



RESEARCH CENTER
Sophia Antipolis - Méditerranée

FIELD

Activity Report 2012

Section Partnerships and Cooperations

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AOSTE Project-Team

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 AcePlover 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 approached 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 administratively 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, Systereel, 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'Énergie Atomique et aux Énergies 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), Fondation Tecnalía 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 pursues 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 L'Aquila (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), Syntavision 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)

GALAAD Project-Team

7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. GEOLMI

GEOLMI - Geometry and Algebra of Linear Matrix Inequalities with Systems Control Applications - is an ANR project working on topics related to the Geometry of determinantal varieties, positive polynomials, computational algebraic geometry, semidefinite programming and systems control applications.

The partners are LAAS-CNRS, Univ. de Toulouse (coordinator), LJK-CNRS, Univ. Joseph Fourier de Grenoble; Inria Sophia Antipolis Méditerranée; LIP6-CNRS Univ. Pierre et Marie Curie; Univ. de Pau et des Pays de l'Adour; IRMAR-CNRS, Univ. de Rennes.

More information available at <http://homepages.laas.fr/henrion/geolmi>.

7.1.2. ANEMOS

ANEMOS - Advanced Numeric for ELMs : Modeling and Optimized Schemes - is an ANR project devoted to the numerical modelling study of such ELM control methods as Resonant Magnetic Perturbations (RMPs) and pellet ELM pacing both foreseen in ITER. The goals of the project are to improve understanding of the related physics and propose possible new strategies to improve effectiveness of ELM control techniques. The study of spline spaces for isogeometric finite element methods is proposed in this context.

The partners are IRFM, CEA, Cadarache; JAD, University of Nice - Sophia Antipolis; Inria, Bacchus; Maison de la Simulation CEA-CNRS-Inria-University of Orsay- University of Versailles St Quentin .

7.2. European Initiatives

7.2.1. FP7 Projects

7.2.1.1. TERRIFIC

Title: Towards Enhanced Integration of Design and Production in the Factory of the Future through Isogeometric Technologies

Type: COOPERATION (ICT)

Defi: PPP FoF: Digital factories: Manufacturing design and product lifecycle manage

Instrument: Specific Targeted Research Project (STREP)

Duration: September 2011 - August 2014

Coordinator: SINTEF, Oslo (Norway)

Others partners:

Alenia Aeronautica (Italy); Inria Méditerranée (France); Jozef Kepler universitet, Linz (Austria); JOTNE, Oslo (Norway); MAGNA, Steyr (Austria); Missler Software (France); Siemens AG (Germany); Technische Universität Kaiserslautern (Germany); University of Pavia (Italy).

See also: <http://terrific-project.eu>

Abstract: The project aims at significant improvement of the interoperability of computational tools for the design, analysis and optimization of functional products. An isogeometric approach is applied for selected manufacturing application areas (cars, trains, aircrafts) and for computer-aided machining. Computer Aided Design (CAD) and numerical simulation algorithms are vital technologies in modern product development, yet they are today far from being seamlessly integrated. Their interoperability is severely disturbed by inconsistencies in the mathematical approaches used. Efficient feedback from analysis to CAD and iterative refinement of the analysis model is a feature of isogeometric analysis, and would be an essential improvement for computer-based design optimization and virtual product development. Our vision is to provide and disseminate tangible evidence of the performance of the isogeometric approach in comparison to traditional ones in four important application areas as well as addressing interoperability and other issues that necessarily arise in a large-scale industrial introduction of isogeometry.

7.2.1.2. EXCITING

Title: Exact geometry simulation for optimized design of vehicles and vessels

Type: FP7-CP-SST-2007-RTD-1-218536, COOPERATION (TRANSPORTS)

Instrument: Specific Targeted Research Project (STREP)

Duration: October 2008 - April 2012

Coordinator: Jozef Kepler universitet, Linz (Austria)

Others partners:

SINTEF, Oslo (Norway); Siemens AG (Germany); National Technical University of Athens (Greece); Hellenic Register of Shipping (Greece); University of Technology, Munich (Germany); Inria Méditerranée (France); VA Tech Hydro (Austria); Det Norske Veritas AS (Norway).

See also: <http://exciting-project.eu/>

Abstract: This project focuses on computational tools for the optimized design of functional free-form surfaces. Specific applications are ship hulls and propellers in naval engineering and car components, frames, and turbochargers in the automotive and railway transportation industries. The objective is to base the corresponding computational tools on the same exact representation of the geometry. This should lead to huge benefits for the entire chain of design, simulation, optimization, and life cycle management, including a new class of computational tools for fluid dynamics and solid mechanics, simulations for vehicles and vessels based. This seamless integration of CAD and FEM will have direct applications in product design, simulation and optimization of core components of vehicles and vessels.

7.2.1.3. SAGA

Title: ShApe, Geometry and Algebra, 2008-2012

Type: FP7-PEOPLE-2007-1-1-ITN.

Instrument: Initial Training Network (ITN)

Duration: November 2008 - October 2012

Coordinator: SINTEF (Norway)

Others partners: University of Oslo (Norway); Johannes Kepler Universitaet Linz (Austria); Universidad de Cantabria, Santander (Spain); Vilniaus Universitetas (Lithuania); National and Kapodistrian University of Athens (Greece); Inria Méditerranée (France); GraphiTech (Italy); Kongsberg SIM GmbH (Austria); Missler Software (France);

See also: <http://saga-network.eu/>

Abstract: The project aims at promoting the interaction between Geometric Modeling and Real Algebraic Geometry and, in general, at strengthening interdisciplinary and inter-sectorial research and development concerning CAD/CAM. Its objective is also to train a new generation of researchers familiar with both academic and industry viewpoints, while supporting the cooperation among the partners and with other interested collaborators in Europe.

7.2.1.4. DECONSTRUCT

Title: Decomposition of Structured Tensors, Algorithms and Characterization.

Type: PEOPLE (FP7-PEOPLE-2009-IEF)

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

Duration: November 2010 - November 2012

Coordinator: Inria (France)

Others partners: No.

See also: <http://www-sop.inria.fr/teams/galaad/joomla/index.php/international-collaborations-147/172-deconstruct.html>

Abstract: Tensors play a wide role in numerous application areas as Signal Processing for Telecommunications, Arithmetic Complexity or Data Analysis. In some applications tensors may be completely symmetric, or symmetric only in some modes, or may not be symmetric. In most of these applications, the decomposition of a tensor into a sum of rank-1 terms is relevant, since tensors of interest have a reduced rank. Most of them are structured, i.e., they are either symmetric or enjoy some index-invariance. Lastly, they are often real, which raises open problems concerning the existence and calculation of the decompositions. These issues build the basic bricks of the research program we propose. The classes of tensors described above have a geometric translation in terms of classical algebraic varieties: Segre, Veronese, Segre-Veronese varieties and Grassmannians and their secant varieties. A complete description of equations for those secant varieties and their dimensions is still not known (only dimensions of secant varieties to Veronesean are classified), although they have been studied by algebraic and differential geometers and algebraists for a long period up to now. The aim of this research project is:

- To attack both the description of the ideal of those secant varieties and their dimensions, starting from low dimensions and low degrees.
- To propose algorithms able to compute the rank of structured tensors.

7.2.2. Collaborations in European Programs, except FP7

7.2.2.1. PHC TOURNESOL FL

Program: Tournesol

Project acronym: PHC TOURNESOL FL 2012 - 26409SH

Project title: Extracting multidimensional shapes

Duration: January 2012 - December 2013

Coordinator: E. Hubert (Inria), A. Cuyt (Universiteit Antwerpen)

Other partners: Inria Sophia-Antipolis (France); Universiteit Antwerpen (Belgium)

Abstract: We are working on the shape-from-moments problem : from measurement-like data, reconstructing a desired object. Since many years, this problem has been solved and optimized in the 2D-case thanks to use of complex numbers. Thanks to a new formula, we want to stay in the real domain in order to generalize this problem to multidimensional shapes - in particular 3D-shapes. For more details about our project Tournesol : <http://www-sop.inria.fr/teams/galaad/joomla/index.php/international-collaborations-147/173-tournesol.html>. For more details about the program Tournesol : <http://www.campusfrance.org/fr/tournesol-communaute-francaise>.

7.3. International Initiatives

7.3.1. Participation In International Programs

7.3.1.1. CNRS-NSFC collaboration with Hangzhou Dianzi University

Contact in China: Xu Gang, College of computer - Hangzhou Dianzi University.

Participants in France: André Galligo, Bernard Mourrain, R. Duvigneau, B. Nkonga.

Abstract: CAD/CAE technology plays an important role in advanced manufacture, and the seamless integration of CAD/CAE is a difficult and important problem. The current CAD/CAE workflow can be classified into three steps: Computer-aided design, finite element analysis (FEA) and shape optimization. From the above workflow in CAD/CAE, the main gap of the geometric data is from the analysis step. Isogeometric analysis (IGA) can be employed to overcome the gap between CAD and finite element analysis by using the same geometric representation based on NURBS for the design and analysis tasks. In this collaboration, we studied the following problems: (1) Parameterization of computational domain for IGA methods, in particular generation of volume parameterization from CAD surface models. (2) IGA on complicated geometry and topology.

7.4. International Research Visitors

7.4.1. Visits of International Scientists

Wen-Shin Lee and Annie Cuyt (University of Antwerp, Belgium) visited on April 23-27 and December 10-22 in the context of the TOURNESOL project .

Nelly Villamizar (University of Oslo, Norway) visited us from March 28 to May 15, to collaborate with B. Mourrain on splines spaces, in the context of the ITN Marie-Curie SAGA.

Ibrahim Adamou (University of Cantabria, Spain) visited us from September 30 to October 8 to collaborate with B. Mourrain on Voronoï diagrams of half-lines and robust geometric computation, for his secondement in the context of the ITN Marie-Curie SAGA.

Gang Xu visited Inria and the university of Nice from November 1 to November 8 in the context of the CNRS-NSFC collaboration program.

Xiao-Shan Gao and Jingsan Chen (Chinese Academy of Science, Beijing) visited from July 18 to July 20.

George Labahn (University of Waterloo, Canada) visited from July 16 to July 22 to explore new collaboration topics with Evelyne Hubert.

GEOMETRICA Project-Team (section vide)

MARELLE Project-Team

6. Partnerships and Cooperations

6.1. National Initiatives

6.1.1. ANR

- We participated in the ANR project DeCert, which started on January 2009. Other participants are CEA List (Paris), LORIA-Inria (Nancy), Celtique (IRISA Rennes), Proval (LRI Orsay), Typical (Inria Saclay), Systemel (Aix-en-provence). The objective of the DeCert project was to design an architecture for cooperating decision procedures. To ensure trust in the architecture, the decision procedures will either be proved correct inside a proof assistant or produce proof witnesses allowing external checkers to verify the validity of their answers.
- We participate in the ANR project TAMADI, which started in October 2010. Other participants are ARENAIRE-Inria Rhone-Alpes and the PEQUAN team from University of Paris VI Pierre and Marie Curie. The objective of the TAMADI project is to study the question of precision in floating-point arithmetic and to provide formal proofs on this topic.

6.2. European Initiatives

6.2.1. FP7 Projects

6.2.1.1. FORMATH

Title: Formath

Type: COOPERATION (ICT)

Defi: FET Open

Instrument: Specific Targeted Research Project (STREP)

Duration: March 2010 - July 2013

Coordinator: Univ Göteborg (Sweden)

Others partners: Radboud University Nijmegen, (the Netherlands), University of La Rioja, (Spain).

See also: <http://wiki.portal.chalmers.se/cse/pmwiki.php/ForMath/ForMath>

Abstract: The objective of this project is to develop libraries of formalised mathematics concerning algebra, linear algebra, real number computation, and algebraic topology. The libraries that we plan to develop in this proposal are especially chosen to have long-term applications in areas where software interacts with the physical world. The main originality of the work is to structure these libraries as a software development, relying on a basis that has already shown its power in the formal proof of the four-colour theorem, and to address topics that were mostly left untouched by previous research in formal proof or formal methods.

6.3. International Initiatives

6.3.1. Inria International Partners

We are in close contact with the University of Chalmers in Göteborg, Sweden and with the IMDEA Software Institute in Madrid, Spain.

6.4. International Research Visitors

6.4.1. Visits to International Teams

- Benjamin Grégoire visited IMDEA in Madrid, Spain in April (23-27), October (1-5), and November (26-30).

APICS Project-Team

8. Partnerships and Cooperations

8.1. European Initiatives

8.1.1. Collaborations with Major European Organizations

APICS is part of the European Research Network on System Identification (ERNSI) since 1992.

Subject: System identification concerns the construction, estimation and validation of mathematical models of dynamical physical or engineering phenomena from experimental data.

8.2. International Initiatives

8.2.1. Inria International Partners

LMS grant, support of collaborative research with Leeds Univ., U.K., School of Mathematics (no. 41130, 2012).

PHC Utique CMCU, cooperation France-Tunisia (no. 10G 1503, led by Univ. Orléans, MAPMO).

NSF CMG collaborative research grant DMS/0934630, “Imaging magnetization distributions in geological samples”, with Vanderbilt University and the MIT (USA).

Cyprus NF grant “Orthogonal polynomials in the complex plane: distribution of zeros, strong asymptotics and shape reconstruction.”

8.3. International Research Visitors

8.3.1. Visits of International Scientists

- Smain Amari (RMC Ontario).
- Bernard Hanzon (Univ. Cork, External Collaborator).
- Tahar Mounni (Univ. Bizerte, Tunisia).
- Jonathan R. Partington (Univ. Leeds, U.K., External Collaborator).
- Vladimir Peller (Michigan state Univ. at East Lansing)
- Yves Rolain (Vrije Universiteit Brussels).
- Nikos Stylianopoulos (Univ. of Cyprus).

8.3.2. Internships

Shubham KUMAR (from May 2012 until Sep 2012)

Subject: Mathematical methods for multiplexers study

Institution: IIT Delhi (India)

Dmitry Ponomarev (from Jun 2012 until Aug 2012)

Subject: Constrained optimization with prescribed values on the disk

Pre-doctoral trainee

Rahul PRAKASH (from May 2012 until Sep 2012)

Subject: Mathematical methods for multiplexers study

Institution: IIT Delhi (India)

Xuan Zhang (from May 2012 until Sep 2012)

Subject: Groebner basis methods for multiplexers study

Institution: Polytech'Nice

Jie Zhou (from May 2012 until Aug 2012)

Subject: A Hardy-Hodge Decomposition on the 2D Sphere

Institution: Ecole des Mines de Nancy

8.4. External collaborators of the team

The following people are external collaborators of the team:

- Smain Amari [RMC (Royal Military College), Kingston, Canada, since October].
- Ben Hanzon [Univ. Cork, Ireland, since October].
- Mohamed Jaoua [French Univ. of Egypt].
- Jean-Paul Marmorat [Centre de mathématiques appliquées (CMA), École des Mines de Paris].
- Jonathan Partington [Univ. Leeds, UK].
- Edward Saff [Vanderbilt University, Nashville, USA].

CASTOR Team

6. Partnerships and Cooperations

6.1. National Initiatives

6.1.1. ANR

- ANR ECINADS
Castor is associated to the ANR ECINADS project started in end of 2009, devoted to the design of new solution algorithms for unsteady compressible flows, adapted to scalable parallelism and to reverse (adjoint) Automatic Differentiation. See in the activity report of Tropics.
- ANR ESPOIR
The ANR ESPOIR (Edge Simulation of the Physics Of Iter Relevant turbulent transport) associates the CASTOR team with the M2P2, LPIIM and LAMP laboratories in Marseille and IRFM in Cadarache to investigate edge plasma turbulence. The numerical simulation of the plasma wall interactions requires efficient codes and thus the development of advanced numerical methods and solvers. The aim of this project is to study different numerical strategies for edge plasma models in the real geometrical and magnetical configurations corresponding to the future Iter machine.
- ANEMOS : ANR-11-MONU-002
ANEMOS : Advanced Numeric for Elms : Models and Optimized Strategies associates JAD Laboratory/Inria (Nice, Manager), IRFM-CEA (Cadarache), "Maison de la Simulation (Saclay)" and Inria EPI Bacchus (Bordeaux) Elms are disruptive instabilities occurring in the edge region (SOL) of a tokamak plasma. The development of Elms poses a major challenge in magnetic fusion research with tokamaks, as these instabilities can damage plasma-facing components, particularly divertor plates. The mitigation or suppression of large Elms is a critical issue for successful operation of ITER. Goal for ANEMOS is to develop and improve numerical tools in order to simulate physical mechanisms of Elms and qualifies some strategies for their control. We then need to design efficient numerical strategies on the most advanced computers available to contribute to the science base underlying of proposed burning plasma tokamak experiments such as ITER.
- ANR IODISEE : IONospheric DIsturbances and Satellite-to-Earth communications. <http://iodissee.math.cnrs.fr/project/index.html>. In this ANR project, CASTOR will address the use of data-models coupling method to identify the input model parameters (especially, the initial data for the electronic density).

6.1.2. Inria initiatives

Large scale Initiative FUSION (2009–2012), http://www-math.u-strasbg.fr/ae_fusion: Modeling and numerical simulation of magnetic fusion plasmas in view of the ITER project.

6.1.3. Federation on Magnetic Confinement Fusion Projects

- FR FCM (Federation on Magnetic Confinement Fusion) project within Euratom-CEA association, "Reconstruction, simulation and control of plasma equilibrium"
- FR FCM (Federation on Magnetic Confinement Fusion) project within Euratom-CEA association, "Two-fluid numerical modelling of edge plasma in tokamak; Application to ITER".

6.2. International Initiatives

6.2.1. Euromediterranée 3+3 Medlagoon program

Participants: Hervé Guillard, Marco Bilanceri.

The goal of the Medlagoon project (<https://project.inria.fr/medlagoon/en>) is to contribute to the design of simulations tools aimed to the integrated mathematical modeling of Mediterranean lagoons ranging from hydrodynamics and sediment transport modeling to biological models for phyto and zoo-plankton. This program associates CASTOR with the Mohamedia Engineering school and the university of Oujda in Morocco, the University of Pisa (Italy), the Polytechnic school of Tunisia, the university of Paris 13, Ain Sham University in Egypt and the Department of Applied Mathematics, University of Crete in Greece.

6.3. International Research Visitors

6.3.1. Visits of International Scientists

6.3.1.1. University of Pilzen : Algebraic Multigrid Solvers

In the framework of a collaboration on algebraic multigrid solvers, Petr Vanek and Roman Kuzel of the University of Pilzen, Czech Republic have visited CASTOR in November.

6.3.1.2. Institute of Mathematical Modeling and university of Moscow : Acoustics

The long-term scientific collaboration with IMM on acoustics focussed this year on new reconstruction schemes for noise propagation with linear and nonlinear hyperbolic models. Ludwig W. Dorodnicyn has visited us in april 2012.

6.3.1.3. University of Oujda: Environmental flows

In the framework of the Medlagoon project, Imad El Mahi has visited us in November 2012

6.3.1.4. National Taiwan University : Granular and Multiphase flows

In the wake created by the Hubert Curien project (ORCHID 08-09), Keh-Ming Shyue (Department of Mathematics, National Taiwan University) has visited us in July 2012.

COFFEE Project-Team

7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. ANR

The ANR-project Monumentalg, led by M. Ribot, is devoted to the modeling and simulation of biological damage on monuments and algae proliferation.

7.1.2. National and European networks

- GdR MoMas.
The research group MoMaS (Mathematical Modeling and Numerical Simulation for Nuclear Waste Management Problems) has activities centered around scientific computing, design of new numerical schemes and mathematical modelling (upscaling, homogenization, sensitivity studies, inverse problems,...). Its goal is to coordinate research in this area, as well as to promote the emergence of focused groups around specific projects In particular, in 2012, R. Masson has been involved in the organization of two MoMaS workshop "Multiphasic flows", Oct. 8-9 2012, with Danielle Hilhorst, University of Orsay.
- S. Junca is involved in the GdR-e "Wave Propagation in Complex Media for Quantitative and non Destructive Evaluation"; in particular he organized the Workshop "Nonlinearities in Acoustics" Nice, March 22-23/2012.
- GdR EGRIN is a newly created CNRS-network, devoted to gravitational flows and natural risks; Coffee is among the members of this network.
- R. Masson, with Pierre Samier (Total) has been organizer of ECMOR XIII European Conference on the Mathematics of Oil Recovery, 10-13 september 2012, Biarritz, France, a scientific event of the European Association of Geoscientists and Engineers.

MCTAO Team

7. Partnerships and Cooperations

7.1. Regional Initiatives

The “région *Provence Alpes Côte d’Azur*” partially supports Helen Heninger’s PhD. The other part come from Thales Alenia space, see section 6.1 .

7.2. National Initiatives

7.2.1. *IMB - Université de Bourgogne, Dijon*

The team is officially a common team with University of Nice, but also has very strong links with Université de Bourgogne and IMB (Institute of Mathematics in Burgundy). Bernard Bonnard is currently in leave from Université de Bourgogne; Jean-Baptiste Caillaud collaborates actively with us; there is also an active common seminar <http://nolot.perso.math.cnrs.fr/JourneesContrôleTransport2.html> .

7.2.2. *GCM (ANR project)*

This is a four year project ending in 2013, on Geometric Control Methods, Sub-Riemannian Geometry and Applications. It is organized in four “poles” and gathers people from Université du Sud Toulon-Var, Université de Bourgogne (Dijon), École Polytechnique (Paris), Nancy-Université, Université Joseph Fourier (Grenoble 1), Université Paris Sud, ParisTech ENSTA and Université Nice Sophia-Antipolis. Bernard Bonnard and Ludovic Rifford (leader of one pole) are members of this project. More details on the site; <http://www-fourier.ujf-grenoble.fr/~charlot/GCM.html>.

7.2.3. *MOA (GDR)*

Bernard Bonnard and Ludovic Rifford participate in this CNRS network on Mathematics of Optimization and Applications. <http://gdrmoa.univ-perp.fr/>.

7.3. European Initiatives

Collaborations with Major European Organizations

Technische Universität München, Department of Chemistry (Germany).

The applications of optimal control to MNR (see sections 4.2 and 5.1.2) are conducted with the group of Prof. Steffen Glaser in Munich.

7.4. International Initiatives

Inria International Partners

University of Hawaii, Department of Mathematics (U. S. A.)

There is a lon term collaboration on optimal control and control of quantum systems, see mostly section 5.1.1 . Besides, Gautier Picot, a former Phd student from Dijon has a temporary position at the Math Department and collaborates with M. Chyba and G. Patterson (second Phd student from M. Chyba) in relation with the Laboratoire d’Astronomie de Paris, to apply the Hampath code to make rendez-vous with quasi-asteroids entering in the solar system near the L1-Lagrange point, in the continuation of the work developed by G. Picot and B. Daoud. This collaboration is very active and has to be emphasized.

University of Toronto, Department of Mathematics (Canada)

Optimal Transport. Alice Erlinger’s PhD is co-supervised by Ludovic Rifford and John Mc Cann from University of Toronto. See section 5.4 .

7.5. International Research Visitors

7.5.1. Visits of International Scientists

Alessio Figalli, from University of Texas at Austin, visited twice, for a total of slightly more than a month.

7.5.2. Visits to International Teams

There is a strong collaboration with the control group in the University of Hawaii around M. Chyba. B. Bonnard visited the group twice in 2012-2013 (a total of 3 months). The purpose of the collaboration is to study the aspects of the contrast problem in Nuclear Magnetic Resonance, see section [5.1.1](#).

NACHOS Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR

8.1.1.1. Analysis of children exposure to electromagnetic waves (*KidPocket*)

Participants: Stéphane Lanteri, Joe Wiart [WHIST Laboratory, Orange Labs, Issy-les-Moulineaux].

The project-team is a partner of the KidPocket project (Analysis of RF children exposure linked to the use of new networks or usages) which is funded by ANR in the framework of the *Réseaux du Futur et Services* program and has started in October 2009 for a duration of 3 years.

See also the ewb page <http://whist.institut-telecom.fr/kidpocket>

8.1.2. Competitivy Clusters

8.1.2.1. Volumic, automatic, industrial and generic mesh generation (*MIEL3D-MESHER*)

Participants: Clément Durochat, Paul-Louis Georges [GAMMA project-team, Inria Paris - Rocquencourt], Stéphane Lanteri, Mark Lorient [Distene, Pôle Teratec, Bruyères-le-Chatel], Philippe Barabinot [LMS Samtech France].

MIEL3D-MESHER is a national project of the SYSTEM@TIC Paris-Région cluster which aims at the development of automatic hexahedral mesh generation tools and their application to the finite element analysis of some physical problems. One task of this project deals with the definition of a toolbox for the construction of non-conforming, hybrid hexahedral/tetrahedral meshes. In this context, the contribution of the team to this project aims at the development of a DGTD- $\mathbb{P}_p\mathbb{Q}_k$ method formulated on such hybrid meshes. Here, \mathbb{P}_p stands for the polynomial interpolation method on tetrahedral elements while \mathbb{Q}_k denotes the polynomial interpolation method on hexahedral elements.

8.1.3. Large-Scale Initiative

8.1.3.1. C2S@Exa - Computer and Computational Sciences at Exascale

Participants: Olivier Aumage [RUNTIME project-team, Inria Bordeaux - Sud-Ouest], Jocelyne Erhel [SAGE project-team, Inria Rennes - Bretagne Atlantique], Philippe Helluy [CALVI project-team, Inria Nancy - Grand-Est], Franck Cappello [GRAND-LARGE project-team, Inria Saclay - Île-de-France], Jean-Yves L'Excellent [ROMA project-team, Inria Grenoble - Rhône-Alpes], Thierry Gautier [MOAIS project-team, Inria Grenoble - Rhône-Alpes], Luc Giraud [HIEPACS project-team, Inria Bordeaux - Sud-Ouest], Stéphane Lanteri [Coordinator of the project], François Pellegrini [BACCHUS project-team, Inria Bordeaux - Sud-Ouest], Christian Perez [AVALON project-team, Inria Grenoble - Rhône-Alpes], Frédéric Vivien [ROMA project-team, Inria Grenoble - Rhône-Alpes].

Since January 2012, the team is coordinating the C2S@Exa http://www-sop.inria.fr/c2s_at_exa Inria large-scale initiative. This national initiative aims at the development of numerical modeling methodologies that fully exploit the processing capabilities of modern massively parallel architectures in the context of a number of selected applications related to important scientific and technological challenges for the quality and the security of life in our society. At the current state of the art in technologies and methodologies, a multidisciplinary approach is required to overcome the challenges raised by the development of highly scalable numerical simulation software that can exploit computing platforms offering several hundreds of thousands of cores. Hence, the main objective of the C2S@Exa Inria large-scale initiative is the establishment of a continuum of expertise in the computer science and numerical mathematics domains, by gathering researchers from Inria project-teams whose research and development activities are tightly linked to high performance computing issues in these domains. More precisely, this collaborative effort involves computer scientists that are experts of programming models, environments and tools for harnessing massively parallel systems, algorithmists that propose algorithms and contribute to generic libraries and core solvers in order to take benefit from all the parallelism levels with the main goal of optimal scaling on very large numbers of computing entities and, numerical mathematicians that are studying numerical schemes and scalable solvers for systems of partial differential equations in view of the simulation of very large-scale problems.

8.2. European Initiatives

8.2.1. Collaborations with Major European Organizations

Prof. Martin Gander: University of Geneva, Mathematics section (Switzerland)

Domain decomposition methods (optimized Schwarz algorithms) for the solution of the frequency domain Maxwell equations

Dr. Maciej Klemm: University of Bristol, Communication Systems & Networks Laboratory, Centre for Communications Research (United Kingdom)

Numerical modeling of the propagation of electromagnetic waves in biological tissues with biomedical applications

8.3. International Initiatives

8.3.1. Participation In International Programs

8.3.1.1. CNPq-Inria HOSCAR project

Participant: Stéphane Lanteri [Coordinator of the project].

Since July 2012, the team is coordinating the HOSCAR <http://www-sop.inria.fr/hoscar> Brazil-France collaborative project. The HOSCAR project is a CNPq - Inria collaborative project between Brazilian and French researchers, in the field of computational sciences. The project is also sponsored by the French Embassy in Brazil.

The general objective of the project is to setup a multidisciplinary Brazil-France collaborative effort for taking full benefits of future high-performance massively parallel architectures. The targets are the very large-scale datasets and numerical simulations relevant to a selected set of applications in natural sciences: (i) resource prospection, (ii) reservoir simulation, (iii) ecological modeling, (iv) astronomy data management, and (v) simulation data management. The project involves computer scientists and numerical mathematicians divided in 3 fundamental research groups: (i) numerical schemes for PDE models (Group 1), (ii) scientific data management (Group 2), and (iii) high-performance software systems (Group 3). Several Brazilian institutions are participating to the project among which: LNCC (Laboratório Nacional de Computação Científica), COPPE/UFRJ (Instituto Alberto Luiz Coimbra de Pós-Graduação e Pesquisa de Engenharia/Alberto Luiz Coimbra Institute for Graduate Studies and Research in Engineering, Universidade Federal do Rio de Janeiro), INF/UFRGS (Instituto de Informática, Universidade Federal do Rio Grande do Sul) and LIA/UFC (Laboratórios de Pesquisa em Ciência da Computação Departamento de Computação, Universidade Federal do Ceará). The French partners are research teams from several Inria research centers.

8.4. International Research Visitors

8.4.1. Visits of International Scientists

Prof. Martin Gander, University of Geneva, Switzerland, July 2-12

Prof. Jay Gopalakrishnan, Portland University, USA, July 2-6

Dr. Maciej Klemm, University of Bristol, UK, June 18-22

Dr. Sascha Schnepf, ETH Zurich, Switzerland, September 25-27

OPALE Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR

8.1.1.1. Project "OMD2", Optimisation Multi-Disciplinaire Distribuée (Distributed Multidisciplinary Optimization)

This project funded by ANR deals with the development of a software platform devoted to Multidisciplinary Design Optimization (MDO) in the context of distributed computing.

The notion of optimization platform based on distributed and parallel codes is undertaken with a distributed workflow management system running on a grid infrastructure using the GRID5000 middleware from Inria.

Renault is the coordinator of this project, which involves also EMSE, ENS Cachan, EC Nantes, Université de Technologie de Compiègne, CD-Adapco, Sirehna, Activeon, and Inria project TAO, OASIS and OPALE. This contract provides the grant supporting two PhD theses (A. Zerbinati and L. Trifan)

8.1.2. Project "OASIS"

The OASIS project, Optimization of Addendum Surfaces In Stamping, is an R&D consortium (CS, Arcelor-Mittal, ErDF, Inria, UTC, EURODECISION, ESILV, NECS, DeltaCAD, SCILAB-DIGITEO) of the Pole Systemic Paris-Region dedicated to develop an optimal design framework (methods-software platforms-applications) for stamping processes. The EPI OPALE/Inria is the leader within the consortium for the Optimization work-package (one of six WP), the role of which is to develop efficient tools well adapted to Pareto front identification of the multicriteria-dependent stamping processes.

The OASIS project yields 2.4 Meuro total financial support (one Ph.D thesis, two post-doctoral positions and 12 months internship for OPALE).

8.1.3. Project "Bulbe"

This project is funded by the Ministry of Fishing and gathers OPALE Project-Team, K-Epsilon company (specialized in CFD for naval hydrodynamics) and PROFIL compagnie (naval architect). The objective is to design and optimize bow shapes for trawler ships, in order to reduce the fuel consumption during fishing campaigns. Our role is to construct an automated optimization loop to improve bow efficiency, on the basis of CFD tools provided by K-Epsilon company and naval architect recommendations.

8.1.4. Project "Memoria"

This project is funded by the National Foundation for Aeronautics and Space (FNRAE). The partners are the University of Toulouse Paul-Sabatier and the CERFACS. The objective is to study optimization methods under uncertainty in the context of aerodynamic problems.

8.2. European Initiatives

8.2.1. FP7 Projects

8.2.1.1. EXCITING

Title: Exact Geometry Simulation for Optimized Design of Vehicles and Vessels

Type: COOPERATION (TRANSPORTS)

Instrument: Specific Targeted Research Project (STREP)

Duration: October 2008 - Mars 2012

Coordinator: Jozef Kepler universitet (Austria)

Others partners: SINTEF (SW), SIEMENS (GER), NTUA (GR), HRS (GR), TUM (GER), HYDRO (AUS), DNV (NOR)

See also: <http://exciting-project.eu/>

Abstract: The objective is to develop simulation and design methods and software based on the isogeometric concepts, that unify Computer-Aided Design (CAD) and Finite-Elements (FE) representation bases. Applications concern hull shape, turbine and car structure design.

8.2.1.2. GRAIN

Title: GReener Aeronautics International Networking

Type: CAPACITIES (TRANSPORTS)

Instrument: Coordination and Support Action (CSA)

Duration: October 2010 - December 2012

Coordinator: CENTRE INTERNACIONAL DE METODES NUMERICIS EN ENGINYERIA (Spain)

Others partners: AIRBUS (SP), ALENIA (I), EADS-IW (F), Rolls-Royce (UK), INGENIA (SP), NUMECA (B), U. SHEFFIELD (UK), U. BIRMINGHAM (UK), CIRA (I), VKI (B), AIRBORNE (NL), LEITAT (SP), CERFACS (F), U. CRANFIELD (UK), CAE (CN), GTE (CN), ARI (CN), FAI (CN), ASRI (CN), SAERI (CN), BIAM (CN), ACTRI (CN), BUAA (CN), NPU (CN), PKU (CN), NUAA (CN), ZJU (CN).

See also: <http://www.cimne.com/grain>

Abstract: The GReener Aeronautics International Networking (GRAIN) is a 24 month project co-funded by the 7th Framework Programme of the European Community (EC) and by the Chinese Ministry of Industry and Information Technology (MIIT). It is managed by the European Commission as a Coordination and Support Action. The main objectives of GRAIN are to identify and assess the future development of large scale simulation methods and tools needed for greener technologies reaching the Vision 2020 environmental goals. GRAIN will prepare the R&T development and exploitation with new large scale simulation tools used on distributed parallel environments to deeper understand and minimize the effects of aircraft/engine design on climate and noise impact. This objective can be met by supporting joint Europe-China networking actions for defining the necessary technologies to improve green aircraft performance.

8.2.1.3. MARS

Title: Manipulation of Reynolds Stress

Type: COOPERATION (TRANSPORTS)

Instrument: Specific Targeted Research Project (STREP)

Duration: October 2010 - September 2013

Coordinator: CENTRE INTERNACIONAL DE METODES NUMERICIS EN ENGINYERIA (Spain)

Others partners: USFD (UK), AIRBUS (SP), FOI (SW), ALENIA (IT), DLR (GER), CNRS (FR), DASSAULT (FR), NUMECA (BEL), UNIMAN (UK), EADS (UK)

See also: <http://www.cimne.com/mars/>

Abstract: The objective is to study flow control devices for aeronautical applications. This project gathers twelve European partners and twelve Chinese partners for a common work that includes both experimental and numerical studies. Opale Project-Team is in charge of developing numerical algorithms to optimize flow control devices (vortex generators, synthetic jets).

8.2.1.4. TraM3

Title: TRaffic Management by Macroscopic Models

Type: IDEAS

Instrument: ERC Starting Grant (Starting)

Duration: October 2010 - September 2015

Coordinator: Inria (France)

See also: <http://www-sop.inria.fr/members/Paola.Goatin/tram3.html>

Abstract: The project intends to investigate traffic phenomena from the macroscopic point of view, using models derived from fluid-dynamics consisting in hyperbolic conservation laws. The scope is to develop a rigorous analytical framework and fast and efficient numerical tools for solving optimization and control problems, such as queues lengths control or buildings exits design.

8.2.2. Collaborations in European Programs, except FP7

Program: PHC Polonium

Project acronym: CROM3

Project title: Crowd Motion Modeling and Management

Duration: jan. 2011 - dec. 2012

Coordinator: P. Goatin (France), M.D. Rosini (Poland)

Other partners: ICM, Warsaw University (Poland)

Abstract: The aim of this collaboration is to provide new analytical and numerical tools for solving control and optimization problems arising in pedestrian traffic management. Our scope is to develop a rigorous analytical framework and fast and efficient numerical tools for solving optimization and control problems, such as buildings exits design. This will allow to elaborate reliable predictions and to optimize traffic fluxes. To achieve this goal, we will study in details the structure of the solutions of the partial differential equations modeling traffic dynamics, in order to construct ad hoc methods to tackle the analytical and numerical difficulties arising in this study.

8.2.3. Collaborations with Major European Organizations

Partner 1: organisme 1, labo 1 (pays 1)

Sujet 1 (max. 2 lignes)

Partner 2: organisme 2, labo 2 (pays 2)

Sujet 2 (max. 2 lignes)

8.3. International Initiatives

8.3.1. Inria Associate Teams

8.3.1.1. ORESTE

Title: Optimal REroute Strategies for Traffic managEment

Inria principal investigator: PaolaGoatin

International Partner (Institution - Laboratory - Researcher):

University of California Berkeley (United States) - Electrical Engineering and Computer Science (EECS) - Alexandre M. Bayen

Duration: 2012 - 2014

See also: <http://www-sop.inria.fr/members/Paola.Goatin/ORESTE/>

ORESTE is an associated team between OPALE project-team at Inria and the Mobile Millennium / Integrated Corridor Management (ICM) team at UC Berkeley focused on traffic management. With this project, we aim at processing GPS traffic data with up-to-date mathematical techniques to optimize traffic flows in corridors. More precisely, we seek for optimal reroute strategies to reduce freeway congestion employing the unused capacity of the secondary network. The project uses macroscopic traffic flow models and a discrete approach to solve the corresponding optimal control problems. The overall goal is to provide constructive results that can be implemented in practice. Both teams have actively contributed to recent advances in the subject, and we think their collaboration is now mature enough to take advantage of the associate team framework. The Inria team and its theoretical knowledge complement the Berkeley team, with its engineering knowledge anchored in practice.

8.3.2. Participation In International Programs

- Inria@SILICONVALLEY :

ORESTE Associated Team with UC Berkeley takes part to the program.

- LIRIMA Team ANO 2010-2014:

The agreement governing the creation of the International Laboratory for Research in Computer Science and Applied Mathematics (LIRIMA) was signed on 24th November 2009 in Yaoundé. LIRIMA enables cooperation between Inria research teams and teams in Africa (Sub-Saharan Africa and the Maghreb) to be reinforced. It is the continuation of the major operation undertaken by the SARIMA program (2004-08 Priority Solidarity Fund created by the French Ministry of Foreign & European Affairs).

The LIRIMA team ANO : Numerical analysis of PDEs and Optimization is a partnership between Opale project and the EMI engineering college, Rabat / National Centre for Scientific and Technical Research (CNRST) Morocco. The Team leader is Prof. Rajae Aboulaïch, EMI. Other french participants are the Project Commands at Saclay, Palaiseau and the team-project DRACULA at Inria Lyon.

The ANO team is composed of ten senior researchers from Morocco and ten senior researchers from France and more than fifteen PhD students.

The themes investigated are biomathematics (Models for plants growth, cardiovascular and cerebral diseases, cardio image segmentation), mathematical finance (optimal portfolio, risk management, Islamic finance), multiobjective optimization in structural mechanics, and vehicle traffic and crowd motion.

8.4. International Research Visitors

8.4.1. Visits of International Scientists

8.4.1.1. Senior Researchers

Pr. Ellaia Rachid

Subject: Theory and algorithms for global and multiobjective optimization.

Institution: Ecole Mohammadia d'Ingénieurs (EMI) , Rabat (Morocco)

8.4.1.2. Internship

Bouthaina Yahyaoui, Asma Ghdami and Marwa Mokni

Subject: Multiobjective optimization of laminated composite Mindlin-Reissner plates

Institution: Institut Supérieur des Mathématiques Appliquées et d'Informatique, Kairouan, (Tunisia)

SCIPORT Team

7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. ANR

7.1.1.1. ECINADS

Sciport is coordinator of the ANR project ECINADS, with CASTOR team, university Montpellier 2, Institut de Mécanique des Fluides de Toulouse and the Lemma company in Sophia-Antipolis. ECINADS concentrates on scalable parallel solution algorithms for state and adjoint systems in CFD, and on the use of this adjoint for mesh adaptation applied to unsteady turbulent flows.

7.2. European Initiatives

7.2.1. FP7 Projects

Program: FP7-PEOPLE-2012-ITN

Project acronym: About Flow

Project title: Adjoint-based optimisation of industrial and unsteady flows

Duration: Nov 2012 - Oct 2016

Coordinator: J.-D. Mueller, Queen Mary University of London

Other partners: Engys (UK), ESI-Group (F), Inria (F), National Technical University of Athens (GR), Rolls Royce (D), RWTH Aachen University (D), Volkswagen AG (D), Warsaw University of Technology (PL).

Abstract: Adjoint-based methods have become the most interesting approach in CFD optimisation due to their low computational cost compared to other approaches. The development of adjoint solvers has seen significant research interest, and a number of EC projects have been funded on adjoint-based optimisation. In particular, partners of this proposal are members of the EC FP7 project FlowHead which develops complete adjoint-based design methods for steady-state flows in automotive design. Integration of the currently available shape and topology modification approaches with the gradient-based optimisation approach will be addressed, in particular development of interfaces to return the optimised shape into CAD for further design and analysis, an aspect that currently requires manual interpretation by an expert user. In industrial practice most industrial flows have small levels of instability, which leads to a lack of robustness and instability of the adjoint, such as trailing edge vortex shedding in turbo-machinery. Many industrial applications are also partly unsteady such as bluff body separation in cars or fully unsteady such as vertical-axis wind turbines. In unsteady adjoints 'checkpoints' of the flow solution at previous timesteps need to be recorded and algorithms for an effective balance between storage and recomputation need to be implemented. The recomputation involves significant memory and runtime overheads for which efficient methods are developed and implemented. The results of the project will be applied to realistic mid-size and large-scale industrial optimisation problems supplied by the industrial project partners ranging from turbo-machinery, to automotive to wind-turbines. Training will be provided by academic, industrial and SME partners in methods development, industrial application and software management. A large programme of complementary training in professional skills will be provided with support from all partners.

7.3. International Initiatives

7.3.1. Inria International Partners

The team's collaboration with the Mathematics and Computer Science (MCS) division of Argonne National Laboratory is recognised by Inria as an "Inria International Partnership". This partnership is named "SAR-DINE" for "Sophia-Antipolis ARgonne Differentiation INitiative".

7.3.2. Participation In International Programs

The team participates in the Joint Laboratory for Petascale Computing (Inria, University of Illinois at Urbana Champaign, Argonne National Laboratory). Laurent Hascoët gave talks at this year's meetings in Rennes and Argonne.

7.4. International Research Visitors

7.4.1. Visits of International Scientists

Trond Steihaug, professor at the University of Bergen, has spent a sabbatical period with the team, from september 2011 to may 2012. He worked on AD of Factorable and of Separable functions [15].

TOSCA Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR

- N. Champagnat and D. Villemonais are members of the ANR MANEGE (Modèles Aléatoires eN Écologie, Génétique et Évolution, started in 2009) whose aim is to provide methodological and conceptual advances in the study of stochastic processes modeling ecology, population genetics and evolution of life. This work is sustained by regular exchanges with biologists from several teams in France. In addition, the three working groups that operate in each of the three poles of the MANEGE project (Paris, Palaiseau, Marseille) gather all local probabilistic interests in the issues of this project. http://www.cmap.polytechnique.fr/~anr-manege/index_en.html
- N. Champagnat is member of the ANR MODECOL (Using mathematical MODELing to improve ECOlogical services of prairial ecosystems, which ended in August 2012), whose goal is to develop computational ecological modeling of terrestrial plants communities via the simulation of a prairie in relation with environmental data. This project focuses on developing an original toolbox that takes advantage of complementary mathematical disciplines (partial differential equations, individual-based stochastic modelling...) to assess ecological problems. Simulations will be extensively processed using distributed computing and webcomputing. Our target application concerns the setup of herbal strips around intensive cereal fields for purificating water from extra nitrate and pesticides, imposed by the European Common Agricultural Policy. <http://ecobio.univ-rennes1.fr/modecol/gb/description.php>
- S. Herrmann, J. Inglis, D. Talay and E. Tanré are member of the ANR MANDy (Mathematical Analysis of Neuronal Dynamics, started in 2009 under the direction of M. Thieullen, Univ. Paris 6). This project, which gathers mathematicians and neuroscientists, aims at developing mathematically rigorous approaches to neuroscience considering single neurons as well as interconnected neuronal populations. Our target is to conduct the mathematical analysis of existing models where there is still much work to be done and to enrich the modelling by proposing new models. See <http://www.proba.jussieu.fr/pageperso/thieullen/MANDy/accueil.html> for a more complete description of this project.
- A. Lejay is member of the ANR SIMUDMRI (Simulation of diffusion MRI signals in biological tissues) which started in November 2010 (directed by Jing-Rebecca Li, Inria Rocquencourt). <http://www.cmap.polytechnique.fr/~jingrebeccali/grants/simudmri.html>
- A. Lejay is member of the ANR H2MNO4 (ANR Cosinus, 2012–2015) on Original Optimized Object Oriented Numerical Model for Heterogeneous Hydrogeology which started in November 2012 (directed by Joceyline Erhel, IRISA, Rennes).

8.1.2. Contract with ADEME

Participants: Mireille Bossy, Jacques Morice.

Carbon value and carbon tax in the context of renewable energies deployment Since January 2009, M. Bossy was member of a collaboration funded by the French Environment and Energy Management Agency (ADEME), involving the Center for Applied Mathematics (CMA) at Mines ParisTech, and COPRIN and TOSCA teams at Inria Sophia Antipolis. It focuses on a short term carbon value derived from the so-called financial *carbon market*, the European Union Emission Trading Scheme (EU ETS), which is a framework for GHG emissions reduction in European industry.

The objective of this project is to study the compatibility and complementarity of a carbon tax and a target for renewable energy deployment. As a first step, we are developing a method for assessing the EU ETS value. We consider the constraints related to emission allowances distributed through national plans of allocation (NAP) and the mechanisms of taxes that are taking place. The work will focus on electricity producers, key players in the market in its first phase (NAP-I, 2005-2007). The impact of the *Renewable Energies* park of the electricity producers on their own carbon value will be particularly studied.

We have selected the financial concept of indifference price as a relevant methodology to assess the European Union Emission Trading Scheme (EU ETS) value. In this setting, modelling strategies of production and emission of market quotas rely on stochastic optimal control problems and associated Hamilton-Jacobi-Bellman equations.

This year, we worked on game theoretic approach for the carbon market price, in the framework of a cap&trade program. Based on the Nash equilibrium concept, we derive an equilibrium price equation for the allowances. The analysis of this equation and its wellposedness strongly depend on the design of the penalty function.

The final report [30] synthesizes of the results of all the work of this 2009-2012 ADEME Convention

8.1.3. Promotion of Mathematics in the industry

D. Talay is the Vice-President of the Fondation d'Entreprise Natixis which aims to contribute to develop research in quantitative finance. He also serves as a member of the Scientific Committee of the Foundation.

D. Talay is a member of the Scientific Committee of the AMIES National Agency aimed to promote interactions between Mathematics and Industry.

8.2. European Initiatives

8.2.1. FP7 Projects

- A. Lejay participates to the *Multifractonality* (action Marie Curie International Research Staff Exchange Scheme FP7-PEOPLE-IRSES-2008) with Nancy, Kiev, Israël and Cardiff (2009–2012).

8.3. International Initiatives

8.3.1. Inria Associate Team: ANESTOC

Title: Stochastic modelling of renewable energies

Inria principal investigator: Denis Talay

International Partner (Institution - Laboratory - Researcher):

Pontificia Universidad Católica de Chile (Chile) - ANESTOC - Rolando Rebolledo

Duration: 2011 - 2013

See also: http://www.anestoc.cl/es/?page_id=1112

This associate team complements a CIRIC research program in Chile. We refer to the TOSCA-ANESTOC project on stochastic modelling of renewable energies, especially wind farms, and oceanic resources. Our associate team ("équipe associée Inria") will conduct its joint research at two different levels. Firstly, the mathematical work on its own which we have called the "Mathematical Kernel" (MK), motivated by a number of fundamental problems raised by the specific applications in which we are interested. The second level of research concerns two main axes of Applications: (A1) Applications to Engineering (Renewable energies) and (A2) Applications to Neuroscience. The Mathematical Kernel includes a number of fields in the domains of Stochastic Analysis, Statistics and Numerical Analysis. In particular, it is worth mentioning the following: 1. Probabilistic resolution of Boussinesq non-linear partial differential equations; 2. Stochastic approach to Pope's equations on wind dynamics; 3. Open system dynamics as a bridge between Molecular Dynamics and Stochastic

Differential Equations; 4. Inference on Stochastic Processes; 5. Algorithms and simulation. The Applications include the stochastic modelling of renewable energy through ocean resources and wind farms (CIRIC-subproject). This subject will be developed with engineers of the Catholic University of Chile. In addition, applications to ion-channel dynamics through cell membranes will be considered jointly with biophysicists of the CINV (Neuroscience Centre of Valparaíso).

8.3.2. Inria International Partners

- TOSCA participates to the NCCR FINRISK (Financial Risk) forum launched by the Swiss National Science Foundation and managed by the University of Zürich.

8.3.3. Participation In International Programs

- D. Talay was the international coordinator of the MathAmsud program 08MATH05 - Stochastic Analysis and Mathematical Physics Research Network which started in 2009, also involved M. Bossy, A. Lejay and E. Tanré, and ended this year.
- M. Bossy, A. Lejay, D. Talay and E. Tanré are members of the CIRIC project *Stochastic Analysis of Renewable Energies: Ocean Energy and Wind Farms; dynamics and numerics* with Chile.

8.4. International Research Visitors

8.4.1. Visits of International Scientists

- L. Beznea (Simion Stoilow of the Institute of Mathematics of the Romanian Academy) has been visiting TOSCA Nancy for five weeks in April, November and December.
- Patricio Orio (Univ. of Valparaíso) visited TOSCA Sophia-Antipolis one week in October.
- The TOSCA *seminar* organized by J. Charrier and J. Inglis in Sophia Antipolis has received the following speakers: Rolando Rebolledo (Universidad de Chile), François Dufour (Université Bordeaux), Nicole El Karoui (Ecole Polytechnique, Palaiseau), Huyên Pham (Université Paris Diderot), Pierre Patie (Université Libre de Bruxelles), Pierre-Louis Lions (Collège de France), Nicolas Perrin (Inria Sophia Antipolis – Méditerranée), Philip Protter (Columbia University, USA), Mathieu Rosenbaum (CREST), Nicolas Bouleau (ENPC), Jean Jacod (Université Pierre et Marie Curie, Paris), Jonathan Mattingly (Duke University, USA), Patricio Orio (Universidad de Valparaíso, Chile), Carl Graham (Ecole Polytechnique, Palaiseau).

8.4.2. Internships

Souhail BOUKHEROUAA (from Mar 2012 until Aug 2012)

Subject: Evaluation of Value-at-Risk and applications to portfolio management

Institution: Université de Lorraine and Alphability

Yi LU (from May 2012 until July 2012)

Subject: Asymptotic expansions methods for options prices.

Institution: École Polytechnique

Rajarshi SARKHAR (from March 2012 until August 2012)

Subject: The First Passage Time Problem

Institution: University of Nice - Master Erasmus Mundus Mathmodes

Khaled SALHI (from Feb 2012 until Jun 2012)

Subject: Uncertainties and stochastic volatility models

Institution: Ecole Polytechnique de Tunisie (Tunisia)

8.4.3. Visits to International Teams

- M. Deaconu was invited one week by Fabio Nobile at the *Ecole Polytechnique Fédérale de Lausanne* in July.
- A. Lejay spend a month at the Bernoulli Center at Ecole Polytechnique Fédérale de Lausanne during the SPDE Semester.
- E. Tanré has visited University of Valparaíso and Pontifical University in Chile in January and March.

ABS Project-Team

6. Partnerships and Cooperations

6.1. National Initiatives

6.1.1. Projets Exploratoires Pluridisciplinaires from CNRS/Inria/INSERM

Reconstruction by Data Integration (RDI) is an emerging paradigm to reconstruct large protein assemblies, as discussed in section 4.1.3 .

Elaborating on our Toleranced Models framework, a geometric framework aiming at inherently accommodating uncertainties on the shapes and positions of proteins within large assemblies, we ambition within the scope of the two year long PEPS project entitled *Modeling Large Protein Assemblies with Toleranced Models* to (i) design TOM compatible with the flexibility of proteins, (ii) develop graph-based analysis of TOM, and (iii) perform experimental validations on the NPC.

6.2. European Initiatives

6.2.1. FP7 Projet

6.2.1.1. CG-Learning

Title: Computational Geometric Learning (CGL)

Type: COOPERATION (ICT)

Defi: FET Open

Instrument: Specific Targeted Research Project (STREP)

Duration: November 2010 - October 2013

Coordinator: Friedrich-Schiller-Universität Jena (Germany)

Others partners: Jena Univ. (coord.), Inria (Geometrica Sophia, Geometrica Saclay, ABS), Tech. Univ. of Dortmund, Tel Aviv Univ., Nat. Univ. of Athens, Univ. of Groningen, ETH Zürich, Freie Univ. Berlin.

See also: <http://cglearning.eu/http://cglearning.eu/>

Abstract: *The Computational Geometric Learning project aims at extending the success story of geometric algorithms with guarantees to high-dimensions. This is not a straightforward task. For many problems, no efficient algorithms exist that compute the exact solution in high dimensions. This behavior is commonly called the curse of dimensionality. We try to address the curse of dimensionality by focusing on inherent structure in the data like sparsity or low intrinsic dimension, and by resorting to fast approximation algorithms.*

6.3. International Research Visitors

6.3.1. Internships

- From May to July 2012, summer internship from Pratik Kumar (Indian Institute of Technology of Bombay). Topic: Modeling density maps in cryo electron microscopy.

ASCLEPIOS Project-Team

7. Partnerships and Cooperations

7.1. European Initiatives

7.1.1. FP7 Projects

7.1.1.1. VPH NOE

Participants: Benoît Bleuzé [correspondant], Olivier Clatz, Maxime Sermesant, Nicholas Ayache.

medinria registration toolbox VPH NOE standards

Title: VPH NoE

Type: COOPERATION (ICT)

Defi: Virtual Physiological Man

Instrument: Network of Excellence (NoE)

Duration: June 2008 - November 2012

Coordinator: University College London, UK

Others partners: Core members include UCL (UK), Oxford (UK), CNRS (FR), ULB (BE), U. of Nottingham (UK), UPF (ES), U. Auckland (NZ), EMBL (DE), U. Sheffield (UK), Karolinka (SE), ERCIM (FR), IOR (IT).

See also: <http://www.vph-noe.eu/>

Abstract: The Virtual Physiological Human Network of Excellence (VPH NoE) is a EU seventh Framework funded project, working to connect and support researchers in the VPH field within Europe and beyond. Inria is one of the core members, and is more dedicated, through Asclepios, to the data fusion part of the VPH toolkit. More precisely, a registration toolbox has been delivered which aims at including registration algorithms from the team and elsewhere into the new version of MedInria (2.x).

7.1.1.2. EUHEART

Title: euHeart

Type: COOPERATION (ICT)

Defi: Virtual Physiological Man

Instrument: Integrated Project (IP)

Duration: June 2008 - May 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. Those models need to be tightly integrated with signal and image processing tools in order to assist clinical decision making and to help reducing morbidity and mortality rates associated with cardiovascular diseases. Asclepios is leading a workpackage on radiofrequency ablation for which electromechanical models of the heart are used to improve the planning of radiofrequency ablation lines for patient suffering from atrial fibrillation and ventricular tachycardia. The research performed in this project is partially described in section 5.4.3 and 5.4.4 .

7.1.1.3. MedYMA

Title: Biophysical Modeling & Analysis of Dynamic Medical Images

Type: IDEAS ()

Instrument: ERC Advanced Grant (Advanced)

Duration: April 2012 - March 2017

Coordinator: Inria (France)

See also: <http://www.inria.fr/en/centre/sophia/news/medical-imagery-and-i.t.-the-personalised-digital-patient>

Abstract: During the past decades, exceptional progress was made with in vivo medical imaging technologies to capture the anatomical, structural and physiological properties of tissues and organs in a patient, with an ever increasing spatial and temporal resolution. The physician is now faced with a formidable overflow of information, especially when a time dimension is added to the already hard to integrate 3-D spatial, multimodal and multiscale dimensions of modern medical images. This increasingly hampers the early detection and understanding of subtle image changes which can have a vital impact on the patient's health. To change this situation, this proposal introduces a new generation of computational models for the simulation and analysis of dynamic medical images. Thanks to their generative nature, they will allow the construction of databases of synthetic, realistic medical image sequences simulating various evolving diseases, producing an invaluable new resource for training and benchmarking. Leveraging on their principled biophysical and statistical foundations, these new models will bring a remarkable added clinical value after they are personalized with innovative methods to fit the medical images of any specific patient. By explicitly revealing the underlying evolving biophysical processes observable in the images, this approach will yield new groundbreaking image processing tools to correctly interpret the patient's condition (computer aided diagnosis), to accurately predict the future evolution (computer aided prognosis), and to precisely simulate and monitor an optimal and personalized therapeutic strategy (computer aided therapy). First applications will concern high impact diseases including brain tumors, Alzheimer's disease, heart failure and cardiac arrhythmia and will open new horizons in computational medical imaging.

7.1.2. Collaborations in European Programs, except FP7

7.1.2.1. Care4Me

Participants: Xavier Pennec [Correspondant], Nicholas Ayache, Hervé Delingette, Kristin McLeod, Erin Stretton, Maxime Sermesant, Marco Lorenzi.

Program: ITEA2

Project acronym: Care4Me

Project title: Cooperative Advanced REsearch for Medical Efficiency

Duration: Sept. 2009 - Sept. 2013

Coordinator: Philips, NL.

Other partners: Alma (ES), Bull (FR), CEA (FR), CIMNE (ES), Compasiss (ES), CVSS (ES), Duodecim (FI), Erasmus MC (NL), ESI (NL), HSP (ES), Helsinki Hosp. (FI), ISI (GGR), LUMC (NL), MediConsult (FI), MEDIS (NL), Nokia (FI), Philips (NL), Pie Medical Imag. (NL), Pohjola (FI), Prowellness (FI), Robotiker (ES), UMC (NL), VTT (FI)

Abstract: This project aims at increasing quality and productivity in the healthcare care cycle by using more advanced medical imaging and decision support methods while combining them with different knowledge sources, from early diagnosis to treatment and monitoring. The final outcome of this project are clinical prototypes of novel medical image analysis and decision support systems for three specific disease areas (cancer, cardio-vascular and neurodegenerative diseases), that connect to the hospital information systems using a new system architecture. In this project, the role of the Asclepios team is to develop atlas of the ageing brain and the beating heart, and to model tumor growth.

7.2. International Initiatives

7.2.1. Inria Associate Teams

Title: Analysis of structural MR and DTI in neonates

Inria principal investigator: Pierre Fillard [Parietal]

Asclepios investigator: Xavier Pennec

International Partner (Institution - Laboratory - Researcher):

University of Pennsylvania (United States) - Penn Image Computing and Science Laboratory - Caroline Brun

International Partner (Institution - Laboratory - Researcher):

Institution: University of Southern California (United States)

Laboratory: Image Lab at Children Hospital at Los Angeles

Researcher: Natasha Leporé

Duration: 2011 - 2013

See also: <http://www.capneonates.org/>

While survival is possible at increasingly lower gestational ages at birth, premature babies are at higher risk of developing mental disorders or learning disabilities than babies born at term. A precise identification of the developmental differences between premature and control neonates is consequently of utmost importance. Nowadays, the continuously improving quality and availability of MR systems makes it possible to precisely determine, characterize and compare brain structures such as cortical regions, or white matter fiber bundles. The objective of this project is to understand the developmental differences of premature versus normal neonates, using structural and diffusion MRI. This work consists in identifying, characterizing and meticulously studying the brain structures that are different between the two groups. To do so, we join forces between the Parietal team at Inria and the University of Southern California. Parietal has a recognized expertise in medical image registration and in statistical analyses of groups of individuals. USC has a broad knowledge in MR image processing. In particular, the Children's Hospital at Los Angeles (CHLA), which is part of USC, is in the process of collecting a unique database of several hundreds of premature and normal neonates MR scans. This joint collaboration is consequently a unique chance of addressing key questions pertaining to neonatal and premature development. It will make it possible to elaborate new tools to analyze neonate MR images while tremendously increasing our knowledge of neuroanatomy at such an early stage in life.

7.2.1.1. COMPUTUMOR

Title: Computational Brain Tumor

Inria principal investigator: Olivier Clatz

International Partner:

Institution: Massachusetts Institute of Technology (United States)

Laboratory: Computer Science and Artificial Intelligence Laboratory (CSAIL)

International Partner:

Institution: German Cancer Research Center (United States)

Laboratory: DKFZ Heidelberg diffusion group

Duration: 2007 - 2012

See also: <http://www-sop.inria.fr/asclepios/projects/boston/>

The CompuTumor associated team has been funded early 2007 and renewed in 2009. The CompuTumor project is dedicated to the study of brain tumor models and their coupling with medical images to better assist diagnosis and therapy. The project strongly enhance the current collaborations between Inria and a group of world leading teams with complementary technical and clinical expertise on these topics in Boston and Nice. More specifically, the project aims at (a) proposing new medical image processing method that could be used to better analyze tumor images, (b) developing new brain tumor models in order to personalise these models with patient data. Microsoft Research has been also recently involved in the collaboration on lesion segmentation. Our most recent activity is described in sections 5.1.1 and 5.4.1 and also on the website of the associated team : <http://www-sop.inria.fr/asclepios/projects/boston/>.

7.2.2. Inria International Partners

7.2.2.1. Collaboration with international hospitals

7.2.2.1.1. St Thomas' Hospital, King's College London, United Kingdom

Maxime Sermesant is a part-time lecturer in the Interdisciplinary Medical Imaging Group, Division of Imaging Sciences, St Thomas' Hospital, King's College London lead by Pr Reza Razavi. The XMR facility within this hospital is a unique possibility to validate and exploit the cardiovascular modelling work.

7.2.2.1.2. Children Hospital, Boston

A collaboration with Dr Simon Warfield, director of the Computational Radiology Laboratory has been active for several years, especially on the issue of atlas-based image segmentation and registration.

7.2.2.1.3. Other International Hospitals

Collaborations with several other European hospitals have been established through the European projects Passport and euHeart.

7.3. International Research Visitors

7.3.1. Visits of International Scientists

- **Marc Niethammer** (Assoc. Prof. at the Biomedical Research Imaging Center (BRIC), Univ. North Carolina Chapel Hill). Hosted by the Inria-Microsoft common research lab. *Control methods in diffeomorphic non linear registration for longitudinal image analysis*. September to November.

ATHENA Project-Team

7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. ANR

7.1.2. ANR ViMAGINE

Participants: Maureen Clerc, Rachid Deriche, Alexandre Gramfort [Parietal project-team, ENST since september 2012], Emmanuel Olivi [Former member of the Athena Project-Team], Théodore Papadopoulo, Anne-Charlotte Philippe.

Duration: July 2008 to July 2013

The partners of this project are Athena, the LENA (CHU Pitié-Salpêtrière), and the Parietal project-team at Inria Futurs and Neurospin-Saclay.

This project takes a new challenge on the non invasive exploration of the Human visual system in vivo. Beyond the basic mechanisms of visual perception – which have already been investigated at multiple scales and through a large variety of modalities – we are primarily interested in proposing and exploring innovative solutions to the investigation of dynamic neural activations and interactions at the systems level. Bridging the elements involved in this endeavour requires that we are capable of observing, modelling and predicting the interplay between the anatomical/functional architecture of the brain systems and some identified timing properties of neural processes. The overall framework in which this project will be conducted is a federation of partners who will be bringing complementary expertise to this multidisciplinary research. The collaborators include experts in (1) electromagnetic and magnetic resonance brain imaging methods, (2) computational models of neural systems and (3) the neuroscience of vision. A central asset of our group is the easy access to state-of-the-art imaging platforms (e.g. high-density MEG and EEG arrays; 3T and 7T MR scanners) that will ensure the acquisition of quality experimental data.

7.1.3. ANR CO-ADAPT

Participants: Maureen Clerc, Dieter Devlaminck, Joan Fruitet, Sebastian Hitziger, Théodore Papadopoulo, Eoin Thomas, Romain Trachel.

Duration: December 2009 to December 2013

The partners of this projects are the INSERM U821 laboratory of Bron, the "laboratoire de Neurologie de la cognition" UMR6155 CNRS of Marseille, The Inria Lille Sequel project-team and the "Laboratoire d'Analyse Topologie et Probabilités UMR6632/CNRS of Université de Provence, Marseille.

Brain Computer Interfaces (BCI) provide a direct communication channel from the brain to a computer, bypassing traditional interfaces such as keyboard or mouse, and also providing a feedback to the user, through a sensory modality (visual, auditory or haptic). A target application of BCI is to restore mobility or autonomy to severely disabled patients, but more generally BCI opens up many new opportunities for better understanding the brain at work, for enhancing Human Computer Interaction, and for developing new therapies for mental illnesses.

In BCI, new modes of perception and interaction come into play, and a new user must learn to operate a BCI, as an infant learns to explore his/her sensorimotor system. Central to BCI operation are the notions of feedback and of reward, which we believe should hold a more central position in BCI research.

The goal of this project is to study the co-adaptation between a user and a BCI system in the course of training and operation. The quality of the interface will be judged according to several criteria (reliability, learning curve, error correction, bit rate). BCI will be considered under a joint perspective: the user's and the system's. From the user's brain activity, features must be extracted, and translated into commands to drive the BCI system. Feature extraction from data, and classification issues, are very active research topics in BCI. However, additional markers may also be extracted to modulate the system's behavior. It is for instance possible to monitor the brain's reaction to the BCI outcome, compared to the user's expectations. This type of information we refer to as meta-data because it is not directly related to the command, and it may be qualitative rather than quantitative. To our knowledge, there is so far no BCI system that integrates such meta-data from the user's brain. From the point of view of the system, it is important to devise adaptive learning strategies, because the brain activity is not stable in time. How to adapt the features in the course of BCI operation is a difficult and important topic of research. A Machine Learning method known as Reinforcement Learning (RL) may prove very relevant to address the above questions. Indeed, it is an adaptive learning method that explicitly incorporates a reward signal, which may be qualitative (hence allowing meta-data integration). The aim of CO-ADAPT is to propose new directions for BCI design, by modeling explicitly the co-adaptation taking place between the user and the system (web site <http://coadapt.inria.fr>).

7.1.4. ANR NucleiPark

Participants: Rachid Deriche, Aurobrata Ghosh, Anne-Charlotte Philippe, Emmanuel Caruyer, Jian Cheng.

Duration: *September 2009 to June 2013*

This project is about High field MR imaging (7T and 3T) of the brainstem, the deep nuclei and their connections in the parkinsonian syndromes with applications to prognosis, pathophysiology and improvement of therapeutic strategies. It involves three partners: The NeuroSpin team including C. Poupon and D. Le Bihan, the Inria with our project as well as the VISAGES project-team and the UPMC (University Pierre and Marie Curie, Paris) including INSERM U678 (H. Benali) and the CENIR (S. Lehericy).

The goal of the project is to find new neuroimaging markers of deep brain nuclei in neurodegenerative diseases that can be used for the diagnosis of Parkinsonian syndromes at the early stage. In addition, the goal is the characterization of lesions of deep brain structures and the detection of biomarkers of neuronal lesions in PD that can be related to clinical signs, such as gait disorders. Biomarkers of Parkinsonian syndromes could be used to create a diagnostic tool of the pathology and to correlate the identified markers with clinical signs. We will perform tractography of small fibre bundles using our HARDI techniques and Diffusion markers (anisotropy, apparent diffusion coefficient, fibre density, curvature, average diameter) will be collected along the reconstructed bundles.

Complementary parts of these objectives directly related to the acquisitions protocols have been accepted within the framework of another proposal submitted by the same partners and accepted for grant for two years (2009 & 2010) by the *France-Parkinson Association*

7.1.5. ANR MULTIMODEL

Participants: Théodore Papadopoulo, Maureen Clerc, Sebastian Hitziger.

Duration: *December 2010 to March 2014*

The general objectives of the MULTIMODEL project are twofold:

- Develop computational models at the level of neuronal systems that will help interpreting neuroimaging data in terms of excitation-, inhibition- and synchronization-related processes.
- Acquire multimodal datasets, obtained in rats and humans under physiological and epileptogenic conditions, which will be used to develop the biophysical models and to test their face validity and predictability.

Specifically, during this 3-year project, the following questions will be dealt with:

- How can models be integrated in order to link data from different modalities (electro/magneto-encephalography, optical imaging, functional MRI)?
- What is the influence of hidden parameters on the observed signals (e.g. ratio of excitation/inhibition and synchronization degree across regions)?
- To what extent can biophysical modelling bring valuable insights on physiological and pathological brain activity ?

We will operate at the level of population of cell, i.e. at a scale compatible with the resolution of neuroimaging tools (at the level of the mm). A novel model structure will be investigated. It will include astrocytes at this “mesoscopic” level and will operate in networks of connected regions. Moreover, models in physiological and pathological conditions will be compared, which will be a step towards a better understanding of mechanisms underlying epileptic condition.

The MULTIMODEL project stems from a conjoint INSERM-Inria scientific initiative launched in December 2008 and ended in 2010. It involves 5 partners (Inserm U751 in Marseille, U678 in Paris, U836 in Grenoble, U642 in Rennes and Inria Athena project-team).

7.1.6. ADT MedInria-NT

Participants: Jaime Garcia Guevara, Loïc Cadour, Théodore Papadopoulo, Maureen Clerc, Rachid Deriche.

Duration: *December 2010 to December 2012, prolonged to december 2014*

The goal of this technical project, funded by Inria for 2 years, is to introduce some tools developed at ATHENA into the medInria platform. There are basically two such facilities:

- Integrate the tools developed for the statistical characterization of brain white matter fiber bundles.
- Develop an interface for M/EEG data within MedInria. This will focus on two main goals:
 - Create a facility to read and visualize M/EEG signals.
 - Integrate M/EEG forward problem tools.

7.1.7. ADT OpenViBe-NT

Participants: Théodore Papadopoulo, Maureen Clerc, Loïc Mahé.

Duration: *October 2012 to December 2014*

OpenViBE is an opensource software which development started in 2005 with the goal of offering an open research tool for BCI and for supporting disabled people. Since its release in 2009, this software has received a lot of success (+10.000 downloads). But since 2005, new use have appeared as well as some limitations. The current software thus lacks of some features that limit its use, deployment and perenity. The goal of this ADT is to solve these problems, to improve and to extend OpenViBe One main goal is to improve the usability and the attractivity of the software and to retain a large community of users so as to ensure its sustainability. This ADT will allow to support the research made in four Inria teams (ATHENA, HYBRID, NEUROSYS and POTIOC) on hot topics such as adaptive or hybrid BCIs.

7.2. International Initiatives

7.2.1. Inria Associate Teams

7.2.1.1. BRAINCONNECTIVITIES

Title: Fusing anatomical and functional connectivity information using diffusion MRI, MEG and EEG.

Inria principal investigator: Théodore Papadopoulo

International Partners (Institution - Laboratory - Researcher):

University of Québec, School of Higher Technology (Canada) - PhysNum Group, Centre de recherches mathématiques, Montréal - Jean-Marc Lina

University of Sherbrooke (Canada) - Département d'Informatique - Maxime Descoteaux

Duration: 2012 - 2014

See also: <http://brainconnectivities.inria.fr/wordpress/>

Currently brain connectivity is studied through two different lenses: 1) Anatomical connectivity aims at recovering the “wires” that connect the various brain cortical “units”, 2) Functional connectivity studies when and how cortical regions are connected. Providing tools to fuse these two complementary views is the central goal of this project. Our effort will focus on three imaging modalities: diffusion MRI (dMRI), Electroencephalography (EEG) and Magnetoencephalography (MEG). dMRI (jointly with traditional MRI) provides a detailed anatomical view of the brain. It allows the recovery of the fiber structure of the white matter: these are the electrical connexions between distant cortical areas. But dMRI does not provide any clue on: 1) on the actual use of connexions during brain activity, 2) on the way information propagates along time for a given task. On the opposite, EEG and MEG (jointly named MEEG) provide (after source reconstruction) time courses of the activity of the cortical areas. It is possible to recover some connectivity information from these time courses, but these are purely signal based and do not take account of the anatomy so there are multiple solutions that are sometimes difficult to discriminate. Furthermore source reconstructions are regularized with purely mathematical a priori taking only partially account of the actual brain structures. The main goals of this project are to provide tools: 1) To acquire diffusion data more efficiently, 2) To use the information of dMRI to define better models and regularization schemes for spatio-temporal MEEG source reconstruction, 3) To use MEEG data to better understand the task-dependent spatio-temporal structure of connectivity patterns.

7.2.2. Participation In International Programs

7.2.2.1. STIC-Algérie

Title: Computational Diffusion MRI.

Inria principal investigator: Rachid Deriche

International Partners: Université des Sciences et des Technologies Houari Boumedienne (F. Boumghar, USTHB - Algiers) - Université de Boumerdes (D. Cherifi).

7.3. International Research Visitors

7.3.1. Visits of International Scientists

In the framework of the BrainConnectivities associate team:

- Pr. Linda Boumghar from USTHB (Université des Sciences et Technologies Hourai Boumedienne, Algiers) visited Athena from Jan. 30 to February 4th, 2012.
- Maxime Descoteaux and Michael Paquette (USherbrooke) visited Athena on Sept. 24th for a week.
- Gabriel Girard (USherbrooke) visited Inria from Sept. 24th to Oct. 26th.
- Jean-Christophe Houde and Maxime Chamberland (USherbrooke) visited Athena October 8-9th.
- Jean-Marc Lina and Younes Zerouali (CRM) visited Athena from Nov. 26 to Dec. 2 with the goal of starting integrating cortical patch information developed at Athena into the source localisation method developed at CRM.

In the framework of the STIC-Algérie program:

- Pr. Linda Boumghar from USTHB (Université des Sciences et Technologies Hourai Boumedienne, Algiers) visited Athena from Jan. 30 to February 4th, 2012.
- Thinhinane Megherbi and Sihem Zeggout from USTHB (Université des Sciences et Technologies Hourai Boumedienne, Algiers) visited Athena from May 17 to June 21th, 2012.

7.3.2. Internships

Tristan Milne (from May 2012 until Aug 2012)

Subject: Constrained Diffusion Kurtosis Imaging Using Ternary Quartics and MLE

Institution: Queen's University, Kingston, Ontario (Canada)

BIOCORE Project-Team

8. Partnerships and Cooperations

8.1. National initiatives

8.1.1. National programmes

- **ANR-GeMCo:** The objective of this project is to do model reduction, experimental validation, and control for the gene expression machinery in *E. coli*. The project is coordinated by M. Chaves (BIOCORE, Inria)
- **ANR-Symbiose:** The objective of this project is both to improve the energetic balance of biofuel microalgal productions and to recycle nitrogen and phosphorus. The project proposes to study the coupling between a microalgal production system and an anaerobic digester. The objectives of BIOCORE are to propose a model of the coupled system, and to compute the optimal fluxes between the various compartments in order to optimize the energy recovery. See <http://anr-symbiose.org/>
- **ANR-Facteur 4:** The objective of this project to propose non GMO strains of microalgae with enhanced performance. BIOCORE is involved in the directed selection of microalgae with interesting properties from an industrial point of view. The theory of competition is used to give a competitive advantage to some species. This competitive advantage can be provided by an online closed loop controller.
- **RESET:** The objective of this project is to control the growth of *E. coli* cells in a precise way, by arresting and restarting the gene expression machinery of the bacteria in an efficient manner directed at improving product yield and productivity. RESET is an “Investissements d’Avenir” project in Bioinformatics (managed by ANR) and it is coordinated by H. de Jong (Ibis, Inria)
- **FUI-Salinalgue:** The objective of this project is to take benefit of endemic microalgae species in areas of high salinity (previously used to produce salt) to produce both biofuel (either lipid based or methane) and co-products. BIOCORE is in charge of lab scale experiments and of the modeling of the process.
- **Green Stars:** Green Stars was laureate of the French call for projects known as the “French Stimulus Initiative” (Investissements d’Avenir), Institute of Excellence on Carbon-Free Energies. It federates a network of collaborative platforms bringing together all the players in the development of microalgae in France. The Institute includes 45 partners, including academics, large companies and SME. BIOCORE plays a key role in the project set up.

8.1.2. Inria funding

- **ColAge:** The goal of this joint Inria-INSERM consortium is to study bacterial growth and aging by using mathematical modeling and computational predictions to design and implement a *de novo* biological system. This Large-Scale Initiative Action is partly funded by Inria and supervised by H. Berry (Beagle, Inria).
- **Nautilus:** O. Bernard is coordinating the Inria-Nautilus ARC whose objective is to understand and model the coupling between hydrodynamics and microalgae photosynthesis.

8.1.3. INRA funding

- **Eco-tuta:** INRA-SPE is funding the project “Ecologie des communautés dans les agro-écosystèmes et implications pour la lutte biologique contre une espèce invasive: le cas *Tuta absoluta* sur tomate” in which BIOCORE is a partner with INRA Sophia Antipolis (2010-2012).
- **Propagules:** INRA-SPE is funding the project “Effet de différentes composantes de la pression de propagules sur le succès d’établissement d’un auxiliaire de lutte biologique” in which BIOCORE is a partner with INRA Sophia Antipolis (2011-2013).

- **Dynamique spatiale:** INRA-SPE is funding the project “Intégration des approches comportementales et démographiques de la dynamique spatiale des populations d’insectes” in which Biocore is a partner with INRA Sophia Antipolis and Agrocampus Ouest (2012-2014).
- **Metacarpe:** This INRA SPE-GAP-EFPA-EA project (call “Gestion durable des résistances des bio-agresseurs”) is entitled “Modélisation de l’évolution des traits d’histoire de vie en lien avec l’agressivité des champignons parasites biotrophes : application au pathosystème rouille-peuplier”. BIOCORE is taking part with CIRAD, INRA Sophia Antipolis, Nancy and Rennes (2010-2012).

8.1.4. Networks

- **RTP-M3D:** BIOCORE is a participant in the RTP-M3D workgroup (Mathématiques et décision pour le développement durable) that is supported by the “Environment and sustainable growth” department of CNRS. L. Mailleret is one of the co-leaders of M3D.
- **GDR PROBBE:** The objective of this GDR is the development of new biotechnological processes based on microorganisms producing metabolites which can be used as fuel for transportation (lipids, sugars, methane, hydrogen, ...). BIOCORE is taking part mainly in the modeling and control aspects of the processes involving anaerobic bacteria or microalgae.
- **COREV:** BIOCORE is an active participant in the research group COREV (Modèles et théories pour le contrôle de ressources vivantes et la gestion de systèmes écologiques).
- **Seminar:** BIOCORE organizes a regular seminar “Modeling and control of ecosystems” at the station zoologique of Villefranche-sur-Mer or at Inria.

8.2. European Initiatives

8.2.1. FP7 Projects

8.2.1.1. PURE

Title: Pesticide Use-and-Risk reduction in European farming systems with Integrated Pest Management

Type: COOPERATION (ICT)

Instrument: Collaborative Project (CP)

Duration: 2011 - 2014

Coordinator: Françoise Lescouret (INRA Avignon, FR)

Other partners: **Research:** Institut National de la Recherche Agronomique - INRA (FR) Rothamsted Research - RReS (UK) Aarhus University - AU (DK) Julius Kühn Institut - JKI (DE) Stichting DLO - DLO (NL) Wageningen University - WU (NL) Consiglio Nazionale delle Ricerche - CNR (IT) Agricultural Institute of Slovenia - KIS (SLO) James Hutton Institute - JHI (UK) Fondazione Edmund Mach - FEM (IT) Instituto Valenciano de Investigaciones Agrarias - IVIA (ES) Institute of Plant Protection - IOR (PL) University of Debrecen - Centre of Agricultural Sciences - UDCAS (HU) Joint Research Centre - Institute for Prospective Technological Studies - JRC-IPTS (EU) **Extension:** Knowledge Centre for Agriculture - VFL (DK) Association de Coordination Technique Agricole - ACTA (FR) **Industry:** Bayer Crop Science (DE) BIOTOP (FR) Natural Plant Protection (FR) Burkard Manufacturing Co Ltd (UK) Blgg Bv (NL) **Management:** INRA Transfert (FR)

See also: <http://www.pure-ipm.eu/project>

Abstract: The overall objective of PURE is to provide practical integrated pest management (IPM) solutions to reduce dependence on pesticides in selected major farming systems in Europe, thereby contributing to a reduction of the risks to human health and the environment and facilitating the implementation of the pesticides package legislation while ensuring continued food production of sufficient quality.

PURE will provide IPM solutions and a practical toolbox for their implementation in key European farming systems (annual arable and vegetable, perennial, and protected crops) in which reduction of pesticide use and better control of pests will have major effects. In that project, L. Mailleret develops modeling approaches dedicated to the optimization of plant protection methods relying on biological control and integrated pest management.

8.2.2. Collaborations with Major European Organizations

Univ. Polytechnique Mons: Service d'Automatique (B)
 Modeling of photosynthesis
 Imperial college, Department of Chemical engineering (UK)
 Modeling and optimization of microalgal based processes.
 Imperial College, Centre for Synthetic Biology and Innovation, Dept. of Bioengineering (UK)
 Study of metabolic/genetic models
 University of Stuttgart, Institute for Systems Theory and Automatic Control (D)
 Identification of gene networks

8.3. International Initiatives

8.3.1. Inria International Partners

Universidad Técnica Federico Santa María, Departamento de Matemática, Valparaíso, Chile
 Universidad de Chile, Departamento de Matemáticas, Ñuñoa Santiago, Chile
 Ben-Gurion University of the Negev, Microalgal Biotechnology Laboratory, Beer Sheva, Israel
 Center for Environmental Technology and Engineering, Massey University , Palmerston North, New Zealand.

8.3.2. Participation In International Programs

BIOCORE is involved in the Bionature project from Inria Chile – CIRIC (the Communication and Information Research and Innovation Center), in collaboration with four Chilean universities (Universidad de Chile, Universidad Tecnica Federico Santa Maria, Pontificia Universidad Catolica de Valparaiso, and Universidad de la Frontera). The Bionature project is devoted to natural resources management and the modeling and control of bioprocesses.

8.4. International Research Visitors

8.4.1. Visits of International Scientists

We only list the visitors that stayed more than 2 days in our project-team

- Benoit Chachuat (Imperial College, Department of Chemical Engineering, UK), 1 week;
- Andreas Nikolaou (Imperial college, Department of Chemical Engineering, UK), 2 months;
- Claude Aflalo (Ben Gurion University of the Neguev, Israel), 1 week;
- Jaime Moreno (UNAM, Automation and Environmental Bioprocesses Departments, Institute of Engineering, Mexico), 1 week;
- Andrei Akhmetzhanov (McMaster University, Department of Biology, Canada), 2 weeks;
- Gonzalo Robledo (Universidad de Chile, Facultad de Ciencias, Departamento de Matemáticas, Chile) , 2 weeks;
- Tomas Gedeon (Montana State University, Department of Mathematical Sciences, USA), 2 days.

8.4.1.1. Internships

Luis CASACCIA (from Apr 2012 until Sep 2012)

Subject: Mathematical and computational analysis of genetic regulatory networks

Institution: National University of Rosario (Argentina)

8.5. Project-team seminar

BIOCORE organized a 3-day seminar in October in Peyresq. On this occasion, every member of the project-team presented his/her recent results and brainstorming sessions were organised. Jérôme Harmand of the Inria MODEMIC team was invited to give talks on this occasion.

An additionnal 2-day seminar was dedicated to modeling and control of microalgae.

DEMAR Project-Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

8.1.1. SANOFI (*Montpellier financial support*)

Participants: Christian Geny (CHU Montpellier), Christine Azevedo-Coste, René Zapata (LIRMM), Lionel Lapierre (LIRMM).

Project SANOFI on developing a robot carrying a video camera for gait analysis of patients with neurological disorders.

8.1.2. CGS Merri (*Languedoc-Roussillon - Montpellier*)

Participants: Christian Geny (CHU Montpellier), Christine Azevedo-Coste, Simone Dalla Bella (UM1 M2H).

Development and evaluation of controlled assistive device for freezing of gait in Parkinson Disease, 30keuros.

8.2. National Initiatives

8.2.1. DEMAR / MXM Innovation Lab "*SoftStim*" project

Participants: David Guiraud, David Andreu.

Inria Innovation-Lab "SoftStim" project (2011-2014). 1 engineer (3 y.), 20keuros.

The aim of this Inria's national initiative is to favor the scientific collaboration and technological transfer of the innovation between DEMAR and MXM.

The aim of this project is to prototype concepts conjointly patented like stimulation unit 's embedded sequencer and processor (new set of instructions), and implantable FES controller with its dedicated software environment.

8.2.2. Cosinus ANR - *SoHuSim*

Participants: Benjamin Gilles, Mitsuhiro Hayashibe, David Guiraud, Maxime Tournier.

Project SoHuSim on modeling muscle tissue during contraction in 3D movements using SOFA software and functional modeling of the organs. 150 kE. Partners: Inria Evasion, Tecnalía, HPC, CHU Montpellier (Oct. 2010 - Oct. 2014).

8.2.3. ADT SENSAS - *SENSBIO*

Participants: Christine Azevedo-Coste, David Andreu.

SENSAS is an Inria ADT (Actions de Développement Technologique), implying several Inria project teams on the "SENSor network ApplicationS" theme. SENSAS aims to propose applications based on wireless sensor and actuator network nodes provided from the work done around senslab and sensstools preliminary projects. SENSAS is organized around the following work packages :

- SensRob : Robotics applications
- SensBio : Bio-Logging applications
- SensMGT : Wireless sensor/actuator network management/configuration applications
- SensBox : Wireless sensor/actuator network simulation applications and tools

Our team is mainly implied in the SensBio work package, in particular for the following applications: Spinal Cord Injured Patients FES-Assisted Sit to Stand, Post-Stroke Hemiplegic Patient FES-correction of drop foot, Gait analysis of parkinson freezing and Motion analysis of longterm race data.

8.2.4. Programme de recherche en qualité hospitaliere (PREQHOS)

Participants: Leader: Jean-Christophe LUCET (GH Bichat - Claude Bernard), Christine Azevedo-Coste, Eric Fleury (Inria), Bruno Grandsebastien (CHRU Lille).

Project: Surgery room behaviour and impact on infectious risks (ARIBO : Attitudes et Risque Infectieux au Bloc Operatoire)

8.2.5. INTENSE project

Participants: David Guiraud, Pawel Maciejasz, Olivier Rossel, Christine Azevedo-Coste, David Andreu, Fabien Soulier.

INTENSE (Initiative Nationale Technologique d'Envergure pour une NeuroStimulation Evoluée) is a PIA-PSPC Project (Programme Investissement d'Avenir, Projets RD Structurants des Pôles de Compétitivité) [2012-2018]. The aim of this project is to develop new implantable devices, based on neurostimulation, for heart failure.

Partners of this project are: DEMAR, SORIN CRM, MXM-Obélia, 3D plus, CEA-Leti, INRA Rennes, INSERM Rennes, HEGP, CHU Rennes.

8.3. European Initiatives

8.3.1. FP7 European project TIME

Participants: David Guiraud, David Andreu, Fabien Soulier, Pawel Maciejasz.

(2008-2012). 375keuros, "*Transverse, Intrafascicular Multichannel Electrode system for induction of sensation and treatment of phantom limb pain in amputees*". Partners : AAU (Aalborg, Denmark), MXM (Vallauris, France), SSSA (Pisa, Italy), IMTEK (Freiburg, Germany), UAB (Barcelona, Spain), UCBM (Roma, Italy), IUPUI (Indianapolis, USA).

8.4. International Initiatives

8.4.1. Inria Associate Teams

8.4.1.1. WALK

Title: Artificial Walking

Inria principal investigator: Philippe Fraisse

International Partner (Institution - Laboratory - Researcher):

Stanford University (United States) - Artificial Intelligence Lab

Duration: 2010 - 2012

See also: <http://www.lirmm.fr/~fraisie/@WALK/>

The motivation approach is the complementary research works of these teams. Indeed, a collaborative project should give an additional value to their research results. On one hand, the DEMAR Project Team has experience in Functional Electrical Stimulation to restore or modulate movements on spinal cord injured patients and post stroke patients. In both pathologies researches on assisted gait using FES (for paraplegics with a walker and hemiplegics) are carried out in the team. On the other hand, the Robotics research group (Stanford) carries out manipulation tasks with a humanoid robot under equilibrium constraints. Within the framework of the previous collaboration, the crossed visits and seminars last year led us to work on two different directions: - FES muscle modeling in Opensim framework - Control mechanisms underlying age-related changes in motor control strategies during Sit-To-Stand.

8.4.2. Inria International Partners

- Collaborative Research agreement on Academic Co-operation (contrat sans financement) "Neuro-muscular function analysis and identification for Rehabilitation" Partner: University of Tokyo (Prof. Yoshihiko Nakamura) Duration: 2011 - 2014

8.4.3. Participation In International Programs

8.4.3.1. STIC AmSud

Title: CARAT (Computer Aided Rehabilitation Algorithms and Tools)

Inria principal investigator: Mitsuhiro Hayashibe

International Partner (Institution - Researcher):

Universidade de Brasília (UnB,Brazil) - Antônio P.L. Bó, Geovany Borges

Pontificia Universidad Católica del Perú (PUCP,Brazil) - Dante Elias

Duration: 2012 - 2013

Throughout the world there is an increasing need for better technologies for rehabilitation and assistance. These new solutions must present improved performance in terms of therapy effectiveness, while at the same time minimizing the corresponding costs. In this scenario, computer-aided methods represent a promising alternative for the challenges currently faced by the rehabilitation domain. Within this collaborative research project, we focus on the following research topics: - Algorithms for human motion analysis for both clinical and residential settings based on portable and external sensing technologies - Sensory feedback devices to improve effectiveness on rehabilitation procedures - Robotic platforms for rehabilitation - Software development for telerehabilitation

8.5. International Research Visitors

8.5.1. Visits of International Scientists

- Prof. Keisuke Morishima (Professor, Osaka University) visited and presented his work on "Emergent Functionality of Cellular Buildup Wet Robotics" (15th, June 2012).
- Prof. Antônio P.L. Bó (Professor, Universidade de Brasília) visited and presented his work on "Human Centered robotics at UnB" (18th, July 2012).
- Prof. Thomas Stieglitz (Professor, Laboratory for Biomedical Microtechnology, Department of Microsystems Engineering - IMTEK, University of Freiburg) visited and presented his work on "Microtechnologies for Neural Implants" (17th, October 2012).
- Prof. Jessica Rose (Associate Professor, Department of Orthopedic Surgery, Stanford University and Director, Motion and Gait Analysis Lab, Lucile Packard Children's Hospital) visited and presented her work on "Gait Analysis in Cerebral Palsy: Applications for Artificial Walking Technologies" (17th, October 2012).
- Prof. Dejan B. Popović (Professor, University of Belgrade, Serbia and Aalborg University, Denmark) visited and presented his work on "Neuroprosthesis: A tool for neurorehabilitation or functional compensation?" (25th, October 2012).

8.5.2. Visits to International Teams

- Mitsuhiro Hayashibe gave invited talk at the Institute of Perception, Action and Behaviour (IPAB), University of Edinburgh, "Identification and Control of the Human Neuromuscular Dynamics toward Advanced Neuroprosthetics", February 2nd 2012.
- Mitsuhiro Hayashibe was Visiting Researcher at Nakamura lab, University of Tokyo and Tokyo University of Agriculture and Technology for JSPS-Inria Ayame project and worked on "Muscle Strength and Mass Distribution Identification Toward Subject-Specific Musculoskeletal Modeling" (March 2012).

- Mitsuhiro Hayashibe gave invited talk at workshop on EMG Technology and Application, Shanghai Jiao Tong University, May 7th 2012.
- Mitsuhiro Hayashibe visited the Laboratory of Automation and Robotics (LARA), Universidade de Brasília for STIC Amsud - CARAT project and made a seminar on "Modeling and identification for Neuroprosthetic systems and some related works for CARAT program" (20th May 2012 -4th June 2012).
- Mitsuhiro Hayashibe was Visiting Researcher at RIKEN BSI-TOYOYA research institute and worked on "Tacit Motor learning for rehabilitation" (Aug.-Sep. 2012).

MODEMIC Project-Team

8. Partnerships and Cooperations

8.1. International Initiatives

8.1.1. Inria Associate Teams

8.1.1.1. Associated team DYMECOS

Participants: T rence Bayen, Fabien Campillo, J r me Harmand, Claude Lobry, Alain Rapaport, Alejandro Rojas-Palma, Tewfik Sari, Matthieu Sebbah.

Program: **Associate Teams**

Title: DYnamical Microbial and Environmental eCOSystems

Inria principal investigator: Alain Rapaport

International Partners (Institution - Laboratory - Researcher):

Universidad de Chile / Departamento de Ingenier a Matem tica - Universidad de Chile / CNRS (Chile) / Centro de Modelamiento Matem tico (CMM) - H ctor Ram rez

Universidad Tecnica Federico Santa Maria (Chile) - Departamento de Matematica - Pedro Gajardo

Duration: 01/01/2010 - 31/12/2012

DYMECOS is an associated team with Chile, mainly with CMM (Centro de Modelamiento Matem tico), Univ. de Chile, Santiago, DIM (Departamento de Ingenier a Matem tica), Universidad de Chile, Santiago and Departamento de Matematica, Universidad Tecnica Federico Santa Maria (UTFSM).

Two kinds of investigations have been conducted:

- minimal time control problems of fedbatch processes with several species, and optimal strategies for the bioremediation of natural water resources,
- stochastic modelling of the chemostat.

The second Franco-Chilean Workshop on Bioprocess Modelling has been co-organized by the team and the Chilean partners in January at Puc n (see <https://sites.google.com/site/eadymecos/events>). The workshop gathers mathematicians, process engineers and micro-biologists.

C. Lobry, A. Rapaport and T. Sari have participated to the 3rd LAWOC (Latin American Workshop on Optimization and Control) held in Valparaiso, Chile [48], [52], [54].

This year, the team has received A. Rojas-Palma as a MSc Internship for 3 months, and M. Sebbah has been hired by Inria-CIRIC for a postdoctoral stay of 3 months in the team (Oct.-Nov. 2012) followed by 13 months in Chile (starting Jan. 2013).

8.1.2. Participation In International Programs

8.1.2.1. CIRIC-Bionature

The team has contributed to the writing proposal of the Bionature line of the CIRIC (Communication and Information Research and Innovation Center) in Chile.

The 16 months postdoctoral grant of M. Sebbah (3 months in France, 13 months in Chile) is supported by Inria-Chile within this research program (see Section 8.1.1.1).

8.1.2.2. TREASURE

Participants: Fabien Campillo, Jérôme Harmand, Claude Lobry, Tewfik Sari.

Program: **Euromediterranean 3+3**

Title: Treatment and Sustainable Reuse of Effluents in semiarid climates

Inria principal investigator: Jérôme HARMAND

International Partners (Institution - Laboratory - Researcher):

University of santiago de compostella (Spain) - Environmental engineering - Juan GAR-RIDO

National Research Center (Egypt) - Water Pollution Control - Helmy EL-ZANFALY

Université Française d’Egypte (Egypt) - mathématiques - Mohamed JAOUA

Institut National de la Recherche Agronomique (France) - dpts EA, MICA et MIA - Pascal NEVEU

University of Tlemcen (Algeria) - Automatic control - Brahim CHERKI

University of Patras (Greece) - Process Control Laboratory - Costas KRAVARIS

Centre de Biotechnology de Sfax (Tunisia) - Department of environmental engineering - Sami SAYADI

Université Cadi Ayyad de Marrakech -Faculté des Sciences de Semlalia - Dépt. de Mathématiques (Morocco) - Centre National de Recherche sur l’Eau et l’Energie - Laila MANDI

Ecole Nationale des Ingénieurs de Tunis (Tunisia) - Mathématiques - Nabil GMATI

The TREASURE network aims at integrating knowledge on the modelling, the control and the optimization of biological systems for the treatment and reuse of wastewaters in countries submitted to semi-arid climates under both socio-economical and agronomic constraints within the actual context of global changes. A special focus of the actual project concerns the integration of technical skills together with socio-economical and agronomic studies for the integrated solutions developed within the network to be evaluated and tested in practice in the partner’s countries and, as possible as it may be within the context of the actual research network, valorizing these proposed technologies with the help of industrial on site in partners from South.

8.1.2.3. LIRIMA Stic-Mada

Participants: Fabien Campillo, Angelo Raheiririna.

Program: **LIRIMA**

Title: Stic-Madagascar

Inria principal investigator: Fabien Campillo

International Partners (Institution - Laboratory - Researcher):

University of Antananarivo (Madagascar) - Lala Andriamampianina

University of Fianarantsoa (Madagascar) - Rivo Rakotozafy

The MODEMIC Project-Team is coordinator of the LIRIMA/Stic-Mada project for the theme: modelling and management of natural resources. In 2012, Angelo Raheiririna (co-advised with F. Campillo and R. Rakotozafy) made a 6 months stay in MODEMIC team-project, he will defend his thesis in January 2013 (see Section 6.2.8).

8.2. International Research Visitors

8.2.1. Visits of International Scientists

D. Dochain, from CESAME, Univ. Louvain-la-Neuve (Belgium), has spent one month in the team. D. Dochain is the coordinator of the CAFE project (see Section 7.1).

8.2.1.1. Internships

A. Rojas-Palma, MSc student at Univ. of Chile, has spent 3 months in the team, in the scope of the Inria Internships (see Section 8.1.1.1).

8.2.2. Visits to International Teams

B. Haegeman is on secondment to CNRS since September 2012. He is working at the Centre of Biodiversity Theory and Modelling which is part of the Station for Experimental Ecology in Moulis (Ariège).

MORPHEME Team

7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. LABEX SIGNALIFE

The MORPHEME team is member of the SIGNALIFE Laboratory of Excellence.

7.1.2. ARC DADA

Participants: Xavier Descombes [PI], Florence Besse, Huei Fang Yang, Alejandro Mottini.

The DADA project (Description et Analyse Dynamique de la Croissance Axonale) is a common projet with the SERPICO team from Inria Bretagne (Charles Kervrann). The goal is to develop new computational techniques to track axons during their growth. We consider 4D data obtained on a bi-photons microscope. In a longer term, we expect to model the morphological development of axons in different populations to characterize some disorders such as the fragile-X syndrom. (**DADA**).

7.1.3. ANR DIAMOND

Participants: Laure Blanc-Féraud [PI], Saima Ben Hadj.

In collaboration with the Pasteur Institute (Jean-Christophe Olivo Marin) , the MIPS laboratory of Université de Haute Alsace (Alain Dieterlen, Bruno Colicchio) , the LIGM of Université Paris-Est (Jean-Christophe Pesquet, Caroline Chaux, Hugues Talbot), and INRA Sophia-Antipolis (Gilbert Engler).

(**DIAMOND**)

7.1.4. ANR MOTIMO

Participants: Laure Blanc-Féraud, Xavier Descombes, Eric Debreuve, Huei Fang Yang, Clarens Caraccio.

In collaboration with Institut de Mathématiques de Toulouse, INRA, Institut de Mécanique des Fluides de Toulouse, Laboratoire J-A Dieudonné, et IMV Technologies (PME).

7.1.5. ANR POXADRONO

Participants: Florence Besse [PI], Xavier Descombes, Laure Blanc-Féraud.

The young researcher ANR project POXADRONO is in collaboration with Caroline Medioni, Hélène Bruckert, Giovanni Marchetti, Charlène Perrois and Lucile Palin from iBV. It aims at studying ARN regulation in the control of growth and axonal guidance by using a combination of live-imaging, quantitative analysis of images, bio-informatic analysis and genetic screening.

7.1.6. Inria Large-scale initiative Morphogenetics

Participants: Grégoire Malandain, Xavier Descombes.

This action gathers the expertise of three Inria research teams (Virtual Plants, Morpheme, and Evasion) and other groups (RDP (ENS-CNRS-INRA, Lyon), RFD (CEA-INRA-CNRS, Grenoble)) and aimed at understanding how shape and architecture in plants are controlled by genes during development. To do so, we will study the spatio-temporal relationship between genetic regulation and plant shape utilizing recently developed imaging techniques together with molecular genetics and computational modelling. Rather than concentrating on the molecular networks, the project will study plant development across scales. In this context we will focus on the Arabidopsis flower, currently one of the best-characterised plant systems.

7.1.7. PEPPI 1

Participants: Laure Blanc-Féraud, Xavier Descombes [PI], Alejandro Mottini.

This project aims at studying graphs in biological context (axons, vascular networks · · ·). In collaboration with Institut de Mécanique des Fluides de Toulouse, CerCo (Toulouse) .

7.1.8. *PEPII 2*

Participants: Laure Blanc-Féraud [PI], Xavier Descombes, Eric Debreuve, Clarens Caraccio.

In collaboration with Institut de Mathématiques de Toulouse, INRA, Institut de Mécanique des Fluides de Toulouse, Laboratoire J-A Dieudonné, et IMV Technologies (PME).

7.1.9. *Informal collaboration*

Participant: Eric Debreuve.

- Partners: Barbara André, Mauna Kea Technologies, Paris, France
- Subject: Automatic classification of endomicroscopic videos

7.2. International Research Visitors

7.2.1. *Visits of International Scientists*

- Roberto Cavicchioli, PhD student, University de Modena and Reggio Emilia. Visting period 01/04/2012 - 30/06/2012; MAEE Research grant.
- Alexandre Dufour, Pasteur Institute, Unité d'Analyse d'Images Quantitative CNRS URA 2582 "Interactions et dynamique cellulaires". 3 december 2012, seminar at I3S.
- Caroline Fonta, CerCo, Toulouse, 7 december 2012, seminar at iBV.
- Charles Deledalle, Ceremade, Paris Dauphine, 3 august 2012, seminar at I3S.

NEUROMATHCOMP Project-Team

6. Partnerships and Cooperations

6.1. National Initiatives

6.1.1. ANR

6.1.1.1. KEOPS

See section “International Initiatives” below.

6.2. European Initiatives

6.2.1. FP7 Projects

6.2.1.1. BRAINSCALES

Title: BrainScaleS: Brain-inspired multiscale computation in neuromorphic hybrid systems

Type: COOPERATION (ICT)

Defi: Brain-inspired multiscale computation in neuromorphic hybrid systems

Instrument: Integrated Project (IP)

Duration: January 2011 - December 2014

Coordinator: Universitaet Ruprecht- Karls Heidelberg (Germany)

Others partners: Nederlandse Akademie van Wetenschappen, Amsterdam; Universitetet For Miljo Og Biovitenskap, Aas; Universitat Pompeu Fabra, Barcelona; University of Cambridge, Cambridge; Debreceni Egyetem, Debrecen; Technische Universität Dresden, Dresden; CNRS-UNIC, Gif-sur-Yvette; CNRS-INCM, Marseille; CNRS-ISM, Marseille; TUG, Graz; Ruprecht-Karls-Universität Heidelberg, Heidelberg; Forschungszentrum Jülich GmbH, Jülich; EPFL LCN, Lausanne; EPFL-BBP, Lausanne; The University Of Manchester, Manchester; KTH, Stockholm; Universität Zürich, Zürich

See also: <http://brainscales.kip.uni-heidelberg.de/>

Abstract: The BrainScaleS project aims at understanding function and interaction of multiple spatial and temporal scales in brain information processing. The fundamentally new approach of BrainScaleS lies in the in-vivo biological experimentation and computational analysis. Spatial scales range from individual neurons over larger neuron populations to entire functional brain areas. Temporal scales range from milliseconds relevant for event based plasticity mechanisms to hours or days relevant for learning and development. In the project generic theoretical principles will be extracted to enable an artificial synthesis of cortical-like cognitive skills. Both, numerical simulations on petaflop supercomputers and a fundamentally different non-von Neumann hardware architecture will be employed for this purpose. Neurobiological data from the early perceptual visual and somatosensory systems will be combined with data from specifically targeted higher cortical areas. Functional databases as well as novel project-specific experimental tools and protocols will be developed and used. New theoretical concepts and methods will be developed for understanding the computational role of the complex multi-scale dynamics of neural systems in-vivo. Innovative in-vivo experiments will be carried out to guide this analytical understanding. Multiscale architectures will be synthesized into a non-von Neumann computing device realised in custom designed electronic hardware. The proposed Hybrid Multiscale Computing Facility (HMF) combines microscopic neuromorphic physical model circuits with numerically calculated mesoscopic and macroscopic functional units and a virtual environment providing sensory, decision-making and motor interfaces. The project also plans to employ petaflop supercomputing to obtain new insights into the specific properties of

the different hardware architectures. A set of demonstration experiments will link multiscale analysis of biological systems with functionally and architecturally equivalent synthetic systems and offer the possibility for quantitative statements on the validity of theories bridging multiple scales. The demonstration experiments will also explore non-von Neumann computing outside the realm of brain-science. BrainScaleS will establish close links with the EU Brain-i-Nets and the Blue Brain project at the EPFL Lausanne. The consortium consists of a core group of 10 partners with 13 individual groups. Together with other projects and groups the BrainScaleS consortium plans to make important contributions to the preparation of a future FET flagship project. This project will address the understanding and exploitation of information processing in the human brain as one of the major intellectual challenges of humanity with vast potential applications.

This project started on January 1st, 2011 and is funded for four years.

6.2.1.2. FACETS-ITN

Title: FACETS-ITN

Instrument: Initial Training Network (ITN)

Duration: September 2009 - August 2013

Coordinator: Universität Heidelberg- Ruprecht-Karls (Germany)

See also: <http://facets.kip.uni-heidelberg.de/ITN/index.html>

This 'Marie-Curie Initial Training Network' (funded by the EU) involves 15 groups at European Research Universities, Research Centers and Industrial Partners in 6 countries. It funds two PhD students in the NeuroMathComp group. Website: <http://facets.kip.uni-heidelberg.de/ITN/index.html>

6.2.1.3. MATHEMACS

Title: Mathematics of Multilevel Anticipatory Complex Systems

Type: Collaborative project (generic) (FP7-ICT)

Defi: develop a mathematical theory of complex multilevel systems and their dynamics.

Instrument: Integrated Project (IP)

Duration: October 2012 - September 2015

Coordinator: Fatihcan Atay, Max Planck Institute for Mathematics in the Sciences, Leipzig (Germany)

Other Partners: Max Planck Institute for Mathematics in the Sciences (Leipzig, Germany), Universität Bielefeld (Germany), Chalmers University of Technology (Gothenburg, Sweden), Ca'Foscari University of Venice (Italy), Università Politecnica delle Marche (Ancona, Italy).

See also: <http://www.mathemacsc.eu/description.html>

Abstract: The MATHEMACS project aims to develop a mathematical theory of complex multi-level systems and their dynamics. This is done through a general formulation based on the mathematical tools of information and dynamical systems theories. To ensure that the theoretical framework is at the same time practically applicable, three key application areas are represented within the project, namely neurobiology, human communication, and economics. These areas not only provide some of the best-known epitomes of complex multi-level systems, but also constitute a challenging test bed for validating the generality of the theory since they span a vast range of spatial and temporal scales. Furthermore, they have an important common aspect; namely, their complexity and self-organizational character is partly due to the anticipatory and predictive actions of their constituent units. The MATHEMACS project contends that the concepts of anticipation and prediction are particularly relevant for multi-level systems since they often involve different levels. Thus, as a further unique feature, the project includes the mathematical representation and modeling of anticipation in its agenda for understanding complex multi-level systems.

This project started on October 1st, 2012 and is funded for four years.

6.2.2. Collaborations in European Programs, except FP7

6.2.2.1. ERC NerVi

Program: ERC IDEAS

Project acronym: NerVi

Project title: From single neurons to visual perception

Duration: January 2009 - December 2013

Coordinator: Olivier Faugeras

Abstract: The project is to develop a formal model of information representation and processing in the part of the neocortex that is mostly concerned with visual information. This model will open new horizons in a well-principled way in the fields of artificial and biological vision as well as in computational neuroscience. Specifically the goal is to develop a universally accepted formal framework for describing complex, distributed and hierarchical processes capable of processing seamlessly a continuous flow of images. This framework features notably computational units operating at several spatiotemporal scales on stochastic data arising from natural images. Mean-field theory and stochastic calculus are used to harness the fundamental stochastic nature of the data, functional analysis and bifurcation theory to map the complexity of the behaviours of these assemblies of units. In the absence of such foundations, the development of an understanding of visual information processing in man and machines could be greatly hindered. Although the proposal addresses fundamental problems, its goal is to serve as the basis for ground-breaking future computational development for managing visual data and as a theoretical framework for a scientific understanding of biological vision.

6.3. International Initiatives

6.3.1. Inria Associate Teams

6.3.1.1. CORTINA

Title: Retina neural network coding

principal investigator: Frédéric Alexandre (Inria Mnemosyne)

International Partner:

Institution: University of Valparaiso (Chile)

Laboratory: Centro Interdisciplinario de Neurociencia de Valparaiso

Researcher: Adrian PALACIOS

International Partner:

Institution: UTFSM Valparaiso (Chile)

Laboratory: Direccion General de Investigacion y Postgrado

Researcher: Maria-Jose ESCOBAR

Duration: 2011 - 2013

See also: <http://cortex.loria.fr/Projects/Cortina>

Much progress has been made in the last decades in understanding the basic organization and function of the nervous system in general. Contributions to this end have come from various domains including computational neuroscience and numerical science of the information in general. The goal of this associate team is to combine our complementary expertise, from experimental biology and mathematical models (U de Valparaiso and U Federico Santa-Maria) to computational neuroscience (CORTEX and NEUROMATHCOMP), in order to develop numerical tools for the study and characterization of neural coding and related sensory-motor loops. Recording and modeling spike trains from the retina neural network, an accessible part of the brain, is a difficult task that our partnership

can address, what constitute an excellent and unique opportunity to work together sharing our experience and to focus in developing computational tools for methodological innovations. To understand How the neural spike coding from natural image sequences works we are addressing the following issues: How visual signals are coded at earlier steps in the case of natural vision? What are their functions? What are the computational "coding" principles explaining (in artificial or biological system) the statistical properties of natural images? We wish to advance our actual knowledge in natural and artificial visual signals processing and apply it to the field of education; to foster better capacities for learning and memory; sensory prosthesis design, to will help unpaired sensory persons to sense the world and physical rehabilitation, among others. In the context of the cooperation between the Inria and Chile we propose to develop new neural decoding algorithms that are transverse to several field and applications.

6.3.2. Participation In International Programs

6.3.2.1. ANR KEOPS

Title: Algorithms for modeling the visual system: From natural vision to numerical applications.

principal investigator: Thierry Viéville (Mnemosyne)

International Partner:

Institution: University of Valparaiso (Chile)

Laboratory: Centro Interdisciplinario de Neurociencia de Valparaiso

Researcher: Adrian PALACIOS

International Partner:

Institution: UTFSM Valparaiso (Chile)

Laboratory: Direccion General de Investigacion y Postgrado

Researcher: Maria-Jose ESCOBAR

Duration: 2011 - 2013

See also: <http://cortex.loria.fr/Research/Keops>

KEOpS attempts to study and model the non-standard behavior of retinal (ganglion cells) sensors observed in natural scenarios. KEOpS also attempts to incorporate the resulting models into real engineering applications as new dynamical early-visual modules. The retina, an accessible part of the brain, is a unique model for studying the neural coding principles for natural scenarios. A recent study proposes that some visual functions (e.g. movement, orientation, anticipatory temporal prediction, contrast), thought to be the exclusive duty of higher brain centers, are actually carried at the retina level. The anatomical and physiological segregation of visual scenes into spatial, temporal and chromatic channels begins at the retina through the action of local neural networks. However, how the precise articulation of this neural network contributes to local solutions and global perception necessary to resolve natural task remains in general a mystery. KEOpS thus attempts to study the complexity of retinal ganglion cells (the output to the brain) behaviors observed in natural scenarios² and to apply this result to artificial visual systems. We revisit both the retinal neural coding information sent to the brain, and at the same time, the development of new engineering applications inspired by the understanding of such neural encoding mechanisms. We develop an innovative formalism that takes the real (natural) complexity of retinal responses into account. We also develop new dynamical early-visual modules necessary to solve visual problems task.

6.4. International Research Visitors

6.4.1. Visits of International Scientists

- Panagiota Theodoni, 11-15 september 2012.
- Gaspar Tkacik, IST Austria, Wien, 04-07 July 2012.

- Olivier Marre, Institut de la Vision, Paris, 04-07 July 2012.
- Thierry Mora, Laboratoire de Physique Statistique, ENS Ulm Paris, 04-07 July 2012.
- Martin Golubitsky, Mathematical Biology Institute (Columbus Ohio) 09-13 June 2012
- Reiner Lauterbach, Mathematics Departement, Hambourg 09-13 June 2012
- Arnd Scheel, Mathematics Department, U of Minnesota (Minneapolis) 09-13 June 2012.

6.4.1.1. Internships

- Viktor Shcherbakov, Master 2, March-July 2012.

VIRTUAL PLANTS Project-Team

6. Partnerships and Cooperations

6.1. Regional Initiatives

6.1.1. *OpenAlea*

Participants: Christophe Pradal, Christophe Godin, Christian Fournier [INRA, LEPSE].

Funding: Agropolis foundation (Contractors for Virtual Plants: CIRAD and Inria from 2009 to 2013)

The aim of this project is to foster the development and the national and international diffusion of the platform OpenAlea. This opensource platform provides an easy-to-use environment for plant modelers through a visual programming interface to efficiently use and combine models or computational methods from different scientific fields in order to represent, analyze and simulate complex plant systems at different scales, from meristems to plant canopy. OpenAlea makes it possible to assemble highly reusable, heterogeneous components. The central point of its architecture is to allow to integrate existing components or modules developed by different teams without rewriting them. These components are developed in multi-languages like C, C++, Fortran or Java as well as Python. Work comprises development of standard data structures, deployment tools, documentation, training, software engineering, user interface, ...

6.1.2. *Fruit3D*

Participants: Mik Cieslak, Frédéric Boudon, Christophe Godin, Nadia Bertin [PSH, Avignon].

Funding: Agropolis foundation (Contractor for Virtual Plants: INRA, from 2009 to 2012)

The aim of this project is to develop a virtual tomato that contains the geometrical description of a growing fruit, physiological models (for sugar and hormone transfers) and mechanical model. The project gathers the competences of plant modelers, physicists and ecophysiologists. Physical and biological laws involved in tissue differentiation and cell growth, in relation to fruit growth and compartmentalization, and a number of related traits of quality (e.g. size, composition and texture) are modeled and integrated within the virtual tomato. Magnetic Resonance Imaging (MRI) techniques are used to provide an in vivo validation of the model by non invasive measurements.

Partners: PSH, INRA, Avignon; LCVN, IES, Université Sud de France, Montpellier.

6.1.3. *PlantScan3D*

Participants: Frédéric Boudon, Chakkrit Preuksakarn, Jean-Baptiste Durand, Christophe Godin, Christian Fournier.

Funding: Agropolis foundation (Contractor for Virtual Plants: CIRAD, From 2009 to 2012)

Automatic acquisition of plant phenotypes, and in particular of architecture phenotypes, constitutes a major bottleneck of the construction of quantitative models of plant development. Recently, 3D Laser scanners have made it possible to acquire 3D images on which each pixel has an associated depth corresponding to distance between camera and the pinpointed surface of the object. The objective of this project is to develop the use of laser scanner for plant geometry reconstruction. For this, we develop methodologies for the automation of numerical 3D acquisition of vegetal structures of different sizes, and new methods for the reconstruction of parsimonious geometrical and structural models usable in agronomic and biological contexts.

Partners: AFEF Team, UMR AGAP, UMR LEPSE (Montpellier), UMR PIAF (INRA Clermont Ferrand), UMR URP3F (Inra Lusignan), EPI Galaad (Inria Sophia Antipolis), EPI Imagine (Inria Grenoble). University of Helsinki, Finland.

6.1.4. Agropolis computational plant seminar

Participants: Yann Guédon, Christine Granier [INRA, LEPSE], Soazig Guyomarc'h [Montpellier 2 University, DIADE].

Funding: Agropolis foundation (Contractor for Virtual Plants: CIRAD. From 2008 to 2012)

In the context of the creation of a world-level pole on plant science in the région Languedoc-Roussillon, we created a monthly seminar on plant modeling and its applications. The seminar is organized by Yann Guédon, Christine Granier (INRA, LESPE) and Soazig Guyomarc'h (Montpellier 2 University, DIADE) with the support of Agropolis International and Agropolis Foundation.

6.1.5. Rhizopolis

Participants: Frédéric Boudon, Christophe Godin, Yann Guédon, Christophe Pradal.

Funding: Agropolis foundation (Contractor for Virtual Plants: INRA, from 2011 to 2013)

Rhizopolis is a multidisciplinary project on the biology and ecology of the plant root that addresses the broad roles of this organ in mineral nutrient and water acquisition. The consortium addresses central issues of root development, that are operationally divided into 3 work packages.

- WP A: Integration of membrane transport activity and structure-function relationships in roots and root symbioses.
- WP B: Key tools for imaging root development: (i) a world unique platform for 4D root imaging of root cell division and root primordia formation, and (ii) an innovative image analysis software for high-throughput phenotyping of root system architecture. These tools will be used to identify mechanisms and traits associated with root system efficiency and plasticity
- WP C: Integrating root-soil interactions in the rhizosphere at the whole root system level – application to water and nutrient acquisition by plants.

Virtual Plants is mainly involved in WP B and in particular in the development of a tool to automatically reconstruct root systems from 2D imaging.

Partners: DAR Team, UMR AGAP, UMR BPMC and UMR LEPSE (Montpellier).

6.2. National Initiatives

6.2.1. ANR

6.2.1.1. Morpholeaf

Participants: Christophe Godin, Etienne Farcot.

Funding: ANR (Contractor for Virtual Plants: Inria, From 2011 to 2014)

The goal of this project is to apply a systems biology approach combining biological investigation and modeling on leaf margin development to elucidate how gene networks and hormone signalling are translated into specific growth patterns and generate complex shapes. The leaf is the main photosynthetic organ of the plant and its margin can show diverse levels of dissections ranging from no (entire margin), mild (serration) to strong (lobes) incisions. The leaf itself can be either simple or dissected into units called leaflets. The CUC genes are part of a network involving negative regulation by a miRNA, miR164 and possible response of the signalling molecule auxin. However, the interplay between the three actors of this network (CUC, miR164 and auxin) is not understood yet. Nor are known the cellular effects of the expression of the CUC genes and their link with differential growth of the leaf margin leading to serration. This project brings together three groups that have complementary expertises in biology, image analysis and modeling to provide new insights into the mechanisms of leaf margin development. By combining biological observations and manipulations, quantitative measurements and modeling, we will specifically determine the dynamics of CUC/miR164/auxin activities during leaf development and their interrelations, establish the contributions of cell proliferation and cell expansion to leaf serration and leaf shape and address the contribution of auxin and CUC2 to differential growth and hence to leaf serration and leaf shape. We will, stepwise, build, test and validate a model of leaf margin development integrating a regulatory network, cellular behaviour and morphogenesis.

Partners: RDP ENS-Lyon; INRA Versailles.

6.2.1.2. *HydroRoot*

Participants: Mikaël Lucas [IRD], Christophe Pradal, Christophe Godin, Christophe Maurel [BPMP].

Funding: ANR (Contractor for Virtual Plants: Cirad, From 2012 to 2014)

The HydroRoot project proposes a unique combination of approaches in the model plant *Arabidopsis thaliana* to enhance our fundamental knowledge of root water transport. Accurate biophysical measurements and mathematical modeling are used, in support of reverse and quantitative genetics approaches, to produce an integrated view of root hydraulics. The HydroRoot project will address as yet unknown facets of root water transport. It will lead to an integrated view of root hydraulics that considers both tissue hydraulics and root architecture and explains how these components are controlled at the molecular level by physiological and/or environmental cues. Because of its strong physiological and genetic background, this research may also directly impact on breeding programs, for production of crops with optimised water usage and stress responses.

6.2.2. *Other national grants*

6.2.2.1. *OpenAlea 2.0*

Participants: Julien Coste, Christophe Pradal, Christophe Godin, Didier Parigot [Inria, Zenith].

Funding: Inria ADT (Contractors for Virtual Plants: Inria from 2012 to 2014)

The goal of this project is to develop an integrated multi-paradigm software environment for plant modeling. This environment will allow the user to draw, model, program or combine models interactively. In a first step, the component architecture of OpenAlea 1.0 will be extended to dynamically add plugin application. In a second step, we move to a decentralized architecture, capable of distributing simulations in the cloud and share virtual experiments on the web. Finally, the modeling environment to be adapted to run in a web browser using HTML5 and WebGL technology

Partners: EPI Zenith

6.2.2.2. *Echap*

Participants: Christophe Pradal, Christian Fournier, Corinne Robert [INRA, EGC].

Funding: ONEMA (Contractor for Virtual Plants: INRA, From 2012 to 2014)

The objective of the ECHAP project is to reduce the frequency of treatments and the doses of pesticides applied on crops by taking advantage of natural mechanisms of disease escape related to crop architecture and by optimizing interception of pesticides by plant canopies. This is a demonstration project focusing on the wheat septoria system, but the modeling approach is generic and intended to apply to other pathosystems. The originality of the project is based on: (i) the plant material used, consisting of innovative wheat varieties selected for their ability to produce contrasting architectures, (ii) the development of an integrative modeling tool coupling the canopy development, the fate of fungicides and the dynamics of the pathogen, and (iii) a proposed approach to multicriteria evaluation of protection strategies including estimation of yields, assessments of environmental impact of pesticides and erosion of efficacy. The project focuses on the development of a modeling tool. This tool is organized around three components: (1) the effect of the architecture of crops on epidemics, (2) the effect of fungicides on infection cycles and (3) the effect of canopy architecture on the fate of fungicides after application. The integration of the three components are performed within the OpenAlea platform that will allow the multicriteria evaluation of various scenarios (climate / varieties / architecture / fungicides) and help design new practices. Field experiments allow testing of treatment strategies associated with a variety of architectures. Data will be used to validate the modeling tool developed. Thanks to the integrated model various scenarios combining climate architecture x fungicide treatment will be simulated to identify and propose efficient strategies for pesticide applications.

Partners: UMR EGC (Paris-Grignon), UMR LEPSE (Montpellier), ARVALIS (Institut du végétal, France), ALTERRA (Research Institute for the Green World, The Netherlands) , ADAS Intitute (UK), CNRS, and IRSTEA .

6.2.2.3. Morphogenetics

Participants: Christophe Godin, Frédéric Boudon, Christophe Pradal, Etienne Farcot, Yann Guédon.

Funding: Inria Action d'Envergure(From 2011 to 2015)

Morphogenetics is an Inria transversal project gathering 3 Inria teams and two Inra teams. It is aimed at understanding how flower shape and architecture are controlled by genes during development. To do so, we study the spatio-temporal relationship between genetic regulation and flower shape utilizing recently developed imaging techniques together with molecular genetics and computational modeling. The project addresses flower development at different scales using the Arabidopsis flower, currently one of the best-characterised plant systems. The workplan is divided into three major parts:

- Through quantitative live-imaging analysis at cellular resolution we will determine how specific gene functions affect both growth patterns and the expression of other key regulators. In particular, by using induced gene disruption together with careful live-imaging analysis, we will obtain dynamic, quantitative and causal data that link gene expression and molecular interactions to morphogenesis at a higher scale.
- We will integrate the results generated from these experiments in a specially designed database called a 3D Atlas.
- We will use these detailed, multidimensional data as direct input to new predictive computational models for morphogenesis and gene regulation that will then be further tested through subsequent rounds of experimental perturbation and analysis. A particular emphasis will be put on the modeling of mechanics in tissues for which different approaches will be developed.

Partners: ENS-Lyon; Imagine Inria Team (Grenoble); Morpheme Inria Team (Sophia-Antipolis).

6.2.2.4. Rose

Participants: Christophe Godin, Frédéric Boudon, Christophe Pradal.

Funding: INRA - Projet de Pari Scientifique (From 2012 to 2014)

Lateral bud outgrowth of aerial stems in plants is known to be regulated by hormonal signals such as auxin and cytokinin. Recently detailed modeling approaches have been successfully developed to explain such regulation. However, it is known that on many species the sugar status of the plant also plays a role in shoot branching. In this project we want to quantify this role and to understand how sugars interfere with hormonal signals to regulate bud outgrowth. For this, experiments will be made on Rose stems to test different levels of sugar conditions and hormonal concentrations on bud outgrowth. An extension of the recently published hormonal model of apical dominance will be made to take into account the role of carbon as a signaling molecule. As a result, it is expected that main branching habits can be reproduced with the model and that experiments can be designed in order to test model predictions.

Partners: UMR SAGAH, Angers

6.3. International Bilateral Relations

6.3.1. ERASysBio+ iSAM

Participants: Christophe Godin, Etienne Farcot, Jan Traas, Teva Vernoux, James A.H. Murray [Univ. Cardiff, UK], Yrjö Helariutta [Univ. Helsinki, Finland].

(Contractor for Virtual Plants: Inria. From September 2008 to September 2011)

This project essentially aims at improving our knowledge of shoot apical meristem, and more specifically the combined action of auxin and cytokinin, using a systems biology approach. It is part of a wider program, the ERASysBio initiative, a consortium of European funding bodies, ministries and project management agencies. The purpose of this consortium is to develop fundamental and strategic collaboration in the funding of systems approaches to biological research. The iSAM project is one of the 16 transnational consortia that have been selected out of 51 proposals; in total they comprise 85 working groups from 14 countries. Four partners are involved in iSAM: the group of J. Murray will focus on mutants of cell cycle regulation, the group of Y. Helariutta is specialized in several aspects of cytokinin regulation, while the group of J. Traas in Lyon provides input regarding auxin regulation and transport, and Virtual Plants is in charge of the modeling aspects, in synergy with the three other groups.

More information on the project can be found at <http://www.erasysbio.net/index.php?index=277>.

6.3.2. Other bilateral relations

Yann Guédon is working with Claudia Negrón (PhD student) and Ted DeJong (University of California, Davis) on the influence of water stress and pruning practices on the branching and axillary flowering structures of almond shoots.

6.4. International Initiatives

6.4.1. Inria International Partners

There is currently a very active connection with the group of Malcolm Bennett, at the Centre for Plant Integrative Biology (CPIB) in Nottingham, UK. The CPIB invests in the development of OpenAlea at the tissue level. In this context, both groups have regular meetings and video conference to progress jointly on the definition of the platform. In particular, C. Godin, M. Walker and E. Farcot went to a 1-week meeting on tissue data-structure definition and several researchers from CPIB came to Montpellier to continue this work and start implementation.

The team of Pr. Prusinkiewicz at the University of Calgary (Canada) has been an *associated team* of *Virtual Plants* from 2009 to 2011. see <http://www-sop.inria.fr/virtualplants/wiki/doku.php?id=projects:eqass-vp-uc>. In 2012 the collaboration continued and a major paper the L-Py language for modeling plants was published in the context of this collaboration.

6.5. International Research Visitors

6.5.1. Visits of International Scientists

The team received several visitors from exterior research groups in 2012:

- Farah Ben Naoum, from Sidi Bel Abbes University, Algeria, visited the team last spring for 1 month. She worked with C. Godin on combinatorial algorithms to compress trees.
- Risto Sievanen, from University of Helsinki, visited the team for 3 months sabbatical leave in spring. He worked in particular with C. Pradal and C. Godin to integrate the model Lignum developed in his group within OpenAlea.
- Philip Benfey, from the University of Duke, USA, visited the group for 1 day at spring. Contacts have been established to exchange students/researchers between the labs for short periods. Julien Diener, working on automated methods for 2D root reconstruction from 2D images, should pay a visit to their lab in 2013.
- Xavier Sirault, from CSIRO and the High Resolution Plant Phenomics Centre in Canberra, Australia, visited the team during one day. It was decided during this visit to launch a project for coupling the phenotyping platform developed in Australia, a similar one developed in Montpellier by the group of F. Tardieu, and OpenAlea. The objective of this project will be to develop an integrated pipeline allowing the thorough analysis of a large number of genotypes, in particular assessment of growths of individual organs, of plant geometry, and of derived variables such as light interception. There is a strong complementarity between the three teams and the combination of expertise brought in the project by the different groups can result in a reference pipeline of model-assisted image analysis for plant phenotyping.

6.5.2. Visits to International Teams

Yann Guédon was invited by Miroslava Rakocevic (IAPAR, Londrina, Parana state) in Brazil during two weeks in september. This visit was funded by an Embrapa project. He visited three research centers: (i) EPAGRI, Caçador, Santa Catarina state; IAPAR, Londrina, Parana state; Embrapa, Campinas, Sao Paulo state. He gave a 8h course about plant architecture analysis at Londrina and gave a talk at Campinas.

Christophe Godin was invited at the Sainsbury Lab in Cambridge. A first collaboration with Henrik Jonsson based on the joint supervision of a post-doc fellow coming from Virtual Plants to Sainsbury was assessed. Other collaboration projects about meristem modeling and imaging were discussed.

FOCUS Project-Team

7. Partnerships and Cooperations

7.1. National Initiatives

- AEOLUS (Mastering the Cloud Complexity) is an ANR-ARPEGE project started on 1st December 2010 and with a 40-month duration. AEOLUS studies the problem of installation, maintenance and update of package-based software distributions in cloud-based distributed systems. The problem consists of representing the distribution and the dependencies of packages, in such a way that *modification plans* can be (semi)automatically synthesized when packages should be updated or the system should be reconfigured. Main persons involved: Gabbrielli, Mauro, Sangiorgi, Zavattaro.
- ETERNAL (Interactive Resource Analysis) is an Inria-ARC project which started on January 1st, 2011 and will end on December 31st, 2012. ETERNAL aims at putting together ideas from Implicit Computational Complexity and Interactive Theorem Proving, in order to develop new methodologies for handling quantitative properties related to program resource consumption, like execution time and space. People involved: Dal Lago, Gaboardi, Martini, Petit.
- REVER (Programming Reversible Recoverable Systems) is an ANR project that started on 1st December 2011 and with a 48-month duration. REVER aims to study the possibility of defining semantically well-founded and composable abstractions for dependable computing on the basis of a reversible programming language substrate, where reversibility means the ability to undo any distributed program execution, possibly step by step. The critical assumption behind REVER is that by adopting a reversible model of computation, and by combining it with appropriate notions of compensation and modularity, one can develop systematic and composable abstractions for recoverable and dependable systems. Main persons involved: Giachino, Lienhardt, Lanese, Laneve, Zavattaro.
- The ANR project PACE (Processus non-standard: Analyse, Coinduction, et Expressivité) has been recently accepted but will start only in 2013. The project targets three fundamental ingredients in theories of concurrent processes, namely coinduction, expressiveness and analysis techniques. The project aims at processes that are beyond the realm of "traditional" processes. Specifically, the models studied exhibit one or more of the following features: probabilities, higher-order, quantum, constraints, knowledge, and confidentiality. These models are becoming increasingly more important for today's applications. Coinduction is intended to play a pivotal role. Indeed, the approaches to expressiveness and the analysis techniques considered in the project are based on coinductive equalities. Main persons involved: Hirschhoff (project coordinator), Dal Lago, Lanese, Sangiorgi, Zavattaro.

7.2. European Initiatives

7.2.1. FP7 Projects

- Hats (Highly Adaptable and Trustworthy Software using Formal Models) is an EU Integrated Project from FP7, started March 2009 and with a 4 year duration. Hats studies formal methods for obtaining high adaptability combined with trustworthiness in the setting of object-oriented languages and software product lines. Most Focus members are involved.
- PLATFORM (Practical Light Types for Resource Consumption) is a Marie Curie IOF project from FP7, started July 2011 with a three-year span. It involves one Focus member (Gaboardi) in research work at University of Pennsylvania and in Bologna. Project aim is the development of a practical programming language with information, in the form of dependent types, about the resources needed by programs during their execution, and where type checking a program will naturally corresponds to exhibit a certification of its resource consumption.

7.2.2. Collaborations in European Programs, except FP7

- The ICT COST Action BETTY (Behavioural Types for Reliable Large-Scale Software Systems), initiated in October 2012 and with a four-year duration, will use behavioural type theory as the basis for new foundations, programming languages, and software development methods for communication-intensive distributed systems. Behavioural type theory encompasses concepts such as interfaces, communication protocols, contracts, and choreography. Main persons involved: Bravetti, Giachino, Lanese, Laneve, Sangiorgi, Zavattaro.
- The EIT activity "Intelligent Services for Digital Cities" in the context of the Digital Cities Action Line, has been approved, with funding to be spent in 2013. Main persons involved: Gabbrielli.

7.2.3. Collaborations with Major European Organizations

We list here the cooperations and contacts with other groups, without repeating those already listed in previous sections.

- ENS Lyon (on concurrency models and resource control). Contact person(s) in Focus: Dal Lago, Gaboardi, Martini, Sangiorgi. Several visit exchanges during the year, in both directions. One joint PhD supervision (J.-M. Madiot).
- Inria EPI Sardes (on models and languages for components, reversibility). Contact person(s) in Focus: Lanese, Sangiorgi. A number of visits in both directions. One joint PhD supervision (C. Mezzina).
- Laboratoire d'Informatique, Université Paris Nord, Villetaneuse (on implicit computational complexity). Contact person(s) in Focus: Dal Lago, Gaboardi, Martini. An Italian PhD student (Marco Solieri) is working on his PhD thesis with joint supervision (Martini, Guerrini).
- Institut de Mathématiques de Luminy, Marseille (on lambda-calculi, linear logic and semantics). Contact person(s) in Focus: Dal Lago, Martini. One joint PhD supervision (Michele Alberti).
- Team PPS, University of Paris-Diderot Paris 7 (on logics for processes, resource control). Contact person(s) in Focus: Dal Lago, Gaboardi, Martini, Sangiorgi. Various short visits in both directions during the year.
- IRILL Lab, Paris (on models for the representation of dependencies in distributed package based software distributions). Contact person(s) in Focus: Zavattaro. Various short visits in both directions during the year.
- University of Innsbruck (on resource control and termination). Contact person(s) in Focus: Dal Lago. A few short visits during 2012.
- Inria EPI Indes, (on orchestration and programming languages). A common meeting was organised in Bologna, January 2012, where 4 people from Indes and almost everybody from Focus participated.
- EPI Carte, Inria-Nancy Grand Est and LORIA (on implicit computational complexity). Contact person(s) in Focus: Dal Lago, Gaboardi. A few short visits during 2012.
- LMU Munich (M. Hofmann) (on Implicit computational complexity and IntML). Contact person(s) in Focus: Dal Lago.
- IMDEA Software, Madrid (G. Barthe) (on Implicit computational complexity for cryptography). Contact person(s) in Focus: Dal Lago.
- Facultad de Informatica, Universidad Complutense de Madrid (on web services). Contact person(s) in Focus: Bravetti. Bravetti is an external collaborator in the Spanish Ministry of Science and Education project TESIS (advanced methodologies and tools for TESTing and web servIceS).

7.3. International Initiatives

7.3.1. Inria International Partners

- Department of Computer and Information Science, University of Pennsylvania. There has been several collaborations in the past. Presently M. Gaboardi is a long-term visiting researcher in the programming language group, working on resource control and programming languages.

7.4. International Research Visitors

7.4.1. Visits of International Scientists

Among the visits below, we note 2 long-term visits: the 6-month visit of Matias Lee (paid by a EADIC II - Erasmus Mundus scholarship); and the sabbatical year of Xian Xu, from East China University of Science and Technology, Shanghai (paid a scholarship from the Chinese Science Foundation).

- Peter Hofner, Nicta, Sydney, Australia. 1 week end of January. Topic: Formal Methods for Wireless Networks.
- Martin Avanzini, Institute of Compute Science, University of Innsbruck, Austria. 23 to 27 April, 2012. Topic: order-theoretic approaches to complexity analysis of functional programs.
- Marco Carbone, IT University of Copenhagen. A week in May/June 2012. Topic: faults and compensations in choreography languages.
- Raju Halder, Macquarie University, Australia. 2 days in May 2012. Topic: Abstract Interpretation and concurrency.
- Luca Fossati, Imperial College London. A week in May 2012. Topic: Liveness properties by means of types in the π -calculus.
- Xian Xu has began in May a year sabbatical in Focus. He is lecturer at the East China University of Science and Technology in Shanghai.
- Matias David Lee. Currently PhD student at Universidad Nacional de Córdoba, Argentina, has spent 5 months during 2012, from January to May (having arrived in November 2011), for a long-term visit.
- Bertrand Meyer, ETH Zurich. One day in September 2012. Topic: Concurrent Object-Oriented Programming.
- Mariangiola Dezani, Univ. Turin, Italy. 4 days October 2012. Topic: Session Types.
- Clement Aubert, LIPN Université Paris 13. From 5 to 16 November 2012. Topic: implicit complexity and the geometry of interaction.
- Matthieu Perrinel, LIP ENS Lyon. From 17 to 21 December 2012. Topic: context semantic and decideable criteria for complexity analysis.

INDES Project-Team

8. Partnerships and Cooperations

8.1. National initiatives

8.1.1. ANR DEFIS ParTout

The PARTOUT project (PARTOUT = PARallélisme parTOUT) is funded by the ANR Défis programme for 4 years, starting January 2009. The partners of this project are the teams INDES (coordinator), CNAM/CÉDRIC, and LRI, Université d'Orsay.

8.1.2. ANR DEFIS PWD

The PWD project (for "Programmation du Web diffus") has been funded by the ANR Défis programme for 4 years, starting November 2009. The partners of this project are the teams INDES (coordinator), LIP6 at University Pierre et Marie Curie and PPS at University Denis Diderot.

8.1.3. MEALS

The MEALS project (Mobility between Europe and Argentina applying Logics to Systems), IRSES program, started October 1st (2011), and will end September 30th, 2015. The project goals cover three aspects of formal methods: specification (of both requirement properties and system behavior), verification, and synthesis. The Indes members are involved in the task of Security and Information Flow Properties (WP3). The partners in this task include University of Buenos Aires, University of Cordoba, Inria (together with Catuscia Palamidessi, Kostas Chatzikokolakis, Miguel Andrés) and University of Twente.

8.1.4. CIRIC

Indes participated in the proposal of the CIRIC project, a joint lab between Inria and Chile, that will start in 2012. Indes members are involved in the line: Internet Research and Development.

8.2. European initiatives

8.2.1. Collaborations in European Programs, except FP7

Program: ICT Cost Action IC1201

Program acronym: BETTY

Project title: Behavioural Types for Reliable Large-Scale Software Systems

Duration: October 2012 - October 2016

Coordinator: Simon Gay, University of Glasgow

Other partners: Several research groups, belonging to 17 european countries

Abstract: The aim of BETTY is to investigate and promote behavioural type theory as the basis for new foundations, programming languages, and software development methods for communication-intensive distributed systems. Behavioural type theory encompasses concepts such as interfaces, communication protocols, contracts, and choreography.

LOGNET Team

7. Partnerships and Cooperations

7.1. European Initiatives

7.1.1. Collaborations in European Programs, except FP7

Program: INTERREG ALCOTRA

Project acronym: myMed

Project title: “ a peer-to-peer programmable social network and cloud platform”

Duration: January 2010-march2014

Coordinator: Luigi Liquori

Other partners: Uni, Turin, POLitech Turin, Univ. Piemonte Orientale, UNIVE

Founded 1.3Meur on 3 year.

Abstract: see above

7.2. International Initiatives

7.2.1. Inria International Partners

University of Udine, collaboration, common paper and visits since 1990.

7.3. International Research Visitors

7.3.1. Visits of International Scientists

- Mariangiola Dezani, fullprof. Univ Turin,
- Luca Paolini, Assistant professor, Univ. Turin,
- Claudio Casetti, Assistant professor, Univ. Piemonte Orientale,
- Massimo Canonico, Assistant professor, Univ. Piemonte Orientale,
- Luigi Alfredo Grieco, Assistant professor, Politech Bari,
- Erol Gelembé, Full professor, Imperial College.

7.3.1.1. Internships

- David Da Silva, “Développement d’une application mobile d’aide aux personnes atteinte d’Alzheimer sur la plate-forme MyMed”, Projet de stage de fin d’année: Licence Info Miage, UNICE, 2012.
- Romain Fritz, “Surveillance des réseaux pair à pair par la réputation”, Projet de stage de fin d’étude: M2 IFI CSSR, UNICE, 2012.
- Romain Fritz, “Security mechanism applicable on Distributed Hash Table”, Projet de stage de fin d’études: M2 IFI CSSR, UNICE, 2012.
- Francesca Guglielmino, “Aide à la constitution d’un bassin d’usagers potentiels du réseau social myMed”, Projet de stage de fin d’études: Master Langues et Affaires Internationales Relations franco-italienne, UNICE, 2012.
- Sarah Breda, “Mise en place d’une application Smartphone dans le cadre du projet Interreg Alcotra myMed”, Projet de stage de fin d’études: Master Langues et Affaires Internationales Relations franco-italienne, UNICE, 2012.
- Elisa Pellicciari, “Assistance et aide à la conception des services myMed, premier réseau informatique transfrontalier”, Projet de stage de fin d’études: Master Langues et Affaires Internationales Relations franco-italienne, UNICE, 2012.
- Guillaume Villena, “A primer on PHP”, Projet de Stage, étudiant Collège.

MAESTRO Project-Team

7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. ANR Verso ECOSCELLS (11/2009–10/2012)

Participants: Eitan Altman, Konstantin Avrachenkov, Philippe Nain.

ANRVERSOECOSCELLS (Efficient Cooperating Small Cells) aims at developing algorithms and solutions which will be required for the deployment of small cell networks. The theoretical studies will define and solve the models needed to understand the behavior of radio channels, and will design the algorithms which will allow the exploitation of the diversity (user, spatial, interference, etc.) in these networks. The consortium gathers two main industrial groups in the telecommunication domain (ALCATEL-LUCENT BELL LABS (leader) and Orange Labs), together with three leading SMEs (3ROAM, SEQUANS and SIRADEL) and six academic partners (Univ. of Avignon, INRIA through its project-teams MAESTRO, MASCOTTE and SWING, INSTITUT EURECOM, LAAS-CNRS and Laboratoire des Signaux et Systèmes/SUPELEC).

<http://perso.citi.insa-lyon.fr/hrivano/contrats/ecoscells.php>

7.1.2. Inria Cooperative Research Initiative (ARC) OCOQS (2011-2012)

Participant: Alain Jean-Marie.

The finishing ARCOCOQS (Optimal threshold policies in COntrolled Queuing Systems) was devoted to the structural analysis of Markov Decision Processes, with the objective to improve the set of formal techniques available to prove that optimal control policies have a particular structure (typically, threshold-type). One of the benchmarks for this project was the extension of the model solved in [27]. This project also involved A. Busic (INRIA project-team TREC), E. Hyon (LIP6 and Univ. Paris 10) and I. Vliegen (Univ. Twente).

<http://www.di.ens.fr/~busic/OCOQS/>

7.2. European Initiatives

7.2.1. FP7 Projects

7.2.1.1. CONGAS

Participants: Eitan Altman, Konstantin Avrachenkov, Alexandre Reiffers.

Title: Dynamics and coevolution in multi level strategic interaction games

Type: Collaborative project

Subprogramme Area: FET Proactive: Dynamics of Multi-Level Complex Systems

Instrument: Specific Targeted Research Project (STREP)

Duration: October 1, 2012 – September 30, 2015

Coordinator: Center for Research and Telecommunication Experimentation for Network Communities (CREATE-NET) (Italy)

Other partners:

- Université D'Avignon et des Pays de Vaucluse (UAPV) (France)
- Technische Universiteit Delft (TUDelft) (The Netherlands)
- Imperial College of Science, Technology and Medicine (IMPERIAL) (United Kingdom)
- Università di Pisa (UNIPi) (Italy)
- Technion - Israel Institute of Technology (TECH) (Israel)

Abstract: CONGAS will develop new mathematical models and tools, rooted in game theory, for the analysis, prediction and control of dynamical processes in complex systems. It will provide a coherent theoretical framework for understanding the emergence of structure and patterns in these systems, accounting for interactions spanning various scales in time and space, and acting at different structural and aggregation levels.

MAESTRO's task is to develop game theoretic models to model (a) the formation of technological and social network; (b) the routing for competing agents; and (b) the competition of information in social networks.

K. Avrachenkov is the coordinator for INRIA. E. Altman is a scientific coordinator of the project.

7.2.1.2. TREND

Participants: Sara Alouf, Delia Ciullo.

Title: Towards Real Energy-efficient Network Design

Subprogramme Area: ICT-2009.1.1 The Network of the Future

Instrument: Network of Excellence (NoE)

Duration: September 1, 2010 – August 31, 2013

Coordinator: Politecnico di Torino (PoliTO) (Italy)

Other partners:

- Alcatel-Lucent Bell Labs (France)
- Huawei Technologies Dusseldorf GmbH (HWDU) (Germany)
- Telefonica Investigacion y Desarrollo (TID) (Spain)
- France Telecom - Orange (FT) (France)
- Fastweb (FW) (Italy)
- Universidad Carlos III (UC3M) (Spain)
- iMinds (Belgium)
- Technical University of Berlin (TUB) (Germany)
- Ecole Polytechnique Fédérale de Lausanne (EPFL) (Switzerland)
- Consorzio Nazionale Interuniversitario per le Telecomunicazioni (CNIT) (Italy)
- Panepistimio Thessalias - University of Thessaly (UTH) (Greece)

Collaborating institutions:

- Fondazione Ugo Bordoni (Italy)
- Technische Universitat Dresden (Germany)
- Deutsche Telekom Laboratories (Germany)
- Institute IMDEA Networks (Spain)
- CNR Institute for High Performance Computing and Networking (ICAR-CNR) (Italy)
- International Hellenic University (Greece)
- Institut National de Recherche en Informatique et en Automatique (Inria) (France)
- Boston University (United States)

See also: <http://www.fp7-trend.eu/>

Abstract: TREND aims at integrating the activities of major European players in networking, including manufacturers, operators, research centers, to quantitatively assess the energy demand of current and future telecom infrastructures, and to design energy-efficient, scalable and sustainable future networks.

MAESTRO's task is to propose and analyze energy-aware network cellular network design and management, in collaboration with the other partners.

7.3. International Initiatives

7.3.1. Inria Associate Teams

7.3.1.1. GANESH

Title: GAMES, Optimization and Analysis of NETWORKS Theory and Applications

Inria principal investigator: Eitan Altman

International Partners (Institution - Laboratory - Researcher):

IISc Bangalore (India) - Electrical Communication Engineering - Anurag Kumar

IIT Mumbai (India) - Department of Electrical Engineering - D. Manjunath

IIT Madras (India) - Electrical Engineering - Venkatesh Ramaiyan

Duration: 2012 - 2014

See also: <http://www-sop.inria.fr/members/Eitan.Altman/Ganesh/Home.html>

This project aims at producing outstanding contributions to the foundations of the theory of networks, in game theory, team theory, optimization and analysis. Three areas in networking will be used to apply these: (i) economy of networks and network neutrality, (2) scheduling in wireless networks, and (3) distributed optimization issues in ad-hoc networks.

7.3.2. Inria International Partners

7.3.2.1. St. Petersburg State Univ.

Participant: Konstantin Avrachenkov.

MAESTRO has a continuing collaboration with St. Petersburg State Univ.. St. Petersburg State Univ. is a partner in INRIA Internship International programme. In particular, MAESTRO hosts every year several intern students from St. Petersburg State Univ.. The collaboration with L. Petrosyan and A. Garnaev is on the application of game theory to resource allocation in networks. The collaboration with V. Dobrynin is on data clustering.

7.3.3. Participation In International Programs

7.3.3.1. STIC Tunisie

Participants: Eitan Altman, Majed Haddad.

E. Altman and M. Haddad have been collaborating with I. Mabrouki (Institut Supérieur d'Informatique et des Techniques de Communication, Tunisia) on intelligent jamming in wireless networks, i.e. jamming in which the jammer is aware of the protocol used by the network.

7.3.3.2. Indo-French Centre for the Promotion of Advanced Research (IFCPAR)

Participants: Eitan Altman, Konstantin Avrachenkov, Manjesh Kumar Hanawal.

Within project 4000-IT on "Emerging Strategies for Wireless Communication Networks," K. Avrachenkov, E. Altman and M. K. Hanawal (also with Univ. Avignon/LIA) have been collaborating with V. Borkar and V. Kavitha (IIT Mumbai, India), A. Kumar, R. Sundaresan and C. Singh (Indian Institute of Science, India) on evaluating and optimization issues in wireless networks. They also worked on network neutrality issues.

7.4. International Research Visitors

7.4.1. Visits of International Scientists

7.4.1.1. Professors / Researchers

- Abdelfettah Belghith (from October 15, 2012 until October 20, 2012)
Institution: ENSI, Univ. of Manouba (Tunisia)
- Amel Ben Slimane (from October 15, 2012 until October 20, 2012)
Institution: ENSI, Univ. of Manouba (Tunisia)
- Vivek Borkar (from June 3, 2012 until June 23, 2012)
Institution: Indian Institute of Technology Bombay (India)
- Ananthanarayanan Chockalingam (from June 11, 2012 until June 22, 2012)
Institution: Indian Institute of Science (India)
- Jerzy Filar (from June 21 2012 until July 7 2012)
Institution: Flinders Univ. (Australia)
- David Hay (from June 25, 2012 until June 26, 2012)
Institution: Hebrew Univ. of Jerusalem (Israel)
- Nelly Litvak (from November 4, 2012 until November 8, 2012)
Institution: Univ. of Twente (Netherlands)
- Issam Mabrouki (from October 15, 2012 until October 20, 2012)
Institution: Univ. of Manouba (Tunisia)
- Evsey Morozov (from September 18, 2012 until September 23, 2012)
Institution: Petrozavodsk State Univ. (Russian Federation)
- Balakrishna Prabhu (from November 21, 2012 until November 23, 2012)
Institution: LAAS-CNRS (France)
- Rajesh Sundaresan (from May 24 until June 14, 2012)
Institution: Indian Institute of Science (India)
- Uri Yechiali (from April 10, 2012 until April 25, 2012)
Institution: Tel Aviv Univ. (Israel)

7.4.1.2. Post-doctoral fellows

- Andrey Lukyanenko (from November 16, 2012 until December 15, 2012)
Institution: Aalto Univ. (Finland)
- Ali Jahromi (from June 24, 2012 until June 30, 2012)
Institution: Univ. of Adelaide (Australia)
- Bruno Ribeiro (from February 4, 2012 until March 7, 2012)
Institution: BBN Technologies (USA)

7.4.1.3. Ph.D. students

- Mohammad Abdel Rahman (from June 27, 2012 until August 14, 2012)
Subject: Elaborating new mobility models for ad hoc networks
Institution: Univ. of Arizona (USA)
- Nicolas Accettura (from February 2012 until August 2012)
Subject: Population size estimation
Institution: Politecnico di Bari (Italy)

Rodrigo Vaca Ramirez (from November 23, 2012 until February 20, 2013)

Subject: Vertical handover framework towards energy efficiency

Institution: Univ. of Edinburgh

7.4.1.4. Graduate students

Imen Mahjri (from October 1, 2012 until December 31, 2012)

Subject: Road Traffic Mobility Models in Complex Systems

Institution: ENSI, Univ. of Manouba (Tunisia)

Yonathan Portilla (From April 23, 2012 until July 6, 2012)

Subject: Analyzing the evolution of written language in Twitter

Institution: Univ. of Avignon

7.4.1.5. Internships

Sushma Hanawal (from August 2012 until February 2013)

Subject: Creation, Simulation and Multidiscipline Evaluation of Dynamic Mobility Models in Complex Systems

Institution: SJCE Mysore (India)

Vasily Medyanikov (from June 20, 2012 until September 29, 2012)

Subject: Monte Carlo Methods for Centrality Measures in Online Social Networks

Institution: St. Petersburg State Univ. (Russian Federation)

7.4.2. Visits to International Teams

MAESTRO members have visited (the)

- Basque Center for Applied Mathematics (BCAM), Bilbao, Spain in the period June 19–20, 2012 (**S. Alouf**);
- BBN Technologies, Cambridge, MA, USA in the periods November 12–13 and 15–16, 2012 (**G. Neglia**);
- École polytechnique fédérale de Lausanne (EPFL), Switzerland in the period November 5–9, 2012 (**D. Ciullo**);
- Fordham Univ. at Rose Hill campus, Bronx, NY, USA in the period November 19–21, 2012 (**G. Neglia**);
- GERAD, Univ. Montreal, Canada in the period April 16–May 11, 2012 (**A. Jean-Marie**);
- Indian Institute of Science (IISc), Bangalore, India in the periods January 10–20, 2012 and July 12–19, 2012 (**E. Altman**);
- Politecnico di Torino, Italy in the period July 23–27, 2012 (**D. Ciullo**);
- Univ. of Liverpool, UK in the period May 14–18 (**K. Avrachenkov**);
- Univ. of Massachusetts at Amherst, USA in the periods February 13–15 and November 20–28, 2012 (**P. Nain**) and on November 14, 2012 (**G. Neglia**);
- Univ. of Palermo, Italy in the period December 17–21, 2012 (**G. Neglia**);
- Univ. of Twente, Enschede, The Netherlands in the period March 26–30 (**K. Avrachenkov**).

MASCOTTE Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR *Jeunes Chercheurs DIMAGREEN, 09/2009-08/2012*

Participants: David Coudert, Frédéric Giroire, Alvinice Kodjo, Joanna Moulhierac, Nicolas Nisse, Truong Khoa Phan, Issam Tahiri.

The objectives of the project DIMAGREEN (DesIgn and MAnagement of GREEN networks with low power consumption) are to introduce and analyze energy-aware network designs and managements in order to increase the life-span of telecommunication hardware and to reduce the energy consumption together with the electricity bill.

(<http://www-sop.inria.fr/teams/mascotte/Contrats/DIMAGREEN/index.php>)

8.1.2. ANR *Blanc AGAPE, 10/2009-09/2013*

Participants: David Coudert, Frédéric Havet, František Kardoš, Ana Karolinna Maia, Grégory Morel, Nicolas Nisse, Stéphane Pérennes, Michel Syska.

The project AGAPE (Parameterized and exact graph algorithms) is led by MASCOTTE and implies also LIRMM (Montpellier) and LIFO (Orléans). The aim of AGAPE is to develop new techniques to solve exactly NP-hard problems on graphs. To do so, we envisage two approaches which are closely related ways to reduce the combinatorial explosion of NP-hard problems: moderately exponential exact algorithms and fixed-parameter tractability.

(<http://www-sop.inria.fr/mascotte/Contrats/Agape.php>)

8.1.3. ANR *VERSO ECOSCells, 11/2009-12/2012*

Participants: David Coudert, Issam Tahiri.

The ECOSCells (Efficient Cooperating Small Cells) project aims at developing the algorithms and solutions required to allow Small Cells Network (SCN) deployment. The consortium gathers industrial groups, together with 3 SMEs and 6 research institutes: ALCATEL-LUCENT BELL LABS (leader), ORANGE LABS, 3-ROAM, SEQUANS, SIRADEL, Inria teams MAESTRO, MASCOTTE and SWING, Université d'Avignon et des Pays de Vaucluse, Laboratoire des Signaux et Systèmes / Supelec, LAAS and Eurecom.

(<http://perso.citi.insa-lyon.fr/hrivano/contrats/ecoscells.php>)

8.1.4. *Action ResCom, ongoing (since 2006)*

Réseaux de communications, working group of GDR ASR, CNRS.

(<http://citi.insa-lyon.fr/rescom/>)

8.1.5. *Action Graphes, ongoing (since 2006)*

Action Graphes, working group of GDR IM, CNRS.

(<http://www.labri.fr/perso/raspaud/pmwiki/pmwiki.php>)

8.2. European Initiatives

8.2.1. FP7 Projects

8.2.1.1. EULER

Participants: David Coudert, Luc Hogue, Aurélien Lancin, Bi Li, Nicolas Nisse, Stéphane Pérennes, Issam Tahiri.

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 Politecnica de Catalunya, Barcelona and University of Girona, Spain

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

Abstract: STREP EULER (Experimental UpdateLess Evolutive Routing) is part of FIRE (Future Internet Research and Experimentation) objective of FP7. It aims at finding new paradigms to design, develop, and validate experimentally a distributed and dynamic routing scheme suitable for the future Internet and its evolution. The STREP EULER gathers 7 partners: Alcatel-Lucent Bell (leader) (Antwerp, Belgique), IBBT (Ghent, Belgium), UCL (Louvain, Belgium), RACTI (Patras, Grece), UPC (Barcelona, Spain), UPMC (ComplexNetworks, Paris 6), Inria (MASCOTTE, GANG, CEPAGE). MASCOTTE is the leader of WP3 on Topology Modelling and Routing scheme experimental analysis.

8.2.2. Collaborations in European Programs, except FP7

8.2.2.1. PICS CNRS (with Charles University, Prague), 01/2009-12/2012

Participants: Frédéric Havet, František Kardoš, Leonardo Sampaio.

Bilateral collaboration funded by the french CNRS. The funding covers scientific visits and workshops.

On Graph coloring: theoretical and algorithmic aspects.

8.2.2.2. PHC PROCOPE (with Discrete Optimization group of RWTH Aachen University), 01/2011-12/2012

Participants: Christelle Caillouet, David Coudert, Alvinice Kodjo, Issam Tahiri.

Bilateral collaboration funded by the french ministry of foreign affairs (MAE), the french ministry of research and education (MESR), and the Deutscher Akademischer Austauschdienst (DAAD). The funding covers scientific visits.

"Défis algorithmiques dans les réseaux de communication". The purpose of the project is to exchange expertise between the discrete optimization group of RWTH Aachen University and the MASCOTTE team at Inria Sophia-Antipolis and to address algorithmic problems in communication networks.

8.3. International Initiatives

8.3.1. Inria Associate Teams

8.3.1.1. ANR International Taiwan GRATEL, 01/2010 – 12/2013

Participants: Jean-Claude Bermond, Frédéric Havet, František Kardoš, Leonardo Sampaio.

GRATEL (Graphs and Telecommunications) has been started in collaboration with LABRI Bordeaux, UJF Grenoble and three partners in Taiwan: Sun Yat-sen University, the National Taiwan University and Academia Sinica.

(<https://gratel.labri.fr/pmwiki.php?n=Main.HomePage>)

8.3.2. Participation In International Programs

Inria FUNCAP (Inria-FAP): ALERTE (ALgorithmes Efficaces pour les Réseaux de TELécommunications), with Pargo Team, Universidade Federal do Ceará, Brazil, accepted in June 2011.

8.4. International Research Visitors

8.4.1. Visits of International Scientists

Jørgen Bang-Jensen: University of Southern Denmark, Odense, Denmark, May 1-31, 2012 (1 month);

Tom Bouvier: Université Bordeaux 1, Bordeaux, France, May 21-25, 2012 (1 week);

Xavier Defago: JAIST, School of Information Science, Ishikawa, Japan, March 5-23, last week of June, September 12 - 30, 2012 (2 months);

Michele Flammini: University of L'Aquila, Italy, June 18 - July 13 (3 weeks);

Ararat Harutyunyan: Simon Fraser University, Vancouver, Canada, May 19-27, 2012 (1 week);

Brigitte Jaumard: Concordia University, Montréal, Canada, April 23 - May 5, 2012 (3 weeks);

Mejdi Kaddour: University of Oran, Algeria, April 22 - 28, November 21-28, 2012 (2 weeks);

Takako Kodate: Tokyo Woman's Christian University, Suginami-ku, Tokyo, Japan, March 19-29 (2 weeks);

Uéverton Souza Dos Santos: Fluminense Federal University, Brazil, July 13-30, 2012 (3 weeks);

Amel Tandjaoui: University of Oran, Algeria, October 16 - November 16, 2012 (1 month);

Martin Tieves: RWTH Aachen University, Germany, December 16-21, 2012 (1 week);

Joseph Yu: Abbotsford and SFU, Vancouver, Canada, March 1 - April 20, 2012 (1 month 1/2).

8.4.2. Visits to International Teams

J.-C. Bermond: Orsay (March 23, 2012); Athens (May 20-29, 2012);

C. Caillouet: FUN Team, Inria Lille Nord Europe (July 1-6, 2012); Mathematics department of RWTH Aachen, Germany (July 29-August 5, 2012);

D. Coudert: Alcatel-Lucent Bell labs, Antwerpen, Belgium (January 10-12, 2012); Mathematics department of RWTH Aachen, Germany (July 24-27, 2012);

F. Giroire: LIP, ENS Lyon (January 23-27, 2012);

F. Havet: LIP, ENS Lyon (January 23-27, 2012); Federal University of Ceara, Brasil (April 21-28, 2012); LABRI, University of Bordeaux 1 (July 9-11 2012);

A. Lancin: LABRI, University of Bordeaux 1 (March 5-7, 2012);

N. Nisse: LIP, ENS Lyon (January 23-27, 2012); LIF, Univ. Marseille (February 20-22, 2012); LRI, Univ. Paris-Sud 11 (March 19-20, 2012); Adolfo Ibanez University, Santiago, Chile (August 4-20, 2012);

T. K. Phan: Mathematics department of RWTH Aachen, Aachen, Germany (August 26 -September 01, October 14 - December 06, 2012);

R. Soares: LABRI, University of Bordeaux 1 (March 5-10, 2012).

OASIS Project-Team

7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. ANR OMD2

Title: MultiDisciplinary Distributed Optimization

Program: Conception and Simulation 2008

Duration: July 2009 - September 2012

Coordinator: Renault

Others partners: SMEs: CD-adapco, SIREHNA, ACTIVEEON, academics: Inria, ENSM-SE, UTC, ECP, IRCCyN, ENS CACHAN, and consortium DIGITEO.

See also: <http://omd2.scilab.org/>

Abstract: OMD2 (MultiDisciplinary Distributed Optimization) is a national research project led by Renault and gathering several academics and industrial partners which aims at developing methods and tools to generalize the use of optimization on large scale engineering problems. Scilab is the chosen generic programming tool to gather the different developments in a unique optimization environment. ProActive Parallel Suite is used to execute the Workflows in parallel, and to manage the Grid and Cloud resources

7.1.2. ANR MCorePhP

Title: Multi-Core Parallel Heterogeneous Programming

Program: Blanc international

Duration: January 2010 - December 2012

Coordinator: Inria Oasis

Others partners: Tsinghua University Beijing (China)

See also: http://www-sop.inria.fr/oasis/mcorephp_home.htm

Abstract: McorePhP is dedicated to programming models and middleware for large-scale, multilevel infrastructures including multi-core, clusters, and large scale grid/cloud resources. We will ensure the compatibility of the new programming model with the China Grid specifications, and will assess the viability and efficiency of the approach on a large example from the area of bioinformatics.

7.1.3. ANR Soceda

Title: SOCial Event Driven Architecture

Program: Platform

Duration: July 2009 - September 2012

Coordinator: Linagora (ex EBM Web Sourcing)

Others partners: SMEs: ACTIVEEON, industry: Thales, OrangeLabs, academics: Inria, CNRS IMAG, LIRIS, ARMINES

See also: <http://www.soceda.org/display/soceda/>

Abstract: SocEDA is an ANR project of type Platform, also labelled by two competitiveness clusters, PEGASE and SCS. The aim is to provide a "Cloud based platform for large scale social aware Event-Driven Architecture (EDA)". OASIS is in charge of managing the storage and publication/subscription of events on the cloud.

7.1.4. ANR Songs

Title: Simulation of Next Generation Systems

Program: Infra 13

Duration: January 2012 - December 2015

Coordinator: Inria (Nancy, Grenoble, Bordeaux)

Others partners: IN2P3 Villeurbanne, LSIIT Strasbourg, I3S Sophia-Antipolis, LINA Nantes

See also: <http://infra-songs.gforge.inria.fr/>

Abstract: SONGS (2012-2015) is the continuity of SIMGRID project (2009-2012), in the ANR INFRA program. The aim of SONGS is to continue the development of the SimGrid simulation platform for the study of large distributed architectures, including data grids, cloud computing facilities, peer-to-peer applications and HPC/exascale architectures.

7.1.5. CPER PacaGrid

Duration: January 2010 - December 2012

See also: <http://www-sop.inria.fr/oasis/pacagrid/>

Abstract: ProActive PacaGrid is a set of machines deployed at Inria Sophia Antipolis (1400 cores, 150 TB storage) accessible via Graphical Interactive interfaces based on ProActive Parallel Suite. This Grid is available for Inria, UNS, and PACA (regional) labs, as well as for SMEs for R&D purpose, and international partners in R&D projects. It has been funded by EU FEDER, PACA and Alpes Maritimes Landers, and EIT ICT Labs (about 1.7 MEuros in total). Users include for instance INRA (Institut de recherche en Agronomie), IPMC INSERM (Institut de Pharmacologie Moléculaire et Cellulaire), LCMBA (Laboratoire de Chimie des Molécules Bioactives et des Arômes), IGS (Laboratoire Information Génomique et Structurale, Marseille), LIFM (Laboratoire d'Informatique Fondamentale de Marseille), K-Epsilon SME, Renault, Sirehna DCNS, Poznań Supercomputing and Networking Center (Poland), National University of Singapore.

7.1.6. FUI CompatibleOne

Title: The Open Source Cloud Broker

Program: Conception and Simulation 2008

Duration: July 2009 - September 2012

Coordinator: OW2

Others partners: industry: ActiveEon, Bull, CityPassenger, eNovance, Eureva, Mandriva, Nexedi, Nuxeo, XWiki, Prologue; academic: Inria, Institut Telecom

See also: <http://www.compatibleone.org>

Abstract: CompatibleOne is an open source project which provides a model, CORDS (CompatibleOne Resource Description System), and a platform, ACCORDS (Advanced Capabilities for CORDS), for the description and federation of different clouds comprising resources provisioned by heterogeneous cloud service providers. CompatibleOne's flexible service architecture makes it independent from any Cloud Service Provider (from OpenStack to OpenNebula, from Azure to Vcloud) and can address all types of cloud services (IaaS, PaaS, SaaS, XaaS, BaaS, ...) and any type of cloud service deployment (public, private, community and hybrid).

7.1.7. FUI CloudForce (now OpenCloudWare)

Program: FSN, labelled by Minalogic, Systematic and SCS.

Duration: January 2012 - December 2014

Coordinator: France-Telecom Research

Others partners: ActiveEon, Armines, Bull, eNovance, eXo Platform, France Telecom (coordinator), Inria, IRIT – INP Toulouse, Linagora, OW2, Peergreen, Télécom Paris Tech, Télécom Saint Etienne, Thales Communications, Thales Services, Université Joseph Fourier, Université de Savoie – LISTIC, UShareSoft

See also: <http://www.opencloudware.org/>

Abstract: The OpenCloudware project aims at building an open software engineering platform, for the collaborative development of distributed applications to be deployed on multiple Cloud infrastructures.

The results of OpenCloudware will contain a set of software components to manage the lifecycle of such applications, from modelling (Think), developing and building images (Build), to a multi-IaaS compliant PaaS platform (Run) for their deployment, orchestration, performance testing, self-management (elasticity, green IT optimisation) and provisioning. Applications will be deployed potentially on multi IaaS (supporting either one IaaS at a time, or hybrid scenarios). The results of the project will be made available as open source components through the OW2 Open Source Cloudware initiative.

7.1.8. Oseo-Isis Spinnaker

Duration: June 2011 - May 2014

Coordinator: Tagsys-RFID

Others partners: SMEs: Inside-Secure, STIC, Legrand; Academic: IPG, ENS des Mines de St Etienne, Un. du Maine, Un. F. Rabelais Tours, AETS ESEO Angers, Un. Marne la Vallée, Un. Paris 6, Un. Rennes 1, Inria.

See also: <http://www.spinnaker-rfid.com/>

Abstract: The objective of Spinnaker is to really allow RFID technology to be widely and easily deployed. The role of the OASIS team in this project is to allow the wide scale deployment and management of the specific RFID application servers in the cloud, so to build an end-to-end robust and flexible solution using GCM technology.

7.2. European Initiatives

7.2.1. FP7 Projects

7.2.1.1. TEFIS

Title: TEstbed for Future Internet Services

Type: COOPERATION (ICT)

Defi: Future Internet Experimental Facility and Experimentally-driven Research

Instrument: Integrated Project (IP)

Duration: June 2010 - November 2012

Coordinator: THALES (France)

Others partners: Engineering Ingegneria Informatica S.p.A. (It); IT Innovation (UK); Fundação de Apoio à Universidade de São Paulo (Br); Thales Communications (Fr); ActiveEon (Fr); Lulea University of Technology (Se); Software Quality System S.A. (Es); Fraunhofer Institute FOKUS (De)

See also: <http://www.tefisproject.eu/>

Abstract: TEFIS will support Future Internet of Services Research by offering a single access point to different testing and experimental facilities for communities of software and business developers to test, experiment, and collaboratively elaborate knowledge.

The project develops an open platform to access heterogeneous and complementary experimental facilities addressing the full development lifecycle of innovative services with the appropriate tools and testing methodologies. Through the TEFIS platform users will be supported throughout the whole experiment lifecycle by access to different testing tools covering most of the software development-cycle activities such as software build and packaging, compliance tests, system integration, SLA dimensioning, large-scale deployment, and user evaluation of run-time services. The platform will provide the necessary services that will allow the management of underlying testbeds resources. In particular, it will handle generic resource management, resource access scheduling, software deployment, matching and identification of resources that can be activated, and measurement services for a variety of testbeds.

7.2.1.2. PLAY

Title: Pushing dynamic and ubiquitous interaction between services Leveraged in the Future Internet by APpLYing complex event processing

Type: COOPERATION (ICT)

Defi: Internet of Services, Software & Virtualisation

Instrument: Specific Targeted Research Project (STREP)

Duration: October 2010 - September 2013

Coordinator: FZI (Germany)

Others partners: EBM WebSourcing (Fr), Inria (OASIS and SARDES) (Fr), France Telecom (Fr), ICCS (Gr), Ecole des Mines Albi (Fr), CIM (Serbia).

See also: <http://www.play-project.eu/>

Abstract: The PLAY project will develop and validate an elastic and reliable architecture for dynamic and complex, event-driven interaction in large highly distributed and heterogeneous service systems. Such an architecture will enable ubiquitous exchange of information between heterogeneous services, providing the possibilities to adapt and personalize their execution, resulting in the so-called situational-driven process adaptivity. The OASIS Team is in charge of designing the key element of the PLAY Platform: the event cloud that is a publish/subscribe P2P based system, developed using the GCM technology.

7.2.1.3. FI-WARE

Title: Morphus

Type: COOPERATION (ICT)

Defi: PPP FI: Technology Foundation: Future Internet Core Platform

Instrument: Integrated Project (IP)

Duration: September 2011 - May 2014

Coordinator: Telefonica (Spain)

Others partners:Thales, SAP, Inria

See also: <http://www.fi-ware.eu/>

Abstract: FI-WARE will deliver a novel service infrastructure, building upon elements (called Generic Enablers) which offer reusable and commonly shared functions making it easier to develop Future Internet Applications in multiple sectors. This infrastructure will bring significant and quantifiable improvements in the performance, reliability and production costs linked to Internet Applications ? building a true foundation for the Future Internet.

7.3. International Initiatives

7.3.1. Inria Associate Teams

7.3.1.1. SCADA

Title: Safe Composition of Autonomic Distributed Applications

Inria principal investigator: Ludovic Henrio

International Partner (Institution - Laboratory - Researcher):

University of Chile (Chile) - NIC Chile Research Labs - Mario Leyton

Duration: 2012 - 2014

See also: <http://team.inria.fr/scada>

The SCADA project aims at promoting the collaboration between NIC LABS (Santiago - Chile) and OASIS team (Inria Sophia Antipolis - France) in the domain of the safe composition of applications. More precisely the project will extend existing composition patterns dedicated to parallel or distributed computing to ease the reliable composition of applications. The strong interactions between formal aspects and practical implementation are a key feature of that projects, where formal methods, and language theory will contribute to the practical implementation of execution platforms, development and debugging tools, and verification environments. The composition models we focus on are algorithmic skeletons, and distributed components; and we will particularly focus on the programming and verification of non-functional features. Overall, from formal specification and proofs, this project should lead to the implementation of tools for the design and execution of distributed and parallel applications with a guaranteed behavior.

7.3.1.2. DAESD

Title: Distributed/Asynchronous, Embedded/synchronous System Development

Inria principal investigator: Eric Madelaine

International Partner (Institution - Laboratory - Researcher):

East China Normal University (ECNU) Shanghai - SEI - Yixiang Chen

Duration: 2012 - 2014

See also: <http://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 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.

7.3.1.3. Dissiminet

Title: Web-Service approaches for simulation

Inria principal investigator: Olivier Dalle

International Partner (Institution - Laboratory - Researcher):

Carleton University (Ottawa, Canada) - Advanced Real-Time Simulation Laboratory -
Gabriel Wainer

Duration: 2011 - 2013

See also: <http://www.inria.fr/en/teams/dissiminet>

This Franco-Canadian team will advance research on the definition of new algorithms and techniques for component-based simulation using a web-services based approach. On one hand, the use of web-services is expected to solve the critical issues that pave the way toward the simulation of systems of unprecedented complexity, especially (but not exclusively) in the studies involving large networks such as Peer-to-peer networks. Web-Service oriented approaches have numerous advantages, such as allowing the reuse of existing simulators, allowing non-computer experts to merge their respective knowledge, or seamless integration of complementary services (eg. on-line storage and repositories, weather forecast, traffic, etc.). One important expected outcome of this approach is to significantly enhance the simulation methodology in network studies, especially by enforcing the seamless reproducibility and traceability of simulation results. On the other hand, a net-centric approach of simulation based on web-services comes at the cost of added complexity and incurs new practices, both at the technical and methodological levels. The results of this common research will be integrated into both teams' discrete-event distributed simulators: the CD++ simulator at Carleton University and the simulation middle-ware developed in the MASCOTTE EPI, called OSA, whose developments are supported by an Inria ADT starting in December 2011.

7.3.2. Inria International Partners

Fit4Green (<http://fit4green.eu>) is a FP7 project that aimed at creating an energy-aware layer of plug-in on top of the current data centres' management tools to orchestrate the placement of VMs with regards to energy-efficiency concerns. In 2012, the consortium decided to rely on Btrplace to compute the VM placement. Accordingly, Fabien Hermenier collaborated with them to integrate their work with BtrPlace.

7.3.3. Participation In International Programs

7.3.3.1. CIRIC Chili

Ciric research line: Telecommunications

Inria principal investigator: Eric Madelaine

Duration: 2012 - 2021

Our activities with CIRIC have slowly been starting during this year, while CIRIC and Inria-Chile set-up their local organisations. We took the opportunity of our visit in July in Santiago de Chile (workshop of the SCADA associated Team), to discuss with Ciric, and to setup our plans. Later in November Tomas Barrós (PI on the Ciric side) visited us in Sophia-Antipolis, and we were able to pursue our plans.

The current state is that we have listed two Chilean software companies, one in the area of telecommunications, the other in the area of banks, that have an interest in method for the development of safe large and complex applications. The role of Ciric in a first step is to set-up a first technical contact with these companies, discuss the use-cases, the common interests, and a preliminary workplan. The next step (in 2013) will involve the work of Ciric engineers on the case-study definition, and a longer visit of E. Madelaine (and possibly other Inria people) in Santiago to start concrete work on this line.

7.4. International Research Visitors

7.4.1. Visits of International Scientists

7.4.1.1. Visiting Scientists

Min Zhang Sep. 15th to Dec. 15th. This visit is in the framework of our “DAESD” Associated Team with ECNU Shanghai. The subject is on contextual/parametric bisimulations for the pNets (Parameterized Networks of Synchronized automata).

Gabriel Wainer Jun. 15th - July 7th. This visit is in the context of the DISSIMINET Associate Team between Inria and Carleton University. The subject is on simulation in the Cloud and Handheld devices.

7.4.1.2. Internships

Yanwen CHEN: Cotutelle with ECNU Shanghai, visits in Inria planned 6 to 9 month each year.

Subject: Programmation d’applications hétérogènes embarquées et distribuées

Institution: UNS & East China Normal University (China)

Quirino ZAGARESE (from Jan 2012 until Aug 2012)

Subject: Lazy loading of data in service oriented and event oriented interaction software architecture models

Institution: University Sannio (Italy)

Michel Jackson DE SOUZA (from Jul 2012 until Aug 2013)

Subject: Distributed coherent snapshot solution for the P2P CAN-based Event Cloud

Institution: UFBA Federal University of Bahia (Brasil), Science sans Frontière brazilian mobility program

7.4.2. Visits to International Teams

- Fabien Hermenier visited the Flux Team at the University of Utah from September to December 2012. This visit allowed us to enhance our collaboration on the study of the Utah’ Emulab in order to improve testbed designs. [22]
- Ludovic Henrio, Eric Madelaine, and Cristian Ruz visited NIC-Labs and CIRIC center in Santiago de Chile in July 2012 (1 week visit); a workshop was also held during the week.

PLANETE Project-Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

PFT (2011-2014) : DGCIS funded project, in the context of the competitiveness cluster SCS, whose aim is to provide to PACA region industrials wishing to develop or validate new products related to future mobile networks and services and M2M application, a networking infrastructure and tools helpful for development, test and validation of those products. Other partners : 3Roam, Audilog Groupe Ericsson, Ericsson, Eurecom, Inria, iQsim, MobiSmart, Newsteo, OneAccess, Orange Labs, Pôle SCS, ST Ericsson, Telecom Valley. Our contribution is centred around providing a test methodology and tools for wireless networks experimentation.

8.2. National Initiatives

ANR FIT (2011-2108): FIT (Future Internet of Things) aims to develop an experimental facility, a federated and competitive infrastructure with international visibility and a broad panel of customers. It will provide this facility with a set of complementary components that enable experimentation on innovative services for academic and industrial users. The project will give French Internet stakeholders a means to experiment on mobile wireless communications at the network and application layers thereby accelerating the design of advanced networking technologies for the Future Internet. FIT is one of 52 winning projects from the first wave of the French Ministry of Higher Education and Research's "Équipements d'Excellence" (Equipex) research grant programme. The project will benefit from a 5.8 million euro grant from the French government. Other partners are UPMC, IT, Strasbourg University and CNRS. See also <http://fit-equipex.fr/>.

ANR ARESA2 (2009-2012): The Planète team is involved in the ARESA2 project which aims at advancing the state of the art in Secure, Self-Organizing, Internet?Connected, Wireless Sensor and Actuator Networks (WSANs). These challenges are to be addressed in an energy-efficient way while sticking to memory-usage constraints. The partners are Inria, CEA-LETI, France Telecom R&D, Coronis Systems, LIG/Drakkar, Verimag and TELECOM Bretagne.

ANR pFlower (2010-2013): Parallel Flow Recognition with Multi-Core Processor. The main objective of this project is to take advantage of powerful parallelism of multi-thread, multi-core processors, to explore the parallel architecture of pipelined-based flow recognition, parallel signature matching algorithms. The project involves Inria (planete), Université de Savoie, and ICT/CAS (China).

Inria Mobilities (2011-2012): as a joint national project with CNIL (the French national committee of Information freedom). Platform for mobile devices privacy evaluation. This project strives to deploy an experimental mobile platform for studying and analyzing the weaknesses of current online (smartphone) applications and operating systems and the privacy implications for end-users. For instance, one of the objectives is to understand trends and patterns collected when they are aimed at obtaining general knowledge that does not pertain to any specific individual. Examples of such tasks include learning of commuting patterns, inference of recommendation rules, and creation of advertising segments.

Collaborative Action CAPRIS (2011-2014): the Collaborative Action on the Protection of Privacy Rights in the Information Society (CAPRIS), is an Inria national project, which goal is to tackle privacy-related challenges and provide solutions to enhance the privacy protection in the Information Society. His main tasks are the identification of existing and future threats to privacy, and the design of appropriate measures to assess and quantify privacy.

ANR CMON (2009-2012) : This project involves, in addition to Inria, Technicolor Paris Lab, LIP6, ENS and the Grenouille.com association. CMON stands for collaborative monitoring. It is an industrial research project that develops the technology needed to allow end-users to collaborate in order to identify the origin and cause of Internet service degradation. The main differentiating assumptions made in this project are that (i) ISPs do not cooperate together, and (ii) one cannot rely on any information they provide in order to diagnose service problems. Even more, CMON considers that these ISP will try to masquerade the user observations in order to make their service look better. The software designed in this project will be added to the toolbox currently provided by the Grenouille architecture. The hope is that such a project will encourage ISPs to improve their quality of service and will contribute to improve customer satisfaction.

See also <http://wiki.grenouille.com/index.php/CMON>.

ANR F-Lab (2011-2013): ANR funded project on the federation of computation, storage and network resources, belonging to autonomous organizations operating heterogeneous testbeds (e.g. PlanetLab testbeds and Sensors testbeds). This includes defining terminology, establishing universal design principles, and identifying candidate federation strategies. Other partners : UPMC, A-LBLF and Thales.

ANR Connect (2011-2012): ANR funded project on content centric Networking architecture. The aim is to propose adequate naming, routing, cache management and transmission control schemes for CCN based networks. Our contribution is centered on network traffic characterization video streaming and on the integration of the CCNx code in the ns-3 simulator. Other partners: UPMC, Alcatel Lucent, Orange R&D, IT.

ANR SCATTER (2011-2012): ANR funded project on Scalable Naming in Information Centric Networks. The goal of this activity is to evaluate the scalability of state of the art naming schemes both from the name resolution and routing points of view. The four main approaches that will be considered are: Content Centric Networking (CCN), Publish-Subscribe Internet Routing Paradigm (PSIRP), Network of Information (NetInf) and Data-Oriented Network Architecture (DONA). Other French partners: UPMC. International KIC partner: SICS.

8.3. European Initiatives

8.3.1. FP7 Projects

8.3.1.1. NOVI

Title: Networking innovations Over Virtualized Infrastructures

Type: COOPERATION (ICT)

Defi: CAPACITIES programme.

Instrument: Specific Targeted Research Project (STREP)

Duration: September 2010 - February 2013

Coordinator: NTUA (Greece)

Others partners: 13 european partners including GARR, ELTE, Cisco, etc.

See also: <http://www.fp7-novi.eu/>

Abstract: NOVI (Networking innovations Over Virtualized Infrastructures) research concentrates on efficient approaches to compose virtualized e-Infrastructures towards a holistic Future Internet (FI) cloud service. Resources belonging to various levels, i.e. networking, storage and processing are in principle managed by separate yet interworking providers. NOVI will concentrate on methods, information systems and algorithms that will enable users with composite isolated slices, baskets of resources and services provided by federated infrastructures.

8.3.1.2. Fed4Fire

Title: Federation for Future Internet Research and Experimentation

Type: COOPERATION (ICT)

Defi: FIRE programme.

Instrument: Integrating Project (IP)

Duration: October 2012 - October 2016

Coordinator: iMinds (Belgium)

Others partners: 17 european partners including iMinds, IT Innovation, UPMC, Fraunhofer, TUB, UEDIN, NICTA, etc.

See also: <http://www.fed4fire.eu/>

Abstract: Fed4FIRE will deliver open and easily accessible facilities to the FIRE experimentation communities, which focus on fixed and wireless infrastructures, services and applications, and combinations thereof. The project will develop a demand-driven common federation framework, based on an open architecture and specification. It will be widely adopted by facilities and promoted internationally. This framework will provide simple, efficient, and cost effective experimental processes built around experimenters' and facility owners' requirements. Insight into technical and socio-economic metrics, and how the introduction of new technologies into Future Internet facilities influences them, will be provided by harmonized and comprehensive measurement techniques. Tools and services supporting dynamic federated identities, access control, and SLA management will increase the trustworthiness of the federation and its facilities. A FIRE portal will offer brokering, user access management and measurements. Professional technical staff will offer first-line and second-line support to make the federation simple to use. The project will use open calls to support innovative experiments from academia and industry and to adapt additional experimentation facilities for compliance with Fed4FIRE specifications. A federation authority will be established to approve facilities and to promote desirable operational policies that simplify federation. A Federation Standardization Task Force will prepare for sustainable standardization beyond the end of the project. The adoption of the Fed4FIRE common federation framework by the FIRE facilities, the widespread usage by both academic and industrial experimenters, and the strong links with other national and international initiatives such as the FI-PPP, will pave the way to sustainability towards Horizon 2020.

8.3.1.3. OPENLAB

Title: OpenLab: extending FIRE testbeds and tools

Type: COOPERATION (ICT)

Defi: ICT 2011.1.6 Future Internet Research and Experimentation (FIRE)

Instrument: Integrated Project (IP)

Duration: September 2011 - January 2014

Coordinator: Université Pierre et Marie Curie (France)

Others partners: 18 European partners (including ETH Zurich, Fraunhofer, IBBT, TUB, UAM, etc.) and Nicta from Australia.

See also: <http://www.ict-openlab.eu/>

Abstract: OpenLab brings together the essential ingredients for an open, general purpose and sustainable large scale shared experimental facility, providing advances to the early and successful prototypes serving the demands of Future Internet Research and Experimentation. OpenLab partners are deploying the software and tools that allow these advanced testbeds to support a diverse set of applications and protocols in more efficient and flexible ways. OpenLab's contribution to a portfolio that includes: PlanetLab Europe (PLE), with its over 200 partner/user institutions across Europe; the NITOS and w-iLab.t wireless testbeds; two IMS telco testbeds that can connect to the public PSTN, to IP phone services, and can explore merged media distribution; an LTE cellular wireless testbed; the ETOMIC high precision network measurement testbed; the HEN emulation testbed; and the ns-3 simulation environment. Potential experiments that can be performed over the available infrastructure go beyond what can be tested on the current internet. OpenLab extends the facilities

with advanced capabilities in the area of mobility, wireless, monitoring, domain interconnections and introduces new technologies such as OpenFlow. These enhancements are transparent to existing users of each facility. Finally, OpenLab will finance and work with users who propose innovative experiments using its technologies and testbeds, via the open call mechanism developed for FIRE facilities.

8.3.1.4. FI-WARE

Title: Future Internet Ware.

Type: COOPERATION (ICT).

Defi: PPP FI: Technology Foundation: Future Internet Core Platform.

Instrument: Integrated Project (IP).

Duration: May 2011 - April 2014.

Coordinator: Telefonica. (Spain)

Others partners: SAP (Germany), IBM (Israel, Switzerland), Thales Communications (France), Telecom Italia (Italy), France Telecom (France), Nokia Siemens Networks (Germany, Hungary, Finland), Deutsche Telekom (Germany), Technicolor (France), Ericsson (Sweden), Atos Origin (Spain), Ingeneria Informatica (Italy), Alcatel-Lucent (Italy, Germany), Siemens (Germany), Intel (Ireland), NEC (United Kingdom), Fraunhofer Institute (Germany), University of Madrid (Spain), University of Duisburg (Germany), University of Roma La Sapienza (Italy), University of Surrey (United Kingdom).

See also: <http://www.fi-ware.eu/>.

Abstract: The goal of the FI-WARE project is to advance the global competitiveness of the EU economy by introducing an innovative infrastructure for cost-effective creation and delivery of services, providing high QoS and security guarantees. FI-WARE is designed to meet the demands of key market stakeholders across many different sectors, e.g., healthcare, telecommunications, and environmental services. The project unites major European industrial actors in an unique effort never seen before. The key deliverables of FI-WARE will deliver an open architecture and implementation of a novel service infrastructure, building upon generic and reusable building blocks developed in earlier research projects. This infrastructure will support emerging Future Internet (FI) services in multiple Usage Areas, and will exhibit significant and quantifiable improvements in the productivity, reliability and cost of service development and delivery - building a true foundation for the Future Internet.

8.3.2. EIT KIC funded activities

Our project team was involved in 2012 in **six activities** funded by the EIT ICT Labs KIC:

Title: **Fitting**, Future InterneT (of ThINGs) facility

Activity Number: 12340

Duration: 2011-2013

Coordinator: UPMC (France)

Others partners: Alcatel Lucent, Fraunhofer FOKUS, BME, IT, U. Paris XI.

Abstract: FITTING develops a testbed federation architecture that combines wireless and wired networks. Through FITTING, components and solutions developed in the projects OneLab2, PII and SensLAB are brought together to facilitate access. These components and devices complement each other – for instance SensLAB enhances the testbed federation by adding wireless sensors. FITTING addresses issues related to usability and accessibility of federated experimentation resources from multiple autonomous organizations. FITTING is a process of federating elements from various European and national initiatives into a global shared resource pool with a standardized interface to access them. Further, FITTING will adopt a user-driven (researchers, developers, students) approach with its running testbeds allowing experimentation with different technologies to meet the variety of

needs of a broad customer base. The FITTING activity is mentioned as a “success story” by the EIT ICT Labs KIC ¹. In fact, after an initial funding in 2010, the french partners succeeded to get the FIT Equipment of Excellence project accepted with a total budget of 5.8 MEuros to develop a testbed federation in France.

Mobile Privacy

This activity deals with privacy issues in mobile and geo-based systems.

Smart-Space Privacy

This activity deals with privacy issues in smart environments, with a particular issue on smart metering systems.

Software-Defined Networking (SDN)

The objective of this activity is to explore software-defined networking at different positions on the axis between basic flow-level processing (using OpenFlow for end-to-end flows) in controlled fixed networks and cooperation between mobile end nodes in the open wireless Internet (using opportunistic networking for resources communicated hop-by-hop).

Information-centric networking (ICN) experimentation

The goal of this activity is to define and implement an early validation environment for ICN proposals.

Seamless P2P video streaming for the web

In this activity, we will extend the current capabilities of the P2P network to distribute content to collaborators. We will analyze privacy concerns in this domain and propose design guidelines to mitigate them.

8.4. International Initiatives

8.4.1. Inria Associate Teams

8.4.1.1. COMMUNITY

Title: Message delivery in heterogeneous networks

Inria principal investigator: Thierry Turletti

International Partner (Institution - Laboratory - Researcher):

University of California Santa Cruz (United States) - School of Engineering - Katia Obraczka

Duration: 2009 - 2014

See also: <http://inrg.cse.ucsc.edu/community/>

During the first three years of the COMMUNITY associate team, we have explored solutions to enable efficient delivery mechanisms for disruption-prone and heterogeneous networks (i.e. challenged networks). In particular, we have designed the MeDeHa framework along with the Henna naming scheme, which allow communication in infrastructure and infrastructure-less networks with varying degrees of connectivity. We have also proposed efficient routing strategies adapted to environment with episodic connectivity that take into account the utility of nodes to relay messages. The various solutions have been evaluated using both simulations and real experimentations in testbeds located at Inria and UCSC. These solutions have demonstrated good performance in challenged networks. However, the ossification of the Internet prevents the deployment of such solutions in large scale. We have decided to extend our collaboration in two research directions: (1) the exploration of the software-defined networking paradigm to facilitate the implementation and large scale deployment of new network architectures to infrastructure-less network environments; and (2) the design of innovative information-centric communication mechanisms adapted to challenged networks.

¹ See <http://eit.europa.eu/kics1/stories-archiv/stories-single-view/article/fitting-from-eit-ict-labs-the-next-generation-testbeds.html>

8.4.1.2. SIMULBED

Title: SIMULBED: Large-Scale Simulation Testbed for Realistic Evaluation of Network Protocols and Architectures

Inria principal investigator: Walid DABBOUS

International Partner (Institution - Laboratory - Researcher):

Keio University (Japan) - Shonan-Fujisawa Campus - Osamu Nakamura

Duration: 2012 - 2014

See also: <http://planete.inria.fr/Simulbed>

Simulators and experimental testbeds are two different approaches for the evaluation of network protocols and they provide a varying degree of repeatability, scalability, instrumentation and realism. Network simulators allow fine grained control of experimentation parameters, easy instrumentation and good scalability, but they usually lack realism. However, there is a growing need to conduct realistic experiments involving complex cross-layer interactions between many layers of the communication stack and this has led network researchers to evaluate network protocols on experimental testbeds.

The use of both simulators and testbeds to conduct experiments grants a better insight on the behavior of the evaluated network protocols and applications. In this project, we focus on the design of SIMULBED, an experimentation platform that aims to provide the best of both worlds. Our project builds on the following state-of-the-art tools and platforms: the open source ns-3 network simulator and the PlanetLab testbed. ns-3 is the first network simulator that includes a mechanism to execute directly within the simulator existing real-world Linux protocol implementations and applications. Furthermore, it can be used as a real-time emulator for mixed (simulation-experimentation) network scenarios. PlanetLab is the well-known international experimental testbed that supports the development and the evaluation of new network services. It is composed of nodes connected to the Internet across the world, and uses container-based virtualization to allow multiple experiments running independently on the same node while sharing its resources.

The overall objective of the project is to make available to networking research community, the SIMULBED platform that will: (1) allow to conduct easily mixed simulation-experimentation evaluation of networking protocols and (2) scale up the size of the PlanetLab experimental testbed, while maintaining a high degree of realism and increasing controllability and reproducibility. We will use the NEPI unified programming environment recently developed in the Planète project-team to help in simplifying the configuration, deployment and run of network scenarios on the platform.

8.4.1.3. CLOUDY

Title: Secure and Private Distributed Data Storage and Publication in the Future Internet

Inria principal investigator: ClaudeCastelluccia

International Partners (Institution - Laboratory - Researcher):

University of California Berkeley (United States) - Electrical Engineering and Computer Science Department - Edward Lee

University of California Irvine (United States) - Donald Bren School of Information and Computer Sciences - Gene Tsudik

Duration: 2012 - 2014

See also: <http://planete.inrialpes.fr/cloudy-associated-team/>

Cloud computing is a form of computing where general purpose clients (typically equipped with a web browser) are used to access resources and applications managed and stored on a remote server. Cloud applications are increasingly relied upon to provide basic services like e-mail clients, instant messaging and office applications. The customers of cloud applications benefit from outsourcing the management of their computing infrastructure to a third-party cloud provider. However, this places

the customers in a situation of blind trust towards the cloud provider. The customer has to assume that the "cloud" always remains confidential, available, fault-tolerant, well managed, properly backed-up and protected from natural accidents as well as intentional attacks. An inherent reason for today's limitations of commercial cloud solutions is that end users cannot verify that servers in the cloud and the network in between are hosting and disseminating tasks and content without deleting, disclosing or modifying any content. This project seeks to develop novel technical solutions to allow customers to verify that cloud providers guarantee the confidentiality, availability and fault-tolerance of the stored data and infrastructure.

8.4.2. Participation In International Programs

- CIRIC: Our project-team was involved in the definition of the topics for the Network and Telecom R&D line of the (the Communication and Information Research and Innovation Center - CIRIC), the Inria research and innovation centre in Chili. In this context, we will extend our collaboration with Universidad Diego Portales, Chile.

8.5. International Research Visitors

8.5.1. Visits of International Scientists

Mostafa Ammar, Visiting Professor (one month in June 2012)

Subject: Investigating fundamental properties of wireless and mobile networks

Institution: Georgia Institute of Technology (United States)

Paul de Hert, Visiting Professor (one month in June 2012)

Subject: Benefits and limitations of the legal notion of "reasonable expectation of privacy"

Institution: Free University of Brussels (Belgium)

Katia Obraczka, Visiting Professor (one week in June 2012)

Subject: Communication in Heterogeneous Networks Prone to Episodic Connectivity

Institution: University of California at Santa Cruz (United States)

Marc Mendonca, Visiting PhD student (from Sep 2012 until Dec 2012)

Subject: Software-Defined Networking in Heterogeneous Networked Environments

Institution: University of California at Santa Cruz (United States)

Ilaria Cianci, Visiting PhD student (from Nov 2012 until Aug 2013)

Subject: Content Centric Networking

Institution: Politecnico di Bari, Italy

8.5.2. Visits to International teams

Mohamed Ali Kaafar, spending a sabbatical at NICTA Australia in Sydney (since February 2012)

Subject: Online Privacy Enhancing Technologies: measuring the risks and designing countermeasures

Thierry Turletti, Visiting researcher to University of California at Santa Cruz (one week in February 2012)

Subject: Community Associated team

Thierry Turletti, Alina Quereilhac and Frederic Urbani, Visitors to NICT, Japan (one week in December 2012)

Subject: Simulbed Associated team

8.5.2.1. Internships

Riccardo Ravaioli (from Mar 2012 until Aug 2012)

Subject: Is the Internet neutral or content-aware? Handling the question by measurements

Institution: Master Ubinet - Sophia Antipolis

Tessema Mindaye (from Mar 2012 until Aug 2012)

Subject: Increasing the space of applications for statistical traffic classification methods

Institution: Master Ubinet - Sophia Antipolis

Francisco Santos (from Mar 2012 until Aug 2012)

Subject: Content management in mobile wireless networks

Institution: EPFL - Lausanne

Lucia Gueguezian Odizzio (from May 2012 until Oct 2012)

Subject: Automatic IP address and routing table assignment for heterogeneous network topologies

Institution: Universidad de la Republica Oriental del Uruguay

Xuan-Nam Nguyen (from March 2012 until Aug 2012)

Subject: Software Defined Networking in Hybrid Networks

Institution: Université de Nice Sophia Antipolis (France)

Sumit BANSAL (from Feb 2012 until Jul 2012)

Subject: Attacks and Defenses for Secure Virtual Coordinate Systems

Institution: IIT Ropar (India)

AXIS Project-Team

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 available: 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 registered 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 Accommodation Web Sites 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

Type: PACALABS

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

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> for a summary of the main outcomes 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 telecommunication 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 led 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 Mediterranean Institute of Risks, Environment and Sustainable development (IMREDD⁷ 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: <http://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

⁷IMREDD: 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 remain 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 available to ICT Usage Lab projects and to other experiments by academics or association of PACA region: EPI Reves (Inria), CSTB, I3M (University 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 European 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 contacts 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 professionals (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 personalised content. Personalisation will be based on context parameters related to the user and available semantic information. The main result will be to develop an engine merging case-based reasoning techniques, recommendation techniques 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 meeting (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 administration 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.elliott-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 deliverables [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, Netherlands) for the two scientific publications [26], the white paper [59] and the deliverables 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 (ECAAF), 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 ECAAF 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 Design 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 Design and Evaluation is a usability and user experience research community running under the auspices of COST (<http://www.cost.esf.org/>). The main objective is to harmonize research and practice on design and evaluation methodologies for computing 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 Orpailleur, AxIS and CIn-UFPE side. It aims at developing Numerical and Symbolical methods of clustering on Multi-valued and Interval Data.

This project aims at developing and comparing clustering algorithms for interval and multi-valued data. Two families of algorithms are studied, namely clustering algorithms based on the use of a similarity or a distance for comparing the objects, and classification algorithms in Formal Concept Analysis (FCA) based on attribute sharing between objects. The objectives here are to combine the facilities of both families of algorithms for improving the potential of each family in dealing with more complex and voluminous datasets, in order to push the complexity barrier farther in the mining of complex data. Biological data, namely gene expression data, are used for test and evaluation of the combination of algorithms. The project involves three teams, one Brazilian team and two French Inria teams, 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)

AYIN Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

- Paula Craciun and Josiane Zerubia met Antoine Mangin, Scientific Director at ACRI-ST (<http://www.acri-st.fr/English/index.html>), in Sophia Antipolis to discuss about Paula Craciun's Master research work on boats detection and counting in Mediterranean harbors using marked point processes.

8.2. European Initiatives

8.2.1. Collaborations with Major European Organizations

LIRA consortium

Partners: Philips R&D (Eindhoven), CWI (Amsterdam), Fraunhofer Institutes (Berlin, Stuttgart, Darmstadt), Inria-SAM

Skincare image and signal processing: Analysis, modeling and characterization of the condition of human skin

8.3. International Initiatives

8.3.1. Participation In International Programs

- In July, during the visit of Prof. Qiyin Fang from Mc Master University (<http://www.mcmaster.ca/>), Hamilton, Canada, we identified a research project of mutual interests related to new optical sensors for skin imaging and their biomedical applications. the visit of Prof. Fang was supported by the French Embassy in Canada and in November we jointly applied to the France-Canada Research Fund to be able to collaborate during the next 2 years.

8.4. International Research Visitors

8.4.1. Visits of International Scientists

8.4.1.1. Internships

Siddharth Buddhiraju (from May 2012 until July 2012)

Subject: Satellite image classification using Bootstrap EM

Institution: IIT Bombay (India)

Paula Craciun (from March 2012 until August 2012)

Subject: Boats detection and counting in Mediterranean harbors

Institution: West University of Timisoara, Romania

8.4.1.2. Visiting professors

Qiyin Fang (One week in September 2012)

Subject: New optical sensors for skin imaging and their biomedical applications

Institution: McMaster University (Canada)

Joseph Francos (One week in March and one week in July 2012)

Subject: Manifold embedding for geometric deformations estimation. Application to both remote sensing and skin imaging

Institution: Ben-Gurion University (Israel)

Ian Jermyn (One week in July 2012)

Subject: Object shape detection in images using prior shape information and higher order active contours

Institution: Durham University (UK)

Zoltan Kato (One week in July 2012)

Subject: Markov random fields for image segmentation

Institution: Sveded University (Hungary)

Nataliya Zagorodna (One month in July 2012)

Subject: Use of periodic or cyclic random processes for image processing, with application to both remote sensing and skin imaging

Institution: Ternopil Ivan Pul'uj Technical University (Ukraine)

8.4.2. Visits to International Teams

- Ikhlef Bechar was visiting Dr. Ian Jermyn at Durham University, UK from October 21, 2012 until November 19, 2012.
- Yannick Verdie visited National Institute of Informatics (Nii) in Tokyo, Japan from February 15, 2012 to June 15, 2012, funded by Nii internship exchange program. He worked there on the topic of exact sub graph matching by mixed-integer linear problem.

COPRIN Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR

8.1.1.1. ID4CS project

Participant: Yves Papegay.

The ID4CS project, supported by French National Research Agency (ANR) through COSINUS program has the ambition to propose a modeling and simulation environment for designing complex systems such as aircrafts, based on a self-adaptive, distributed and open multi-agent architecture distributing the optimization process inside the agents.

As a partner of the project we are mainly involved in the definition of the use case on preliminary aircraft design, in collaboration with Airbus (6.3.1), in development of uncertainty analysis algorithms, and in automatic generation of agents based on models.

8.1.1.2. COGIRO project

Participants: Julien Alexandre Dit Sandretto, David Daney [correspondant], Jean-Pierre Merlet.

We are collaborating with LIRMM, LASMEA and TECNALIA for the development of large scale wire-driven parallel robots⁵. We are especially involved in the calibration of a prototype developed by LIRMM and TECNALIA, see section 6.2.1.2.

8.2. European Initiatives

8.2.1. FP7 Projects

Participants: Laurent Blanchet, David Daney, Jean-Pierre Merlet [correspondant], Odile Pourtallier, Yves Papegay.

Program: FP7-2011-NMP-ICT-FoF, Factory of the Future

Project acronym: CableBot

Project title: Parallel Cable Robotics for Improving Maintenance and Logistics of Large-Scale Products

Duration: December 2011- December 2014

Coordinator: Tecnalía

Other partners: LIRMM (France), FRAUNHOFER-IPA (Germany), Duisburg-Essen University (Germany), EADS (France), ACCIONA (Spain), VICINAY (Spain)

Abstract: The CableBOT project deals with a novel methodology for designing, developing and evaluating cable robots customized for the automation in large-scale auxiliary processes. Parallel cable robots extend the payloads and workspace of conventional industrial robots by more than two orders of magnitude. The main objective is to develop a new generation of modular and reconfigurable robots able to perform many different steps in the post-production of large-scale structures.

⁵<http://www2.lirmm.fr/cogiro/>

GRAPHIK Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR

8.1.1.1. ASPIQ

Participants: Jean-François Baget, Jérôme Fortin, Marie-Laure Mugnier, Michel Leclère.

ASPIQ (ASP technologies for Querying large scale multisource heterogeneous web information), is an ANR white program that started in Oct. 2012. The project coordinator is Odile Papini (LSIS), and it involves partners from CRIL and LERIA.

The main objective of this project is to propose:

- extensions of standard ASP for representing OWL2 tractable sublanguages;
- new operations for merging conflicting information in this extended ASP;
- the identification of subclasses of this extended ASP allowing for efficient query answering mechanisms;
- an implementation of a prototype reasoning system.

8.1.1.2. Pagoda

Participants: Jean-François Baget, Marie-Laure Mugnier, Malanie König, Michaël Thomazo.

Pagoda is an ANR JCJC (young researchers) that will begin in Jan. 2013. The project coordinator is Meghyn Bienvenu (LRI), and it involves partners from the EPI LEO, the LIG, and the Anatomy Laboratory of Grenoble.

The primary aim of this project is to help address challenges brought by scalability and the handling of data inconsistencies by developing novel OBDA query answering algorithms and practical methods for handling inconsistent data.

8.1.1.3. Qualinca

Participants: Michel Leclère, Michel Chein, Madalina Croitoru, Lăuza Guizol, Akila Ghersedine, Rallou Thomopoulos, Marie-Laure Mugnier.

Qualinca is an ANR Contint project that started in Apr. 2012 and will end in Sept. 2015. The project coordinator is Michel Leclère (GraphIK), and it involves partners from LRI, LIG, ABES and INA.

The main objective is to elaborate mechanisms allowing to:

- evaluate the quality of an existing documents base;
- maintain a given level of quality by controlling updating operations;
- increase the quality of a given base;
- develop generic methods that take into account the quality of a given base (for instance for searching documents or interconnecting bases).

8.1.2. Competitivity Clusters

We are taking part in the Laboratory of Excellence ("labex") *NUMEV* (Digital and Hardware Solutions, Modelling for the Environment and Life Sciences), led by University of Montpellier 2 in partnership with CNRS, University of Montpellier 1 and Inria. This project aims at developing information and communication technologies for environmental and life sciences. We are participating to one of the four axis, namely "Scientific Data: processing, integration and security".

8.2. European Initiatives

8.2.1. FP7 Projects

8.2.1.1. EcoBioCap

Participants: Patrice Buche, Madalina Croitoru, J  r  me Fortin, Patricio Mosse.

FP7-KBEE, March 2011–March2015. Led by INRA (and scientifically managed by Montpellier IATE laboratory). Sixteen partners among which Cork University (Ireland), CSIC (Spain), Roma University La Sapienza (Italy), SIK (Sweden). The objective of EcoBioCAP is to “provide the EU food industry with customizable, ecoefficient, biodegradable packaging solutions with direct benefits both for the environment and EU consumers in terms of food quality and safety”. GraphIK is involved in this project via its common members with IATE-KRR team. The budget is managed by IATE team. This project will feed Axis 2.

- See Sect. 6.2 (argumentation for decision making in agronomy) for the results obtained this year.

8.2.2. Collaborations with Major European Organizations

Leon van der Torre: University of Luxembourg, Computer Science and Communications Research Unit (Luxembourg)

Souhila Kaci collaborates with Leon van der Torre on argumentation aspects. They co-supervise a PhD student (Tjitze Rienstra).

Sebastian Rudolph: University of Karlsruhe, AIFB (Germany)

Jean-Fran  ois Baget, Marie-Laure Mugnier and Micha  l Thomazo collaborate with Sebastian Rudolph on the study of complexity classes for fragments of existential rules. This successful work has already led to major publications (see Sect. 6.1).

Srdjan Vesic: University of Luxembourg, Individual and Collective Reasoning research group (Luxembourg)

Madalina Croitoru collaborates with Srdjan Vesic on the link between inconsistency tolerant reasoning and argumentation.

Nir Oren: University of Aberdeen, Department of Computing Science (United Kingdom)

Madalina Croitoru and J  r  me Fortin collaborate with Nir Oren on argumentation and preference logics.

Ioannis A. Vetsikas: University of Athens, IIT (Greece)

Madalina Croitoru collaborates with Ioannis A. Vetsikas on mechanism design aspects of multi-agent knowledge allocation.

8.3. International Research Visitors

8.3.1. Visits of International Scientists

- Feb. 2012: Leon van der Torre (Pr., University of Luxembourg), collaboration on argumentation systems (2 days)
- Mar. 2012: Meghyn Bienvenu (CR CNRS, IASI/LEO), collaboration on Ontology-Based Data Access (5 days)
- Apr. 2012: Karima Sedki (MdC AgroCampus-Rennes, IRISA), Seminar on "Reasoning with preferences and deciding under uncertainty"
- May. 2012: Safa Yahy (MdC University of Marseille, LSIS), Seminar on "Management of inconsistency with justified argumentative inference"
- Sept. 2012: Bernard Moulin (Universit   Laval, Canada), collaboration on argumentation and dynamic systems (1 month)

- Oct. 2012: Jean-François Condotta (CRIL), collaboration on representation and treatment of inconsistencies (2 days)
- Nov. 2012: Frank van Harmelen (Freie Univ. Amsterdam), seminar on "Reasoning over very, VERY large knowledge bases: towards a web-scale knowledge base of a 100 million facts and beyond"

8.3.1.1. Internships

Patricio Mosse (6 months)

Subject: Argumentation based preference aggregation (cf Ecobiocap in Sect. 8.2)

Institution: University of Buenos Aires (Argentina)

Awa Diattara (6 months)

Subject: Default rules for an agronomy application (cf CTFC in Sect. 7.2)

Institution: University Gaston Berger of Saint-Louis, SÃn@gal

8.3.2. Visits to International Teams

- Madalina Croitoru and JÃrÃme Fortin. Visit to the Department of Computer Science (University of Aberdeen). 5 days in January 2012.
- Souhila Kaci. Visit to Leon van der Torre (University of Luxembourg). January 2012.
- Michaël Thomazo. Visit to KIT (Karlsruhe Institute of Technology). 6 weeks in June/July 2012. Collaboration with Sebastian Rudolph on Ontology-Based Data Access. Funded by DAAD http://paris.daad.de/bourses_de_recherche_de_courte_duree.html.
- Madalina Croitoru. Visit to Srdjan Vesic (University of Luxembourg). 1 week in November 2012. Collaboration on the link between maximal repairs and argumentation extensions
- Jean-François Baget, Marie-Laure Mugnier and Michaël Thomazo. Visit to the Information Systems Group (University of Oxford). 3 days in December 2012. Scientific Exchanges on Existential Rules and Datalog+/-.

LAGADIC Project-Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

8.1.1. *FUI Rev-TV project*

Participants: Céline Teulière, François Chapeau, Eric Marchand.

no. Inria Rennes 4549, duration: 36 months.

This project started in January 2010. It is composed of a consortium managed by Technicolor with Artefacto, Istia, Telecom Bretagne, Soniris, Bilboquet and Inria Lagadic and Metiss groups. The goal of this project is to provide tools to develop new TV programs allowing the final user to interact within an immersive and convivial interface. Within this project, we focused on the development of tracking algorithms (3D localization) and on visual servoing techniques for camera localization.

8.1.2. *i-Lab ExtAR*

Participants: Clément Samson, Eric Marchand.

duration: 24 months.

ExtAR is an Inria i-Lab with Artefacto that started in March 2011. Its goal is to develop an augmented reality library for smartphones.

8.1.3. *Apash project*

Participants: Rafik Sekkal, François Pasteau, Marie Babel.

no Insa Rennes 2012-230, duration : 24 months.

Started in September 2012, the Apash project is supported by the Images & Réseaux cluster. It involves three laboratories connected to Insa Rennes, namely Irisa/Inria, IETR and LGCGM. Two industrial partners take part into this project: AdvanSEE and Ergovie. It aims at designing a driving assistance for electrical wheelchair towards the autonomy and security of disabled people. The work realized within this project is described in Section 6.3.6 .

8.2. National Initiatives

8.2.1. *DGA/DGCIS Rapid Canari*

Participants: Patrick Rives, Cyril Joly.

no. Inria Sophia 4979, duration : 36 months.

This project started in July 2010. It aims at developing a full autonomous indoor mobile robot dedicated to survey missions. The partners are Robopec and ECA companies. We are in charge of the development of Slam aspects. The contract supported Cyril Joly's engineer grant (see Section 6.3.3).

8.2.2. *ANR Contint Prosit*

Participants: Tao Li, Alexandre Krupa.

no. Inria Rennes 3585, duration: 46 months.

This project is led by the Prisme lab in Bourges. It started in December 2008 in collaboration with LIRMM in Montpellier, LMS in Poitiers, CHU of Tours, and the Robosoft company. Its goal is to develop an interactive master-slave robotic platform for medical diagnosis applications (tele-echography) with assistance functionalities. The work that we have realized within this project is described in Section 6.4.2 .

8.2.3. ANR Contint US-Comp

Participants: Caroline Nadeau, Alexandre Krupa.

no. Inria Rennes 3560, duration: 42 months.

This project, led by Alexandre Krupa, started in December 2008. It involves a collaboration with the Visages team in Rennes, LSIT in Strasbourg and Lirmm in Montpellier. Its goal is to provide methodological solutions for real-time compensation of soft tissues motion during ultrasound imaging. The approach consists in synchronizing the displacement of a 2D or 3D ultrasound probe to stabilize the observed image by the use of a robotic arm. The work that we have realized within this project is described in Sections 6.4.1 and 6.4.3 .

8.2.4. ANR P2N Nanorobust

Participants: Le Cui, Eric Marchand.

no. URI 11FA310-06D, duration: 48 months.

This project started in November 2011. It is composed of a consortium managed by Femto-ST in Besançon with LPN and Isir in Paris, Thalès and Lagadic group through the Université de Rennes 1. Nanorobust deals with the development of micro- and nano-manipulation within SEM (Scanning Electron Microscope). Our goal is to provide visual servoing techniques for positioning and manipulation tasks with a nanometer precision.

8.2.5. PEA Decsa

Participants: Aurélien Yol, Eric Marchand, François Chaumette.

no Inria Rennes 6630, duration: 36 months.

This project started in November 2011. It is composed of a consortium managed by Astrium with the Novadem, Sirehna, Spot Image and Magellium companies, and with the Inria Lagadic and Steep groups. It is devoted to the development of navigation and perception algorithms for small drones in urban environment.

8.2.6. Equipex Robotex

Participants: Aurélien Yol, Fabien Spindler, François Chaumette.

no Inria Rennes 6388, duration: 10 years.

Lagadic is one of the 15 French partners involved in the Equipex Robotex network. It is devoted to get significative equipments in the main robotics labs in France. This year, it allowed us to buy the Viper S650 arm and the Pioneer 3DX described in Sections 5.4 and 5.5 . In a near future, we plan to buy a humanoid robot, Romeo, by Aldebaran Robotics.

8.2.7. Inria Large Scale Initiative Action Pal

Participants: Patrick Rives, Marie Babel, François Chaumette, Luca Marchetti, Cyril Joly, Rafik Sekkal, François Pasteau.

Lagadic participates in the large-scale initiative action Pal (Personally Assisted Living) to develop technologies and services to improve the autonomy and quality of life for elderly and fragile persons. The purpose of Pal is to provide an experimental infrastructure, in order to facilitate the development of models, tools, technologies and concept demonstrations. Using the skills and objectives of the involved teams, four research themes have been defined: a) assessing the degree of frailty of the elderly, b) mobility of people, c) rehabilitation, transfer and assistance in walking, and d) social interaction. Lagadic is currently involved in the themes "mobility of people" and "assistance in walking" through collaborations with the EPI E-motion (Grenoble), EPI Coprin (Sophia Antipolis), and Handibio (Toulon). See Sections 6.3.6 , 6.2.4 and 6.3.5 .

8.3. European Initiatives

8.3.1. FP7 Regpot Across

Program: Regpot

Project acronym: Across

Project title: Center of Research Excellence for Advanced Cooperative Systems

Duration: from September 2011 till March 2015

Coordinator: Prof. Ivan Petrovic from University of Zagreb (Croatia)

Other partners: KTH (Sweden), ETHZ (Switzerland), TUM (Germany), University of Manchester (UK), Vienna University of Technology (Austria), Politecnico di Milano (Italy), University of Sevilla (Spain), Eindhoven University of Technology (The Netherlands), University of Athens (Greece), etc.

8.4. International Initiatives

8.4.1. Participation in International Programs

8.4.1.1. Inria/CNPq MuNave

The project MuNave (2010 - 2012) funded through the Inria/CNPq collaboration framework, succeeds to a long time collaboration between Patrick Rives and the CTI in Campinas (Brazil). This project aims at investigating new research themes in perception and control for autonomous mobile robots.

8.5. International Research Visitors

8.5.1. Visits of International Scientists

- Shogo Arai, Assistant Prof. at the University of Tohoku in Sendai, Japan, spent a two-month visit in our group in Rennes in March and April 2012 to work on visual servoing.
- Nicolas Alt, Ph.D. student at the Technische Universität München, Germany, visited our group in Sophia Antipolis from July 2 to September 26. He worked on the detection and modeling of transparent objects using a Kinect.
- Rogelio Esteller Curto, Assistant Prof. at the University of Jaume-I in Castellon, Spain, has spent a one-month visit in our group in Rennes in November 2012 to work on visual servoing.

8.5.2. Internships

Thanks to the FP7 Regpot project (see Section 8.3.1), we have got three internships from University of Zagreb from March to June 2012:

- Ante Trbojevic
- Petra Bosilj
- Petar Palasek.

Two internships from the University of Guanajuato started in December 2012:

- Raul Orlando Alvarado Lara
- Francisco Javier Rangel Butanda.

REVES Project-Team

7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. ANR ALTA

Participants: Emmanuelle Chapoulie, Adrien David, Stefan Popov, George Drettakis.

The ANR ALTA project started in October 2011, and focuses on the development of novel algorithms for realistic and efficient global illumination. The project is coordinated by the Grenoble Inria group ARTIS (N.Holzschuch), and the Bordeaux Inria group MANAO (X. Granier) is also a partner.

Our participation is the study of error bounds for these algorithms and the development of interactive global illumination solutions that can be used in Virtual Reality solutions, for example in the context of the immersive space.

7.1.2. ANR DRAO

Participants: Emmanuel Iarussi, Adrien Bousseau.

The ANR DRAO is a young researcher project coordinated by Adrien Bousseau, in collaboration with the InSitu project team at Inria Saclay - Ile de France (W. Mackay and T. Tsandilas) and the MANAO project team (P. Barla and G. Guennebaud) and POTIOC project team (M. Hachet) at Inria Bordeaux - Sud Ouest. The goal of this collaboration is to develop novel drawing tools for amateurs as well as for expert designers and illustrators, combining expertise in Computer Graphics (REVES and MANAO) and Human-Computer Interaction (InSitu, POTIOC). This ANR project funds the PhD of Emmanuel Iarussi.

The first part of the project will be to observe how people draw with existing tools. To do so we will conduct observational studies where we will interview designers and illustrators and collect data by videotaping drawing sessions and by recording drawings with digital pens. In the second part of the project we will deduce from our observations new user interfaces and rendering algorithms that automate part of the drawing process and enrich 2D drawings with realistic rendering capabilities. We will combine computer vision and computer graphics techniques to estimate geometric information from sketches. We will then use this information to guide rendering algorithms that generate plausible depictions of material and lighting over the drawing. In the third part of the project, we plan to develop computer-assisted drawing lessons to teach amateurs to draw from photographs and 3D models. We will apply image analysis algorithms to estimate the structure of a photograph and use that structure as guidance for drawing. To summarize, the goal of the ANR DRAO project is to make amateurs more confident in their drawing skills and to allow expert designers to produce complex illustrations more effectively.

7.1.3. ADT Interact3D

Participants: Adrien David, George Drettakis.

This ADT involves half time software development for ARC NIEVE, and the other half general support to the new Immersive Space Gouraud-Phong in Sophia-Antipolis (supervised by Jean-Christophe Lombardo of the DREAM service). The main contribution was the complete rewrite of our VR application environment with the development of the Imerse software. This platform will allow first experiments, and the development of a generic Virtual Reality framework addressing neuroscience/psychology applications. This generic platform is based on osgVR which aims at a high-quality context abstraction to be usable in several domains, as well as distributed rendering capacities. These improvements, deployable for a variety of applications to come, are tightly coupled with the current ARC NIEVE, thus contributing to its implementation. Future prospects for the ADT Interact 3D include developing novel multimodal interaction techniques for example for gesture-based interaction etc.

7.1.4. ARC NIEVE: Navigation and Interfaces in Emotional Virtual Environments

Participants: Peter Vangorp, Adrien David, George Drettakis, Gaurav Chaurasia, Emmanuelle Chapoulie.

The goal of this joint research project is to develop and evaluate improved interfaces for navigation in immersive virtual environments (VEs) such as the 4-wall stereoscopic ISpace system in the Immersive Space Gouraud-Phong.

There is evidence of significant overlap in brain structures related to spatial memory and orientation and those related to emotion. We examine the influence of high-quality 3D visual and auditory stimuli on the emotions evoked by the virtual environment. Our study focuses on the phobia of dogs as a way to modulate emotion in audiovisual VEs (see Figure 13).

Navigation in VEs involves the use of different views, i.e., egocentric (“first person”) and allocentric (“bird’s eye”) views during navigation tasks. We study appropriate visual representations for each view (for example, the level of realism ranging from abstract map-like rendering for top-down views to photorealistic rendering for first-person views), and appropriate transitions between the different views.

We develop an appropriate methodology to evaluate such navigation interfaces in stressful environments, based on the insights gained by the emotion modulation study in phobic settings. This novel methodology can be seen as a “stress-test” for navigation interfaces: if the navigation interfaces developed are successful even in stressful setups, they will definitely be successful under “normal conditions”.

ARC NIEVE has resulted in several publications this year: [21], [13].



Figure 13. A person immersed in a virtual environment where the behaviors of several dogs will evoke different levels of anxiety.

This is a joint research project with Isabelle Viaud-Delmon (IRCAM, CNRS), Anatole Lécuyer and Maud Marchal (VR4I project team, IRISA-INSA/Inria Rennes - Bretagne Atlantique), and Jean-Christophe Lombardo (DREAM / Inria Sophia Antipolis). Interact3D (Section 7.1.3) is associated with this ARC.

7.1.5. National French Bilateral Collaboration

We have ongoing collaborations with Maud Marchal and Anatole Lécuyer (VR4I project team, IRISA-INSA/Inria Rennes - Bretagne Atlantique) [13], [17], and Bruno Galerne (ENST/ENS Cachan) [15].

7.2. European Initiatives

7.2.1. FP7 Projects

7.2.1.1. VERVE

- Title: VERVE
- Type: COOPERATION (ICT)
- Defi: Services to promote E-inclusion using socially realistic virtual environments
- Instrument: Integrated Project (IP)
- Duration: October 2011 - September 2014
- Coordinator: Trinity College - Dublin (Ireland)
- Others partners: DFKI (Germany), CNRS-ParisTech (France), CNRS-IRCAM (France), U. of Zaragoza (Spain), Testaluna (IT), KAINOS (UK)
- See also: <http://www.verveconsortium.eu/>

Social exclusion has many causes, but major factors are the fear and apathy that often accompany a disability. The European e-Inclusion policy stresses the importance of ICT in improving the quality of life in potentially disadvantaged groups, including older people and persons with disabilities. In this project, we will develop ICT tools to support the treatment of people who are at risk of social exclusion due to fear and/or apathy associated with a disability. These tools will be in the form of personalised VR scenarios and serious games specifically designed for therapeutic targets and made broadly available via a novel integration of interactive 3D environments directly into Web browsers. We will perform cutting edge research into rendering and simulating personalised and populated VR environments, 3D web graphics, and serious games. These technical efforts will be underpinned by our clinical/laboratory and industry partners, who will be fully involved throughout in the requirements, design and evaluation of VERVE, and liaison with the stakeholders (i.e., participants, carers/family, and health professionals). They will implement the VERVE interventions in three use-cases, each targeting a different group of participants: Fear of falling, Apathy related to cognitive decline and behavioural disturbances, and other emotional disturbances linked to anxiety. While developing clinical assessment methods and interventions for the first two patient groups is our primary focus, our results will be applicable to a much wider range of potentially disadvantaged individuals.

For the first year period (October 2011 - September 2012), the consortium focused its effort on the following main actions:

- Designing scenarios for different situations, 3 main scenarios were designed:
 1. DogPhobia scenario (for phobias),
 2. Kitchen scenario (for Alzheimer patients),
 3. MeMoVE (for memory complaints).
- Ethical approvals submission for the different scenarios.
- Conducting different experiments in the context of these different scenarios, especially DogPhobia scenario.
- Development and adaptation of different technologies in order to implement the scenarios:
 - Image based rendering (IBR) for virtual realistic environment modeling,
 - Emotive avatars,
 - Crowds simulation,
 - Realistic human skin rendering.
- Development of different technical tool:
 - Virtual environment for mobile device serious game (Kitchen scenario),
 - Porting the IBR to immersive space for the MeMoVE scenario,
 - Adapting the partner's technologies to the different platforms within the consortium.

The first year review of the VERVE project was hold on October 2nd, 2012, and the project were judged good and follows the defined plan.

7.3. International Initiatives

7.3.1. Inria Associate Teams

7.3.1.1. CRISP

Title: Creating and Rendering Images based on the Study of Perception

Inria principal investigator: Adrien Bousseau

International Partner (Institution - Laboratory - Researcher):

University of California Berkeley (United States) - Electrical Engineering and Computer Science - Maneesh Agrawala

Duration: 2011 - 2013

See also: <http://www-sop.inria.fr/revs/crisp/>

The goal of the CRISP associate team between REVES and University of California (UC) Berkeley is to investigate novel ways to create, render and interact with images based on the study of human Perception. This novel and emerging area has been the focus of ongoing collaborations between researchers from the REVES research group at Inria (Adrien Bousseau, George Drettakis) and researchers in Computer Science and Vision Science at UC Berkeley (Maneesh Agrawala, Ravi Ramamoorthi, Martin S. Banks (Human Vision Science)). All of the researchers involved in CRISP share a common interest in creating and manipulating effective synthetic imagery. To achieve this goal we will focus on understanding how people perceive complex material, lighting and shape, on developing new rendering algorithms based on this understanding, and on building interactive tools that enable users to efficiently specify the kind of image they wish to create. More specifically, we will explore the following research directions :

Perception: Images are generated from the interaction of lighting, material, and geometry. We will evaluate how people perceive material, lighting, and geometry in realistic images such as photographs, and non realistic images such as drawings and paintings. This knowledge of human perception is essential for developing efficient rendering algorithms and interaction tools that focus on the most important perceptual features of an image. We have started several projects on the perception of materials in realistic and non realistic images, with promising results.

Rendering: We will develop rendering algorithms that generate images that are plausible with respect to the user's intent and allocate resources on the visual effects that best contribute to perception. Current projects on rendering include work on enhancing material variations in realistic and non realistic rendering.

Interaction: We will facilitate the creation of material, lighting, and geometric effects in synthetic images by developing novel user interfaces for novice and professional users. We are currently working on interfaces to draw object appearance and to relight photographs.

Our contributions have the potential to benefit different applications of image creation such as illustration (archeology, architecture, education), entertainment (video games, movies) and design (sketching, photograph editing). This research naturally falls in Inria's strategic objective of interacting with real and virtual worlds.

7.4. Bilateral Collaborations

7.4.1. France-USA

Participants: Gaurav Chaurasia, Pierre-Yves Laffont, Adrien Bousseau, George Drettakis, Christian Richardt, Jorge Lopez-Moreno.

We have an ongoing collaboration with Yale University (Holly Rushmeier and Julie Dorsey), on weathering, resulting in the publication [17]. We continue this collaboration on stone aging.

We have an ongoing collaboration with Adobe Research (Sylvain Paris) and MIT (Fredo Durand) on intrinsic images for mutiple lighting conditions, resulting in the publication [19].

We also collaborate with M. Banks, R. Ramamoorthi and M. Agrawala from the University of California, Berkeley in the context of our CRISP associate team, resulting in the publications [14], [12]. Gaurav Chaurasia spent 6 weeks this summer at UC Berkeley in the context of this collaboration. Adrien Bousseau and George Drettakis also visited UC Berkeley for 3 days in August.

7.4.2. *France-Switzerland*

Participants: Gaurav Chaurasia, Sylvain Duchêne, George Drettakis.

We collaborate with O. Sorkine at ETH Zurich on image-based rendering, which resulted in a submission to ACM TOG.

7.4.3. *France-Germany*

Participant: George Drettakis.

We collaborate with the Max-Planck-Institut, Germany, where P. Vangorp is now a PostDoc. We collaborate on perception techniques for rendering and on interactions for virtual environments. This resulted in the following publication [13].

7.4.4. *France-Spain*

Participants: George Drettakis, Adrien Bousseau.

We collaborate with C. Bosch who is now at the University of Girona (Spain), on weathering.

7.4.5. *France-Italy*

Participant: Adrien Bousseau.

We collaborate with F. Pellacini from Sapienza Università di Roma on lightfield editing.

7.4.6. *France-Canada*

Participant: Adrien Bousseau.

We collaborate with K. Singh (University of Toronto) and Alla Scheffer (U. British Columbia, Vancouver), on sketching techniques for designers. This collaboration resulted in the publication [20] and in the 3 weeks visit of Xu Baoxuan (PhD student at U. British Columbia).

7.4.7. *France-Belgium*

Participant: George Drettakis.

We have continued the collaboration with A. Lagae from the Catholic University of Leuven, resulting in the publication [15].

7.5. International Research Visitors

7.5.1. *Visits of International Scientists*

We hosted several researchers this year:

- Maneesh Agrawala (Univ. of Berkeley), in May-June
- Brian Curless (Univ. of Washington), in October
- Eugene Fiume (Univ. of Toronto), in June
- Michael Gleicher (Univ. of Wisconsin), in June
- Diego Gutierrez (Univ. of Zaragoza), in October
- Ares Lagae, (KU Leuven), in November
- Hendrik Lensch (Univ. of Ulm), in October
- Pierre Poulin (Univ. of Montreal), in May
- Alla Sheffer (Univ. of British Columbia), in May-June
- Karan Singh (Univ. of Toronto), in May-June
- Kartic Subr (Univ. College London), in March
- Peter Vangorp (Univ. Giessen), in September and November
- Romain Vergne (Univ. of Giessen), in March
- Brian Xu (Univ. of British Columbia), in September-October

7.5.1.1. Internships

Emmanuel IARUSSI (from Mar 2012 until Aug 2012), Inria Internship Program

Subject: Computer-assisted drawing lessons

Institution: National University of the Center of the Buenos Aires Province (Argentina)

Felicitas Hetzelt (from Mar 2012 until Aug 2012)

Subject: Computer-assisted drawing lessons

Institution: University of Erlangen (Germany)

STARS Team

7. Partnerships and Cooperations

7.1. Regional Initiatives

7.1.1. Collaborations

- Stars has a strong collaboration with the CobTek team (CHU Nice).
- G. Charpiat works with Yuliya Tarabalka (AYIN team) and with Bjoern Menze (Computer Vision Laboratory at ETH Zurich, Medical Vision group of CSAIL at MIT, and collaborator of Asclepios team) on the topic of shape growth/shrinkage enforcement for the segmentation of time series.
- G. Charpiat worked with former members from the ARIANA team: Ahmed Gamal Eldin (now LEAR team), Xavier Descombes (MORPHEME team) and Josiane Zerubia (AYIN team) on the topic of multiple object detection.

7.2. National Initiatives

7.2.1. ANR

7.2.1.1. VIDEO-ID

Program: ANR Sécurité

Project acronym: VIDEO-ID

Project title: VideoSurveillance and Biometrics

Duration: February 2008-February 2012

Coordinator: Thales Security Systems and Solutions S.A.S

Other partners: Inria; EURECOM; TELECOM and Management Sud Paris; CREDOF ; RATP

See also: <http://www-sop.inria.fr/pulsar/projects/videoid/>

Abstract: Using video surveillance, the VIDEO-ID project aims at achieving real time human activity detection including the prediction of suspect or abnormal activities. This project also aims at performing identification using face and iris recognition. Thanks to such identification, a detected person will be tracked throughout a network of distant cameras, allowing to draw a person's route and his destination. Without being systematic, a logic set of identification procedures is established: event and abnormal behaviour situation and people face recognition.

7.2.1.2. SWEET-HOME

Program: ANR Tecsan

Project acronym: SWEET-HOME

Project title: Monitoring Alzheimer Patients at Nice Hospital

Duration: November 2009-November 2012

Coordinator: CHU Nice Hospiteal (FR)

Other partners: Inria (FR); LCS (FR); CNRS unit - UMI 2954, MICA Center in Hanoi (VN); SMILE Lab , National Cheng Kung University (TW); National Cheng Kung University Hospital (TW).

Abstract: SWEET-HOME project aims at building an innovative framework for modeling activities of daily living (ADLs) at home. These activities can help assessing elderly disease (e.g. Alzheimer, depression, apathy) evolution or detecting pre-cursors such as unbalanced walking, speed, walked distance, psychomotor slowness, frequent sighing and frowning, social withdrawal with a result of increasing indoor hours.

7.2.2. FUI

7.2.2.1. QUASPER

Program: FUI

Project acronym: QUASPER

Project title: QUALification et certification des Systèmes de PERception

Duration: June 2010 - May 2012

Coordinator: THALES ThereSIS

Other partners: AFNOR; AKKA; DURAN; INRETS; Sagem Sécurité; ST Microelectronics; Thales RT; Valeo Vision SAS; CEA; CITILOG; Institut d'Optique; CIVITEC; SOPEMEA; ERTE; HGH.

See also: <http://www.systematic-paris-region.org/fr/projets/quasper-rd>

Abstract: QUASPER project gathers 3 objectives to serve companies and laboratories: (1) to encourage R&D and the design of new perception systems; (2) to develop and support the definition of European standards to evaluate the functional results of perception systems; (3) to support the qualification and certification of sensors, software and integrated perception systems. Target domains are Security, Transportation and Automotive.

7.2.3. Investment of future

7.2.3.1. Az@GAME

Program: DGCIS

Project acronym: Az@GAME

Project title: un outil d'aide au diagnostic médical sur l'évolution de la maladie d'Alzheimer et les pathologies assimilées.

Duration: January 2012- December 2015

Coordinator: Groupe Genius

Other partners: IDATE, Inria(Stars), CMRR (CHU Nice) and CobTek team.

See also: <http://www.azagame.fr/>

Abstract: This French project aims at providing evidence concerning the interest of serious games to design non pharmacological approaches to prevent dementia patients from behavioural disturbances, most particularly for the stimulation of apathy.

7.2.4. Large Scale Inria Initiative

7.2.4.1. PAL

Program: Inria

Project acronym: PAL

Project title: Personally Assisted Living

Duration: 2010 -2014

Coordinator: COPRIN team

Other partners: AROBAS, DEMAR, E-MOTION, PULSAR, PRIMA, MAIA, TRIO, and LAGADIC Inria teams

See also: <http://www-sop.inria.fr/coprin/aen/>

Abstract: The objective of this project is to create a research infrastructure that will enable experiments with technologies for improving the quality of life for persons who have suffered a loss of autonomy through age, illness or accident. In particular, the project seeks to enable development of technologies that can provide services for elderly and fragile persons, as well as their immediate family, caregivers and social groups.

7.2.5. Collaborations

- G. Charpiat works with Gabriel Peyré, François-Xavier Vialard and Giacomo Nardi (CNRS, CEREMADE, Université Paris-Dauphine) on the topic of piecewise rigid movements.
- G. Charpiat works with Yann Ollivier (Computer Science department in Paris-Sud University (Orsay)), on the topic of image compression.

7.3. European Initiatives

7.3.1. FP7 Projects

7.3.1.1. PANORAMA

Title: PANORAMA

Duration: April 2012 - March 2015

Coordinator: Philips Healthcare (Netherlands)

Other partners :Medisys (France), Grass Valley (Netherlands), Bosch Security Systems (Netherlands), STMicroelectronics (France), Thales Angenieux (France), CapnaDST (UK), CMOSIS (Belgium), CycloMedia (Netherlands), Q-Free (Netherlands), TU Eindhoven (Netherlands) , University of Leeds (UK), University of Catania (Italy), Inria(France), ARMINES (France), IBBT (Belgium).

See also: <http://www.panorama-project.eu/>

Abstract: PANORAMA aims to research, develop and demonstrate generic breakthrough technologies and hardware architectures for a broad range of imaging applications. For example, object segmentation is a basic building block of many intermediate and low level image analysis methods. In broadcast applications, segmentation can find people's faces and optimize exposure, noise reduction and color processing for those faces; even more importantly, in a multi-camera set-up these imaging parameters can then be optimized to provide a consistent display of faces (e.g., matching colors) or other regions of interest. PANORAMA will deliver solutions for applications in medical imaging, broadcasting systems and security & surveillance, all of which face similar challenging issues in the real time handling and processing of large volumes of image data. These solutions require the development of imaging sensors with higher resolutions and new pixel architectures. Furthermore, integrated high performance computing hardware will be needed to allow for the real time image processing and system control. The related ENIAC work program domains and Grand Challenges are Health and Ageing Society - Hospital Healthcare, Communication & Digital Lifestyles - Evolution to a digital lifestyle and Safety & Security - GC Consumers and Citizens security.

7.3.1.2. VANAHEIM

Title: Autonomous Monitoring of Underground Transportation Environment

Type: COOPERATION (ICT)

Defi: Cognitive Systems and Robotics

Instrument: Integrated Project (IP)

Duration: February 2010 - July 2013

Coordinator: Multitel (Belgium)

Other partners: Inria Sophia-Antipolis (FR); Thales Communications (FR); IDIAP (CH); Torino GTT (Italy); Régie Autonome des Transports Parisiens RATP (France); Ludwig Boltzmann Institute for Urban Ethology (Austria); Thales Communications (Italy).

See also: <http://www.vanaheim-project.eu/>

Abstract: The aim of this project is to study innovative surveillance components for the autonomous monitoring of multi-Sensory and networked Infrastructure such as underground transportation environment.

7.3.1.3. SUPPORT

Title: Security UPgrade for PORTs

Type: COOPERATION (SECURITE)

Instrument: IP

Duration: July 2010 - June 2014

Coordinator: BMT Group (UK)

Other partners: Inria Sophia-Antipolis (FR); Swedish Defence Research Agency (SE); Securitas (SE); Technical Research Centre of Finland (FI); MARLO (NO); INLECOM Systems (UK).

Abstract: SUPPORT is addressing potential threats on passenger life and the potential for crippling economic damage arising from intentional unlawful attacks on port facilities, by engaging representative stakeholders to guide the development of next generation solutions for upgraded preventive and remedial security capabilities in European ports. The overall benefit will be the secure and efficient operation of European ports enabling uninterrupted flows of cargos and passengers while suppressing attacks on high value port facilities, illegal immigration and trafficking of drugs, weapons and illicit substances all in line with the efforts of FRONTEX and EU member states.

7.3.1.4. Dem@Care

Title: Dementia Ambient Care: Multi-Sensing Monitoring for Intelligent Remote Management and Decision Support

Type: COOPERATION (ICT)

Defi: Cognitive Systems and Robotics

Instrument: Collaborative Project (CP)

Duration: November 2011-November 2015

Coordinator: Centre for Research and Technology Hellas (G)

Other partners: Inria Sophia-Antipolis (FR); University of Bordeaux 1(FR); Cassidian (FR), Nice Hospital (FR), LinkCareServices (FR), Lulea Tekniska Universitet (SE); Dublin City University (IE); IBM Israel (IL); Philips (NL); Vistek ISRA Vision (TR).

Abstract: The objective of Dem@Care is the development of a complete system providing personal health services to persons with dementia, as well as medical professionals, by using a multitude of sensors, for context-aware, multiparametric monitoring of lifestyle, ambient environment, and health parameters. Multisensor data analysis, combined with intelligent decision making mechanisms, will allow an accurate representation of the person's current status and will provide the appropriate feedback, both to the person and the associated medical professionals. Multi-parametric monitoring of daily activities, lifestyle, behaviour, in combination with medical data, can provide clinicians with a comprehensive image of the person's condition and its progression, without their being physically present, allowing remote care of their condition.

7.3.2. Collaborations in European Programs, except FP7

7.3.2.1. ViCoMo

Program: ITEA 2

Project acronym: ViCoMo

Project title: Visual Context Modeling

Duration: October 2009 - October 2012

Coordinator: International Consortium (Philips, Acciona, Thales, CycloMedia, VDG Security)

Other partners: TU Eindhoven; University of Catalonia; Free University of Brussels; Inria; CEA List;

Abstract: The ViCoMo project is focusing on the construction of realistic context models to improve the decision making of complex vision systems and to produce a faithful and meaningful behavior. ViCoMo goal is to find the context of events that are captured by the cameras or image sensors, and to model this context such that reliable reasoning about an event can be performed.

7.4. International Initiatives

7.4.1. Inria International Partners

7.4.1.1. Collaborations with Asia

Stars has been cooperating with the Multimedia Research Center in Hanoi MICA on semantics extraction from multimedia data. Stars also collaborates with the National Cheng Kung University in Taiwan and I2R in Singapore.

7.4.1.2. Collaboration with U.S.

Stars collaborates with the University of Southern California.

7.4.1.3. Collaboration with Europe

Stars collaborates with Multitel in Belgium and the University of Kingston upon Thames UK.

7.4.2. Participation In International Programs

7.4.2.1. EIT ICT Labs

EIT ICT Labs is one of the first three Knowledge and Innovation Communities (KICs) selected by the European Institute of Innovation & Technology (EIT) to accelerate innovation in Europe. EIT is a new independent community body set up to address Europe's innovation gap. It aims to rapidly emerge as a key driver of EU's sustainable growth and competitiveness through the stimulation of world-leading innovation. Among the partners, there are strong technical universities (U Berlin, 3TU / NIRICT, Aalto University, UPMC - Université Pierre et Marie Curie, Université Paris-Sud 11, Institut Telecom, The Royal Institute of Technology); excellent research centres (DFKI, Inria, Novay , VTT, SICS) and leading companies (Deutsche Telekom Laboratories, SAP, Siemens, Philips, Nokia, Alcatel-Lucent, France Telecom, Ericsson). This project is largely described at <http://eit.ictlabs.eu>.

Stars is involved in the EIT ICT Labs - Health and Wellbeing .

7.5. International Research Visitors

7.5.1. Visits of International Scientists

7.5.1.1. Internships

This year Stars has hosted 12 internships:

- Pierre Aittahar, Nice University.
- Guillaume Barbe, Nice University.
- Sorana Capalnean, Cluj-Napoca University.
- Cintia Corti, FCEIA Facultad de Ciencias Exactas Ingenieria y Agrimensura, National University of Rosario.
- Eben Freeman, MIT USA.
- Vaibhav Katiyar, Asian Institute of Technology Khlong Luang Pathumtani, Thailand.
- Vannara Loch, Nice University.
- Qioa Ma, Ecole centrale de Pékin, University of Beihang (China).
- Firat Ozemir, Sabancı Universitesi Orta Mahalle, University Caddesi Istanbul.
- Luis Sanchez, Buenos Aires University.
- Abhineswar Tomar , Ku Leuven University, Belgium.
- Swaminathan Sankaranarayanan, Delft University of Technology.

WIMMICS Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

Nhan Le Thanh is animator of a multidisciplinary working group (PSP) on personalized eHealth in the Alpes-Maritimes department.

8.2. National Initiatives

8.2.1. Ministry of Culture: DBpedia.fr

This project named "DBpedia.fr" proposes the creation of a French chapter of the base DBpedia used in many English applications, in particular for the publication of cultural collections. Because DBpedia is focused on the English version of Wikipedia it ignores some of the French topics and their data. This projects aims at extracting a maximum of RDF data from the French version and providing a stable and scalable end-point for them. We now consider means to improve both the quantity and the quality of the data. The DBpedia.fr project was the first project of the Semanticpedia convention signed by the Ministry of Culture, the Wikimedia foundation and Inria.

Web site: <http://wimmics.inria.fr/projects/dbpedia>

8.2.2. ANR Datalift

DataLift is an ANR project (2010-2013). Its goal is to design a platform to publish and interlink datasets on the Web of data. Datalift will both publish datasets coming from a network of partners and data providers and propose a set of tools for easing the datasets publication process. DataLift brings raw structured data coming from various formats (relational databases, CSV, XML, ...) to semantic data interlinked on the Web of Data.

Partners: Inria Exmo & Wimmics, LIRMM, Eurecom, Mondeca, Atos, IGN, INSEE, FING

Web site: <http://www.datalift.org>

8.2.3. ANR Kolflow

Kolflow is an ANR project (2011-2014), it proposes to extend collective intelligence with smart agents relying on automated reasoning. Smart agents can significantly reduce the overhead of communities in the process of continuously building knowledge. Consequently, continuous knowledge building is much more efficient. Kolflow aims at building a social semantic space where humans collaborate with smart agents in order to produce knowledge understandable by humans and machines.

Partners: Inria Orpailleur & Wimmics, Silex U. Claude Bernard Lyon, GDD U. of Nantes

Web site: <http://kolflow.univ-nantes.fr>

8.2.4. ANR OCKTOPUS

This new ANR project is starting in December 2012. The objective of OCKTOPUS is to increase the potential social and economic benefit of the large and quickly growing amounts of user-generated content, by transforming it into useful knowledge. We believe that it is possible to considerably improve upon existing generic Information Retrieval techniques by exploiting the specific structure of this content and of the online communities which produce it. Specifically, we will focus on a multi-disciplinary approach in order to address the problem of finding relevant answers to questions within forums and question-answer sites. To create metrics and predictors of content quality and use them to improve the search experience of a user, we will take advantage of:

- the experience of the CRG (the management research institute of Ecole Polytechnique and CNRS) to understand better the incentives of, and interactions between individuals who produce online content within large communities;
- the experience of the Wimmics research team to analyze the structural and temporal aspects of the complex typed social graphs found within these communities;
- the ability of Alcméon (a start-up developing a search application dedicated to user-generated content) to integrate and test the results of OCKTOPUS within a common demonstration framework, in order to assess their practical usefulness when applied to concrete large-scale datasets.

We believe that this approach will maximize the scientific, economic and social impact of OCKTOPUS by giving high visibility to the research results produced by our academic partners, and by providing a direct route to transfer these results to the internet marketplace through Alcméon's commercial products.

Partners: Alcméon, CRG, Inria Wimmics.

Web site: <http://ocktopus.alcmeon.com>

8.2.5. CNRS Mastodons CrEDIBLE

We participate to the CrEDIBLE research project funded by the MASTODONS program of the interdisciplinary mission of CNRS which objective is to bring together scientists from all disciplines involved in the implementation of systems sharing of distributed and heterogeneous medical imaging, provide an overview of this area and to evaluate methods of state of the art and technology that affect this area. In this framework, we participated to the organization of a 3-days workshop and we worked with members of the I3S Modalis team on the distribution of algorithms in the Corese/KGRAM engine [33], [63], [64].

Web site: <https://credible.i3s.unice.fr>

8.2.6. Inria Large scale initiative action PAL

Wimmics entered this year the Inria large scale initiative Personal Assistant Living (PAL), devoted to the assistance to elderly and fragile people. Our contribution in PAL is described in section 6.16.2 .

Web site: <http://pal.inria.fr>

8.2.7. Follow up: GDR I3I

In the continuation of a specific action (AS) *Interopérabilité des Systèmes d'Information et Ingénierie des Modèles*, funded by GDR I3I in 2011, C. Faron-Zucker worked in 2012 on a synthesis work on the contributions of model driven engineering to the interoperability of information systems [45]. She was specially involved on model and data integration issues which can also be found in the CrEDIBLE project.

8.3. International Initiatives

8.3.1. Participation In International Programs

LIRIMA, Senegal

The Wimmics team participates to the LIRIMA ²⁵.

We have a collaboration with Moussa Lo, Computer Science department of university Gaston Berger at Saint-Louis in Senegal. We participate to a AUF funded project: *Social Semantic Web Platform for Knowledge Sharing in West-africa Communities*

U. of Annaba, Algeria

Catherine Faron-Zucker is responsible in France of a scientific collaboration project with the LabGed laboratory of university of Annaba funded by CNRS and DPGRF (Algeria). This project aims to study the personalization and socialization of ubiquitous e-learning systems based on Semantic Web models and techniques. In this framework, she co-supervise with Algerian colleague Hassina Seridi two PhD students at LabGed.

²⁵<http://www.lirima.uninet.cm/>

In 2012, Khaled Halimi continued the development of a personal learning system with the aim of providing for each user a personal space according to his/her profile, providing intelligent recommendations based on the analysis of the user's interactions, relations and activities, recommending to students the best learning paths according to the recommendation of the best collaborators and the best learning resources, making all users aware of what happens in the system.

Samia Beldjoudi is working on the personalization of resource recommendations based on the analysis of tag-based user profiles; in 2012 she focused on social interactions between the folksonomy's members in order to extract the meaning of terms and overcome the problems of tags' ambiguity and spelling variations [25].

8.4. International Research Visitors

8.4.1. Visits of International Scientists

8.4.1.1. Internships

Eric Toguem (October 8th to November 27th)

Subject: *Distributed LOD*

Institution: *University Yahoundé (Cameroun)*

Fatou Kamara (November 5th to 15th)

Subject: *Semantic Distance*

Institution: *University Gaston Berger (Saint-Louis, Senegal)*

ZENITH Project-Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

8.1.1. Labex NUMEV, Montpellier

URL: <http://www2.lirmm.fr/numev>

We are participating in the Laboratory of Excellence (labex) NUMEV (Digital and Hardware Solutions, Modelling for the Environment and Life Sciences) headed by University of Montpellier 2 in partnership with CNRS, University of Montpellier 1, and Inria. NUMEV seeks to harmonize the approaches of hard sciences and life and environmental sciences in order to pave the way for an emerging interdisciplinary group with an international profile. The NUMEV project is decomposed in four complementary research themes: Modeling, Algorithms and computation, Scientific data (processing, integration, security), Model-Systems and measurements. Patrick Valduriez heads the theme on scientific data.

8.1.2. Institut de Biologie Computationnelle (IBC), Montpellier

URL: <http://www.ibc-montpellier.fr>

IBC is a 5 year project with a funding of 2Meuros by the MENRT (“Investissements d’Avenir” program) to develop innovative methods and software to integrate and analyze biological data at large scale in health, agronomy and environment. Patrick Valduriez heads the workpackage on integration of biological data and knowledge.

8.1.3. ModSiCS2020 Working Group, Montpellier

The ModSiCS2020 (Modeling and Simulation of Complex Systems in 2020) working group was set up by UM2 to analyze the local situation (forces and weaknesses, current projects), identify the critical research directions and propose concrete actions in terms of research projects, equipment facilities, human resources and training to be encouraged in Montpellier. The group was headed by Patrick Valduriez and gathered a small number of experts in different disciplines (agronomy, bioinformatics, computer science, environmental science, life science, etc.). The conclusions of the group [57] were presented at the ModSiCS2020 workshop on Data, Models and Theories for Complex Systems: new challenges and opportunities, organized by UM2 in march. Following the work of the group, a “Groupement d’Intérêt Scientifique (GIS)” is being proposed in Montpellier.

8.2. National Initiatives

8.2.1. ANR

8.2.1.1. VERSO DataRing(2008-2012, 300Keuros)

Participants: Reza Akbarinia, Zohra Bellahsène, Emmanuel Castanier, Duy Hoa Ngo, Esther Pacitti, Didier Parigot, Guillaume Verger, Patrick Valduriez [leader].

URL: <http://www-sop.inria.fr/teams/zenith/dataring>

The DataRing project, headed by P. Valduriez, involves the Leo project-team (Inria Saclay Ile de France), LIG, LIRMM and Telecom ParisTech. The objective is to address the problem of data sharing for online communities, such as social networks (e.g. sites like MySpace and Facebook) and professional communities (e.g. research communities, online technical support groups) which are becoming a major killer application of the web. The project addresses this problem by organizing community members in a peer-to-peer (P2P) network ring across distributed data source owners where each member can share data with the others through a P2P overlay network. In this project, we study the following problems: schema matching, query processing with data uncertainty, data indexing and caching, data privacy and trust. To validate our approach, we develop services based on our prototypes WebSmatch, SON, P2Prec and ProbDB.

8.2.1.2. OTMedia (2011-2013), 150Keuros

Participants: Alexis Joly, Julien Champ, Pierre Letessier.

The Transmedia Observatory project, launched in November 2010, aims to develop processes, tools and methods to better understand the challenges and changes in the media sphere. Studying and tracking media events on all media (web, press, radio and television) are the two prioritized research areas. OTMedia brings together six partners: Inria (ZENITH), AFP (French Press Agency), INA (French National Audiovisual Institute), Paris 3 Sorbonne Nouvelle (researchers in Information Science and Communication), Syllabs (a SME specialized in semantic analysis and automatic creation of text) and the Computer Science Laboratory of Avignon University. ZENITH addresses more specifically the research challenges related to the trans-media tracking of visual contents (images and videos) and the clustering of heterogeneous information sources.

8.2.2. Others

8.2.2.1. RTRA Pl@ntNet (2009-2013), 1Meuros

Participants: Alexis Joly, Hervé Goëau, Saloua Litayem, Mathias Chouet.

The Pl@ntNet project <http://www.plantnet-project.org/> was launched in 2009 by a large international consortium headed by three groups with complementary skills (UMR AMAP ³, IMEDIA project team at Inria, and the French botanical network TelaBotanica ⁴), with financial support from the Agropolis Foundation. Due to the departure of Nozha Boujemaa from the head of IMEDIA and the mobility of Alexis Joly in 2011, ZENITH has been entrusted with the Inria's management and scientific coordination of the project in spring 2012. The objectives of the project are (i) to develop cutting-edge transdisciplinary research at the frontier between integrative botany and computational sciences, based on the use of large datasets and expertise in plant morphology, anatomy, agronomy, taxonomy, ecology, biogeography and practical uses (ii) provide free, easy-access software tools and methods for plant identification and for the aggregation, management, sharing and utilization of plant-related data (iii) promote citizen science as a powerful means to enrich databases with new information on plants and to meet the need for capacity building in agronomy, botany and ecology.

8.2.2.2. CIFRE INA/Inria (2011-2013), 100Keuros

Participants: Alexis Joly, Pierre Letessier.

This CIFRE contract with INA funds a 3-years PhD (Pierre Letessier) to address research challenges related to content-based mining of visual objects in large collections.

8.2.2.3. CNRS INS2I Mastodons (2012), 30Keuros

Participants: Florent Masegla, Patrick Valdrieux, Esther Pacitti [leader].

This project deals with the problems of big data in the context of life science, where masses of data are being produced, e.g. by Next Generation Sequencing technologies or plant phenotyping platforms. In this project, Zenith addresses the specific problems of large-scale data analysis and data sharing.

8.3. European Initiatives

8.3.1. FP7 Projects

Program: FP7

Project acronym: CHORUS+ (avmediasearch.eu)

Project title: European coordination action on Audio-Visual Media Search

Duration: 2010 - 2012

Coordinator: JCP consulting

³<http://amap.cirad.fr/en/>

⁴<http://www.tela-botanica.org/>

Other partners: CERTH-ITI (Greece), University of Trento (Italy), HES-SO (Switzerland), Technicolor (France), Vienna University of Technology (Austria), Engineering Ingegneria Informatica SPA (Italy), JRC Institute for Prospective Technological Studies (EU)

Abstract: CHORUS+ <http://avmediasearch.eu/> objective is to coordinate national and international projects and initiatives in the Search-engine domain and to extend this Coordination in non-European countries. ZENITH actively participated to this action, Alexis Joly being member of the steering committee and leader of a work package. We particularly promoted scientific data as an essential challenge to be addressed by this community through the co-organization of international events (CBMI 2012 panel, ImageCLEF 2012, international workshop on search computing) and discussions with leaders of European projects belonging to the cluster of the coordination action. Besides, we did work on technology transfer issues and the potential of benchmarking campaigns as a tool to foster it (conduction of a survey of about hundred people from both academy and industry, organization of a think-tank with about 20 stakeholders, writing of a recommendation report for the EU commission).

8.4. International Initiatives

8.4.1. Inria International Partners

We have regular scientific relationships with research laboratories in

- North America: Univ. of Waterloo (Tamer Özsu), Univ. of California, Santa Barbara (Divy Agrawal, Amr El Abbadi).
- Asia: National Univ. of Singapore (Beng Chin Ooi, Stéphane Bressan), Wonkwang University, Korea (Kwangjin Park)
- Europe: Univ. of Amsterdam (Naser Ayat, Hamideh Afsarmanesh), Univ. of Madrid (Ricardo Jiménez-Periz), UPC Barcelona (Josep Lluís Larriba Pey, Victor Muñoz)

8.4.2. Participation In International Programs

We are involved in the following international actions:

- CNPq-Inria project DatLuge (Data & Task Management in Large Scale, 2009-2012) with UFRJ (Marta Mattoso, Vanessa Braganholo, Alexandre Lima), LNCC, Rio de Janeiro (Fabio Porto), and UFPR, Curitiba (Eduardo Almeida) to work on large scale scientific workflows;
- FAPERJ-Inria project SwfP2Pcloud (Data-centric workflow management in hybrid P2P clouds, 2011-2013) with UFRJ (Marta Mattoso, Vanessa Braganholo, Alexandre Lima) and LNCC, Rio de Janeiro (Fabio Porto) to work on large scale scientific workflows in hybrid P2P clouds;
- CNPq-Inria project Hoscar (HPC and data management, 2012-2015) with LNCC (Fabio Porto), UFC, UFRGS (Philippe Navaux), UFRJ (Alvaro Coutinho, Marta Mattoso) to work on data management in high performance computing environments;
- EGIDE Osmoze project SECC (Services for Curricula Comparison, 2011-2012), with Riga Technical University (Janis Grundspenkis, Marité Kirikova) to work on automatic analysis and mapping of conceptual trees and maps acquired from digital documents.

8.5. International Research Visitors

8.5.1. Visits of International Scientists

Prof. Jens Dittrich (Univ. Saarland, Germany) gave a seminar at LIRMM on data management with MapReduce.

Prof. Marta Mattoso (UFRJ, Rio de Janeiro) gave a seminar at LIRMM in the context of IBC on data provenance in scientific workflows.

8.5.2. Visits to International Teams

Esther Pacitti and Patrick Valduriez were invited researchers at the National University of Singapore in July.