Activity Report 2011

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8. Partnerships and Cooperations

8.1. Regional initiatives

Participants: Sylvain Contassot-Vivier, Lucas Nussbaum, Martin Quinson.

8.1.1. CPER MISN, EDGE project

Martin Quinson and Lucas Nussbaum are leading a project of the regional CPER contract, called Expéri-
mentations et calculs distribués à grande échelle (EDGE). A cluster targeting large-scale experiments (144
single-CPU nodes) was bought in 2010 in that context. In 2011, we focused on maintaining and improving
the local Grid’5000 infrastructure, and animating both the research on experimental grids and the research

8.1.2. Other regional grants

Martin Quinson received a grant from the Lorraine Region for two years (2010–2011) to fund our exploratory
work on the possibility to use formal methods such as model-checking to ensure some properties (such as the
lack of deadlocks in any case) of large-scale distributed algorithms. The results of this action are described in
Section 6.2.2.

Sylvain Contassot-Vivier received a grant from the Lorraine Region for two years (2011–2013) to support a
research project over dynamical systems: Dynamical systems: theoretical study and application to parallel
algorithmic for PDEs solving.

8.2. National Initiatives

Participants: Sébastien Badia, Sylvain Contassot-Vivier, Stéphane Genaud, Jens Gustedt, Emmanuel Jean-
voie, Lucas Nussbaum, Martin Quinson, Tinaherinantenaina Rakotoarivelo, Luc Sarzyniec, Stéphane Vialle.

8.2.1. INRIA ADT SimGrid for human beings (2009–2011)

SimGrid for human beings is another INRIA Technological Development Action aiming at providing engi-
neering manpower to the SimGrid project to improve the documentation and to provide stock implementations
of classical algorithms in order to ease its usage by the users. Mehdi Fekari was hired on this project, leading
to the results described in Section 6.2.1.

8.2.2. INRIA ADT Aladdin-G5K (2007–2012?)

ADT Aladdin-G5K (A LArge-scale Distributed Deployable INfrastructure) is an INRIA Technological Devel-
opment Action. It is a management structure for Grid’5000. The goal of Aladdin-G5K is to further develop the
Grid’5000 testbed, and perform system administration and maintenance, as well as additional tasks such as
maintaining the various tutorials. Three engineers from Nancy (two from AlGorille, one from SED) are con-
tributing to Aladdin-G5K: Tina Rakotoarivelo (hired for the ADT), Sébastien Badia (IE CPER) and Benjamin
Dexheimer (SED).

8.2.3. INRIA ADT Kadeploy (2011–2013)

ADT Kadeploy focuses on the Kadeploy software. Kadeploy is a tool for efficient, scalable and reliable cluster
deployment, used on several clusters at INRIA and playing a key role on the Grid’5000 testbed. This ADT
allows us to continue the development of Kadeploy, by improving its performance, its reliability and its
security. We are also adding features that are required in some contexts so that it will be possible to further
distribute Kadeploy and increase its usage. During the ADT, we are collaborating with INRIA platforms that
do not use Kadeploy yet, but have similar needs, as well as with industry. Luc Sarzyniec was hired as young
engineer (IJD) as part of this project.
8.2.4. INRIA ADT Solfege (2011–2013)

ADT Solfege (Services et Outils Logiciels Facilitant l’Experimentation à Grande Échelle) aims at developing or improving a tool suite for experimentation at large scale on testbeds such as Grid’5000. Specifically, we will work on control of a large number of nodes, on data management, and on changing experimental conditions with emulation. Emmanuel Jeanvoine (SED) is delegated in the AlGorille team for the duration of this project.

8.2.5. INRIA AEN HEMERA

Héméra is an INRIA Large Wingspan project, started in 2010, that aims at demonstrating ambitious up-scaling techniques for large scale distributed computing by carrying out several dimensioning experiments on the Grid’5000 infrastructure, at animating the scientific community around Grid’5000 and at enlarging the Grid’5000 community by helping newcomers to make use of Grid’5000.

Within that project, Martin Quinson, Lucas Nussbaum and Stéphane Genaud lead three working groups, respectively on simulating large-scale facilities, on conducting large and complex experimentations on real platforms, and on designing scientific applications for scalability.

8.2.6. CNRS initiatives, GDR-ASR and specific initiatives

We participate at numerous national initiatives. In the GDR-ASR (architecture, systems, and networks) we take part in RGE action 1. The finances of RGE, led by Stéphane Vialle at SUPÉLEC, are provided by the GDR ASR of CNRS and maintained by AlGorille. The RGE action organizes three meetings per year, and usually gathers 40-45 people per meeting.

Sylvain Contassot-Vivier decided to stop his animation role in the Embedded Pole in 2011 in order to focus on his research activities. However, he continues his expert analysis for the MEI (Mission d’Expertises Internationales).

8.2.7. ANR USS-SimGrid (2009–2011) and ANR SONGS (2011–2015)

Martin Quinson is the principal investigator of one project of the ARPEGE call from the ANR (french funding agency), called USS-SimGrid (Ultra Scalable Simulation with SimGrid – 2009–2011). It aims at improving the scalability of the SimGrid simulator to allow its use in Peer-to-Peer research in addition of Grid Computing research. The challenges to tackle include models being more scalable at the eventual price of slightly reduced accuracy, automatic instantiation of these models, tools to conduct experiments campaigns, as well as a partial parallelization of the simulator tool.

Martin Quinson is also the principal investigator of a project of the INFRA call from the ANR, called SONGS (Simulation Of Next Generation Systems – 2012-2016). It aims at increasing the target community of SimGrid to two new research domains, namely Clouds (restricted to the Infrastructure as a Service context) and High Performance Computing. We will develop new models and interfaces to enable the use of SimGrid for generic and specialized researches in these domains.

As project leading team, we are involved in most parts of these projects, which allows the improvement of our tool even further and set it as the reference in its domain (see Sections 6.2.1 through 6.2.5).

8.2.8. Bilateral Collaborations

With Arnaud Giersch from the University of Franche-Comté, we work on the design and implementation of a decentralized load-balancing algorithm, based on asynchronous diffusion, that works with dynamical networks. In such a context, we consider that the nodes are always available but the links between them may be intermittent. According to the load-balancing task, this is a rather difficult context of use.

Lucas Nussbaum and Martin Quinson are participating to a research effort lead by F. Suter from the Computing Center of IN2P3. This project is jointly funded by CNRS’ Institut des Grilles and INRIA’s ADT Aladdin in a program that aims at bridging the production grids and distributed systems research communities. The overall goal of the project is to explore ways to enable the scientific study and the evaluation of improvements in the context of the gLite grid middleware. New results in this project are described in Section 6.2.7.

1 Réseau Grand Est
8.3. European Initiatives

8.3.1. Collaborations in European Programs, except FP7

8.3.1.1. Energy efficiency in large scale distributed systems.

Stéphane Vialle, Sylvain Contassot-Vivier and Thomas Jost participate to the COST (European Cooperation in the field of Scientific and Technical Research) Action IC0804 (Energy efficiency in large scale distributed systems), started in 2010.

Our designs of PDE solvers using synchronous and asynchronous distributed algorithms, implemented and experimented both on CPU and GPU clusters, have led to the design of some performance models. Main results have been introduced in 2011 in a book chapter [26].

Moreover, in 2011 we achieved a first design of a software architecture to build self-configurating applications, in order to track a user instruction (to run fast, or to run consuming low energy, or to run achieving a compromise) in an execution environment imposing some energy constraints on application runs. This software architecture has been introduced to the COST IC0804 meeting of May 19-20, 2011 in Budapest. This software architecture is still under investigation, and its implementation is planned for 2012.

Finally, in 2011 we have achieved the implementation of an American option pricer on our GPU clusters, and we have run many experiments to measure its speedup and energy gain. A second version, more efficient, including an optimized 4D to 2D reduction on each GPU node, is under experimentation at the end of 2011. These research are conducted in collaboration with some colleagues of University of Marne-la-Vallée.

8.4. International Initiatives

8.4.1. Bilateral Collaborations

This year, we formalized the collaboration on the modeling of storage elements that we had with the team PH-ADP-DDM lead by V. Garone at CERN and with F. Suter from the Computing Center of IN2P3. This work will now be done in the context of the SONGS project, that got funded by the ANR this year.

We also started working with IBM France and IBM Haifa on the modeling of Cloud jobs and resources, also in the loose context of the SONGS project. This collaboration should take some more momentum in the next few years.

Finally, we are working with the team of Jan Broeckhove (Professor at university of Antwerp, Belgium), in a project funded (2010-2011) by the PHC Tournesol program. This project aims at exploring Large-Scale Discrete-Event Simulation of Distributed Systems.

We collaborate with Henri Casanova of University of Hawai‘i at Manoa on the SimGrid framework, as detailed in 5.4. The result obtained this year on the simulation of MPI applications are detailed in Section 6.2.4.

We also collaborate with David Elizondo from the University of Leicester in Great Britain on the problem of linear separability determination. Our current work deals with the design and implementation of a fast algorithm to determine whether or not two or more sets of points in $\mathbb{R}^n$ are linearly separable. We have already obtained an interesting result in 2D whose publication is in preparation. The next step is the extension to $n > 2$ dimensions.

8.4.2. INRIA International Partners

8.4.2.1. Internships

Matías Ezequiel Vara
Subject: Ordered Read-Write Locks on Multicore Architectures
Institution: Universidad Nacional de La Plata (Argentina)
8. Partnerships and Cooperations

8.1. Regional Initiatives

- **Modeling and rendering with distance functions**: This project is a collaboration between the ALICE / INRIA Nancy Grand-Est team and the Computer Graphics group of the Karlsruhe Institute of Technology (KIT). It is funded by INRIA Nancy Grand-Est for a 12 months period (COLORS grant) and serves as a first step in what we hope to become a continued collaboration between our teams.

8.2. National Initiatives

8.2.1. ANR projects

8.2.1.1. ANR Similar Cities

**Participants**: Samuel Hornus, Anass Lasram, Sylvain Lefebvre.

- **Title**: Similar Cities
- **Principal Investigator**: Sylvain Lefebvre (INRIA ALICE)
- **Participants**: INRIA Nancy, CSTB, Allegorithmic
- **See also**: GoodShape

**Abstract**: Similar Cities aims at enhancing the visual appearance of virtual cities, using procedural methods. Our key insight is to replace the numerous textures used to faithfully render large virtual cities by procedural equivalents. These procedural textures are thousands of times smaller but can still be quickly generated whenever required by the rendering engine. Our every-day tools for this research are procedural texture generators, texture synthesis by example, texture streaming algorithms and image processing tools.

8.2.1.2. ANR Physigraphics

**Participants**: Alejandro Galindo, Kun Liu, Rhaleb Zayer.

- **Title**: Physigraphics
- **Principal Investigator**: Rhaleb Zayer (INRIA ALICE)
- **Instrument**: ANR “chaire d’excellence” grant
- **See also**: Physigraphics

**Abstract**: Physigrafix is a research effort geared towards bridging the gap between acquisition and modeling in the context of deformable objects. The will project proceed on two complementary tracks. The first is the acquisition and tracking of deformable models, and the second is the mathematical modeling of the captured deformation behavior. The central idea is to rely on the exhibited physics to drive the mathematical model, in this way problems commonly encountered in simulation modeling can be avoided in the first place. This research is motivated by real world applications, and in a broad scope touches upon disciplines such as virtual medicine, manufacturing and feature film industry.
8.2.1.3. ANR Morpho

**Participants:** Dobrina Boltcheva, Phuong Ho, Bruno Lévy.

Title: Morpho
Coordinator: Edmond Boyer (INRIA MORPHEO)
Participants: LJK/INRIA Grenoble, INRIA Nancy/LORIA, GIPSA-Lab
See also: Morpho

Abstract: Morpho is aimed at designing new technologies for the measure and for the analysis of dynamic surface evolutions using visual data. The interest arises in several application domains where temporal surface deformations need to be captured and analyzed. It includes human body analyses but also extends to other deforming objects, sails for instance. Potential applications with human bodies are anyway numerous and important, from the identification of pathologies to the design of new prostheses. The project focus is therefore on human body shapes and their motions and on how to characterize them through new biometric models for analysis purposes.

8.2.1.4. ANR Moditere

**Participant:** Dmitry Sokolov.

Title: Moditere
Coordinator: C. Gentil (LIRIS)
Participants: LIRIS Lyon, LE2I Dijon, LORIA/INRIA Nancy, PEP(Pôle Européen de Plasturgie d’Oyonnax).

Abstract: Moditere aims at developing new 3D modeling tools, that extend the editing capabilities of classical CAD/CAM representations (Splines) to new geometries, such as fractal objects.

8.3. European Initiatives

8.3.1. FP7 Projet

8.3.1.1. GoodShape

**Participants:** Thomas Jost, Bruno Lévy, David Lopez, Romain Merland, Vincent Nivoliers, Jeanne Pellerin, Nicolas Ray.

Title: Numerical Geometric Abstractions: from bits to equations
Type: IDEAS
Instrument: ERC Starting Grant (Starting)
Duration: August 2008 - July 2013
Coordinator: INRIA (France)
See also: GoodShape

Abstract: GOODSHAPE involves several fundamental aspects of 3D modelling and computer graphics. GOODSHAPE is taking a new approach to the classic, essential problem of sampling, or the digital representation of objects in a computer. This new approach proposes to simultaneously consider the problem of approximating the solution of a partial differential equation and the optimal sampling problem. The proposed approach, based on the theory of numerical optimization, is likely to lead to new algorithms, more efficient than existing methods. Possible applications are envisioned in inverse engineering and oil exploration.
8.4. International Initiatives

8.4.1. INRIA International Partners

8.4.1.1. Cooperation with Hong-Kong University

Participant: Bruno Lévy.

In the frame of the GOODSHAPE project, we cooperate with Hong-Kong university on Centroidal Voronoi Tesselations and their applications. Researchers and students from Nancy and Hong-Kong visit each other on a regular basis. This year (2011), we had the following common publications on optimal sampling, centroidal Voronoi tesselations and their variations [23], [20], [21].

8.4.1.2. Cooperation with Girona University (Spain)

Participant: Sylvain Lefebvre.

We continued our cooperation with Gustavo Patow (researcher) and Ismael Garcia (PhD student) of Girona University, Spain, on the topic of data structures for spatial caching on the GPU. This year, we published a common article in ACM Siggraph ASIA / ACM Transactions on Graphics [16].
8. Partnerships and Cooperations

8.1. Regional Initiatives

Co-direction of a PhD thesis by J-M. Monnez:

Partner: Ecole de Hautes Etudes en Santé Publique (Nancy).
Title: Influence of socio-economic and environmental characteristics on infant mortality.
PhD thesis of M. Lalloué.

Regional project leaded by T. Bastogne:

Partners: Contrat de Projets Etat-Région, MISN (Modélisation, Information et Système Numérique), Thème AOC (Analyse, Optimisation et Contrôle).
Title: EMC2 (Experimental design, Modeling and Control in Cancerology).

8.2. National Initiatives

- C. Lacaux is member of the MATAIM (Modèles Anisotropes de Textures. Applications à l’Imagerie Médicale) ANR project, leaded by F. Richard (University of Provence).
- S. Tindel is co-leader the ECRU (Exploration des Chemins Rugueux) ANR project, jointly with M. Gubinelli (University of Paris Dauphine).
- P. Vallois is member of the MASTERIE (Malliavin Stein Random Irregular Equation) ANR project, leaded by F. Russo (ENSTA, Paris).
- T. Bastogne is leader of the MOCOBIO (MOdeling and COntrol of heterogeneous systems in systems BIOlogy) CNRS-PEPS project.
- T. Bastogne is member of the PDTX (Active Nanoplatforms for Photodynamic Therapy) ANR project, leaded by M. Verelst (Université Paul Sabatier, Toulouse)
- T. Bastogne is member of the Nano-VTP (Nanoparticles for Imaging and Vascular Photodynamic Treatment of Brain Tumors) ANR project, leaded by M. Barberi-Heyob (Centre de Recherche en Automatique de Nancy, Centre Alexis Vautrin).

8.3. European Initiatives

8.3.1. Collaborations in European Programs, except FP7

Program: UGR (Université de la Grande Région)
Project acronym: I-DERBI
Project title: I-DERBI
Duration: January 2010 - April 2012
Coordinator: C. Carlberg (Luxembourg)
Other partners: Université du Luxembourg, Université de Liège (Belgium), Saarland University (Germany)
Abstract: We stand at the brink of a fundamental change in how medicine will be practiced in the next 5-20 years. This change will require the unprecedented integration of biology, medicine, technology and computation as well as societal issues of major importance: ethical, regulatory, public policy, economic, and others. These needs have encouraged the emergence of a biology-based inter-disciplinary study field, systems biology, which focuses on the modeling of complex biological systems. Systems biology covers a large spectrum of applications: biomedicine, bioprocesses engineering, environmental science and pharmaceutical discovery. The ambition of the I-DERBI pilot project is to initiate and develop synergy of education and research in Systems Biology within the Grande Région.

8.3.2. Major European Organizations with which Bigs has followed Collaborations

Partner: Universitat Autònoma de Barcelona, Departament de Matemàtiques (Spain).
Subject: Stochastic model for bacteriophage systems.

Partner: TU Kaiserslautern, Department of Mathematics.
Subject: Parameter estimation for differential systems driven by Gaussian processes.

8.4. International Initiatives

8.4.1. Internships

Yosra Chemli
Subject: Statistical Emulation of High Dimensional Biological Dynamic Models
Institution: Ecole Polytechnique de Tunisie (Tunisia)

Raouf Souabni
Subject: Simulation of the light propagation in biological tissues. Application to interstitial photodynamic therapy.
Institution: Université de Tunis El Manar - Faculté des Sciences (FST) (Tunisia)

8.5. Teaching

BIGS is a team whose composition includes University staff only. All members teach numerous courses, ranging from L1 to M2 levels.

PhD & HdR:


PhD : R. Keijn, *Modélisation de la croissance d’une tumeur après traitement par radiothérapie*, Université de Nancy 1, 2/12/2011, Advisors: T. Bastogne, P. Vallois.


7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. CEA Projects

- FR FCM (CNRS Federation on Magnetic Confinement Fusion) project within Euratom-CEA association, Title: “Full wave modeling of lower hybrid current drive in tokamaks” The goal of this projet is to develop a full wave method to describe the dynamics of lower hybrid current drive problem in tokamaks.

- FR FCM (CNRS Federation on Magnetic Confinement Fusion) project within Euratom-CEA association, Title: “Numerical Methods for GYSELA”, the goal is to help improving the numerical algorithms used by the GYSELA code developed at CEA Cadarache for the simulation of turbulence in magnetic fusion plasmas.

7.1.2. ANR projects

- GYPSI project (2010–2014), https://sites.google.com/site/anrgypsi/ : coordinator Philippe Ghendrih (CEA Cadarache), other participants, University of Marseille, Universities of Strasbourg and Nancy (CALVI project-team). The aim is to understand the physics of turbulence in magnetically confined plasma using numerical simulation.

7.1.3. INRIA initiatives


7.2. European Initiatives

7.2.1. Major European Organizations with which you have followed Collaborations

Claus-Dieter Munz: University of Stuttgart, IAG (Germany)
Development of particle in cell methods for the Vlasov-Maxwell equations

7.3. International Initiatives

7.3.1. Participation In International Programs

J. R. Roche participated in the CAPEs-COFECUB binational project with the COPPE-Federal University of Rio de Janeiro and the National Laboratory of Scientific Computing of Brazil.
CAMUS Team

7. Partnerships and Cooperations

7.1. National Initiatives

Philippe Clauss, Alain Ketterlin and Vincent Loechner are involved in the proposition of an INRIA Large Wingspan Project (*Action d’Envergure Nationale*) entitled “Software for multicores and hardware accelerators” and regrouping several french teams doing researches in compilers, parallel computing and program optimization. Philippe Clauss shares the head of the project with Gilles Muller of the INRIA REGAL team. A new version of the project will be submitted to INRIA at the end of 2011.

7.2. International Initiatives

7.2.1. INRIA Associate Teams

7.2.1.1. ANCOME

Title: Memory and applications memory behavior
INRIA principal investigator: Philippe Clauss
International Partner:

- Institution: Universidad de Buenos Aires (Argentina)
- Laboratory: Departamento de Computacion, Facultad de Ciencias Exactas y Naturales

Duration: 2011 - 2013

This associate team focuses on developing original methods for the analysis of programs memory behavior, in particular in the context of applications using dynamic memory allocation. The proposed approaches consists of analyzing and modeling the runtime behavior, where extracted properties are then verified thanks to static analysis processes. Thus pure static approaches limits are overpassed. Further, the case of multi-threaded applications run on multi-core architectures is studied in order to elaborate and extend our analysis techniques and to extract properties specific to this context. The issues are mainly concerned with the conception of real-time applications using dynamic memory allocation.

7.2.2. INRIA International Partners

Rachid Seghir, researcher and teacher at the University of Batna, Algeria, works in close collaboration with Vincent Loechner. He is the co-author of the ZPolyTrans software and of a forthcoming paper in the journal ACM Transactions on Architecture and Code Optimization [13].

Benoît Meister, Managing Engineer at Reservoir Labs, New York, USA, has collaborated with Vincent Loechner and Rachid Seghir on a forthcoming publication [13].

Jean Christophe Beyler, Senior HPC Engineer at Intel and in the International Exascale project, University of Versailles, France, is experimenting energy saving strategies using the VMAD framework of the CAMUS team.

7.2.3. Visits of International Scientists

7.2.3.1. Visits

Sergio Yovine (from Jun 6 2011 until Jun 12 2011)
Institution: Universidad de Buenos Aires (Argentina), EA INRIA Ancome

Diego Garbervetsky (from Apr 1 2011 until Apr 10 2011 and from Aug 1 2011 until Sept 2 2011)
Institution: Universidad de Buenos Aires (Argentina), EA INRIA Ancome

7.2.3.2. Internships

Luis Mastrangelo (from Mar 2011 until Aug 2011)
Subject: A Virtual Machine for Automatic Program Parallelization
Institution: Universidad de Buenos Aires (Argentina)

Bruno Cuervo Parrino (from May 2011 until Oct 2011)
Subject: Formalizing a new validation mechanisms under assumptions for speculative parallelism
Institution: Universidad de Buenos Aires (Argentina)

Jose Cacherosky (from Jul 2011 until Dec 2011)
Subject: Dynamic dependence profiling for Java
Institution: Universidad de Buenos Aires (Argentina)

7.2.4. Participation In International Programs

The CAMUS team is associated to the CNRS-CONICET Associated International Laboratory France-Argentina INFINIS\(^\text{10}\) (INformatique Fondamentale, logIque, laNgages, vérIfication et Systèmes) inaugurated in December 2011.

\(^\text{10}\) https://dri-dae.cnrs-dir.fr/spip.php?article3009
7. Partnerships and Cooperations

7.1. Regional Initiatives

7.1.1. Function field sieve: implementation and hardware acceleration

Participants: Jérémie Detrey [contact], Pierrick Gaudry, Hamza Jeljeli, Emmanuel Thomé.

The team has obtained for the year 2012 a financial support from the Région Lorraine and INRIA for a project focusing on the hardware implementation and acceleration of the function field sieve (FFS).

The FFS algorithm is currently the best known method to compute discrete logarithms in small-characteristic finite fields, such as may occur in pairing-based cryptosystems. Its study is therefore crucial to accurately assess the key-lengths which such cryptosystems should use. More precisely, this project aims at quantifying how much this algorithm can benefit from recent hardware technologies such as GPUs or CPU-embedded FPGAs, and how this might impact current key length recommendations.

7.2. National Initiatives

7.2.1. ANR DEMOTIS (Collaborative Analysis, Evaluation and Modelling of Health Information Technology)

Participants: Marion Videau.

The project from “programme ARPEGE” involves three INRIA project-teams as a single partner (SMIS, SECRET and CARAMEL) together with colleagues from CECOJI (CNRS) and the company Sopinspace. It has been running from January 2009 and will continue until the beginning of 2012.

The project experiments new methods for the multidisciplinary design of large information systems that have to take into account legal, social and technical constraints. Its main field of application is personal health information systems.

7.2.2. ANR CHIC (Courbes Hyperelliptiques, Isogénies, Comptage)

Participants: Gaëtan Bisson, Romain Cosset, Pierrick Gaudry, Sorina Ionica, Pascal Molin, Emmanuel Thomé [contact].

The team has obtained a financial support from the ANR (“programme blanc”) for a project, common with colleagues from IRMAR (Rennes) and IML (Marseille). The ANR CHIC grant covers the period 09/2009 to 08/2012. The purpose of this ANR project is the study of several aspects of curves in genus 2, with a very strong focus on the computation of explicit isogenies between Jacobians.

This ANR project has been an important source of motivation for both permanent researchers and PhD students, giving notably PhD students the opportunity to meet interested colleagues on a regular basis. In 2011, a server with a huge large of central memory has been bought, to help with CHIC-related experiments. Two PhD thesis were defended (Bisson and Cosset) on the topic.

7.3. European Initiatives

7.3.1. PHC application with EPFL

The team obtained a PHC Germaine de Staël grant in collaboration with the LACAL team from EPFL (Lausanne, Switzerland), in 2011. The grant has been renewed for 2012. This collaboration focuses on integer factorization and discrete logarithms.
8. Partnerships and Cooperations

8.1. National Initiatives

- ANR Complice
- Project CyS of GIS 3SGS on smartphone forensics.

We have active collaborations with:
- Alexander Shen (LIF),
- Laurent Bienvenu (LIAFA),
- Florian Deloup came in our group for six months as a CNRS researcher.

8.2. European Initiatives

8.2.1. FP7 Projet

8.2.1.1. FI-WARE

Title: Morphus
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: Thales, SAP, INRIA
See also: http://www.fi-ware.eu/

Abstract: FI-W AR E 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.

8.2.2. Major European Organizations with which Carte has followed Collaborations

Stefano Galatolo (Universitá di Pisa),
Daniel Graça (University of Faro),
Georg Moser (University of Innsbruck),
Klaus Weihrauch (FernUniversitet Hagen).

8.3. International Initiatives

- ARC CaCO3 (France-Egypt), http://carte.loria.fr/index.php?option=com_content&view=article&id=63&Itemid=77

8.3.1. INRIA Associate Teams

8.3.1.1. COMPUTR
Title: COntinuous tiMe comPUTations, computation on the Reals
INRIA principal investigator: Emmanuel Hainry
International Partner:
   Institution: Instituto de Telecomunicações (Portugal)
   Laboratory: Security and Quantum Information Group
Duration: 2009 - 2011
See also: http://carte.loria.fr/index.php?option=com_content&view=article&id=60&Itemid=74

8.3.1.2. CRISTAL
Title: Resource Control by Semantic Interpretations and Linear Proof Theory
INRIA principal investigator: Romain Péchoux
International Partner:
   Institution: Universita degli Studi di Torino (Italy)
   Laboratory: Dipartimento di informatica
Duration: 2010 - 2012
See also: http://carte.loria.fr/index.php?option=com_content&view=article&id=61&Itemid=75

8.3.2. INRIA International Partners
We have active collaboration with:
   • Peter Gács (Boston University),
   • Cristóbal Rojas (Toronto),
   • José Fernandez (Montreal),
We also start some collaborations with Dawn Song at Berkeley.

8.3.3. Visits of International Scientists
8.3.3.1. Internship
   • Daniel Leivant (Indiana University, invited for six months)
   • John Case (University of Delaware), http://www.cis.udel.edu/~case/
   • Walid Gomaa (University of Cairo), http://www.alexeng.edu.eg/~wgomaa/
8. Partnerships and Cooperations

8.1. International Grants

- French-Tunisian project on Security Policies and Configurations of Firewalls: Compilation and Automated Verification. We collaborate with SupCom Tunis and the INRIA project-team Dahu in the context of STIC-Tunisia.

8.2. National Grants

- ANR SESUR AVOTÉ—Formal Analysis of Electronic-Voting protocols, duration: 4 years, started in January 2008. Electronic voting promises the possibility of a convenient, efficient and secure facility for recording and tallying votes. However, the convenience of electronic elections comes with a risk of large-scale fraud. The AVOTÉ project aims at proposing techniques for formally analyzing e-voting protocols. Cassis is the coordinator of the project. Partners are: France Telecom Lannion, LSV Cachan, Verimag Grenoble.

- ANR DECERT — Deduction and Certification, coordinated by Thomas Jensen (IRISA). This project focuses on the design of decision procedures, in particular for fragments of arithmetic, and their integration into larger verification systems, including skeptical proof assistants. Partners are: IRISA Rennes, LRI Orsay, INRIA Sophia, Systerel and CEA. From INRIA Nancy, the teams Veridis and Cassis are involved. This project started in January 2009 for three years.

- ANR TASCCC Test Automatique basé sur des Scénarios et Critères Communs – Automated Testing based on Scenarios and Common Criteria, duration: 3 years, starting in December 2009. The project aims at completing the model-based testing process initiated in the POSE project, using scenarios to specify the test cases that have to be generated by model animation. The goal is here to provide an automated means for generating the scenarios from a given set of properties. The overall objective is to ease the Common Criteria evaluation of secure softwares. Partners: Trusted Labs (leader), Gemalto, LIG, LIFC, Supelec, Smartesting, and Serma Technologies. The local coordinator is Frédéric Dadeau.

- ANR PROSE Protocoles de sécurité : modèle formel, modèle calculatoire, and implémentations — Security protocols : formal model, computational model, and implementations, duration: 4 years, started in December 2010. The goal of the project is to increase the confidence in security protocols, and in order to reach this goal, provide security proofs at three levels: (i) the symbolic level, in which messages are terms, (ii) the computational level, in which messages are bitstrings, and (iii) the implementation level: the program itself. Partners are Cascade Paris (leader), LSV Cachan, Cassis and Verimag Grenoble.

- ANR STREAMS Solution for Peer-to-peer Real-Time Social Web, duration: 3 years, starting in October 2010. This project proposes to design peer-to-peer solutions that offer underlying services required by real-time social web applications and that eliminate the disadvantages of centralised architectures. There exists a tension between sharing data with friends in a social network deployed in an open peer-to-peer network and ensuring privacy. One of the most challenging issues in social applications is how to balance collaboration with access control to shared objects. This project aims at providing theoretical solutions to these challenges as well as practical experimentations. Partners are: LORIA Score team (leader), INRIA project-teams Regal, Asap, Cassis, and XWiki.
- ANR FREC *Frontiers of recognizability*, duration: 4 years, starting in October 2010. The goal of this project is to be a driving force behind the extension of the algebraic theory of regular languages made possible by recent advances. Four directions will be investigated: tree languages, λ-terms, automata with counters, algebraic and topological tools. Partners are LABRI (leader), LIAFA (University Paris 7). Pierre-Cyrille Héam is a member of this project, attached to Paris 7 for administrative facilities.

- FUI SQUASH *Software QUality ASSurance enHancement*, duration: 2 years, starting in April 2011. This project aims to industrialize and to structure software testing activities. The project can be provide methodology and tools framework based on open source components.

- ANR OSEP *Online and offline model-based testing of SEcurity Properties*, duration: 2 years, starting in December 2011. The goal of this project is to test the security with online and offline model-based testing approach. The main element of project is to capitalize or to reuse a test model with different testing method. So, we develop new algorithms to allow online testing. This approach must be compatible with our previous offline approach to increase the number of artefacts that can be shared. This approach can be applied to the components of security and the Software Radio. Partners are DGA and Smartesting.

- Collaborative Research Initiative INRIA, ARC ACCESS. This project is concerned with the security and access control for Web data exchange, in the context of Web applications and Web services. We aim at defining automatic verification methods for checking properties of access control policies (ACP) for XML, like consistency or secrecy. Partners are: INRIA project-teams Dahu, Mostrare and Cassis.

### 8.3. International Collaborations

- In the area of automated test generation from a formal model, we have an active collaboration with Dr Mark Utting from the Formal Method group from the University of Waikato. This cooperation is supported by the France-New-Zealand scientific program.

- In the area of business applications, we have been working on the may-/must semantics of coloured work-flow Petri nets with the Information System group of Professor W. van der Aalst from the Technical University of Eindhoven, The Netherlands.

- In the area of security protocols penetration testing, we have started a collaboration with Karlsruhe Institute of Technology (Germany) led by Prof. Alexander Pretschner. This collaboration is mainly supported by KIT, in the context of the FP7 SPACIOS project.

### 8.4. Individual Involvement


*V. Cortier:* Principal Investigator of the ERC Starting Grant ProSecure (2011-2016); coordinator of the ANR SESUR AVOTÉ (started in Jan. 2008); PC member of ESORICS 2011 (16th European Symposium on Research in Computer Security), MFPS 2011 (27th Conference on the Mathematical Foundations of Programming Semantics), FC 2011 (15th International Conference on Financial Cryptography and Data Security), RTA 2011 (22nd International Conference on Rewriting Techniques and Applications); member of selection committees: INRIA Bordeaux (CR position), Caen University (Full Professor); member of the Evaluation Committee of the INRIA since Sept. 2008.


A. Imine: PC Member of the 22nd International Conference on Database and Expert Systems Applications (DEXA’2011), the 8th Colloquium on Optimization and Information Systems (COSI’2011) and the 3rd International Conference on Computer Science and its Applications (CIIA’2011). Member of the scientific committee of InterOP (Interest Group on Enterprise Systems Interoperability).

O. Kouchnarenko: Director of the LIFC Laboratoire d’informatique de Franche Comté; Member of the “Comité de direction” of the FEMTO-ST Institut; Member of the selection committees at the UFC; PC member of “International Workshop on Abstractions for Petri Nets and Other Models of Concurrency”, APNOC’11.


C. Ringeissen: PC member of ProCoS’11 (Frontiers of Combining Systems) and SoICT 2011 (International Symposium on Information and Communication Technology). Member of the COST Committee of INRIA since Oct. 2011 (working group “Actions Incitatives”).


L. Vigneron: Member of the FTP steering committee; Member of the IFIP Working Group 1.6 on Rewriting; Webmaster of the site Rewriting Home Page and of the RTA conference Web site. Member of the “Conseil de laboratoire” of LORIA. Director of the “Licence-Master MIAGE (Méthodes Informatiques Appliquées à la Gestion des Entreprises)” in the University of Nancy 2.

P.-C. Héam: Co-head of the FORWAL working group of GDR-GPL-CNRS. Director of the “Licence Informatique” in the University of Franche-Comté until Sept. 2011.

8.5. Visits of Foreign Researchers

Adel Bouhoula (SupCom Tunis, Tunisie) has visited Cassis (July 14 - July 21) to work on firewall policies.

Chris Lynch (University of Clarkson, USA) has visited Cassis (August 8 - August 15) to work on automated deduction.

Paliath Narendran (University of Albany, USA) has visited Cassis (August 19 - August 25) to work on unification algorithms for security protocol analysis.

Olivier Pereira (Université Catholique de Louvain, Belgium) has visited Cassis to work on developments of Helios (November 28).

Valerio Senni (University of Roma “Tor Vergata”, Italy) has visited Cassis (30th September - 3rd October) for a seminar and to work on structured data generation for testing.

Bogdan Warinschi (University of Bristol, UK) has visited Cassis three times to work on privacy for voting protocols and combination techniques for soundness results of symbolic model (January 17-19, June 20 - 24, and November 20 - 30).
8.6. Visits of Team Members

*Olga Kouchnarenko* has visited Natalia Sidorova (Eindhoven Univ. of Technologies, Netherlands) to work on the may-/exit-semantics of workflow Petri nets and on their configurations to ensure weak termination (November 6 - 13).

*F. Dadeau and P.-C. Héam* have visited Alexander Pretschner (Karlsruhe Institute of Technology) to work on testing security protocols (August 25-26).
8. Partnerships and Cooperations

8.1. Regional Initiatives

8.1.1. Collaboration with Université de Franche Comté

In September 2010, we began a cooperation with Université de Franche-Comté within a COLOR project funded for one year by INRIA-Nancy Grand Est. The main objective of the cooperation is the control of the bilinear Schrödinger equation with unbounded control potentials. The first results have been submitted to international journals [63], [62] or international conferences [60], [61] and are currently under review.

8.2. National Initiatives

8.2.1. Administrative responsibilities

- Henrot is the head of Fédération Charles Hermite (FR CNRS 3198) which is a Federation of four scientific units: CRAN (Research Center for Automatic Control), IECN (Institut Elie Cartan of Nancy), LMAM (Mathematical Center of research in Metz), LORIA ((Lorraine Laboratory of IT Research and its Application). He is also head of the “ANR blanc project” GAOS in Nancy.
- Tucsnak
  - Head of the Institut Élie Cartan de Nancy (IECN)
  - Member of the Scientific Council of UHP and at INRIA.
  - Member of the Executive Team and of the Project Committee of the INRIA Nancy-Grand Est Research Centre.
- Alabau is member of CNU, section 26.

8.2.2. National Projects

- CPER (“Contrat Plan Etat Région”):
  - Serres, Sigalotti (leader), Vivalda, Chambrion and Munnier are in “Stabilité et Commande des Systèmes à Commutations”. This project in the AOC theme, in collaboration with the Automatic Control team at CRAN, is devoted to the stabilization of hybrid systems arising in the domain of DC-DC converters.
  - Scheid, Takahashi (leader) and Tucsnak are in the project “Se propulser dans un fluide, analyse, contrôle et visualisation” (AOC theme), in collaboration with the INRIA team, ALICE.

- Our team is part of the GDR entitled “Fluid-Structure Interactions”.

8.3. European Initiatives

- Henrot is coordinating an application for an International Training Network (ITN - Marie Curie) in the FP7 Program of the European Union. The application involves 11 nodes in 7 European countries.
- Alabau is main coordinator for France of the GDRE CONEDP in Control of PDE between France and Italy.
- Alexandre Munnier, Takéo Takahashi, Marius Tucsnak are in a PHC project PESSOA with a group of IST (Portugal).
• Tucsnak is also involved in a Romanian-French project (Brancusi) with the University of Craiova, on Controllability of coupled systems.

8.4. International Initiatives

8.4.1. Projects

Indo-French project (CEFIPRA) with the Tata Institute for Fundamental Research, Bangalore, on Control of partial differential equations;

8.4.2. Phd co-supervision

• PhD student Roberto Guglielmi from University Tor Vergata, Roma, Italy is co-supervised by Alabau with, since october 2010.
• PhD student Erica Schwindt is co-supervised by Takahashi and Conca (CMM, university of Santiago of Chile).
• PhD student Imen Ellouze is co-supervised by Vivalda and Mohamed-Ali Hammami from the University of Sfax (Tunisia) (Phd defended in December 2010).

8.4.3. Visits of Foreign researchers

Evans Harrell (Georgia Tech, Atlanta), Gérard Philippin (U. Laval, Québec), Paolo Salani (U. Florence).
7. Partnerships and Cooperations

7.1. Regional initiatives

7.1.1. Action Situated Informatics of the CPER

Participants: Laurent Bougrain, Octave Boussaton, Thierry Viéville.

In the framework of the Contrat de Projet État Région, we are contributing to the axis IS (Informatique Située) through the project CoBras whose goal is to study reinforcement learning to better control a robotic arm in a Brain-Machine interface. We bought a JACO robotic arm for wheelchair by Kinova.

7.2. National initiatives

7.2.1. DGE Ministry grant COMAC “Optimized multitechnique control of aeronautic composite structures”

Participants: Laurent Bougrain, Octave Boussaton, Marie Tonnelier.

The goal of this three-years project is to develop a powerful system of control on site, in production and in exploitation, of aeronautical pieces made of composite. It takes up the challenge of the precise, fast and local inspection on composite pieces of aeronautical structures new or in service by using techniques of non-destructive control more effective and faster to increase the lifespans of the structures of planes. This project requires a decision-making system including fast methods of diagnostic based on several optical technics as non-destructive control.

7.2.2. INRIA ADT project LOIC

Participants: Laurent Bougrain, Baptiste Payan.

This national software collaborative project with the INRIA research team BUNRAKU (Rennes) is devoted to OpenViBE (cf. § 5.4). The objectives of the project are:

- Software enhancement:
  - Make the software compatible with new devices
  - Create new BCI scenarios (e.g. SSVEP, hybrid BCI...)
  - Create new 3D visualization
  - Create bridges to other softwares (e.g. MATLAB, TurboFieldTrip, BCI 2000)
  - Enhance global computation performance

- Software dissemination:
  - Gforge, website, support management...
  - Create new demos and tutorials
  - Organise training sessions

- Explore new research topics:
  - Hybrid BCI (e.g. visual and auditory, visual and tactile)
  - Immersive neurofeedback
7.2.3. ANR project KEOPS

Participants: Frédéric Alexandre, Laurent Bougrain, Thierry Viéville.

This «ANR International White Project» involving NEUROMATHCOMP and CORTEX Inria EPI in France with the U. of Valparaiso, U. Tecnica Frederico Santa-Maria, and U. De Chili is a 3 years, 248 person-months, sensory biology, mathematical modeling, computational neuroscience and computer vision, project addressing the integration of non-standard behaviors from retinal neural sensors, dynamically rich, sparse and robust observed in natural conditions, into neural coding models and their translation into real, highly non-linear, bio-engineering artificial solutions. An interdisciplinary platform for translation from neuroscience into bioengineering will seek convergence from experimental and analytical models, with a fine articulation between biologically inspired computation and nervous systems neural signal processing (coding / decoding).

7.2.4. ANR project PHEROTAXIS

Participants: Dominique Martinez, Thomas Voegtlin.

How can animals so successfully locate odour sources? This apparently innocuous question reveals on analysis unexpectedly deep issues concerning our understanding of the physical and biological world and offers interesting prospects for future applications. Pherotaxis focuses on communication by sex pheromones in moths. The main aim of the project is to integrate the abundant experimental data on the pheromone plumes, neural networks and search behaviour available in the literature, as well as that collected or being collected by us at the molecular, cellular, systemic and behavioural levels into a comprehensive global model of the pheromonal olfactory processes. To reach this objective, the consortium combines several groups of specialists with different and complementary fields, in physics (Institut Pasteur IP), neurobiology (INRA) and bio-robotics (INRIA).

7.2.5. ANR project PHEROSYS

Participants: Dominique Martinez, Hana Belmabrouk.

This collaborative project in systems Biology (ANR-BBSRC SysBio) with INRA (Paris, FR) and the University of Sussex (UK) explores olfactory coding in the insect pheromone pathway through models and experiments. More information available at http://www.informatics.sussex.ac.uk/research/projects/PheroSys/index.php/.

7.2.6. ANR project MAPS

Participants: Frédéric Alexandre, Yann Boniface, Nicolas Rougier, Wahiba Taouali, Thierry Viéville.

This collaborative project with INCM (Marseille), UMR Perception and Movement (Marseille) and LIRIS (Lyon) that finished this year aimed at re-examining the relationship between structure and function in the brain, taking into account the topological (spatial aspects) and hodological (connectivity) constraints of the neuronal substrate. Particularly, we focused on the oculomotor function and explored the dynamical and topological representation of information in the superior colliculus.

7.2.7. Project of the CNRS NeuroInformatics program on cortical signals to control a two-finger robotic hand (CorticoRobot)

Participants: Laurent Bougrain, Thierry Viéville.

Nowadays, the understanding of the control of manual dexterity in primates can be reached. Over the last twenty years, thanks to improved techniques for intra-cranial recordings, several advances have been obtained in particular to predict the direction of movement of the upper limb. Recent work has shown that it is possible to predict from brain data the flexion and the strength of fingers. The main objective of this project is to study the control of two anthropomorphic fingers (index finger and thumb) through intra-cortical signals recorded in the monkey during grasping movements (precision grip), forecasting both the finger position and the electromyographic activity (EMG) of the muscles involved in the movements of these two fingers. The project aims at (i) acquiring high-quality recordings using an array of 96 micro-electrodes, (ii) improving our experimental site for the grasping, and (iii) evaluating new modelings. This project is a cooperation between the University of Paris V, the Mediterranean Institute for Cognitive Neuroscience (INCM) and the EPI CORTEX.
7.2.8. Project CNRS PEPII: A large-scale, robotically embodied decision making model

Participants: Frédéric Alexandre, Nicolas Rougier, Thierry Viéville.

This project is a collaboration between the “Institut des Maladies neuro-dégénératives” (UMR 5293, team “Approche systémique de la Boucle Extrapyramidale”), Supélec (“Information, Multimodalité, Signal”) and the Cortex team. This project aims at studying the decision making process viewed as a high-level brain function, actioned by a distributed network of cortical and sub-cortical structures, interconnected in positive and negative feedback loops.

7.2.9. Project CNRS PEPII IMAVO

Participants: Nicolas Rougier, Yann Boniface.

This project is a collaboration between the "Institut des Neurosciences Cognitives et Intégratives d’Aquitaine” (UMR 5287), the “Institut des Systèmes Intelligents et de Robotique” (Systèmes Intégrés Mobiles et Autonomes) and the LORIA (Maia and Cortex groups). This project aims at investigating model-free and model-based approaches in the decision process in order to propose a computational model of the decision process in simple tasks.

7.2.10. Project of the CNRS NeuroInformatics program on oscillations in the rat olfactory bulb

Participants: Axel Hutt, Dominique Martinez, Thomas Voegtlin.

This project is a collaboration between the CORTEX group and the "Neurosciences et Systèmes sensoriels” group (CNRS UMR 5020) at University of Lyon 1. The goal of the project is to understand why the frequency of LFP oscillations in the olfactory bulb changes during the respiratory cycle (alternance beta/gamma). The project combines experimental (in-vivo experiments) and theoretical work (computer simulations).

7.2.11. Project INRA-INRIA

Participants: Dominique Martinez, Thomas Voegtlin.

This project is a collaboration between the CORTEX group at INRIA and the PISC group at INRA. This project aims at reconstructing and explaining the encoding of the pheromone stimulus in the early neural pathway of the moth olfactory system. Models of single neurons based on Hodgkin-Huxley formalism are being developed to incorporate the ionic conductances found in experiments and to account for the overall properties of the cells. A network model is also built to account for the different response types in the moth olfactory system with respect to the temporal structure of the stimulus. The simulations are performed with the Sirene and Mvaspike softwares developed in our group.

7.3. European Initiatives

7.3.1. FP7 Projet

7.3.1.1. MathAna

Title: Mathematical Analysis of Anaesthesia

Type: IDEAS ()

Instrument: ERC Starting Grant (Starting)

Duration: January 2011 - December 2016

Coordinator: INRIA (France)

See also: ___ http://cordis.europa.eu/fetch?CALLER=FP7_PROJ_EN&ACTION=D&DOC=1&CAT=PROJ&RCN=97256
___
Abstract: General anaesthesia is an important method in today’s hospital practice and especially in surgery. To supervise the depth of anaesthesia during surgery, the anaesthesist applies electroencephalography (EEG) and monitors the brain activity of the subject on the scalp. The applied monitoring machine calculates the change of the power spectrum of the brain signals to indicate the anaesthetic depth. This procedure is based on the finding that the concentration increase of the anaesthetic drug changes the EEG-power spectrum in a significant way. Although this procedure is applied world-wide, the underlying neural mechanism of the spectrum change is still unknown.

The project aims to elucidate the underlying neural mechanism by a detailed investigating a mathematical model of neural populations. The investigation is based on analytical calculations in a neural population model of the cortex involving intrinsic neural properties of brain areas and feedback loops to other areas, such as the loop between the cortex and the thalamus. Currently, there are two proposed mechanisms for the characteristic change of the power spectrum: a highly nonlinear jump in the activation (so-called phase transition) and a linear behaviour.

The project mainly focusses on the nonlinear jump to finally rule it out or support it. A subsequent comparison to previous experimenta results aims to fit the physiological parameters. Since the cortex population is embedded into a network of other cortical areas and the thalamus, the corresponding analytical investigations takes into account external stochastic (from other brain areas) and time-periodic (thalamic) forces. To this end it is necessary to develop several novel nonlinear analysis technique of neural populations to derive the power spectrum close to the phase transition and conditions for physiological parameters.

7.3.1.2. FP7-ICT project NEUROCHEM

Participant: Dominique Martinez.

The european project NEUROCHEM explores biologically inspired computation for chemical sensing, in collaboration with the University of Barcelona, the royal institute of technology (Sweden), INRA (Paris), the university of Manchester, the university Pompeu Fabra (Spain), CNR-IMM (Italy) and the university of Leicester. More information is available at http://www.neurochem-project.org/

7.4. International Initiatives

7.4.1. INRIA Associate Teams

7.4.1.1. Cortina, associate team with Chile

Participants: Frédéric Alexandre, Thierry Viéville, Laurent Bougrain.

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 common tools for the analysis and formalization 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.

7.4.2. Visits of International Scientists

7.4.2.1. Internships

NOUHA BOUJELBEN (from Feb 2011 until Jul 2011)

Subject: Information Reduction in the Brain
Institution: Ecole Nationale d’Ingénieurs de Sfax (Tunisia)

Juan Ignacio PORTA (from Mar 2011 until Jul 2011)
Subject: Randomly spiking neural fields
Institution: Universidad Nacional de Rosario (Argentina)

Mouid KESKES (from Feb 2011 until Jul 2011)
Subject: Modeling early vision with artificial neural networks
Institution: Ecole Nationale d’Ingénieurs de Tunis (Tunisia)

7.4.2.2. CONICYT-INRIA Program of Cooperation with Chile: AMVIS
Participants: Frédéric Alexandre, Thierry Viéville.

This project gathers chilean partners (U de Valparaiso and U Federico Santa-Maria) to french computational neuroscientist (CORTEX and NEUROMATHCOMP EPI). Recording and modeling non-standard retina neural network involved in sensori-motor perceptual tasks is targeted here: 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?
MADYNES Project-Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

The TEAM is involved in several actions of the regional CPER (Contrat Plan Etat Region) initiative on networked security as well as in the security of industrial networked systems initiative. We are also involved in the smart living initiative of the CPER where we provide our expertise on embedded operating systems and sensors.

8.2. National Initiatives

The team is participating in several national research projects: ANR MAPE and coordinator of the ANR VAMPIRE project. In addition the team is involved in one P2P project with the University of Troyes (GIS 3S).

8.3. European Initiatives

8.3.1. Think tanks and european institutes

Olivier Festor is member of the Future Media Internet think tank at the European Commission, part of the european Future Internet Assembly. In 2011, the think tank did contribute to the FIA events and issue one white paper on the Future Media Internet Architecture [37].

Since november 1st 2011, Olivier Festor is the Director of Research of the European Institute of Innovation and Technology EIT ICT Labs.

8.3.2. Academics cooperations

MADYNES has an ongoing collaboration with the university of Luxembourg on network security. Two joint thesis are part of this collaboration: the thesis of Gerard Wagener on high interaction honeypot models and the thesis of Sheila Becker on game theory-based protocol fuzzing.

We are also members of the EUNICE consortium. EUNICE has been established to foster the mobility of students, faculty members and research scientists working in the field of information and communication technologies and to promote educational and research cooperations between its member institutions. The major event of EUNICE is an annual summer school which brings together lecturers, researchers, students and people from the industry across Europe for one week of presentations, discussions and networking. Isabelle Chrisment is member of EUNICE technical committee.

8.3.3. FP7 Projects

8.3.3.1. Univerself

Title: Univerself
Type: COOPERATION (ICT)
Defi: The Network of the Future
Instrument: Integrated Project (IP)
Duration: September 2010 - August 2013
Coordinator: Alcatel Lucent Bellabs (France)
Others partners: Alcatel-Lucent Bell Labs (France), Alcatel Lucent Ireland Limited (Ireland), Alcatel-Lucent Deutschland AG (Germany), NEC Europe Ltd. (Germany), Thales Communications SA (France), France Telecom SA (France), Telecom Italia S.p.A (Italia), Telefonica Investigacion y Desarrollo (Spain), Fraunhofer-Gesellschaft Zur Foerderung Der Angewandten Forschung E.V (Germany), Interdisciplinary Institute for Broadband Technology (Belgium), Inria (France), VTT Technical Research Centre of Finland (Finland), University College London (UK), University of Surrey (UK), National and Kapodistrian University of Athens (Greece), University of Piraeus Research Centre (Greece), Universiteit Twente (The Netherlands)

See also: www.univerself-project.eu/

Abstract: This FP7 European integrated project aims at consolidating the autonomic methods and techniques supporting the management of the future Internet, and at integrating these methods into a unified management framework. The objective of this framework is to address the management issues of the evolving Internet through the self-organisation of the control plane and the empowerment of the management plane with cognition.

Our work in the Univerself project mainly concerns the security and safety challenges posed by the unified management framework, in particular the prevention of configuration vulnerabilities.

8.3.3.2. FI-WARE

Title: Future Internet Core Platform
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: Telefonica I+D (Spain), SAP AG (Germany), IBM, Thales (France), Telecom Italia (Italy), Orange Labs - France Telecom (France), Nokia Siemens Networks (Germany), Deutsche Telekom (Germany), Technicolor (France), Ericsson (Sweden), ATOS ORIGIN S.A.E (Space), Engineering Ingegneria Informatica S.p.A (Italy), Alcatel-Lucent Deutschland AG (Germany), Alcatel-Lucent Italia S.p.A (Italy), Siemens AG (Germany), Intel (Ireland), NEC Europe Ltd. (Germany), Fraunhofer Institute for Open Communication Systems FOKUS (Germany), Inria (France), Universidad Politecnica de Madrid (Spain), University of Duisburg-Essen (Germany), University of Rome - Sapienza (Italy), University of Surrey (UK),

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.

The MADYNES contributions to the FI-WARE project are:

- a fuzzing framework for the Internet of Things part dimension of the FI-WARE platform. More specifically we will instantiate the KIF framework to a SCADA case study;
- a smartphone level flow monitoring appliance;
- integration facility of OVAL specifications into the FI-WARE ecosystem.
8.3.3.3. SCAMSTOP

Title: SCAMSTOP
Type: CAPACITIES (Research for SMEs)
Instrument: Research for the Benefit of SMEs (SME)
Duration: January 2010 - December 2011
Coordinator: Fraunhofer Institute for Open communication Systems FhG Fokus (Germany)
Others partners: TEI of Mesolonghi (Greece), Inria (France), Telio (Norway), Voz Telecom (Spain), PDM & FC (Portugal)
See also: http://www.sme-scamstop.eu/
Abstract: SCAMSTOP will provide a complete framework/solution for automatic fraud detection that alarms providers when suspicious behaviour is detected. Thereby, SCAMSTOP will make fraud detection not only simpler but much faster as well. The developed tools can be used by VoIP/ISP providers to protect their services against losses due to fraud and to identify previously uncollected revenue sources.

We do contribute to this project by the design and implementation of fraud detection mechanisms based on advanced clustering techniques.

8.4. International Initiatives

We actively participate to the Internet Research Task Force (IRTF) Network Management Research Group (NMRG). Since March 1st 2011, Olivier Festor was named co-chair of this research group within IRTF. The group did organize one meeting in Quebec in July 2011. A workshop on flow-level management will be held in conjunction with the next IETF (March 2012) in Paris.

8.4.1. INRIA International Partners

We have established a strong cooperation with the team of Thomas Djotio at the Polytechnical Superior National School (PSNS) of the Yaoundé University. We currently have two joint Ph.D. students and regular exchanges of researchers.

8.4.2. Visits of International Scientists

8.4.2.1. Invited researchers and professors
Ramin Sadre from University of Twente, spent 3 weeks in the team, working on anomaly detection based on flow analysis.
Pr Priyadarssi Nanda from the University of Technology, Sydney Australia spent 6 months on the team working on new naming schemes and advanced routing on wireless sensor networks.

8.4.2.2. Internships

Balkiss Souissi (from Feb 2011 until Aug 2011)
Subject: A self-monitoring approach for RPL-enabled wireless sensor networks
Institution: Ecole Nationale d’Ingénieurs de Tunis (ENIT) (Tunisia)

Cesar Bernardini (from Mar 2011 until Oct 2011)
Subject: An Offensive Security Tool for 6lowpan Networks
Institution: Universidad Nacional de Cordoba (Argentina)

Bilel Saadallah (from Mar 2011 until Aug 2011)
Subject: Passive Monitoring of 802.15.4/6LowPan-enabled Wireless Sensor Networks
Institution: Ecole Nationale des Sciences de l’Informatique (Tunisia)

Lucia Masola

Subject: Collaborative Sharing of Vulnerability Descriptions in Autonomic Networks
Institution: Universidad Nacional del Centro de la Provincia de Buenos Aires (Argentina)

François Despaux

Subject: Highly Modular SIP Honeypot
Institution: Universidad de la Republica (Uruguay)

Damian Vicino

Subject: Design and Implementation of a Multi-Protocol Peer-to-Peer Client
Institution: Universidad de Buenos Aires (Argentina)

Prabhjot Prabhjot Singh

Subject: NETCONF Friendly Firewall Configuration Models
Institution: IIT Bombay (India)

Imen Mahjri (from Mar 2011 until Aug 2011)

Subject: Exploring cognitive techniques for sensor networks management
Institution: Ecole Nationale des Sciences de l’Informatique (Tunisia)
MAGRIT Project-Team (section vide)
7. Partnerships and Cooperations

7.1. Regional Initiatives

7.1.1. COMAC

Participants: Mauricio Araya, Marie Tonnelier, Vincent Thomas, Olivier Buffet, François Charpillet.

Laurent Bougrain (CORTEX team, LORIA) is an external collaborator.

The COMAC project is part of the Materalia competitive cluster. The main objective of the project is to develop diagnosis tools for the low cost identification of defaults in aeronautics parts made of composite materials.

In collaboration with Laurent Bougrain, one of our objectives is to propose a software toolbox for computer-aided diagnosis in this context. The current project is a system relying on expert knowledge taking the form of a database of labeled images.

In the MAIA team, our research effort focuses more precisely on information gathering problems involving active sensors, i.e., an intelligent system which has to select the observations to perform (which sensor, where, at which resolution). Mauricio Araya’s undergoing PhD looks precisely at the topic of Active Sensing (Section 5.1.8).

7.1.2. Multi-agent simulation of public transportation

Participant: Vincent Chevrier.

This collaboration with the CUGN (communauté urbaine du grand Nancy - Pole Transport) aims at a better understanding of the functioning of the transportation of the Grand-Nancy. A first part of the work aims at providing an accurate and meaningful understanding of the transportation system. Through student projects we propose different viewpoints to enhance this understanding. After validation of the Pole Transport, some of these viewpoints have been integrated in tools to produce daily report at the Pole Transport.

A second part is dedicated to the explanation of the dynamics of transportation systems. We are developing a multi-agent model of the tramway line which integrates real data (traveling time during stops). We are able to reproduce an equivalent functioning without perturbation. Recently, we showed that if we perturb the system, it responds similarly as the real system. For example, halting a tramway at a stop, figuring a lot of people being waiting and taking it, induces a comparable response in the simulator regarding to the real system.

7.2. National Initiatives

7.2.1. ANR project BARQ

Participants: Jörg Hoffmann, Olivier Buffet, Bruno Scherrrer.

This project has been granted by ANR in the “Chaires d’Excellence” program. The project is funded with ca. 400000 EUR and will hire four non-permanent researchers (Doctorants and/or Postdocs). Jörg Hoffmann is the project leader, Olivier Buffet and Bruno Scherrrer collaborate. Other collaborators from LORIA are Stephan Merz, Ammar Oulamara, and Martin Quinson. The project also has several international collaborators, in particular Prof. Blai Bonet (Universidad Simon Bolivar, Caracas, Venezuela), Prof. Carmel Domshlak (Technion Haifa, Israel), Prof. Hector Geffner (Universitat Pompeu Fabra, Barcelona, Spain), Dr. Malte Helmert (University of Freiburg, Germany), and Prof. Stephen Smith (CMU, Pittsburgh, USA).

8COMAC = contrôle optimisé multi-techniques des aérostructures composites / optimised multi-technique control of composite aeronautic parts
The project unites research from four different areas, namely classical planning, probabilistic planning, model checking, and scheduling. The underlying common theme is the development of new methods for computing lower bounds via state aggregation. Specifically, the basic technique investigated allows explicit selection of states to aggregate, in exponentially large state spaces, via an incremental process interleaving it with state space re-construction steps. The two main research questions to be addressed are how to choose the states to aggregate, and how to effectively obtain, in practical scenarios, anytime methods providing solutions with increasingly tighter performance guarantees.

So far, we have hired Dr. Michael Katz as a PostDoc (for 2 years) working on classical planning, and Manel Tagorti as a PhD student (for 3 years) working on probabilistic planning. The Conseil Regional de Lorraine has accepted to co-finance, for 2011, 50% of the position of Michael Katz for a period of 1 year. Chao-Wen Perng was funded from BARQ for an internship of 5 months during which she worked on her MSc report, laying some basis for the research direction to be followed by Manel Tagorti.

7.2.2. PEPS project GEST - 2010/2011

**Participant:** Vincent Chevrier.

This project “Gouvernance Enactive des Systèmes de Transports” (GEST) is the consequence of the work undertaken within the GEST project funded by the IXXI (“Institut Rhône Alpin des Systèmes Complexes”). It involves teams from the LIG (Laboratoire d’informatique de Grenoble) and from the LIESP (Laboratoire d’informatique pour l’entreprise et les systèmes de production), and is associated to the CUGN.

This project aims at a fundamental level at proposing an enactive perspective for the governance issue in case of complex socio-technical systems, and more specifically, in case of public transportation systems. From a more applicative perspective, we seek at specifying a participatory and reflexive simulation system based on a multi-agent model.

This exploratory project is grounded on core ideas coming from the IXXI work. It aims at gathering researchers coming from different domains (social cognition, decision theory, simulation, serious game, etc) in order to clarify interdisciplinary issues.

A workshop was organized in the beginning of January 2011 in Lyon followed by three other meetings.

7.2.3. ANR project CARTOMATIC

**Participants:** Olivier Simonin, François Charpillet, Antoine Bautin.

This project has been granted by ANR in the Robotics Carotte challenge (CArtographie par ROboT d’un TERRitoire) from the Contenus et Interactions program. The project is funded with ca. 50000 EUR to purchase the robotics platform. The Maia team was also funded with a PhD fellowship. The Cartomatic consortium is formed by LISA/Université d’Angers (leader), Maia/LORIA and Wany robotics (Montpellier).

This project concerns the mapping of an indoor structured but unknown environment, and the localization of objects, with one or several robots. We aim at studying multi-robot or swarm algorithms to achieve such a challenge, while showing the robustness and the accuracy of the mapping when using cooperation between several autonomous robots. In the work of Antoine Bautin PhD thesis (started in 2009) we have proposed a distributed algorithm XXXXXXXX multi-robot deployment and mapping. (Section 5.2.2.1 ).

7.2.4. INRIA AEN PAL Personally Assisted Living

**Participants:** François Charpillet, Olivier Simonin.

The PAL project is an INRIA National Initiative (Action d’Envergure Nationale) involving several teams of the institute (Arubas, Coprin, E-motion, Lagadic, Demar, Maia, Prima, Pulsar and Trio). It is coordinated by David Daney (INRIA Sophia-Antipolis EPI Coprin). The project focuses on the design of smart home and robot assistant. Maia is particularly involved in the People Surveillance work package, by studying and experimenting intelligent environments, funded on smart tiles (cf. Sec. 5.2.3.1 ) and multi-sensor devices.

As a first action, the consortium organized a Workshop “De l’Autonomie au Domicile” in Nice, on November 29 & 30, 2010. [http://www-sop.inria.fr/coprin/pal/workshop/](http://www-sop.inria.fr/coprin/pal/workshop/)
7.2.5. PEA-DGA SUSIE 2009-12

Participants: François Charpillet, Olivier Simonin, Romain Mauffray.

This project relies on results and questions arising from the SMAART project (2006-08). During this project we adapted the EVAP algorithm 5.2.1.4 to the patrol with UAVs, while providing a generic digital pheromone based patrolling simulator Concerning sharing authority, we proposed an original interface to manipulate groups of UAVs. However, experiments with operators have shown that they succeed in improving the whole system when dealing with the patrolling task.

So, the aim of the SUSIE project is twofold: (i) studying and improving parameters of the EVAP algorithm through the SMAART simulator, (ii) defining new ways to manipulate pheromones fields in order to improve the sharing authority.

7.2.6. INRIA ADT project ROMEA (2009-11)

Participants: Olivier Simonin, François Charpillet, Nicolas Beaufort, Alain Dutech, Olivier Buffet.

ROMEA, for “RObots Mobiles et Environnements Actifs”, is a project proposed by the Maia team and funded by INRIA NGE through an ADT “Action de Developpement Technologique”. The project deals with the development and the study of intelligent and collective behaviors with Khepera III mobile robots. In particular we develop a new experimental device, called *interactive table for robots*, which provides a graphical active environment where robots can read and write pieces of information (e.g. digital pheromones). During 2010, with O. Rochel (INRIA research engineer) and N. Beaufort (INRIA IJD), we designed such a device which is now used for swarm robotics experiments, see Section 5.2.2.2. Nicolas Beaufort was hired for a second year as an INRIA IJD engineer to develop the required functions on the interactive table and the robots.

7.2.7. CNRS PEPII project “IMAVO” (2011-2012)

Participant: Alain Dutech.

IMAVO, for “Interactions entre Modules pour l’Apprentissage dans un environnement VOlatile”, is a PEPII project of the INSB institute of the CNRS. It involves Alain Marchand and Etienne Coutureau from the INCIA Lab of Bordeaux (Behavioral Neurosciences - INSB), Mehdi Khamassi and Benoît Girard from the ISIR Lab of Paris (Robotics and Neurosciences - INS2I), Alain Dutech and Nicolas Rougier from the Loria Lab of Nancy (Computational Neurosciences and Machine Learning - INS2I).

This project investigates *model-based* and *model-free* reinforcement learning approaches for rats learning in volatile environments (*i.e.* context and reward can change during learning). It aims at designing new concept for modularized decision-making systems, allowing a better understanding of the underlying neuro-biological process involved in rats and humans and applications in the field of autonomous robotics.

It is a logical extension of a cooperation between MaIA and the INCIA Lab of Bordeaux [7].

7.3. European Initiatives

7.3.1. Collaborations in European Programs, except FP7

7.3.1.1. Agent Technical Fora

The Agent Technical Fora have been created by AgentLink III. and consist of several working groups called Technical Forum Groups. These groups of researchers and developers share an interest in a specific sub-area of agent and multi-agent technology. Since the end of AgentLink, the Technical Fora have been organized jointly to the EUMAS conference, starting in 2006.

7.3.1.1.1. Technical Forum Group: “Self-Organization”

Participants: Christine Bourjot, Vincent Chevrier, Vincent Thomas.

Vincent Chevrier was promoter of the Technical Forum Group “Self Organization”. The aim of the TFG is to work on self-organization in complex distributed systems such as multi-agent systems. The group members have been involved in the writing of a book entitled *Self-Organising Software - From Natural to Artificial Adaptation* where the MAIA team is responsible for two chapters [44], [45].
7.3.1.1.2. Technical Forum Group: Simulation

**Participants:** Vincent Chevrier, Julien Siebert.

The Simulation Technical Forum meets for the first time this year. It aims at working on the main challenges of agent and multi-agent-based simulation while establishing links between members of the simulation community which could lead to share common research activities and projects.

The promoters of this forum solicited MAIA members to present their point of view on current issues in multiagent simulation.

7.3.1.2. European project INTERREG IVB “InTraDE” (2009-12)

**Participants:** François Charpillet, Alexis Scheuer, Olivier Simonin, Olivier Buffet.

The InTraDE project (Intelligent Transportation for Dynamic Environments, [http://www.intrade-nwe.eu/](http://www.intrade-nwe.eu/) ) is funded by the European North West Region. The project is coordinated by Rochdi Merzouki from University of Science and Technology of Lille (LAGIS lab.). Other partners are the Maia team, Liverpool John Moores University (LOOM), the National Institute for Transport and Logistics in Dublin Institute of Technology, the South East England Development Agency, the AGHO Port of Oostende and the CRITT in Le Havre. In the context of seaports and maritime terminals, the InTraDE project aims to improve the traffic management and space optimization inside confined spaces by developing a clean and safe intelligent transportation system. This transportation system will operate in parallel with virtual simulation software of the automated site, allowing a robust and real-time supervision of the goods handling operation.

The Maia team partner focuses on decentralized approaches to deal with the control of automated vehicle platooning and the adaptation of the traffic. Maia is funded with two PhD fellowships and one engineer. Both PhD thesis started in the end of 2010. The PhD of Jano Yazbeck, supervised by F. Charpillet and A. Scheuer, aims at studying a “Secure and robust immaterial hanging for automated vehicles”. The PhD of Mohamed Tlig, supervised by O. Simonin and O. Buffet, addresses “Reactive coordination for traffic adaptation in large situated multi-agent systems”.

7.3.2. Major European Organizations with which you have followed Collaborations

- University of Basel, Departement Informatik (Switzerland)
- New lower-bound heuristics for deterministic planning

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

**Sujet 2** (max. 2 lignes)

7.4. International Initiatives

7.4.1. Visits of International Scientists

- Dr. Sylvie Thébaux, Director of the Canberra Research Laboratory of NICTA (Australia), visited MAIA for 1 week in June 2011.
- Dr. Ingo Weber, Senior Research Associate at the University of New South Wales (Sydney, Australia), visited MAIA for 1 day in August 2011.
- Dr. Iadine Chadès, Research Scientist at CSIRO, Ecosystem Sciences division (Brisbane, Australia), visited MAIA for 1 week in September 2011.
- Dr. Van Parunak, Chief Scientist at Vector Research Center, Ann Arbor, USA, visited MAIA for 2 days at the occasion of Olivier Simonin’s HDR defense. December 2010.
7. Partnerships and Cooperations

7.1. Regional Initiatives

MASAIE has obtained a grant from Région Lorraine for a research project: “Dynamique des populations de pathogènes”.

7.2. International Initiatives

7.2.1. Participation In International Programs

MASAIE is involved in a cooperation program with Brazil. This project, funded by CAPES-COFECUB, “new methods in epidemiology and early detection of events” for 4 years, has begun in January 2011.

A. Iggidr and G. Sallet have spent 3 weeks in Brazil and M-L Penna (UFF) and M. De Souza (UFF) has visited MASAIE in 2011. This program includes Federal University Fluminense (Rio), Unicam (Caminas), UPFE (Recife), Foundation Fiocruz (Brazilian Ministry of Health), Foundation Getulio Vargas and IMPA. A research program on dengue has been established and a common paper is under writing. The common research team is constituted half by mathematicians and computer scientist and half by public health researchers.

7.2.1.1. EPLS

MASAIE has developed a cooperation with Pasteur Institute and EPLS to model Bilharzia on Senegal river basin.
8. Partnerships and Cooperations

8.1. International projects and collaborations

8.1.1. Fapemig INRIA Project: Incorporating knowledge models into scalable data mining algorithms

**Participants:** Mehdi Kaytoue, Amedeo Napoli [contact person], Chedy Raïssi.

This Fapemig – INRIA research project involves researchers at Universidade Federal de Minas Gerais in Belo Horizonte – a group led by Prof. Wagner Meira– and the Orpailleur team at INRIA Nancy Grand Est. In this project we are interested in the mining of large amount of data and we target two relevant application scenarios where such issue may be observed. The first one is text mining, i.e. extracting knowledge from texts and document categorization. The second application scenario is graph mining, i.e. determining relationship-based patterns and use these relations to perform classification tasks. In both cases, the computational complexity is large either because the high dimensionality of the data or the complexity of the patterns to be mined.

One strategy to ease the execution of such data mining tasks is to use existing knowledge to restrict the search space and to assess the quality of the patterns found. This existing knowledge may be formalized in ontologies but also in other ways whose study is a research issue in this project. Once we are able to build knowledge models, we need to determine how to use such knowledge models, which is a second major research issue in this project. In particular, we want to design and evaluate mechanisms that allow the exploitation of existing knowledge for sake of improving data mining algorithms.

Finally, the computational complexity of the algorithms remains a major issue and we intend to address it through parallel algorithms. Data mining algorithms, in general, represent a challenge for sake of parallelization because they are irregular and intensive in terms of both computing and communication. Accordingly, in a first joint work, we developed a new parallel algorithm to build skycubes based on the Anthill framework developed at UFMG. The paper was presented in a local Brazilian Conference and an extended journal version will appear in a 2012 special issue of the International Journal of Parallel Programming.

8.1.2. Search for anti-HIV drugs acting as entry-blockers

**Participants:** Thomas Bourquard, Marie-Dominique Devignes, Anisah Ghoorah, Lazaros Mavridis, Violeta Pérez-Nuño, Dave Ritchie, Malika Smaïl-Tabbone, Vishwesh Venkatraman.

In collaboration with computational chemistry colleagues at the University of Bari and the Institut Chimique de Sarria (IQS) in Barcelona, Dave Ritchie has published reviews of the state of in silico protein structure modeling and virtual drug screening techniques for the CCR5 [87], and CXCR4 [111], entry-blocking molecules. As there now exist several hundred such entry-blockers, there is considerable interest in the chemoinformatics community in how best to use knowledge of known drug molecules to develop new and more potent new drug candidates [112]. The spherical harmonic clustering approach developed by Dave Ritchie and Violeta Pérez-Nuèno was recently used successfully in a virtual screening study at the IQS to discover new high-affinity ligands for CXCR4 [109].

8.1.3. International collaborations in Mining complex data

**Participants:** Isiru Bayissa, Adrien Coulet, Mehdi Kaytoue, Amedeo Napoli, Chedy Raïssi.
A first collaboration involves “Université du Québec à Montréal” (UQAM) in Montréal with Prof. Petko Valtchev and Laboratoire LIRMM in Montpellier with Prof. Marianne Huchard. This collaboration is supported by a CNRS PICS project (2011-2014), which is called “Concept Analysis driving Ontology Engineering” and abbreviated in “CAdOE”. The research work within this project is aimed at defining and implementing a semi-automatic methodology supporting ontology engineering based on the joint use of Formal Concept Analysis (FCA) and Relational Concept Analysis (RCA). At the moment, some elements of this methodology are existing and were used in text mining [85], [84]. However, the first methodology should be completed and improved, especially regarding the applicability on complex data and the interoperability with knowledge representation modules. This year, some publications were already obtained and some others are in preparation for next year [36], [56], [75].

A second collaboration involves Sergei Kusnetsov at Higher School of Economics in Moscow (HSE). Mehdi Kaytoue and Amedeo Napoli visited HSE laboratory in July 2010 granted by the Poncelet Laboratory in Moscow, a joint CNRS – INRIA laboratory. This visit was the occasion of preparing a number of publications, among which a publication in a first-rank conference in Artificial Intelligence (major [5]), together with some other important publications [49], [33], [48]. This shows that the collaboration is on-going and that there is still a substantial research work to be done. This year, Amedeo Napoli visited HSE laboratory in June 2011 while Sergei Kuznetsov visited Loria in October 2011.

A third collaboration—a PHC Zenon project—exists with Florent Domenach, associated professor at the University of Nicosia in Cyprus. This project is entitled “Knowledge Discovery for Complex Data in Formal and Relational Concept Analysis” (KD4CD) and is aimed at studying and combining different types of classification process in the framework of FCA. These processes can be based on Galois connections but also on the so-called “overhangings”, i.e. a kind of generalization of closure systems. Moreover, another interest is put on consensus theory where the objective is to find the better classification of a set of objects according to a quality measure (this could be applied to ontologies). This year, there were two visits from France to Cyprus in May and December 2011 while there was one visit from Cyprus to France in October 2011.

8.2. European Initiatives

8.2.1. FP7 Projet: DOVSA

- Title: Development of Virtual Screening Algorithms: Exploring Multiple Ligand Binding Modes Using Spherical Harmonic Consensus Clustering.
- Type: PEOPLE.
- Instrument: Marie Curie Intra-European Fellowships for Career Development (IEF).
- Duration: July 2010 – July 2012.
- Coordinator: INRIA Nancy Grand-Est (France).
- Others partners: None.
- Abstract (see also Section 6.3.6 of this document):
  This project will advance the state of the art in virtual drug screening by developing novel spherical harmonic-based consensus clustering algorithms. The main disease that will be targeted in this project is the acquired immune deficiency syndrome (AIDS), caused by the human immuno-deficiency virus (HIV). However, the approach will be quite generic and will be broadly applicable to many other diseases. The approach will be tested and validated using 40 well-known drug targets from the DUD dataset. It will then be used to screen the French Chimiothèque Nationale library of some 36000 compounds for novel ligands which will bind the CCR5 co-receptor and hence block HIV infection. A small list of candidate entry-blocking compounds will be sent to Barcelona for experimental testing. By extending the SH-based consensus clustering technique, this project will provide a generic tool to help deal with cases where multiple ligands may be associated with multiple pocket sub-sites or which may bind multiple targets, and it will help to find new HIV entry-blocking compounds.
8.3. National Initiatives

8.3.1. ANR Kolflow: man-machine collaboration in continuous knowledge-construction flows

Participants: Jean Lieber [contact person], Amedeo Napoli, Emmanuel Nauer, Julien Stévenot, Yannick Toussaint.

Kolflow (http://kolflow.univ-nantes.fr/) is a 3-years basic research project taking place from February 2011 to July 2014, funded by French National Agency for Research (ANR), program ANR CONTINT. The aim of the project is investigation on man-machine collaboration in continuous knowledge-construction flows. Kolflow partners are Edelweiss (INRIA Sophia Antipolis), GDD (LINA Nantes), Silex (LIRIS Lyon), Orpailleur, and Score (LORIA).

8.3.2. ANR Trajcan: a study of patient care trajectories

Participants: Elias Egho, Nicolas Jay [contact person], Amedeo Napoli, Chedy Raïssi.

Since 30 years, many patient classification systems (PCS) have been developed. These systems aim at classifying care episodes into groups according to different patient characteristics. In France, the so-called “Programme de Médicalisation des Systèmes d’Information” (PMSI) is a national wide PCS in use in every hospital. It systematically collects data about millions of hospitalizations. Though it is used for funding purposes, it includes useful knowledge for other public health domains such as epidemiology or health care planning.

The objective of the Trajcan project is to represent and analyze “patient care trajectories” (patient suffering from cancer limited to breast, colon, rectum, and lung cancers) and the associated healthcares. The data are related to patients receiving hospital cares in the “Bourgogne” region and using data from the PMSI. Such an analysis involves various data, e.g. type of cancer, number of visits, type of stays, hospitalization services and therapies used, and demographic factors, i.e. age, gender, place of residence.

One thesis is currently carried out on this subject whose objective is to design a knowledge discovery system working on multidimensional and sequential data for characterizing Patient Care Trajectories (PCT). This thesis combines knowledge discovery and knowledge representation methods for improving the definition of patient care trajectories as temporal objects (sequential data mining). The overall objective id to provide in decision support for improving healthcare in detecting for example typical or exceptional trajectories for planning with precision healthcare for a given population. In order to discover groups of patients showing similar health condition, treatments or journeys through the healthcare system, PCT are mined with multilevel and multidimensional sequential itemsets search, using external knowledge on hospitals, medical procedures and diagnoses. FCA capabilities for dealing with large amounts of data and for filtering (with a measure such as stability) are then used as a post-processing step for selecting the most interesting patterns [46].

8.4. Local initiatives

8.4.1. Contrat Plan État Région” (CPER)

The links between the Regional Administration and LORIA are materialized through an administrative contract called “Contrat Plan État Région” (CPER) running from 2007 to 2013. The associated scientific program is called “Modélisations, informations et systèmes numériques” (MISN) and includes two tracks in which the Orpailleur team is involved.

- “Modeling Bio-molecules and their Interactions” (MBI).

This project is coordinated by Marie-Dominique Devignes (http://bioinfo.loria.fr) and the general objective is to study how domain knowledge can be taken into account for improving modeling of biomolecules and their interactions, and how, in sequence, this guides the modeling of biological systems. Six scientific projects are currently under development and involve collaborations with computer scientists, and people working either in biology or chemistry.
An INRIA experimental research platform is currently developed in the framework of MBI (http://bioinfo.loria.fr/Plateforme%20MBI). This platform is aimed at sharing data and computing resources. Its specific features are relative to biomolecules modeling, classification, and to data integration for data mining. In parallel with the bioinformatics platforms in Strasbourg, Reims, Lille, and Nancy-INIST, it constitutes the North-East node of RENABI (“Réseau National des Plateformes Bioinformatiques”).

- “Traitement Automatique des Langues et des Connaissances” (TALC).

TALC has to be understood as “Automatic Processing of Languages and Knowledge” and the general objective is to study the relations existing between knowledge discovery, knowledge representation, reasoning, and natural language processing. In this framework, the Orpailleur team plays an important role as the research themes are closely related to those of the team. Actually, research projects are currently under development on knowledge management and decision support in the large involving in particular the Kasimir and the Taaable systems.

8.4.2. Other initiatives

8.4.2.1. Cancéropole Grand-Est

A collaboration with the “Laboratoire de Bioinformatique et Génomique Intégratives (LBGI)” at IGBMC Strasbourg involves a thesis funded by INCa (“Institut National du Cancer”) with a bipartite direction. This thesis is considered as one research operation within the annual meeting of “Canceropole Grand-Est”.

8.4.2.2. BioProLor

The Orpailleur team is member of the BioProLor consortium composed of 5 enterprises and 7 academic research teams. This consortium is funded for 2 years (2010-2012) by the AME (“Agence pour la Mobilisation Economique”). The objective of BioProLor is the design of a production filière for compounds with high added-value which originate from plants in Lorraine. The Orpailleur team and the associated start-up “Harmonic Pharma” are in charge of the computational aspects of this research work.

In addition, a CIFRE contract was set up with Harmonic Pharma for funding the thesis of Emmanuel Bresso on the following subject: “Organisation et exploitation des connaissances sur les réseaux d’interactions biomoléculaires pour l’identification de gènes candidats et la caractérisation de profils pharmacologiques et effets secondaires de principes actifs”.

7. Partnerships and Cooperations

7.1. National Initiatives

We participate in the “Logic and Complexity” part of the GDR–IM (CNRS Research Group on Mathematical Computer Science), in the projects “Logic, Algebra and Computation” (mixing algebraic and logical systems) and “Geometry of Computation” (using geometrical and topological methods in computer science).

We participate and co-animate the “Transformation” group of the GDR–GPL (CNRS Research Group on Software Engineering).

7.1.1. ANR Complice (2009-2012)

Participant: Yves Guiraud.

The ANR project “Complexité implicite, concurrence et extraction” (Complice), headed by Patrick Baillot (CNRS, LIP Lyon), federates researchers from Lyon (LIP), Nancy (LORIA) and Villetaneuse (LCR). The coordinator for the LORIA site is Guillaume Bonfante (Carte).

7.1.2. ARC ACCESS (2010-2011)

Participant: Horatiu Cirstea.

This project is concerned with the security and access control for Web data exchange, in the context of Web applications and Web services. We aim at defining automatic verification methods for checking properties of access control policies (ACP) for XML, like consistency or secrecy. A more detailed presentation is available at http://acxml.gforge.inria.fr/.

7.1.3. FRAE QUARTEFT (2009-2012)

Participants: Jean-Christophe Bach, Horatiu Cirstea, Pierre-Etienne Moreau.

“QUARTEFT: QUAlifiable Real TimE Fiacre Transformations” is a research project founder by the FRAE (Fondation de Recherche pour l’Aéronautique et l’Espace). A first goal is to develop an extension of the Fiacre intermediate language to support real-time constructs. A second goal is to develop new model transformation techniques to translate this extended language, Fiacre-RT, into core Fiacre. A main difficulty consists in proposing transformation techniques that could be verified in a formal way. A more detailed presentation is available at http://quarteft.loria.fr/dokuwiki/.

7.2. International Initiatives

7.2.1. Visits of International Scientists

Cooperation with Prof. Mark van den Brand from Technical University of Eindhoven.
8. Partnerships and Cooperations

8.1. International Contracts

8.1.1. CMCU - Tunis University

This cooperation involves the LSTS (Laboratoire des systèmes et Traitement du Signal) of Tunis University headed by Prof. Noureddine Ellouze and Kais Ouni. This new project involves the investigation of automatic formant tracking, the modelling of peripheral auditory system and more generally speech analysis and parameterization that could be exploited in automatic speech recognition.

8.1.2. The Oesovox Project 2009-2011: 4 international groups associated...

It is possible for laryngectomees to learn a substitution voice; the esophageal voice. This voice is far from being natural. It is characterized by a weak intensity, a background noise that bothers listening, and a low pitch frequency. A device that would convert an esophageal voice to a natural voice would be very useful for laryngectomees because it would be possible for them to communicate more easily. Such natural voice restitution techniques would ideally be implemented in a portable device. In order to answer the INRIA Euromed 3+3 Mediterranean 2006 call, the INRIA Parole group (Joseph Di Martino, LORIA senior researcher, Laurent Pierron, INRIA engineer and Pierre Tricot, Associated Professor at INPL-ENSEM) associated with the following partners:

- **Spain**: Begoña Garcia Zapirain, Deusto University (Bilbao-Spain), Telecommunication Department, PAS-"ESOIMPROVE" research group.
- **Tunisia**: Sofia Ben Jebara, TECHTRA research group, SUP’COM, Tunis.
- **Morocco**: El Hassane Ibn-Elhaj, SIGNAL research group, INPT, Rabat.

This project named LARYNX has been subsidized by the INRIA Euromed program during the years 2006-2008. Our results have been presented during the INRIA 2008 Euromed colloquium (Sophia Antipolis, 9-10 October 2008). During this international meeting, The French INRIA institute decided to renew our project with the new name "OESOVOX". This new project will be subsidized during the years 2009-2011.

In the framework of the European COADVISE-FP7 program, two PhD students have assigned to the Euromed 3+3 Oesovox project. These students are, Miss Fadoua Bahja from INPT-Rabat (Morocco) whose PhD thesis title is "Detection of F0 in real-time for audio: application to pathological voices" and Mr. Ammar Werghi from SUP’COM-Tunis (Tunisia) whose PhD thesis title is "Voice conversion techniques applied to pathological voice repair". The activity reports of these two students for the year 2009 is described in 6.1.6.

8.2. European Initiatives

8.2.1. Collaborations in European Programs, except FP7

Program: Interreg
Project acronym: Allegro
Project title: Adaptive Language LEarning technology for the Greater Region
Duration: 01/01/2009 to 31/12/2012
Coordinator: Saarland University
Other partners: Supélec Metz and DFK Kaiserslautern
Abstract: Allegro is an Interreg project (in cooperation with the Department of COmputational LINGuistics and Phonetics of the Saarland University and Supélec Metz) which started in April 2010. It is intended to develop software for foreign language learning. Our contribution consists of developing tools to help learners to master the prosody of a foreign language, i.e. the prosody of English by French learners, and then the prosody of French by German learners. We started by recording (with the project Intonale) and segmenting a corpus made up of English sentences uttered by French speakers and we analyzed specific problems encountered by French speakers when speaking English.

Program: Eurostar
Project acronym: Emospeech
Project title: Interagir naturellement et émotiellement avec des environnements virtuels
Duration: 01/06/2009 to 01/06/2012
Coordinator: Artefacto
Other partners: Acapela Speech group

Abstract: The Emospeech project is an Eurostar project started on 1st June 2010 in cooperation with SMEs Artefacto (France) and Acapela (Belgium). This project comes within the scope of serious games and virtual worlds. If existing solutions reach a satisfying level of 3D physical immersion, they do not provide satisfactory natural language interactions. The objective is thus to add spoken interactions via automatic speech recognition and speech synthesis. EPI Parole and Talaris take part in this project and the contribution of Parole will be about the interaction between the virtual world, automatic speech recognition and the dialogue management.

8.3. International Initiatives

8.3.1. Visits of International Scientists

8.3.1.1. Internships

Nicolas VINUESA (from Mar 2011 until Aug 2011)

Subject: Dealing with automatic classification uncertainty in training acoustic models for speech recognition
Institution: Universidad Nacional de Rosario (Argentina)
8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR ConcoRDanT ANR-10-BLAN-0208 (2010–2013)

Participants: Pascal Urso [contact], Mehdi Ahmed-Nacer, Claudia Ignat, Gérald Oster.

Partners: REGAL project-team (INRIA Paris - Rocquencourt / LIP6, coordinator), CITI institute (Universidade Nova de Lisboa, Portugal), GDD team (University of Nantes) and SCORE team.

Website: http://concordant.lip6.fr/

Massive computing systems and their applications suffer from a fundamental tension between scalability and data consistency. Avoiding the synchronisation bottleneck requires highly skilled programmers, makes applications complex and brittle, and is error-prone.

The ConcoRDanT project (oct. 2010 – sep. 2013) will investigate a promising new approach that is simple, scales indefinitely, and provably ensures eventual consistency. A Commutative Replicated Data Type (CRDT) is a data type where all concurrent operations commute. If all replicas execute all operations, they converge; no complex concurrency control is required. We have shown in the past that CRDTs can replace existing techniques in a number of tasks where distributed users can update concurrently, such as co-operative editing, wikis, and version control. However CRDTs are not a universal solution and raise their own issues (e.g., growth of meta-data).

The ConcoRDanT project engages in a systematic and principled study of CRDTs, to discover their power and limitations, both theoretical and practical. Its outcome will be a body of knowledge about CRDTs and a library of CRDT designs, and applications using them. We are hopeful that significant distributed applications can be designed using CRDTs, a radical simplification of software, elegantly reconciling scalability and consistency.

8.1.2. ANR STREAMS ANR-10-SEGI-010 (2010–2013)

Participants: Gérald Oster [coordinator], Luc André, Claudia Ignat, Pascal Urso, Hien Thi Thu Truong.

Partners: SCORE team (coordinator), ASAP project-team (University of Rennes 1 / INRIA Rennes - Bretagne Atlantique), CASSIS project-team (INRIA Nancy - Grand Est / Nancy University), REGAL project-team (INRIA Paris - Rocquencourt / LIP6) and GDD team (University of Nantes / LINA).

Website: http://streams.loria.fr/

The STREAMS project (nov. 2010 – oct. 2013) proposes to design peer-to-peer solutions that offer underlying services required by real-time social web applications and that eliminate the disadvantages of centralised architectures. These solutions are meant to replace a central authority-based collaboration with a distributed collaboration that offers support for decentralisation of services.

The STREAMS project aims to advance the state of the art on peer-to-peer networks for social and real-time applications. Scalability is generally considered as an inherent characteristic of peer-to-peer systems. It is traditionally achieved using replication technics. Unfortunately, the current state of the art in peer-to-peer networks does not address replication of continuously updated content due to real-time user changes. Moreover, there exists a tension between sharing data with friends in a social network deployed in an open peer-to-peer network and ensuring privacy. One of the most challenging issues in social applications is how to balance collaboration with access control to shared objects. Interaction is aimed at making shared objects available to all who need them, whereas access control seeks to ensure this availability only to users with proper authorisation. STREAMS project aims at providing theoretical solutions to these challenges as well as practical experimentations.
8.1.3. Wiki 3.0 (2009–2012)

**Participants:** Claudia Ignat [contact], Luc André, Gérald Oster, Gérôme Canals, Bogdan Flueras.

**Partners:** XWiki SAS, SCORE team and Mandriva.

**Website:** [http://wiki30.xwikisas.com/](http://wiki30.xwikisas.com/)

The Wiki 3.0 project (dec. 2009 - juin 2012) is sponsored by the call for projects “Innovative Web” launched by the French Ministry of Economy. The objective of this project is the development of an open-source platform based on XWiki ([http://www.xwiki.org](http://www.xwiki.org)) that addresses the three major evolution axes of collaborative Web: real-time collaboration, social interaction integrated into the production (chat, micro-blogging, etc) and on demand scalability (cloud computing). This platform should be competitive with major editors of collaborative Web developed by Google such as Google Wave, IBM and Microsoft.


**Participants:** Gérôme Canals, Christophe Bouthier.

**Partners:** INRIA, Bull, Orange Labs, Xerox, TELECOM & Management Sud Paris, CELI France, Bearstech, Gnurandal, Object Direct.

**Website:** [http://www.projet-coclico.org/](http://www.projet-coclico.org/)

The Coclico project (oct. 2009 – nov. 2011) aims to boost software forges communities by structuring a free and open source ecosystem for which a critical mass of actors exists in France. This reinforcement of communities is a key aspect to leverage issues related to collaborative and distributed software development that business companies are confronted.

In the framework of this project, SCORE Team has been designing and prototyping a demonstrator of the first semantic-based software forge.

8.1.5. ANR Kolflow (2011–2014)

**Participant:** Gérôme Canals.

**Partners:** GDD team (University of Nantes / LINA), Loria (Orpailleur and Score Teams), Silex Team (LIRIS, University of Lyon), Edelweiss (INRIA Project).


Kolflow aims at building a social semantic space where humans collaborate with smart agents in order to produce knowledge understandable by humans and machines. Humans are able to understand the actions of smart agents. Smart agents are able to understand actions of humans. Kolflow targets the co-evolution of content and knowledge as the result of interactions of humans and machines.


**Participant:** François Charoy [contact].

This project is a collaboration between LORIA, the Technological University of Troyes and EDF R&D and is sponsored by the GIS 3SGS. It aims to start a pluridisciplinary investigation on facilitating crisis management decision-making.

8.2. International Initiatives

8.2.1. INRIA International Partners

François Charoy has been invited by NICTA (National ICT Australia Ltd) in the team of Anna Liu during his stay in Australia to contribute to a project involving BPM and the Cloud. This work is ongoing.

8.2.2. Visits of International Scientists

Victor Grishchenko, post-doc, TU Delft visited our group for two days in February 2011.
Ilaria Liccardi, postdoc in In-situ INRIA team in Paris who finished her Phd thesis at University Southampton visited our group for one day in September 2011.

8.2.3. Participation In International Programs

8.2.3.1. GIS Interop Grande Région

Participants: Nacer Boudjlida [responsible], Khalid Benali, François Charoy, Olivier Perrin.

Following the INTEROP Network of Excellence, the INTEROP V-Lab (International Virtual Laboratory on interoperability, http://www.interop-vlab.eu/) has been officially created in Brussels on March 2007 as an international non-profit making association. In this context, Nancy played also a leading role in the definition of the V-Lab and in the settlement of the so-called INTEROP Grande Region pole, a partner of the INTEROP V-Lab http://www.interop-grande-region.eu/. On behalf of UHP Nancy 1, Nacer Boudjlida is the legal representative of this pole in the V-Lab and he is also the head of its management board. The Grande Region pole encompasses University of Namur, University of Paris I La Sorbonne, University Henri Poincaré Nancy 1 and University of Nancy 2 as the founding partners. It is defined as a Scientific (International) Interest Group (Groupement d’Intérêt Scientifique or GIS). Its attachment to the INTEROP V-Lab has been achieved in May 2009. In 2010, three institutions joined the INTEROP Grande Region pole: INSA Lyon, University Lyon III and INSA Strasbourg.

8.2.3.2. Associate Team INRIA VanaWeb

SCORE is involved in the Associate Team INRIA VanaWeb (with UTFSM Valparaiso, Chili) which is interested in autonomous constraint solving concepts and their application to composition problems for Web services. The coordinators of this project are Carlos Castro (UTFSM Valparaiso, Chili) and Christophe Ringeissen (CASSIS).

8.2.3.3. Co-advisory of PhD Thesis

- PhD Thesis of Yongxin Liao (UHP Nancy 1, LORIA and CRAN): started November 2010
- PhD Thesis of Badrina Gasmi with Béjaia University, Algeria: starts January 2011 (Nacer Boudjlida)
- PhD Thesis of Faïza Bouchaib with Béjaia University, Algeria: starts January 2011 (Nacer Boudjlida)
7. Partnerships and Cooperations

7.1. Regional Initiatives

7.1.1. DiaRaFor

DiaRaFor, Dialogues, rationalités et formalismes. Études croisées logique / psychologie / épistémologie is a MSH-Lorraine project.

Schizophrenia is well-known among mental illnesses for the strength of the thought disorders it involves, and for their widespread and spectacular manifestations: from deviant social behavior to delusion, not to speak about affective and sensitive distortions. In the present paper we expose the first steps of a scientific research about one specific manifestation, namely disorders in conversational speech. This is an interdisciplinary research, both empirical and theoretical from several domains, namely psychology, philosophy, linguistic and informatics.

Maxime Amblard is envolved in this project which ended in 2011. A new application on this topic is send in 2011 to the MSH with Maxime Amblard as leader: SLAM - Schizophrenia and Language: Analysis and Modeling.
7. Partnerships and Cooperations

7.1. McFIID

Program: CPER MISN/TALC
Project acronym: McFIID
Project title: Clustering; Statistical Analysis; Textual data; Time-evolving data; Distributed data
Duration: 2007-01-01 / 2011-12-31
Coordinator: Jean-Charles Lamirel
Other partners: INIST
Abstract: The McFIID project is a CPER project continuing the CPER CLASSIF project. It concerns the development of incremental multi-clustering techniques for managing distributed and evolving flows of textual data. New approach of diachronic analysis based on the use of multiple viewpoints combined with unsupervised bayesian reasoning, as well as new online incremental clustering techniques based on non standard similarity measures, are tested in the curse of these project.

7.2. National Initiatives

7.2.1. CCCP-Prosodie

Program: ANR CONTINT
Project acronym: CCCP Prosodie
Project title:
Duration: 2008-01-12 / 2011-31-06
Coordinator:
Other partners: Institut Télécom, UTC Compiégne, UNSA (Univ. Nice Sophia-Antipolis), Univ. de Versailles St-Quentin
Abstract: The goal of CCCP-Prosodie is to empirically investigate the functioning of online communities such as Wikipedia, and particular to link their activities and their use of language (as recorded in such corpora as email exchanges, for example). The TALARIS team is involved in this project for three reasons: to provide Natural language processing tools, to design an annotation scheme capable of dealing with information from both the social sciences (sociology and economics) and the humanities (psychology and ergonomics), and to provide help with inference technology.
See also: http://recherche.telecom-bretagne.eu/labo_communicant/cccprosodie/

7.2.2. PORT-MEDIA

Program: ANR CONTINT
Project acronym: PORT-MEDIA
Project title:
Duration: 2009-03-01 / 2012-03-01
Coordinator:
Other partners: ELDA, LIG/GETALP, LIA, LIUM, LORIA
Abstract: The PORT-MEDIA project is an ANR project that aims to collect linguistic data for multiple domains and to investigate the use of a high-level semantic representation for annotating dialogue corpora. TALARIS contributed to the high-level semantics specification for annotating the MEDIA corpus and to the development of tools for the manual annotation (e.g., ATOOL and SRL-Web Annotation) as well as to the development of the blackboard architecture for the automatic annotation of the MEDIA corpus. Additionnally, Talaris provided the automatic annotation of the whole corpus and its evaluation.

See also: http://www.port-media.org/doku.php?id=start

7.2.3. SYFRAP

Program: PEPS INS2I-INSHS
Project acronym: SYFRAP
Project title: Analyse syntaxique du français parlé
Duration: 2011-06-01 / 2013-06-01
Coordinator: Claire Gardent, LORIA
Other partners: ATILF Nancy, LLF Paris 7
Abstract: SYFRA is an exploratory interdisciplinary project (PEPS INS2I-INSHS) funded by the CNRS. It gathers researchers from LORIA (Nancy), LLF (Paris 7) and from ATILF (Nancy); and aims to develop resources (annotated corpora) and tools for the syntactic analysis of spoken French.

See also: http://talc.loria.fr/-SYFRAP71-.html

7.3. Collaborations in European Programs, except FP7

7.3.1. Allegro

Program: INTERREG IV A
Project acronym: Allegro
Project title:
Duration: 01.2010 - 12.2012
Coordinator: U. Saarbrücken (Germany)
Other partners: Supelec Metz, INRIA Nancy Grand Est
Abstract: The Allegro project aims to develop NLP techniques that support language teaching for French and German.

7.3.2. Emospeech

Program: Eurostars
Project acronym: Emospeech
Project title:
Duration: 2010-09-01 / 2013-08-31
Coordinator: Artefacto, Rennes
Other partners: Acapella, INRIA Nancy Grand Est
Abstract: The EMOSPEECH project aims to augment serious games with natural language (spoken and written dialog) and emotional abilities (gesture, intonation, facial expressions).

7.3.3. Metaverse
Program: ITEA2
Project acronym: Metaverse
Project title:
Duration: 2009-01-01 / 2011-04-31
Coordinator:
Other partners: Belgian partners: Alcatel-Lucent Bell N.V., Nazooka, IBBT-SMIT; French partners: Alcatel-Lucent France, Orange Labs, CEA List, Artefacto; Greek partners: Forthnew S.A., Ellinoger-maniki Agogi; Dutch partners: Philips Research, Philips I-Lab, DevLab, Technical University Eindhoven, University of Twente, Stg. EPN, VU Economics & BA, VU CAMeRA; Spanish partners: Innovalia, Ceeda, VirtualWare, CBT, Nextel, Corsa, Avantalia, I&IMS, VicomTECH, E-PYME, CIC Tour Game, UPF-MTH; Israeli partners: Metaverse Labs.
Abstract: Metaverse is an exciting project whose goal is to provide a standardized global framework enabling the interoperability between virtual worlds (for example Second Life, World of Warcraft, IMVU, Active Worlds, Google Earth and many others) and the Real world (sensors, actuators, vision and rendering, social and welfare systems, banking, insurance, travel, real estate and many others).

7.4. International Initiatives

7.4.1. INRIA Associate Teams

7.4.1.1. INTOHYLO

Title: Inference Tools for Hybrid Logics and Applications for Natural Language Processing
INRIA principal investigator: Carlos Areces
International Partner:
Institution: Universidad de Buenos Aires (Argentina)
Laboratory: Universidad de Buenos Aires, GLyC
Duration: 2009 - 2011
See also: http://led.loria.fr/dokuwiki/doku.php?id=intohylo_-_inria_equipes_associees

The main aim of the InToHyLo project is to investigate inference methods for hybrid logics, to develop highly optimized inference tools based on these methods, and to use these tools in natural language applications. Talaris and GLyC are currently leaders in automated theorem proving for hybrid logics, and they are the developers of the two provers HyLoRes (based on resolution) and HTab (based on tableaux). With the InToHyLo project we want to investigate how to combine resolution and tableaux algorithms to allow our provers to collaborate and share partial results. We will integrate our tools in a platform suitable for inference in NLP applications (focusing on Dialogue Systems and Textual Entailment). This platform will include not only tools for satisfiability testing, but also for model building, model checking, bisimulation checking, and knowledge maintenance and retrieval. Finally, we want to develop parallel inference algorithms to improve performance, and distributed testing to speed up developing.

7.4.2. Visits of International Scientists

- Kristina Striegnitz, Union College, Schenectady, NY, 1 week in January 2011
- Eva Banik, Computational Linguistics Ltd, 1 week in May 2011
7.4.3. Participation In International Programs

7.4.3.1. GIVE challenge organisation

Talaris co-organized the 2.5 edition of the Generation of Instructions in Virtual Environment challenge. This challenge brought together six universities or laboratories working on natural language generation: University of Aberdeen, University of Bremen, University of Cordoba, University of Postdam, University of Twente, and the LORIA. The challenge was available online for players to test the different systems. Eight systems were participating to the campaign. Over two months, we collected 536 games, which is lower than last year. We assume that the summer break which coincided with the challenge played a role. Our participation in the organisation of the campaign involved rewriting the network layer, a complete change of the visibility algorithm, and advertising the challenge.
8. Partnerships and Cooperations

8.1. National Initiatives

- N. Champagnat is a member of the ANR MANEGE and MODECOL (see Section 7.1.1).
- S. Herrmann, D. Talay and E. Tanré are members of the ANR MANDy (see Section 7.1.1).
- P.-E. Jabin is a member of the ANR MONUMENTALG (see Section 7.1.1).
- A. Lejay is a member of the ANR ECRU and SIMUDMRI (see Section 7.1.1).
- 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, jointly with M. Crouhy
  (Président, Natixis), N. El Karoui (École Polytechnique), R. Gibson (Université de Genève), P.-L.
  Lions (Collège de France), J.-P. Laurent (Université Claude Bernard, Lyon).
- D. Talay is a member of the Scientific Committee of the AMIES Agency aimed to promote
  interactions between Mathematics and Industry.

8.2. European Initiatives

8.2.1. Collaborations in FP7 Programs

- A. Lejay participates to the Multifractionality (action Marie Curie International Research Staff

8.3. International Initiatives

8.3.1. INRIA Associate Teams

8.3.1.1. ANESTOC

Title: Stochastic modelling of renewable energies
INRIA principal investigator: Denis Talay
International Partner:
Institution: Pontificia Universidad Catolica de Chile (Chile)
Laboratory: ANESTOC

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 ("Equipe 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 Valparaiso).

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. Visits of International Scientists

8.3.3.1. Visits of Professors and Researchers

- P. Carmona (Princeton University) has been visiting the team for three days in March.
- M. Cissé (ENSAE, St. Louis, Sénégal) has been visiting the team six weeks in September and October.
- J. Fontbona (Univ. de Chile) has been visiting the team twice three days in May and June.
- J.-F. Jabir (Univ. Toulouse) has been visiting the team three months between April and July, and one week in October.
- L. Lindholm (KTH Royal Institute of Technology, Sweden) has been visiting the team three weeks in August and September.
- A. Rousseau (MERE team, INRIA Sophia – Antipolis, Montpellier) has been visiting the team for two days in January.
- The TOSCA seminar organized by N. Champagnat and J. Charrier in Sophia Antipolis has received the following speakers: Viet Chi Tran (Université des Sciences et Technologies Lille 1), Martin Riedler (Heriot-Watt University Edimbourg, UK), Arturo Kohatsu-Higa (Osaka University, Japan), Dan Crisan (Imperial College, UK), Laurent Miclo (Université Paul Sabatier Toulouse), Sylvain Maire (Université du Sud Toulon – Var), Thomas Önskog (Umea University, Sweden), Denis Villemonais (Ecole Polytechnique, Palaiseau), Gérard Ben Arous (Courant Institute, New York University), Joaquin Fontbona (Universidad de Chile), Jun Yu (Ecole Polytechnique, Palaiseau), Julia Charrier (INRIA Sophia Antipolis – Méditerranée).

8.3.3.2. Internships

Omar Abbes
Subject: Stochastic approaches for wave modelling
Institution: Ecole Polytechnique de Tunisie (Tunisia)

Amine Chourou
Subject: Stochastic volatility models - new numerical methods
Institution: Ecole Polytechnique de Tunisie (Tunisia)

Jun Xu
Subject: Bank networks systemic risk propagation models
Institution: Ecole Polytechnique

Mauricio Tejo
Subject: Mean Field behaviour of ionic channel in neuroscience
Institution: Pontificial Universitat Catolica (Chile)

8.3.4. Participation In International Programs

- P.-E. Jabin is member of the KiNet network, NSF Focus Research Group grant on kinetic description of multi-scale phenomena (as co P.I., main P.I.: E. Tadmor)
- D. Talay is the international coordinator of the MathAmsud program 08MATH05 - Stochastic Analysis and Mathematical Physics Research Network which started in 2009, and also involves M. Bossy, A. Lejay and E. Tanré.
TRIO Project-Team (section vide)
VEGAS Project-Team (section vide)
8. Partnerships and Cooperations

8.1. European Initiatives

8.1.1. Cooperation with NUI Maynooth, Ireland

We are involved in a bilateral research project with the National University of Ireland at Maynooth, funded by the Ulysses program between France and Ireland. The project addresses the question of formally verifying safety critical properties of software control systems, guaranteeing their reliability and safety. In particular, we address the following questions: What is the best methodology for generating a formal system requirements document (written in Event-B) for an already existing tram control system? What is the relationship between Event-B and Programmable Logic? How effectively can we support the formal translation of a system specification written in Event-B to its implementation written in programmable logic? Can we demonstrate that this formal transformation preserves the safety critical properties as specified for an existing tram control system? A combination of reverse engineering and refinement techniques are used to prove the safety critical properties of a tram control system, generating a suite of proof based patterns that may be used in the verification of safety critical properties of similar systems. Case studies involving subsystems of the tram control system will be used to develop Master level courses, ensuring technology transfer between industry and the classroom, and vice versa. Visits of Dominique Méry in February, August and December led to a series of lectures in the master program and in a Summer School organised by NUI Maynooth; Dominique Méry is completing models for ensuring the quality of produced codes. During a reciprocal visit of Rosemary Monahan of NUI Maynooth in October, she gave a tutorial on the verification of C# programs using Spec# and Boogie 2.

8.2. International Initiatives

8.2.1. INRIA International Partners

8.2.1.1. Cooperation with Universidade Federal do Rio Grande de Norte, Brazil

VeriDis has a close working relationship with a team at Universidade Federal do Rio Grande de Norte (UFRN), Brazil, and more particularly with Prof. Anamaria Martins Moreira and Prof. David Déharbe. Two long exchanges took place in 2011. Bruno Woltzenlogel Paleo visited UFRN for one month in March, and David Déharbe visited VeriDis from June 20 to July 20 as an INRIA invited researcher. The project is centered around the development and applications of the veriT solver (section 5.1 ), of which David Déharbe and Pascal Fontaine are the main developers. Diego Caminha was previously a student at UFRN and prepared his PhD thesis with the VeriDis team. Our cooperation is also supported by the INRIA-CNPq project SMT-SAVeS from 2010 throughout 2012.

8.2.1.2. Cooperation with Tiaret University

Mostapha Belardi (Université Ibn Khaldoun de Tiaret), Camel Tanougast (Univ. Paul Verlaine, Metz), Dominique Méry and Stephan Merz have started a joint project entitled CIPRONoC : Conception Incrémentale Prouvée pour pRototypage rapide de NoC Tolérant aux Fautes à base de technologie FPGA. The project is sponsored by the STIC Algérie program.

8.2.2. Visits of International Scientists

8.2.2.1. INRIA Internship program

Hernán Ponce de Leon (from April 2011 until August 2011)

Subject: Formally Verified Automata Construction for Real Linear Equations

Institution: Universidad Nacional de Rosario (Argentina)
8.2.2.2. Invited scientists

David Déharbe from Universidade Federal do Rio Grande de Norte, Brazil, visited VeriDis from June 20 to July 20 as an INRIA invited researcher. The work resulted in several improvements of the veriT solver and contributed to its integration within the toolsets for the B and TLA+ methods.