.1. *Internships*

Thomas Roberts (from Jun 2012 until Aug 2012)

Subject: Lefff-like English syntactic lexicon

Institution: Massachusetts Institute of Technology (United States)

6. Partnerships and Cooperations

6.1. Regional Initiatives

6.1.1. *PREDIT (ADEME) TIC TAC (2010 - 2012)*

Participants: Carole Goffart, Guillaume Pilot, Bernard Senach, Brigitte Trousse, Florian Bonacina.

Title: TIC TAC

Type: PREDIT groupe 3, Mobilité dans les régions urbaines

Challenge: Information and Communication Technologies – Transportation

Instrument: Mobilité dans les régions urbaines

Duration: 2010 - March 2012

Coordinator: VuLOG

Others partners: MHC Conseils

Abstract: TICTAC project aims at providing an advanced travellers' information system in which real time information about waiting time at bus stop will be avalaible: users define their "favourite" and can call a vocal server which give them immediately the requested information.

This year, we conducted a second experimentation with an improved version of real-time information system. Main modification were : a lighter interaction with the vocal server, simpler registration procedure, on-line memo . . . The experiment started in January 2012 and lasted till end of February and 62 people registrated to the experiment [57]. The quantitative log analysis was articulated with two appreciation questionnaires. Results show that there was few access to the vocal server and a small rise of web server consultation in comparison with the first experimentation. The error rate and the response time were rather high and the users didn't have a very good experience with the service. The service was acknowledged as very useful and the user interface was perceived as easy to use but TICTAC didn't met its users expectations: very few of them used it on a daily basis [52], [51].

The second experimentation was also a good opportunity to test our new approach of co-creation and we conducted a workshop with users to identify functionalities of a real-time traveler information system and to test a first mock-up.

6.1.2. *PACALABS HOTEL-REF-PACA (2010 - 2012)*

Participants: Florian Bonacina, Bernard Senach, Brigitte Trousse, Yves Lechevallier, Nicolas Béchet, Ehab Hassan.

Title: HOTEL-REF-PACA

Type: PACALABS

Challenge: Referencing Accomodation Web Sitesi in PACA Region

Instrument: PACALABS (Paca Region and FEDER fundings)

Duration: October 2010 - May 2012

Coordinator: Full performance

Others partners : General Council of Maritim Alps

This project is conducted with Full Performance, a SME specialized in Web site referencing. It aims at improving hinterland tourism and hotel-keepers as well as tourists are involved in the experimentation. Experiments of different new referencing rules are conducted with Web site visitors in order to study their effect on behavioral changes and on touristic choices. The experimentation consists in three stages: current referencing rules are first studied and their efficiency estimated through eye-tracking experiments. Then new rules are explored and tested with users. When the convenient new rules are selected, their efficiency is evaluated through data mining analysis and qualitative studies.

Due to some delay in the experiment (mainly tag installation, data access), our task related to data analysis was postponed until May 2012. This year we conducted several eye tracking studies on different sites (general council 06 in Nice, Draguignan citizen space, Inria) in order to understand the visual search behavior when looking for ill-defined or well defined targets on a Google results page. The results show that commercial ads are rarely looked at and that for the intended users (touristic hosts) a good natural referencing is more efficient than commercial ads. The impact of ergonomic recommendations about web site users interface provided to hotel and restaurant owners participating in the project was evaluated. The pool showed that the participant had a deeper understanding of on line referencing and awareness of the weight of usability quality [54], [44], [42], [43], [45].

6.1.3. PACALABS ECOFFICES (2010 - 2012)

Participants: Guillaume Pilot, Yves Lechevallier, Bernard Senach, Brigitte Trousse [correspondant].

> Title: ECOFFICES
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> Type: PACALABS
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> Challenge: Energy Challenge within Offices
>
> Instrument: PACALABS (Paca Region and FEDER fundings)
>
> Duration: august 2010 - november 2011
>
> Coordinator: Osmose
>
> Others partners: CASA, CSTB
>
> See also: http://www.ecoffices.com/
>
> Abstract: ECOFFICES is an eco-challenge within an enterprise: offices are equipped with sensors and actuators. Actions of employees on actuators are registered and consumption behaviors are tracked. The experimentation consists in three successive stages: data are first recorded during the usual work of the challengers, then feed-back is provided through user interface and in the challenge phase, 3 teams are competing to reach the best economy level. After the challenge, registered data are analysed to study the change of practices, if any. The goal of the project is to provoke behavioral changes and our team is in charge of the evaluation.

The ECOFFICES project based on the concept of **energy challenge** in tertiary sector ended officially in november 2011, but due to the complexity of cleaning data before data analysis, we analysed usage data and IoT data up to February 2012. The final assessment showed that the participation rate was higher than expected. The most notable behavior change at the office concerns a declared increase of switching off of aircon and electrical devices when leaving the office for a long time. At the end of the challenge, participants were not convinced about effective savings and the sustainability of emergent eco-behaviour is questioned. Our main contribution is described in Section 5.5.3 and reported in three main deliverables related to the qualitative and quantitative analysis of experimental data, which are summarised in [64] and the final report [62].

6.1.4. PACALABS ECOFAMILIES (2011- 2012)

Participants: Xavier Augros, Florian Bonacina, Brigitte Trousse [correspondant].

> Title: ECOFAMILIES
>
> Type: PACALABS
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> Challenge: Design by end users of an user interface for energy savings
>
> Instrument: PACALABS (Paca Region and FEDER fundings)
>
> Duration: October 2011 - October 2012
>
> Coordinator: CSTB
>
> Others partners : University of Nice Sophia Antipolis (I3M), NCA

See also: http://www.ictusagelab.fr/projet/ecofamilies fro a summary of the mainoutcomes of the project.

The ECOFAMILIES project has proposed to prototype and experiment an innovative technological solution to promote energy-aware behaviors at home, through a participatory design approach. A web-based user interface has been developed by SME Ekenos (Italy). It provides a set of customized contents, ranging from basic information to proposal of actions aiming at reducing energy consumption.

ICT Usage Lab (cf. section 6.1.8) was a sponsor partner and was represented in this project by AxIS team for advices on the experimentation and co-design protocol (through the supervising committee) and various supports to partners related to the dissemination via the Web site, to the workshop animation and Focuslab tools (Sphinx tool, Eye-tracker,) and to the redaction of some deliverables (D2,D3, D3.2 and the final report [61]).

For some pictures of such workshops: http://www.flickr.com/photos/ecofamilies/ ECOFAMILIES Was presented during a report at TV during the 19-20 journal France 3 on October 17. See also a summary of the project ECOFAMILIES on the Web site [69].

6.1.5. CPER Telius - FocusLab (2008 - 2013)

Participants: Xavier Augros, Guillaume Pilot, Brigitte Trousse [correspondant].

This grant, funded by Regional and European support, covers 3 areas: an experimental platform for research on telecomnumication networks, a software and informatics platform (including a virtual reality environment, a medical imaging platform, and a peer-to-peer computing grid), and an experimental platform on the usage of information systems. AxIS is being funded through the experimental platform on the usage of information systems called Focus (and renamed FocusLab) (cf. section 5.6).

Projects using elements of the FocusLab platform are reported in [70]. The following list identifies AxIS projects where our platform was used: TIC TAC, ECOFFICES, ECOFAMILIES. In addition to others Inria teams (WIMMICS, REVES), we can cite external organisations/teams: I3M laboratory from university of Nice Sophia Antipolis, CSTB (Sophia Antipolis), the Ergonauts Association, Elliot partners such as BIBA (Germany) and HSR (Italy).

6.1.6. IMREDD

Participant: Brigitte Trousse [correspondant].

Our activities on Internet of things (IoT), Environment and Health&Well Being, mainly leaded in the context of the european ELLIOT Project (cf. section 6.3.1.1) are related to "Environment and health", one of the three topics of the Mediterannean Institute of Risks, Environment and Sustainable development (IMREDD [7] in French). This institute is in relation to the EcoCampus of the OIN (*Opération d'intérêt National de la Plaine du var* (University of Nice Sophia Antipolis and Nice Côte d'Azur Metropole).

URL: htmladdnormallinkhttp://unice.fr/universite/imreddhttp://unice.fr/universite/imredd.

6.1.7. Labex UCN@Sophia

Participant: Brigitte Trousse.

Title: User-Centered Network

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

Instrument: Labex

Coordinator: University of Nice - Sophia Antipolis

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

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[7]IMREDD: Institut Méditerranéen des Risques,de l'Environnement et du Développement Durable

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: e-Health to allow persons with reduced autonomy to retain at home and Intelligent Transport Systems.

AxIS is mainly concerned by Intelligent Transport Systems (mainly by co-creating ITS applications with users and stakeholders) and potentially all the research directions involving users. AxIS experience in ITS domain is based on various projects (c. section 3.2).

6.1.8. *ICT Usage Lab*

Participants: Brigitte Trousse [correspondant], Bernard Senach.

This year was rich in concrete projects with experiments with citizens or professionals for various members of ICT Usage Lab: CSTB, I3M (UNiversity of Nice Sophia Antipolis) and AxIS (Inria).

The FocusLab platform (CPER Telius 6.1.5) has been avalaible to ICT Usage Lab projects and toother expriments by academics or association of PACA region: EPI Reves (Inria), CSTB, I3M 5university of Nice) and the association Ergonautes.

ICT Usage Lab was partner of the Innovatice City Convention event organised in June 2012 (Nice Côte d'Azur): http://www.innovative-city.fr/partenaires/partners/. In this context we invited two speakers for ICC 2012: Michael Nilsson (CDT, Lulea, Finland) and Khaldoun El Agha (ICT Labs - EIT, Paris).

ICT Usage Lab have several dissemination activities related to ECOFAMILIES, ECOFFICES and ELLIOT projects at the europena level.

ICT Usage Lab was co-founder of the Association France Living Labs (cf. section 6.2.4).

Let us note the visit of Noel Conryut from the living lab for Teaching and Learning (Island of the Reunion) at the end of december in order to identify collaboration topics with our living lab.

6.1.9. *Involvement in Regions*

PACA Region

- B. Trousse as Inria representative is a member of the expert committee of the PACALABS and of the strategic committee of the PACALABS orientation of the Regional Council.

- B. Trousse and B. Senach are members of the coordination committee of the ICT Usage Lab (Inria, CSTB, Orange Labs and UNS).

- B. Senach and B. Trousse pursued the reactivation started in 2008 of the living lab ICT Usage Lab by increasing our contacts with territories and academics disseminating the living lab approach and/or involving them as supporters or partners of experiments. This year, in addition to previous contacts (NCA, CASA, CG06) we had fruitful meetings with PAP (Pôle Azur Provence, a cluster of hinterland territorial communities) to set up collaboration about ecological behaviour changes and with CG06 about eco-tourism. Inside ICT Usage Lab, we had contcats with I3M (University of Sophia Antipolis) involved in the ECOFAMILIES project. See the activities of ICT usage lab (cf. section 6.1.8).

- B. Senach, G. Pilot and B. Trousse had contact with ADEME and CASA in order to promote the real-time traveler information system MOBILTIC which capitalized on the TicTac Project.

- B. Trousse (Inria and ICT Usage Lab representative) was member of the program committee of Innovative City Convention (ICC) 2012 (Nice).

- AxIS as responsible of Elliot experiments has established relations with the Environment department of the urban community of Nice Côte d'Azur (NCA) and CHU Nice in order to organize co-creation workshops.

- B. Trousse gave a talk about ECOFFICES project at the smart grid group (Cap Energies and SCS clusters).

- B. Trousse met in january Stéphane Delalaye from Arsenic association (PACA). Following this contact, we have the opportunity to organise one experiment for HOTEL-REF-PACA in a citizen space at Draguignan (ERIC) and another one for the ELLIOT project in the Hublot (ERIC, Nice).

- AXIS organised two Elliot workshops for professionnels (Health & Environment) in the Environment department of Nice Côte d'Azur (cf. section 6.3.1.1).

Midi Pyrénées Region

- AxIS (C. Detraux and D. L. Scapin) are involved in ANR-PIMI project (cf. section 6.2.1) where the Midi-Pyrénées region and IUT Tarbes are pilot-partners.

6.2. National Initiatives

6.2.1. *ANR PIMI (2010 - 2013)*

Participants: Claudia Detraux, Dominique Scapin [correspondant].

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 5.4.1 .

6.2.2. *FIU FIORA (2012-2015)*

Participants: Yves Lechevallier [correspondant], 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. Perosnnalisation will be based on context parameters related to the user and avalaible 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 Health (use of the cohort Nutrinet with more than 200 users) and b) e-tourism.

This project starts at the end of 2012.

6.2.3. Competitivity Clusters

Cap Digital: B. Trousse was reviewer for the selection of proposals for Cap Digital competitively cluster related to the call for Projects "Expérimentation in situ et in vivo de projets" (deadline : September 19th) of Paris Region.

SCS and Cap Energies: B. Trousse was invited for a talk on *Ecoffices: the usages aspect* during a meeeting (April 19th, Brignoles) of the working group Smart grid in PACA (common to two clusters, SCS and Cap Energies clusters).

6.2.4. France Living Labs

The French Network of Living Labs has created the association named "France Living Labs" (F2L) in order to promote the French Living and to facilitate user-driven open innovation on a national level. From the first ENoLL wave in 2006, the French network of living labs has grown from one ENoLL accredited living lab to 47 living labs up to this date after the ENoLL 6th Wave of Call for Membership applications.

The French Network of Living Labs have had annual meetings since 2008. Due the growing number of the French network of living labs, a majority of living labs (25 among 36) has decided to create an association on March 2012 in order to support operations of its members, mainly for common international/European projects, b) to animate the network, promoting the concept of living lab, supporting the sharing of methods and tools and c) to promote the ENoLL label and the Living lab approach by organizing various events and to finally contributing to the maturity of Living Labs European initiative by capitalizing knowledge and experiences and to support the defining KPI indicators for impact assessment of a Living Lab.

ENoLL and France Living Labs are looking into opportunities of closer communication and cooperation in their activities and initiatives through meetings, exchanging of information, knowledge, experiences and best practice. This will be done through signing a formal cooperation agreement (MoU).

B. Trousse (Inria) and A. Zarli (CSTB) are the official representatives of the ICT Usage Living Lab which is a founding member of France Living Labs and member of the administration council. Brigitte Trousse was elected President of the Association in the adminsitration council of april 2012. The association wrote a press communication on June 18.

Three Council Meetings: august (Universcience, Paris), may and october (Inria, Paris).

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

6.3. European Initiatives

6.3.1. FP7 Projects

6.3.1.1. STREP ELLIOT (2010 - 2013)

Participants: Anne-Laure Negri, Mylène Leitzelman, Bernard Senach, Caroline Tiffon, Brigitte Trousse [correspondant].

> Title: Experiential Living Lab for the Internet of Things
> Type: COOPERATION (ICT)
> Defi: Internet of Things and enterprise environments
> Instrument: Specific Targeted Research Project (STREP)
> Duration: September 2010 - February 2013
> Coordinator: TXT Polylemia (Italy)
> Others partners:
> See also: http://www.elliot-project.eu/
> Abstract: The ELLIOT project (Experiential Living Labs for the Internet of Things) aims at developing an Internet Of Things (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 the following activities:

- 3 co-conception workshops (1 group of health and/or air professionals) were held in order to identify the ideas and positions of professionals related to potential internet of things services based on air and noise measurements. These workshops took place in Nice during spring 2012; both Aloha! and GenIoT co-creation methods were used and an evaluation of these methods is reported in Section 5.5.2 and [56].

- An experiment with IoT probe (a fake green watch) was run in order to test the online diary and data analysis.

- Specification of the methodology for user experience measurement for Green Services Use case and application for delivrables [50], [63].

- Implementation of MyGreenServices application which collects IoT data from electric cars and citizens sensors and provides some services such as alerts. Usage data are stored in order to be sent to the ELLIOT platform.

- Development of Focuslab V1.3 (cf. section 5.6) in relation to the ELLIOT platform..

- Contribution to a lot of deliverables, five public [47], [46], [55], [50], [63] and three others.

- Co-organisation of two workshops on user experience measurement (KSB model, use cases, data analysis) at Inria Sophia Antipolis and one general meeting dedicated to ELLIOT partners.

6.3.1.2. ICT CSA FIREBALL (2010 - 2012)

Participants: Marc Pallot, Brigitte Trousse [correspondant], Caroline Tiffon, Bernard Senach.

Title: FIREBALL

Type: CAPACITIES (ICT)

Defi: Future Internet Experimental Facility and Experimentally-driven Research

Instrument: Coordination and Support Action (CSA)

Duration: May 2010 - April 2012

Coordinator: Luleå University of Technology (Sweden)

Others partners: AALTO (Finland), AENESCEN (Italy), MCC (United Kingdom), SAIM (Netherlands), ESADE (Spain), ALFAMICRO (Portugal), ISA (Portugal), E-NOVA (Portugal) HK (Finland), Inria (France), DIMES (Finland), IBBT (Belgium), AUTH (Greece), OY (Finland), IMAGES & RESEAUX (France), BCN (Spain)

URL: http://www.fireball4smartcities.eu/

Abstract: FIREBALL (Future Internet Research and Experimentation By Adopting Living Labs - towards Smart Cities) is a coordination action which establishes a coordination mechanism through which a network of Smart Cities across Europe engages in long term collaboration for adopting User Driven Open Innovation to explore the opportunities of the Future Internet.

We mainly have collaborations with Prof. Dr Nicos Komninos (Faculty of Engineering, Aristotle University of Thessaloni, Greece) and Hans Schaffers (Expert at ESoCE Net, Director of Adventure research, Nederlands) for the two scientific publications [26], the white paper [59] and the delivrables D1.2 [58] and D2.1 [60].

This year we finalize a contribution (about 25 pages) on Paca Region - Sophia Antipolis - Nice Côte d'Azur Assets Case Study for a Fireball deliverable [58].

6.3.1.3. SSH CSA IDEAS (2010 - 2012)

Participants: Yves Lechevallier [correspondant], Marc Csernel, Ehab Assan.

> Title: IDEAS
>
> Instrument: Coordination and Support Action (CSA)
>
> Type: CAPACITIES (SSH)
>
> Duration: January 2010 - June 2012
>
> Coordinator: École française d'Extrême Orient (EFEO)
>
> Others partners: Institute of Ethnology of the University of Turku, Hungarian Academy of Sciences, British Academy, Asien-Afrika-Institut of the University of Hamburg, Istituto italiano per l'Africa e l'Oriente (IsIAO).
>
> Abstract: The overall objective of IDEAS is to make progress in coordinating and bringing together academic research, researchers and policy-makers. IDEAS will make use of the expertise and resources of a recently created network, the European Consortium for Asian Field Study (ECAF), which comprises 44 research institutions from ten EU countries and nine Asian countries and Russia, which specialize in Asian studies, and a network of 22 field research centers run by ECAF members across Asia. The task attributed to Inria was to provide the pilot of a website devoted to the presentation of Asian manuscripts (France)

The contribution of Axis was not only a pilot, as requested within the contract, but also a methodology leading to the construction of a smart search engine dedicated to the pilot. As a prototype website we took the IsIAO website according to our partner's wishes and because it was an opportunity to get together, at the same place, a set of manuscripts and large collection of photographs: the Tucci's collection. The Tucci's collection was a good opportunity to test our methodology and our search engine. The main goal of our search engine is to provide a "reasonable" amount of answers whatever the question is.

The reason of the construction of this search engine was the observation of a lot of orientalist websites, included the most famous one the such IDP (International Dunhuang Project). We find that after a query done by a naive user (one of us) most of the time we obtained either no answer, either a lot too much of them. This was a strong motivation and our pilot tested on the Tucci's collection provide now a "reasonable" amount of answers either according to one of our queries.

6.3.2. Collaborations in European Programs, except FP7

6.3.2.1. COST TwinTide (2010-2013)

Participant: Dominique Scapin [correspondant].

> Program: COST IC0904
>
> Project acronym: TwinTide
>
> Project title: Towards the Integration of Transectorial IT De- sign and Evaluation
>
> Duration: 2010 - 2013
>
> Coordinator: Effie Lai-Chong Law - Swiss Federal Institute of Technology (ETH Zürich), Switzerland (CH) / University of Leicester, UK
>
> Other partners: see http://www.irit.fr/recherches/ICS/projects/twintide
>
> Abstract: Towards the Integration of Transectorial IT De- sign 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 artifacts, across sectors and disciplines, bringing together researchers and D&E professionals.

6.3.2.2. EIT ICT Labs

B. Trousse managed several actions related to EIT ICT Labs:

- Participation at the Living Lab Business Models Coaching and Best-practice Sharing workshop (Telecom italia lab, Turin, April 2-3) organised by the Experience & Living Labs (E&LL) catalyst of the Research component of the european institute EIT ICT Labs http://www.eitictlabs.eu/
- Interaction with Khaldoun El Agha, Valerie Issarny, Olivier Festor and Bruno le Dantec related to the action line called "Digital Cities of the Future" and Proposition of an invited talk at ICC 2012 http://www.innovative-city.fr.
- Participation at the submission at the ICT Labs call (2013) related to E&LL catalyst (which was accepted).

6.4. International Initiatives

6.4.1. Participation in International Programs

6.4.1.1. FACEPE CM2ID, Brazil 2003-2013

Participants: Yves Lechevallier, Marc Csernel.

During 2012 we start a new collaboration on social network data analysis with F.A.T. De Carvalho from Federal University of Pernambuco (Recife) and two Inria Teams AxIS (Inria Rocquencourt) 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 F. De Carvalho and A. Napoli has been accepted by FACEPE and Inria. The project started on january and will end on 12/2013. Researchers and students are concerned by this project from Orpailleu, 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, 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.

6.4.2. Participation to Standards in Ergonomics

Participant: Dominique Scapin [correspondant].

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) [41].
- 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).

6.5. International Research Visitors

6.5.1. Visits of International Scientists

AxIS Rocquencourt welcomed various international scientists from Brazil:

- Francisco de Carvalho (UFPE, Brazil) [17], [34], [27], [23],
- Sergio Queiroz (UFPE, Brazil) [27],
- Cleber Zanchettin (UFPE, Brazil).

B. Trousse visited in October Hicham Behja which is involved in a new position at the National High School of Electrical and Mechanical engineering (ENSEM) at Casablanca in Morocco in October.

6.5.2. Internships

Bruno ALMEIDA PIMENTEL (from Feb 2012 until Jul 2012)

Subject: Social Network Aggregation

Institution: Federal University of Pernambuco (Brazil)

<h1 style="text-align:center; color:red;">IMARA Project-Team</h1>

8. Partnerships and Cooperations

8.1. Regional Initiatives

8.1.1. LINK&GO

Title: LINK&GO

Duration: 12 months

Coordinator: AKKA Group

Others partners: AKKA Technologies, Inria, ControlSys Engineering, DBT

See also: http://automobile.yvelines.fr/fr/lappel-a-projets-2011/laureats-du-2nd-appel-a-projets/linkandgo-le-vehicule-autonome-dakka-technologies/

Abstract: LINK&GO in a regional project financed by the CG78 (Yvelines Region). Link & Go is presented as the solution for next-generation mobility. It is the first dual-mode electric vehicle: the driver can choose between manual and automatic modes. The vehicle will move independently from the specific infrastructure such as car parks or roads. Safe and secure, Link & Go vehicle is intelligent establishing contact with the users through their personal devices and with the infrastructure via touch screen controls, voice and gestures. In addition, the system Sarveca allow the vehicle to automatically connect to the charging station can intelligently optimize the grid and facilitate the identification, payment, maintenance, etc..

8.1.2. TRANSY'VES

Title: TRANSY'VES

Duration: 12 months

Coordinator: ADM Concept

Others partners: Inria

See also: http://automobile.yvelines.fr/fr/lappel-a-projets-2011/laureats-du-2nd-appel-a-projets/transyves-la-borne-automatique-dadm-concept/

Abstract: The proposed project, called Transy'Ves, is based on two technological components. The first brick aims to optimize routes with electric vehicles, developing an indispensable tool for the appropriation of its use: the EVCO (Electric Vehicle Cruise Optimizer). This is a system for real-time assistance and course management for users of electric vehicles. The second brick aims to facilitate intermodal transport by developing a fully automatic guidance system in order to democratize the parking valet system in new generation parking lots.

8.2. National Initiatives

8.2.1. ANR

8.2.1.1. ABV

Title: Automatisation basse vitesse

Instrument: ANR

Duration: 2009-2012

Coordinator: IFFSTAR

Others partners: Continental, IBISC, IEF, Induct, 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. PUMAS

Title: Plate-forme Urbaine de Mobilité Avancée et Soutenable

Instrument: FUI

Duration: February 2010 - October 2012

Coordinator: Egis Mobilité

Others partners: Induct, Intempora, Armines, Insa-Rouen, Esigelec

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

Abstract: The purpose of the project PUMAS is to create a platform for travel time information for cities and towns.

8.2.1.3. SCORE@F

Title: Système COopératif Routier Expérimental Français

Instrument: FUI

Duration: 2010-2013

Coordinator: Renault-REGIENOV

Others partners: UTAC, LAB, EURECOM, IFSTTAR, Inria, Telecom 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.

8.2.1.4. Travesti

Title: Traffic Volume Estimation via Space-Time Inference

Instrument: ANR SYSCOMM

Duration: January 2009 - June 2012

Coordinator: Inria (TAO)

Others partners: Armines

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

Abstract: This project addresses the problem of modelling large scale complex systems to provide predictions of their macroscopic behaviour. For application purpose, we focus here on the particular problem of the real-time prediction of traffic conditions on a road network.

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 new PhD thesis student supervised by IMARA research; 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

Title: DRIVE C2X – Accelerate cooperative mobility

Type: COOPERATION (ICT)

Defi: Driving implementation of car 2 x communication technology

Instrument: Integrated Project (IP)

Duration: January 2011 - December 2013

Coordinator: DAIMLER AG (Germany)

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

See also: http://www.drive-c2x.eu/project

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

Title: IPv6 ITS Station Stack for Cooperative ITS FOTs

Type: COOPERATION (ICT)

Defi: IPV6 ITS Station Stack for Cooperative Systems FOTs

Instrument: Specific Targeted Research Project (STREP)

Duration: February 2011 - January 2014

Coordinator: Inria (France)

Others partners: Universidad de Murcia, Institut Telecom, lesswire, SZTAKI, IPTE and BlueTechnix.

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

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 objectif is to deliver an optimized IPv6.

8.3.1.3. SANDRA

Title: Seamless Aeronautical Networking through integration of Data links, Radios and Antennas.

Type: COOPERATION (TRANSPORTS)

Instrument: Integrated Project (IP)

Duration: October 2009 - September 2013

Coordinator: Selex Communications (Italy)

Others partners: 30 partners.

See also: http://www.sandra-project.eu/2012/

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

8.3.1.4. PICAV

Title: Personal Intelligent City Accessible Vehicle System (PICAV)

Type: COOPERATION (TRANSPORTS)

Instrument: Specific Targeted Research Project (STREP)

Duration: August 2009 - July 2012

Coordinator: Univ. Gênes (Italy)

Others partners:University College London (UK), Universite di Pisa (Italy), TCB (Portugal), ZTS (Slovakia), Mazel (Spain)

See also: http://www.dimec.unige.it/pmar/picav/

Abstract: The proposal presents a new mobility concept for passengers ensuring accessibility for all in urban pedestrian environments. The concept addresses a new Personal Intelligent City Accessible Vehicle (PICAV) and a new transport system that integrates a fleet of PICAV units.

8.3.1.5. CATS

Title: City Alternative Transport System

Type: COOPERATION (TRANSPORTS)

Instrument: Specific Targeted Research Project (STREP)

Duration: January 2010 - December 2013

Coordinator: Lohr Industrie (France)

Others partners: CTL (I), EPFL (CH), TECHNION (IL), GEA (CH), ERT (F), and the cities of Formello (I), Strasbourg (F), Ploiesti (R)

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

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 utilisation 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.

8.3.1.6. FURBOT

Title:Architectures of Light Duty Vehicles for urban freight transport

Type: COOPERATION (TRANSPORTS)

Instrument: Specific Targeted Research Project (STREP)

Duration: November 2011 - October 2014

Coordinator: Univ. Gênes (Italy)

Others partners: Bremach (Italy), ZTS (Slovakia), Universite di Pisa (Italy), Persico (Italy), Mazel (Spain), TCB (Portugal)

See also: http://www.furbot.eu/

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.

8.3.1.7. DESERVE

Title: DEvelopment platform for Safe and Efficient dRiVE

Duration: September 2012 - August 2015

Coordinator: VTT (Finland)

Others partners: CRF (I), CONTINENTAL (F), FICOSA (I), Inria (F), TRW (GB), AVL (A), BOSCH (D), DAIMLER (D), VOLVO (S),...(26 partners)

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

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.

8.3.1.8. CITYMOBIL-2

Title: CityMobil-2

Duration: September 2012 - August 2016

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

Others partners: Inria (F), DLR (D), GEA Chanard (CH), POLIS (B), ERT (B), EPFL (CH),...(45 partners!)

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.

8.4. International Initiatives

8.4.1. Inria International Partners

- NAIST (Nara Institute of Sciences and Technologies – Nara – Japan): IMARA and NAIST are extending their cooperation on research activities regarding ITS communications. In 2012, IMARA received 2 visiting researchers, 1 PhD student, and 1 internship student, deepening cooperative research activities on service discovery, geo-networking, and medium access control for vehicular communications.

- IMARA and YAMAHA Motors Company (YMC) have signed a NDA for the exchange of information in view of the participation of both parties in the New generation AGV project.

- IMARA and the South-West Research Institute (SwRI) renewed their collaboration agreement on the collaboration in the design and development of innovative Advanced Driver Assistance System.

8.4.2. Participation In International Programs

IMARA is a partner of ict-PAMM, which is an ICT-ASIA project accepted in 2011 for 2 years. It is funded by the French Ministry of Foreign Affairs and Inria. The coordinator of the project is Anne Spalanzani from UPMF University and Inria Co-coordinator is Philippe Martinet from Blaise Pascal Institute. This project aims at conducting common research activities in the areas of robotic mobile service and robotic assistance of human in different contexts of human life. From France the partners are: Inria/e-Motion, Inria/IMARA, Institut Blaise Pascal. From Asia, the partners are: ISRC-SKKU - Suwon, (Korea), ITS Lab - Kumamoto (Japan), IRA-Lab (Taiwan), Mica Institute - Hanoi (Vietnam).

http://emotion.inrialpes.fr/people/spalanzani/HomePAMM.html

8.5. International Research Visitors

8.5.1. Visits of International Scientists

- Professor Masatoshi Kakiuchi (Nara Institute of Sciences and Technologies) visited IMARA from November 2011 to October 2012;

- Professor Satoshi Matsuura (Nara Institute of Sciences and Technologies) visited IMARA from April 2012 to March 2013;

- Professor Plamen Petrov (Technical University of Sofia) visited IMARA from July 2012 to September 2012.

IMEDIA2 Team

7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. Pl@ntNet project [2009-2013]

It is a joint project with AMAP (CIRAD, INRA, IRD, Montpellier) and Tela Botanica, an international botanical network with 8,500 members and an active collaborative web platform (10,000 visits /day). The project has its financial support from Agropolis International Foundation http://www.agropolis.fr/ and is titled "Plant Computational Identification and Collaborative Information System".

In addition to the results presented in [7], [13], [11], [12], [18], [20], [21], [9], [8], a demo of the Pl@ntNet platform has been done by Vera Bakic at World Wide Web conference (WWW 2012) in Lyon.

7.2. European Initiatives

7.2.1. FP7 Projects

7.2.1.1. I-SEARCH

Title: I-SEARCH (A unified framework for multimodal content SEARCH)

Type: COOPERATION (ICT)

Defi: Networked Medias & 3D Internet

Instrument: Specific Targeted Research Project (STREP)

Duration: January 2010 - December 2012

Coordinator: CENTRE FOR RESEARCH AND TECHNOLOGY HELLAS (Greece)

Others partners: CERTH (Greece), JCPC (France), ATTC (Greece), ENG (Italy), Google (Germany), UNIGE (Italy), Exalead (France), FHE (Germany), ANSC (Italy), EGR (Germany)

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

Abstract: The I-SEARCH project aims to provide a novel unified framework for multimodal content indexing, sharing, search and retrieval. The I-SEARCH framework will be able to handle specific types of multimedia and multimodal content (text, 2D image, sketch, video, 3D objects and audio) alongside with real world information, which can be used as queries and retrieve any available relevant content of any of the aforementioned types. IMEDIA2 is workpackage leader of "RUCOD COMPLIANT Descriptor Extraction".

7.2.1.2. Glocal

Title: Glocal (Event-Based Retrieval of Networked Media)

Type: COOPERATION (ICT)

Defi: Networked Medias & 3D Internet

Instrument: Integrated Project (IP)

Duration: December 2009 - November 2012

Coordinator: Univ. Degli Studi di Trento (Italy)

Others partners: UNITN (Italy), ISOCO (Spain), ALINARI (Italy),CERTH (Greece), Yahoo Iberia SL (Spain), AFP (France), DFKI (Germany), Exalead (France), LUH (Germany), BUT (Czech Republic)

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

Abstract: The key idea underlying the project is to use events as the primary means for organizing and indexing media. Within networked communities, common (global) descriptions of the world can be built and continuously enriched by a continuous flow of individual (local) descriptions. With two leading search companies and four content providers, the consortium attempts to realize and evaluate this approach in several application domains, which will involve professional and amateur users dealing with professional and generic contents. IMEDIA2 is responsible of three research tasks related to visual-based event indexing, retrieval and mining, notably in distributed contexts.

7.2.1.3. CHORUS+

Title: CHORUS+ Network of Audio-Visual Media Search

Type: CAPACITIES (ICT)

Defi: Networked Medias & 3D Internet

Instrument: Coordination and Support Action (CSA)

Duration: January 2010 - December 2012

Coordinator: JCP-Consult (France)

Others partners: UNITN (Italy), HES-so (Switzerland), Thomson R&D (France), JCPC (France), CERTH (Greece), TU Wien (Austria), ENG (Italy), IPTS (Belgium)

See also: http://www.ist-chorus.org/

Abstract: CHORUS + has been funded in the continuity of the former CHORUS initiative thanks to its success. Beyond CHORUS coordination objectives, CHORUS+ includes new key issues such as extended cooperation and coordination to Asian countries and US, support to integration and implementation, support to coordinated research evaluations or support to results dissemination of EU projects. Nozha Boujemaa is part of the management board of the project.

7.3. International Research Visitors

7.3.1. Visits of International Scientists

Don Geman from John Hopkins University.

7.3.1.1. Internships

OLFA MZOUGHI (from Jan 2012 until Jul 2012)

Subject: Analyse et description de la morphologie foliaire: Application à la classification et l'identification d'espèces de plantes

Institution: Université de Tunis El Manar - Faculté des Sciences (Tunisia)

SMIS Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR DEMOTIS (Feb. 2009 - Feb. 2012)

Partners: SopinSpace (coordinator), Inria (SMIS, SECRET), CECOGI
SMIS funding: 85k€
http://www.demotis.org/
The design and implementation of large-scale infrastructure for sensitive and critical data (e.g., electronic health records) have to face a tangle of legal provisions, technical standards, and societal concerns and expectations. DEMOTIS project aims to understand how the intrication between legal and technical domains constrains the design of such data infrastructures. DEMOTIS consists of two interdependent facets: legal (health law, privacy law, intellectual property law) and computer science (database security, cryptographic techniques). Combining expertise of researchers in Law and computer scientists should help to better assess whether law statements can be actually put in practice, to characterize the related technological challenges when mismatches are detected and, when possible, to suggest preliminary solutions.

8.1.2. 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.

8.1.3. 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 signicance 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.

8.2. European Initiatives

8.2.1. 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 well-suited 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 will be managed by the IT University of Copenhagen and will cover the expenses for two co-supervised PhD students (including regular visits to and from Denmark).

8.2.2. Collaborations with Major European Organizations

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

- P. 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 Initiatives

8.3.1. Inria International Partners

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

- Dennis Shasha (Professor at the University of New-York, USA): collaboration on tamper-resistant data management issues. Dennis Shasha has done a one year sabbatical stay in SMIS (July 2006 to June 2007).

- I. Ray and I.Ray (Professors at Colorado State University, USA): collaboration on data privacy and usage control (Indrajit and Indrakshi Ray have visited SMIS from September 2009 up to February 2010).

- Cristian Borcea (Associate Professor at New Jersey Institute of Technology, USA): collaboration on spatio-temporal data management issues.

8.4. International Research Visitors

8.4.1. Visits of International Scientists

8.4.1.1. Internships

- Quoc-Cong To (Vietnam): Internship on distributed query processing in the PDS architecture. September 2012 - February 2013.

- Athanasia Katsouraki (Greece): Internship on usage control models. January-September 2012.

- Danae Boutara (Greece): Internship on Minimal exposure. April-August 2012.

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

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. Agence Nationale de la Recherche: DETECT (ENS)
Participant: Josef Sivic.

The DETECT project aims at providing new statistical approaches for detection problems in computer vision (in particular, detecting and recognizing human actions in videos) and bioinformatics (e.g., simultaneously segmenting CGH profiles). These problems are mainly of two different statistical nature: multiple change-point detection (i.e., partitioning a sequence of observations into homogeneous contiguous segments) and multiple tests (i.e., controlling a priori the number of false positives among a large number of tests run simultaneously).

This is a collaborative effort with A. Celisse (University Lille 1), T. Mary-Huard (AgroParisTech), E. Roquain and F. Villers (Univeristy Paris 6), in addition to S. Arlot and F. Bach from Inria SIERRA team and J. Sivic from Willow.

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: Cross-linking Visual Information and Internet Resources using Mobile Networks (Inria)
Participants: Ivan Laptev, Josef Sivic.

The goal of this project within the European EIT-ICT activity is to perform basic research in the area of semantic image and video understanding as well as efficient and reliable indexing into visual databases with a specific focus on indexing visual information captured by mobile users into Internet resources. The aim is demonstrate future applications and push innovation in the field of mobile visual search.

This is a collaborative effort with C. Schmid (Inria Grenoble) and S. Carlsson (KTH Stockholm).

8.2.3. European Research Council (ERC) Advanced Grant
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.

8.3. International Initiatives

8.3.1. IARPA FINDER Visual geo-localization (Inria)
Participants: Josef Sivic, Petr Gronát.

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, 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.

8.4. International Research Visitors

8.4.1. Visits of International Scientists

Alexei Efros (Carnegie Mellon University) and René Vidal (Johns Hopkins University) have visited WIllow during summer 2012.

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 Inria associate team VIP.

Armand Joulin has done a 3 months internship at Microsoft Research in Redmond, U.S.A.