RESEARCH CENTER
Grenoble - Rhône-Alpes

FIELD

Activity Report 2013

Section Partnerships and Cooperations

Edition: 2014-03-19

ARIC Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR HPAC Project

Participants: Claude-Pierre Jeannerod, Nicolas Louvet, Clément Pernet, Nathalie Revol, Damien Stehlé, Philippe Théveny, Gilles Villard.

"High-performance Algebraic Computing" (HPAC) is a four year ANR project that started in January 2012. The Web page of the project is http://hpac.gforge.inria.fr/. HPAC is headed by Jean-Guillaume Dumas (CASYS team, LJK laboratory, Grenoble); it involves AriC as well as the Inria project-team MOAIS (LIG, Grenoble), the Inria project-team PolSys (LIP6 lab., Paris), the ARITH group (LIRMM laboratory, Montpellier), and the HPC Project company.

The overall ambition of HPAC is to provide international reference high-performance libraries for exact linear algebra and algebraic systems on multi-processor architecture and to influence parallel programming approaches for algebraic computing. The central goal is to extend the efficiency of the LinBox and FGb libraries to new trend parallel architectures such as clusters of multi-processor systems and graphics processing units in order to tackle a broader class of problems in lattice-based cryptography and algebraic cryptanalysis. HPAC conducts researches along three axes:

- A domain specific parallel language (DSL) adapted to high-performance algebraic computations;
- Parallel linear algebra kernels and higher-level mathematical algorithms and library modules;
- Library composition, their integration into state-of-the-art software, and innovative high performance solutions for cryptology challenges.

8.1.2. ANR TaMaDi Project

Participants: Nicolas Brisebarre, Florent de Dinechin, Guillaume Hanrot, Vincent Lefèvre, Jean-Michel Muller, Damien Stehlé, Serge Torres.

The TaMaDi project (Table Maker's Dilemma, 2010-2013) was funded by the ANR and headed by Jean-Michel Muller. It started in October 2010 and ended in October 2013. The other French teams involved in the project are the Marelle team-project of Inria Sophia Antipolis-Méditerranée, and the PEQUAN team of LIP6 lab., Paris.

The aim of the project was to find "hardest to round" (HR) cases for the most common functions and floating-point formats. In floating-point (FP) arithmetic having fully specified "atomic" operations is a key-requirement for portable, predictable, and provable numerical software. Since 1985, the four arithmetic operations and the square root are IEEE specified (it is required that they should be correctly rounded: the system must always return the floating-point number nearest the exact result of the operation). This is not fully the case for the basic mathematical functions (sine, cosine, exponential, etc.). Indeed, the same function, on the same argument value, with the same format, may return significantly different results depending on the environment. As a consequence, numerical programs using these functions suffer from various problems. The lack of specification is due to a problem called the Table Maker's Dilemma (TMD). To compute $f(x)$ in a given format, where x is a FP number, we must first compute an approximation to $f(x)$ with a given precision, which we round to the nearest FP number in the considered format. The problem is the following: finding what the accuracy of the approximation must be to ensure that the obtained result is always equal to the "exact" $f(x)$ rounded to the nearest FP number. In the last years, our team-project and the CACAO team-project of Inria Nancy-Grand Est designed algorithms for finding hardest-to-round cases. These algorithms do not allow to tackle with large formats. The TaMaDi project mainly focuses on three aspects:

- big precisions: we must get new algorithms for dealing with precisions larger than double precision. Such precisions will become more and more important (even if double precision may be thought as more than enough for a final result, it may not be sufficient for the intermediate results of long or critical calculations);
- formal proof: we must provide formal proofs of the critical parts of our methods. Another possibility is to have our programs generating certificates that show the validity of their results. We should then focus on proving the certificates;
- aggressive computing: the methods we have designed for generating HR points in double precision require weeks of computation on hundreds of PCs. Even if we design faster algorithms, we must massively parallelize our methods, and study various ways of doing that.

The various documents on the project can be found at http://tamadiwiki.ens-lyon.fr/tamadiwiki/index.php/Main_Page.

8.1.3. PEPS Quarenum

Participants: Nicolas Louvet, Nathalie Revol.

"Quarenum" is an abbreviation for *Qualité et Reproductibilité Numériques dans le Calcul Scientifique Haute Performance*. This project focuses on the numerical quality of scientific software, more precisely of high-performance numerical codes. Numerical validation is one aspect of the project, the second one regards numerical reproducibility.

8.2. European Initiatives

8.2.1. FP7 Projects

Damien Stehlé was awarded in 2013 a "starting" ERC grant for his project "Euclidean lattices: algorithms and cryptography" (LattAC).

8.3. International Initiatives

8.3.1. Inria Associate Teams

QOLAPS (Quantifier elimination, Optimization, Linear Algebra and Polynomial Systems) is an Associate Team between the Symbolic Computation Group at North Carolina State University (USA), the PolSys team at LIP6, Paris 6, and the AriC team. Participants: Clément Pernet, Nathalie Revol, Gilles Villard.

8.3.2. Inria International Partners

8.3.2.1. Declared Inria International Partners

We contributed to the creation in 2008 of the IEEE 1788 working group on the standardization of interval arithmetic http://grouper.ieee.org/groups/1788/. and N. Revol chairs this group since its creation. More than 140 persons from over 20 countries take part in the discussions, around 2500 public messages were exchanged in 2013. The deadline granted by IEEE is December 2014. In 2013 we managed to elaborate a close-to-final draft of the standard text. This last year will be devoted to the final ballot from the working group and to a sponsor ballot, by experts designated by IEEE.

The annual in-person meeting, chaired by N. Revol, took place at the end of the IFSA-NAFIPS 2013 conference in Edmonton, Canada, the 25th of June.

V. Lefèvre participated in various discussions, either in the mailing-list or in small subgroups (he sent around 390 email messages in 2013).

8.3.2.2. Informal International Partners

Our international academic collaborators are from Courant Institute of Mathematical Sciences (USA), Hamburg University of Technology (Germany), Imperial College (UK), Macquarie University (Australia), Mc Gill University (Canada), Monash University (Australia), Nanyang Technological University (Singapore), North Carolina State University (USA), Technical University of Cluj-Napoca (Romania), University of California, Los Angeles (USA), University of Delaware (USA), University of Southern Denmark (Denmark), University of Western Ontario (Canada), University of Waterloo (Canada), Uppsala University (Sweden).

We also collaborate with Intel (Portland, USA).

8.3.3. Participation In other International Programs

CANTAL (Cryptography, Algorithmic Number Theory and Lattices) is a CNRS Associate Team between the cryptography group of Macquarie University (Australia), the cryptography group of Monash University (Australia) and the AriC team. Participants: Nicolas Brisebarre, Guillaume Hanrot, Fabien Laguillaumie, Adeline Langlois, Damien Stehlé.

Damien Stehlé is a Partner Investigator in the Australian Research Council Discovery Grant on Cryptography and Algorithmic Number Theory, headed by Christophe Doche (Macquarie U.), Igor Shparlinski (U. of New South Wales), and Ron Steinfeld (U. of Monash), and in a Singaporean Ministry of Education grant of Code-based and Lattice-based cryptography, headed by San Ling (Nanyang Technological U.) and Huaxiong Wang (Nanyang Technological U.).

8.4. International Research Visitors

8.4.1. Visits of International Scientists

Xiao-Wen Chang (McGill U., Canada) visited the team from mid-April to mid-June 2013, under the invited professor scheme from ENS de Lyon.

Warwick Tucker (Uppsala U., Sweden) visited the team from mid-February to the end of March 2013, both under the invited professor scheme from ENS de Lyon and thanks to a funding provided by the LIP laboratory.

Peter Kornerup (U. of Southern Denmark) visited the team the last two weeks of September 2013.

8.4.1.1. Internships

Saruchi (IIT Delhi) did a 3-month Master degree internship under the supervision of Damien Stehlé, from April to June 2013.

8.4.2. Visits to International Teams

Nicolas Brunie was invited for 6 months by Intel (Portland, USA) to work on the implementation of elementary functions.

AVALON Team

7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. French National Fund for the Digital Society Project (FSN)

7.1.1.1. FSN XLcloud, 2012-2014

Participants: Jean-Patrick Gelas, Laurent Lefèvre, François Rossigneux.

Focused on high-performance computing, the XLcloud collaborative project sets out to define and demonstrate a cloud platform based on *HPC-as-a-Service*. This is designed for computational intensive workloads, with interactive remote visualisation capabilities, thus allowing different users to work on a common platform. XLcloud project's members design, develop and integrate the software elements of a High Performance Cloud Computing (HPCC) System.

Expected results of the projects include : Functional and technical specification of the XLcloud platform architecture, open source API of the XLcloud platform, implementation of algorithms for 3D and video streaming display, prototype of the XLcloud platform including the support of on-demand virtual clusters and remote visualisation service, use cases for validation, illustrating the performance and suggesting future improvements.

XLcloud aims at overcoming some of the most important challenges of implementing operationally high performance applications in the Cloud. The goal is to allow partners of the project to take leadership position in the market, as cloud service providers, or as technology providers. XLcloud relies on a consortium of various partners (BULL (project leader), TSP, Silkan, EISTI, Ateme, Inria, CEA List, OW2, AMG.Lab).

In this project, the Avalon team investigates the issue of energy awareness and energy efficiency in OpenStack Cloud based platforms.

7.1.2. French National Research Agency Projects (ANR)

7.1.2.1. ANR INFRA MOEBUS, Multi-objective scheduling for large computing platforms, 4 years, ANR-13-INFR-000, 2013-2016

Participants: Christian Perez, Laurent Lefèvre, Frédéric Suter.

The ever growing evolution of computing platforms leads to a highly diversified and dynamic landscape. The most significant classes of parallel and distributed systems are supercomputers, grids, clouds and large hierarchical multi-core machines. They are all characterized by an increasing complexity for managing the jobs and the resources. Such complexity stems from the various hardware characteristics and from the applications characteristics. The MOEBUS project focuses on the efficient execution of parallel applications submitted by various users and sharing resources in large-scale high-performance computing environments.

We propose to investigate new functionalities to add at low cost in actual large scale schedulers and programming standards, for a better use of the resources according to various objectives and criteria. We propose to revisit the principles of existing schedulers after studying the main factors impacted by job submissions. Then, we will propose novel efficient algorithms for optimizing the schedule for unconventional objectives like energy consumption and to design provable approximation multi-objective optimization algorithms for some relevant combinations of objectives. An important characteristic of the project is its right balance between theoretical analysis and practical implementation. The most promising ideas will lead to integration in reference systems such as SLURM and OAR as well as new features in programming standards implementations such as MPI or OpenMP.

7.1.2.2. ANR ARPEGE MapReduce, Scalable data management for Map-Reduce-based data-intensive applications on cloud and hybrid infrastructures, 4 years, ANR-09-JCJC-0056-01, 2010-2013
Participants: Frédéric Desprez, Gilles Fedak, Sylvain Gault, Christian Perez, Anthony Simonet.

MapReduce is a parallel programming paradigm successfully used by large Internet service providers to perform computations on massive amounts of data. After being strongly promoted by Google, it has also been implemented by the open source community through the Hadoop project, maintained by the Apache Foundation and supported by Yahoo! and even by Google itself. This model is currently getting more and more popular as a solution for rapid implementation of distributed data-intensive applications. The key strength of the MapReduce model is its inherently high degree of potential parallelism.

In this project, the AVALON team participates to several work packages which address key issues such as efficient scheduling of several MapReduce applications, integration using components on large infrastructures, security and dependability, and MapReduce for Desktop Grid.

7.1.2.3. ANR COSINUS COOP, Multi Level Cooperative Resource Management, 3.5 years, ANR-09-COSI-001-01, 2009-2013
Participants: Frédéric Desprez, Christian Perez, Noua Toukourou.

The main goals of this project are to set up a cooperation as general as possible between programming models and resource management systems and to develop algorithms for efficient resource selection. In particular, the project targets the SALOME platform and the GRID-TLSE expert-site (http://gridtlse.org/) as an example of programming models, and PadicoTM, DIET and XtreemOS as examples of communication manager, grid middleware and distributed operating systems.

The project is led by Christian Perez.

7.1.2.4. ANR INFRA SONGS, Simulation Of Next Generation Systems, 4 years, ANR-12-INFRA-11, 2012-2015
Participants: Frédéric Desprez, Georgios Markomanolis, Jonathan Rouzaud-Cornabas, Frédéric Suter.

The last decade has brought tremendous changes to the characteristics of large scale distributed computing platforms. Large grids processing terabytes of information a day and the peer-to-peer technology have become common even though understanding how to efficiently such platforms still raises many challenges. As demonstrated by the USS SIMGRID project, simulation has proved to be a very effective approach for studying such platforms. Although even more challenging, we think the issues raised by petaflop/exaflop computers and emerging cloud infrastructures can be addressed using similar simulation methodology.

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

Any sound study of such systems through simulations relies on the following pillars of simulation methodology: Efficient simulation kernel; Sound and validated models; Simulation analysis tools; Campaign simulation management.

7.1.3. Inria Large Scale Initiative

7.1.3.1. HEMERA, 4 years, 2010-2014
Participants: Christian Perez, Laurent Pouilloux, Laurent Lefèvre.

Hemera deals with the scientific animation of the GRID'5000 community. It aims at making progress in the understanding and management of large scale infrastructure by leveraging competences distributed in various French teams. Hemera contains several scientific challenges and working groups. The project involves around 24 teams located in all around France.

C. Pérez is leading the project; L. Lefevre and L. Pouilloux are managing scientific challenges on GRID'5000.

7.1.3.2. C2S@Exa, Computer and Computational Sciences at Exascale, 4 years, 2013-2017
Participants: Frédéric Desprez, Christian Perez, Laurent Lefèvre.

Since January 2013, the team is participating to the C2S@Exa Inria Project Lab (IPL). This national initiative aims at the development of numerical modeling methodologies that fully exploit the processing capabilities of modern massively parallel architectures in the context of a number of selected applications related to important scientific and technological challenges for the quality and the security of life in our society. At the current state of the art in technologies and methodologies, a multidisciplinary approach is required to overcome the challenges raised by the development of highly scalable numerical simulation software that can exploit computing platforms offering several hundreds of thousands of cores. Hence, the main objective of C2S@Exa is the establishment of a continuum of expertise in the computer science and numerical mathematics domains, by gathering researchers from Inria project-teams whose research and development activities are tightly linked to high performance computing issues in these domains. More precisely, this collaborative effort involves computer scientists that are experts of programming models, environments and tools for harnessing massively parallel systems, algorithmists that propose algorithms and contribute to generic libraries and core solvers in order to take benefit from all the parallelism levels with the main goal of optimal scaling on very large numbers of computing entities and, numerical mathematicians that are studying numerical schemes and scalable solvers for systems of partial differential equations in view of the simulation of very large-scale problems.

7.1.4. Inria ADT

7.1.4.1. Inria ADT Aladdin, 4 years, 2008-2014

Participants: Simon Delamare, Frédéric Desprez, Matthieu Imbert, Laurent Lefèvre, Christian Perez.

ADT ALADDIN is an Inria support action of technological development which supports the GRID'5000 instrument. Frédéric Desprez is leading this action (with David Margery from Rennes as the Technical Director). More information at Section 5.8 .

7.2. European Initiatives

7.2.1. FP7 Projects

7.2.1.1. PRACE 2IP

Participants: Zhengxiong Hou, Vincent Lanore, Christian Perez.

Title: PRACE – Second Implementation Phase Project

Type: Integrated Infrastructure Initiative Project (I3)

Instrument: Combination of Collaborative projects and Coordination and support action

Duration: September 2011 - August 2014

Coordinator: Thomas Lippert (Germany)

Others partners: Jülich GmbH, GCS, GENCI, EPSRC, BSC, CSC, ETHZ, NCF, JKU, Vetenskapsradet, CINECA, PSNC, SIGMA, GRNET, UC-LCA, NUI Galway, UYBHM, CaSToRC, NCSA, Technical Univ. of Ostrava, IPB, NIIF

See also: http://prace-ri.eu

Abstract: The purpose of the PRACE RI is to provide a sustainable high-quality infrastructure for Europe that can meet the most demanding needs of European HPC user communities through the provision of user access to the most powerful HPC systems available worldwide at any given time. In tandem with access to Tier-0 systems, the PRACE-2IP project will foster the coordination between national HPC resources (Tier-1 systems) to best meet the needs of the European HPC user community. To ensure that European scientific and engineering communities have access to leading edge supercomputers in the future, the PRACE-2IP project evaluates novel architectures, technologies, systems, and software. Optimizing and scaling of application for Tier-0 and Tier-1 systems is a core service of PRACE.

Inria participates to Work Package 12 which is about novel programming techniques.

7.2.1.2. PaaSage

Participants: Amine Bsila, Christian Perez, Jonathan Rouzaud-Cornabas.

Title: PaaSage: Model-based Cloud Platform Upperware

Type: Seventh Framework Programme

Instrument: Collaborative project

Duration: October 2012 - September 2016 (48 months)

Coordinator: Pierre Guisset (GEIE ERCIM)

Others partners: SINTEF, STFC, HLRS, University of Stuttgart, Inria, CETIC, FORTH, be.wan, EVRY, SysFera, Flexiant, Lufthansa Systems, AG GWDG, Automotive Simulation Center Stuttgart e.V.

See also: http://paasage.eu

Abstract: PaaSage will deliver an open and integrated platform, to support both deployment and design of Cloud applications, together with an accompanying methodology that allows model-based development, configuration, optimization, and deployment of existing and new applications independently of the existing underlying Cloud infrastructures. Specifically it will deliver an IDE (Integrated Development Environment) incorporating modules for design time and execution time optimizations of applications specified in the CLOUD Modeling Language (CLOUD ML), execution-level mappers and interfaces and a metadata database.

7.2.2. Collaborations in European Programs, except FP7

7.2.2.1. SEED4C

Program: Celtic-Plus

Project acronym: SEED4C

Project title: Security Embedded Element and Data privacy for the Cloud.

Duration: 2012-2015

Coordinator: Bertrand Marquet (Alcatel-Lucent lab)

Other partners: Gemalto, ENSI Bourges, Inria, Wallix, VTT Technical Research centre of Finland, Mikkelin Puhelin Oyj, Cygate, Nokia Siemens Networks, Finceptum OY (Novell), Solacia, Innovalia Association, Nextel, Software Quality Systems, Ikusi, Vicomtech, Biscaytik

Abstract: SEED4C is a Celtic-Plus project: an industry-driven European research initiative to define, perform and finance through public and private funding common research projects in the area of telecommunications, new media, future Internet, and applications and services focusing on a new "Smart Connected World" paradigm. Celtic-Plus is a EUREKA ICT cluster and is part of the intergovernmental EUREKA network.

The cloud security challenge not only reflects on the secure running of software on one single machine, but rather on managing and guaranteeing security of a computer group or cluster seen as a single entity. Seed4C focus is to evolve from cloud security with an isolated point or centralized points of enforcement for security to cloud security with cooperative points of enforcement for security.

7.2.2.2. COST IC804

Participants: Ghislain Landry Tsafack Chetsa, Mohammed El Mehdi Diouri, Laurent Lefèvre.

Program: COST

Project acronym: IC804

Project title: : Energy efficiency in Large Scale Distributed Systems

Duration: 2009-2013

Coordinator: J.M. Pierson (IRIT Toulouse)

Other partners: 26 research institute and countries

Abstract: The COST Action IC0804 proposes realistic energy-efficient alternate solutions to share IT distributed resources. As large scale distributed systems gather and share more and more computing nodes and Storage resources, their energy consumption is exponentially increasing. While much effort is nowadays put into hardware specific solutions to lower energy consumptions, the need for a complementary approach is necessary at the distributed system level, i.e. middleware, network and applications. This Action characterizes the energy consumption and energy efficiencies of distributed applications. Then based on the current hardware adaptation possibilities and innovative algorithms it proposes adaptive and alternative approaches taking into account the energy saving dimension of the problem. This Action also characterizes the trade-off between energy savings and functional and non-functional parameters, including the economic dimension. Deliverables includes workshop proceedings, books, good practice leaflets fostering consciousness rise at ICT researchers, scientists, managers and users levels. Finally, benefits addresses scientific and societal needs.

7.2.2.3. COST IC0805

Participants: Ghislain Landry Tsafack Chetsa, Mohammed El Mehdi Diouri, Laurent Lefèvre.

Program: COST

Project acronym: IC0805

Project title: Open Network for High-Performance Computing on Complex Environments (ComplexHPC)

Duration: 2009-2013

Coordinator: Emmanuel Jeannot (Inria Bordeaux - Sud Ouest)

Other partners: 26 research institute and countries

Abstract: The main objective of the Action is to develop an integrated approach for tackling the challenges associated with heterogeneous and hierarchical systems for High Performance Computing.

7.2.2.4. CHIST-ERA STAR

Participants: Laurent Lefèvre, Olivier Glück.

Title: SwiTching And tRansmission project

Type: CHIST-ERA (European Coordinated Research on Long-term Challenges in Information and Communication Sciences & Technologies ERA-Net)

Duration: 2013-2015

Coordinator: Jaafar Elmirghani (University of Leeds - UK)

Others partners: Inria ,University of Cambridge (UK), University of Leeds (UK), AGH University of Science and Technology Department of Telecommunications (Poland)

See also: http://www.chistera.eu/projects/star

Abstract: The Internet power consumption has continued to increase over the last decade as a result of a bandwidth growth of at least 50 to 100 times. Further bandwidth growth between 40% and 300% is predicted in the next 3 years as a result of the growing popularity of bandwidth intensive applications. Energy efficiency is therefore increasingly becoming a key priority for ICT organizations given the obvious ecological and economic drivers. In this project we adopt the GreenTouch energy saving target of a factor of a 100 for Core Switching and Routing and believe this ambitious target is achievable should the research in this proposal prove successful. A key observation in core networks is that most of the power is consumed in the IP layer while optical transmission and optical switching are power efficient in comparison, hence the inspiration for this project. Initial studies by the applicants show that physical topology choices in networks have the potential to significantly reduce the power consumption, however network optimization and the consideration of traffic and the opportunities afforded by large, low power photonic switch architectures will lead to further power savings. Networks are typically over provisioned at present to maintain quality of service. We

will study optimum resource allocation to reduce the overprovisioning factor while maintaining the quality of service. Protection is currently provided in networks through the allocation of redundant paths and resources, and for full protection there is a protection route for every working route. Avalon is contributing to STAR in terms of software network protocols and services optimizations which will be combined with more efficient photonic switches in order to obtain a factor of 100 power saving in core networks can be realised through this project with significant potential for resulting impact on how core photonic networks are designed and implemented.

7.3. International Initiatives

7.3.1. Inria International Partners

7.3.1.1. GreenTouch

Participants: Laurent Lefèvre, Jean-Patrick Gelas.

GreenTouch is a consortium of leading Information and Communications Technology (ICT) industry, academic and non-governmental research experts dedicated to fundamentally transforming communications and data networks, including the Internet, and significantly reducing the carbon footprint of ICT devices, platforms and networks.

In this project, we explore the design of virtual home gateway at large scale [62], [72] and participate in the SEASON project.

7.3.2. Inria International Labs

7.3.2.1. Inria-UIUC-NCSA Joint Laboratory for Petascale Computing

Participants: Eddy Caron, Frédéric Desprez, Mohammed El Mehdi Diouri, Olivier Glück, Vincent Lanore, Laurent Lefèvre, Christian Perez, Jonathan Rouzaud-Cornabas.

The Joint Laboratory for Petascale Computing focuses on software challenges found in complex high-performance computers. The Joint Laboratory is based at the University of Illinois at Urbana-Champaign and includes researchers from the French national computer science institute called Inria, Illinois' Center for Extreme-Scale Computation, and the National Center for Supercomputing Applications. Much of the Joint Laboratory's work will focus on algorithms and software that will run on Blue Waters and other petascale computers.

BAMBOO Project-Team

7. Partnerships and Cooperations

7.1. Regional Initiatives

- Title: Inférence de graphes de régulations génétiques à partir de données d'expression
- Coordinator: H. Charles
- BAMBOO participant(s): H. Charles, L. Brinza, M.-F. Sagot
- Type: Pré-Projet de Recherche de l'IXXI (2012-2013)
- Web page: Not available

7.2. National Initiatives

7.2.1. ABS4NGS

- Title: Solutions Algorithmiques, Bioinformatiques et Logicielles pour le Séquençage Haut Débit
- Coordinator: E. Barillot
- BAMBOO participant(s): V. Lacroix
- Type: ANR (2012-2015)
- Web page: Not available

7.2.2. Colib'read

- Title: Methods for efficient detection and visualization of biological information from non assembled NGS data
- Coordinator: P. Peterlomgo
- BAMBOO participant(s): V. Lacroix, A. Julien-Lafferière, C. Marchet, G. Sacomoto, M.-F. Sagot, B. Sinaimeri
- Type: ANR (2013-2016)
- Web page: http://colibread.inria.fr/

7.2.3. Exomic

- Title: Functional annotation of the transcriptome at the exon level
- Coordinator: D. Auboeuf (Inserm, Lyon)
- BAMBOO participant(s): V. Lacroix, M.-F. Sagot
- Type: INSERM Systems Biology Call (2012-2015)
- Web page: Not available

7.2.4. ImmunSymbArt

- Title: Immunity and Symbiosis in Arthropods
- Coordinator: D. Bouchon
- BAMBOO participant(s): F. Vavre
- Type: ANR Blanc (2010-2014)
- Web page: Not available

7.2.5. Metagenomics of Bemisia tabaci

- Title: Metagenomics of *Bemisia tabaci* symbiotic communities

- Coordinator: L. Mouton (LBBE, UCBL)
- BAMBOO participant(s): F. Vavre, M.-F. Sagot
- Type: Genoscope Project
- Web page: Not available

7.2.6. SpeciAphid

- Title: Evolutionary genetics and mechanisms of plant adaptation in aphids
- Coordinator: Jean-Christophe Simon (IGEPP, INRA, Rennes)
- BAMBOO participant(s): H. Charles, Y. Rahbé
- Type: ANR (2012-2014)
- Web page: Not available

7.3. European Initiatives

7.3.1. FP7 Projects

7.3.1.1. BacHBerry

- Title: BACterial Hosts for production of Bioactive phenolics from bERRY fruits
- Coordinator: Jochen Förster (Novo Nordisk Foundation Center for Biosustainability (CFB), Copenhagen, Danemark)
- BAMBOO participant(s): V. Lacroix, Alice J. Lafferière, M.-F. Sagot, A. Viari, M. Wannagat
- Type: KBBE (2013-2016)
- Web page: Not yet available.

7.3.1.2. DroParCon

- Title: Drosophila parasitoid consortium
- Coordinator: Jochen Förster (Novo Nordisk Foundation Center for Biosustainability (CFB), Copenhagen, Danemark)
- BAMBOO participant(s): F. Vavre
- Type: PHC (2012-2014)
- Web page: http://www.droparcon.org.

7.3.1.3. Microme

- Title: The Microme Project: A Knowledge-Based Bioinformatics Framework for Microbial Pathway Genomics
- Coordinator: P. Kersey (EBI)
- European partners: Amabiotics (France), CEA (France), CERTH (Greece), CSIC (Spain), CNIO (Spain), DSMZ (Germany), EBI (UK), HZI (Germany), Isthmus (France), Molecular Nertwork (Germany), SIB (Switzerland), Tel Aviv Univ. (Israel), Université Libre de Bruxelles (Belgium), WTSI (UK), Wageningen Univ. (The Netherlands)
- BAMBOO participant(s): Anne Morgat
- Type: Collaborative Project. Grant Agreement Number 222886-2
- Web page: http://www.microme.eu

7.3.1.4. SISYPHE

- Title: Species Identity and SYmbiosis Formally and Experimentally explored
- Coordinator: M.-F. Sagot
- BAMBOO participant(s): Whole BAMBOO team

- Type: ERC Advanced Grant (2010-2015)
- Web page: http://pbil.univ-lyon1.fr/members/sagot/htdocs/team/projects/sisyphe/sisyphe.html

7.3.1.5. SWIPE

- Title: Predicting whitefly population outbreaks in changing environments
- Coordinator: E. Zchori-Fein
- BAMBOO participant(s): F. Vavre
- Type: European ERA-NET program ARIMNET (2012-2015)
- Web page: http://www.arimnet.net/index.php?p=fp_swipe

7.3.1.6. Symbiox

- Title: Role of the oxidative environment in the stability of symbiotic associations
- Coordinator: F. Vavre
- BAMBOO participant(s): F. Vavre
- Type: Marie Curie IOF for Natacha Kremer (2011-2014)
- Web page: http://www.2020-horizon.com/SYMBIOX-Role-of-the-oxidative-environment-in-the-stability-of-symbiotic-associations%28SYMBIOX%29-s4673.html

7.4. International Initiatives

7.4.1. Inria International Partners

Bamboo has an Inria International Partnership, called AMICI (see http://team.inria.fr/bamboo/amici/), with three partners in Italy (Universities of Rome “La Sapienza", Florence, and Pisa) and one in the Netherlands (Free University of Amsterdam / CWI). There are two unifying interests to all the projects of AMICI: algorithmics, and biology. At the present time, mostly because the current work of BAMBOO is centered on the ERC project SISYPHE (“Species Identity and SYmbiosis Formally and Experimentally explored"), the biology is very oriented to the general study, at the molecular level, of the symbiotic relation (genomics and other associated “omics", evolution, biochemical and interaction networks). This should evolve in future to extend the symbiotic study to either the ecological or a more health-oriented level, or to address new biology-related problems using mathematical modelling and techniques, and algorithmics.

7.4.2. Inria International Labs

BAMBOO participates in a project within the Inria-Chile CIRIC (Communication and Information Research and Innovation Center) titled “Omics Integrative Sciences”. The main objectives of the project are the development and implementation of mathematical and computational methods and the associated computational platforms for the exploration and integration of large sets of heterogeneous omics data and their application to the production of biomarkers and bioidentification systems for important Chilean productive sectors. The project started in 2011 and is coordinated in Chile by Alejandro Maass, Mathomics, University of Chile, Santiago.

7.4.3. Participation In other International Programs

BAMBOO is member of a CNRS-UCBL-Inria Laboratoire International Associé (LIA) with the Laboratório Nacional de Computação Científica (LNCC), Petrópolis, Brazil. The LIA has for acronym LIRIO (“Laboratoire International de Recherche en bIOinformatique") and is coordinated by Ana Tereza Vasconcelos from the LNCC and Marie-France Sagot from BAMBOO. The LIA was created in January 2012 for 4 years, renewable once. A preliminary web page for the LIA LIRIO is available at this address: http://team.inria.fr/bamboo/en/cnrs-lia-laboratoire-international-associe-lirio/.

BAMBOO has two other projects with Brazil. One is the Inria-Faperj project RAMPA (“Bioinformatics for the Reconstruction and Analysis of the Metabolism of PArasites") whose coordinators are M.-F. Sagot (France) and A. T. Vasconcelos (LNCC, Brazil). This project will finish at the end of 2013. Its main objective was to computationally and experimentally study the dialog between the trypanosomatids *Angomonas deanei* and *Strigomonas culicis* and their respective endosymbiont mainly at the metabolic level. The second project is the CAPES-COFECUB project titled: “Multidisciplinary Approach to the Study of the Biodiversity, Interactions and Metabolism of the Microbial Ecosystem of Swines". The coordinators are M.-F. Sagot (France) and A. T. Vasconcelos (LNCC, Brazil) with also the participation of Arnaldo Zaha (Federal University of Rio Grande do Sul. The project started in 2013 for 2 years, renewable once. The main objective of this project is to experimentally and mathematically explore the biodiversity of the bacterial organisms living in the respiratory tract of swines, many of which are pathogenic.

7.5. International Research Visitors

7.5.1. Visits of International Scientists

During 2013, the team had 4 international scientists visiting our group for at least one week. These included:

- Carlos Norberto Fischer, São Paulo State University, Rio Claro, Brazil, visit 3 months;
- Maria Cristina Motta, Federal University of Rio de Janeiro, Rio de Janeiro, Brazil, visit 15 days;
- Susana Vinga, INESC-ID, IST Lisbon, Portugal, visit of 1 week;
- Arnaldo Zaha, Federal University of Rio Grande do Sul, Porto Alegre, Brazil, visit 15 days.

The above does not count the frequent visits of our external collaborators, members of the Inria International Partnership AMICI or of the LIA LIRIO.

7.5.2. Visits to International Teams

The visits to international teams were done mostly in the context of the Inria International Partnership AMICI, the LIA LIRIO, or the CIRIC project with Chile. Besides those, there were also visits of at least one week to Susana Vinga, INESC-ID, IST Lisbon, Portugal.

BEAGLE Project-Team

7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. ANR

- Stochagene (2011-2014). Objective: identify the molecular basis of the stochasticity of gene expression in eukaryotic cells. Partners: CGPhyMC (Olivier Gandrillon, Lyon, Leader), Genethon (Andras Paldi, Evry). Participants: G Beslon, H Berry, Gael Kaneko
- Ancestrome: phylogenetic reconstruction of ancestral "-omes", a five-year project (2012-2016), call "Bioinformatics" of the "Investissements d'avenir". Supervisor: V. Daubin (CNRS, LBBE, Lyon) ; with Institut Pasteur, ENS Paris, ISEM (Univ Montpellier 2) Participant: Eric Tannier.
- Foster: Spatiotemporal data mining: application to the understanding and monitoring of soil erosion (2011-2014). Supervisor: Nazha Selmaoui and Frédéric Flouvat (PPME Univ. Nouvelle Caledonie); with LISTIC Univ. Savoie, ICube Univ. Strasbourg, BlueCham Company. Participant: Christophe Rigotti.

7.1.2. CNRS

- E Tannier participates to a PEPS (Projet exploratoire premier soutien) called C1P: algorithmics of 1D structures, 2012-2013. Supervisor: M. Raffinot (CNRS, LIAFA, Paris), involved teams from Marne-la-Vallée, Nantes, Marseille, Bordeaux, Lyon.

7.2. European Initiatives

7.2.1. FP7 Projects

7.2.1.1. EvoEvo

Type: COOPERATION
Defi:
Instrument: Specific Targeted Research Project
Objectif: NC
Duration: November 2013 - October 2016
Coordinator: Guillaume Beslon (Inria)
Partners: Université Joseph Fourier (France, D. Schneider), Utrecht University (Nederland, P. Hogeweg), University of York (UK, S. Stepney) and CSIC (Spain, S. Elena)
Inria contact: Guillaume Beslon
Abstract: Evolution is the major source of complexity on Earth, at the origin of all the species we can observe, interact with or breed. On a smaller scale, evolution is at the heart of the adaptation process for many species, in particular micro-organisms (e.g. bacteria, viruses). Microbial evolution results in the emergence of the species itself, and it also contributes to the organisms' adaptation to perturbations or environmental changes. These organisms are not only organised by evolution, they are also organised to evolve. The EvoEvo project will develop new evolutionary approaches in information science and will produce algorithms based on the latest understanding of molecular and evolutionary biology. Our ultimate goal is to address open-ended problems, where the specifications are either unknown or too complicated to express, and to produce software able to operate in unpredictable, varying conditions. We will start from experimental observations of micro-organism evolution, and abstract this to reproduce EvoEvo, in biological models, in computational models, and in application software. Our aim is to observe EvoEvo in action, to model EvoEvo, to understand EvoEvo and, ultimately, to implement and exploit EvoEvo in software and computational systems. The EvoEvo project will have impact in ICT, through the development of new technologies. It will also have impact in biology and public health, by providing a better understanding of micro-organism adaptation (such as the emergence of new pathogens or the development of antibiotic resistances).

7.2.1.2. Neuron-Astro-Nets

Type: PEOPLE

Defi:

Instrument: ERCIM and Marie Curie International Outgoing Fellowships for Career Development

Objectif: NC

Duration: Juin 2013-Mai 2017 (ERCIM Juin 2013-mai 2014 puis IOF Marie Curie Juin 2014-mai 2017)

Coordinator: Hugues Berry

Partner: N. Brunel, Statistics Dept, University of Chicago (USA)

Inria contact: Maurizio DE PITTA

Abstract: Healthy functionality in the brain relies on intricate neuron-glia networks. Recent data suggest that glial, including astrocytes, play a crucial role in the processing and storing on by the brain. In particular, synapses might not be bipartite, but rather tripartite structures, comprised of the pre- and the postsynaptic terminals and the surrounding astrocyte. Moreover, astrocytes, like neurons, form intricate interconnected networks that afford long-range communication via the propagation of calcium waves. Therefore, neurons and astrocytes form intertwined neuron-glial networks supporting active partnership between the two cell populations. Hence, understanding the nature of neuron-glia interactions is essential to understand how the brain functions, and will serve as a stepping stone for deciphering brain disorders. Our long-term goal is to reveal the mechanisms that control and regulates the activity of combined neuron-glia networks. The specific objectives of this application, which are fundamental in the pursuit of that goal, are (1) to determine the properties of astrocytic modulation of synaptic transmission; and (2) to characterize how such modulation shapes neuronal activity in neuron-glia networks of the brain. To pursue these aims we will employ a comprehensive theoretical investigation to develop mathematical and biophysical models in support to experiments, at the many levels and scales of action of neuron-astrocyte signaling. The significance of understanding glia-neuron interactions is several-fold as it pertains to a very wide range of applications, from basic understanding of neuronal activity, to developing therapeutic strategies toward the treatment of neurological disorders. Here, we will focus on how modulations of synaptic transmission by astrocytes could favor the emergence of synchronized neuronal, leveraging the predictions of our theoretical approach in the perspective of brain disorders, and epilepsy in particular.

7.2.2. Collaborations with Major European Organizations

European PRACE 7th regular call.

Allocation of 34 million hours computing on the Curie super-computer for the project "Thousands of trees for 4 billon years of life evolution on Earth" led by Bastien Boussau (LBBE, UMR CNRS 5558, Lyon) and involving Eric Tannier from the Beagle team.

7.3. International Initiatives

7.3.1. Inria International Partners

7.3.1.1. Informal International Partners

- Ecole Polytechnique Fédérale de Lausanne (EPFL). We collaborate with Marion Leleu and Jacques Rougemont of the Bioinformatics and Biostatistics Core Facility of the EPFL. The general objective of this exploratory work is to investigate the relationships between epigenetic profiles and 3D structure of the genome. More precisely, we currently compare the clustering of DNA intervals based on descriptors computed from epigenetic profiles in two cases: with and without making use of information about the 3D structure of the genome. We have co-supervised a Master student (Duc Thanh Phan) in 2012-2013 on this topic.

7.3.2. Participation In other International Programs

7.3.2.1. Research Networks Program of the High Council for Scientific and Technological Cooperation between France-Israel: Astrocytic regulation of neuronal network activity (2012-2013)

The specific objectives of this joint project with groups from Tel Aviv University are to determine the properties of astrocytic calcium wave propagation and to reveal how astrocyte signals dynamically affect synaptic information transfer, thus regulating neuronal network activity. To this aim, we combine theoretical and experimental investigations of small neuron-glial networks.

Beagle (H. Berry) is coordinator of the project for the French side and supervises the modeling aspects. The coordinator for the Israeli group is Pr. Y. Hanein (Tel Aviv University Institute for Nanoscience and Nanotechnology, http://nano.tau.ac.il/hanein), who is responsible for the experimental parts. The other partner is Pr. E. Ben-Jacob (School of Physics and Astronomy, Tel Aviv University, http://tamar.tau.ac.il/~eshel/EBJG/). The project also gathers 4 PhD or Master students in Tel Aviv and Lyon.

Total amount funded : 160 k€.

7.3.2.2. ANR/NSF Bilateral programme for Collaborative Research in Computational Neuroscience (CRCNS): Modelling the vocal apparatus of birds (2013-2016)

This joint project with F. Theunissen (UC Berkeley, USA) aims at modelling the vocal apparatus of birds (Zebra Finches) to recreate vocal range of this bird using a sparser representation than the spectrum. This new representation can be used as a new parameter space to test acoustic neural coding.

This collaboration has been granted by ANR/NSF Bilateral program for Collaborative Research in Computational Neuroscience (CRCNS)(CRCNS 2012), which promotes collaborations between French and American teams. Beagle (H. Soula) is coordinator of the project for the French side and supervises the modeling aspects.

7.3.2.3. France Berkeley Fund: User-friendly phylogenomics: Bayesian simultaneous reconstruction of gene trees and species trees

We obtained a grant for a common project with J. Huelsenbeck's lab (UC Berkeley, USA) on the development of probabilistic models of genome and sequence evolution to simultaneously reconstruct gene trees and species trees, and thus study how species and their genomes have changed through time.

7.4. International Research Visitors

7.4.1. Visits of International Scientists

7.4.1.1. Visiting Professors

Participant: Sergei Fedotov.

Dates: 3 weeks in March 2013 and 3 weeks in September 2013

Institution: Mathematical School, University of Manchester (UK)

Funded by the "Lyon Mathematics Labex MiLyon, and by Inria's visiting professor's program.

Participant: Nadia El-Mabrouk.

Dates: April 2013

Institution: Département d'Informatique et de Recherche Opérationnelle in Montréal (Canada)

Funded by Inria's visiting professor's program.

7.4.1.2. Internships

Osama Khalil

Subject: Computational systems biology of signal transduction in living cells: synaptic plasticity of striatum neurons

Date: from Feb 2013 until May 2013

Institution: American University in Cairo (Egypt)

7.4.2. Visits to International Teams

During the whole 2012-2013 academic year, Hédi Soula was an Invited Professor at UC Berkeley (USA) in F. Theunissen's lab.

BIPOP Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR

- CHASLIM Chattering Free Sliding Mode Control: ANR BLAN 2011 BS03 007 01 (octobre 2011–octobre 2015), coordinator B. Brogliato.

8.2. International Research Visitors

- Valentina Sessa from the University of Benevento, Italy, DIS, a six–month internship as a PhD student under the supervision of V. Acary and B. Brogliato,.

8.2.1. Visits of International Scientists

Visit of Prof. Yury Starovetsky from Technion, Israel, four weeks in 2013.

COMPSYS Project-Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

Compsys has increased its relationship with the CITI laboratory (Insa-Lyon) and, in particular, the team of Tanguy Risset (Socrate Inria project http://www.citi-lab.fr/team/socrate/). Compsys and Socrate made several common working groups in 2012 and 2013, and are mutually invited to seminars organized by the other team. Streaming languages are a common topic of interest. In this context, Socrate, with the help of Compsys, will organize a thematic day (April 14, 2014) on the "compilation and execution of streaming programs", in Domaine des Hautannes, St Germain au Mont d'Or. Lionel Morel and Laure Gonnord have also common topics of interest.

Compsys has stronger connections with the Grame music/computer laboratory (http://www.grame.fr) in Lyon and, in particular, Yann Orlarey, also due to common interests on streaming languages, in particular the language Faust developed by Grame. Yann Orlarey was one of the invited speaker of the keynotes on parallel languages (see the description the thematic quarter on compilation in Section 9.1.2). Alexandre Isoard's Master 1 training period was on Faust, co-advised by Alain Darte and Yann Orlarey. For 2014, Laure Gonnord and Yann Orlarey proposed a Master research topic on the generation of invariants for the Faust language.

Compsys is also involved in the Labex MILYON (Mathématiques et Informatique Fondamentale de Lyon), which regroups Institut Camille Jordan, and the mathematics and computer science labs of ENS-Lyon. The aim of MILYON is "to strengthen our international relationships, in particular by organizing thematic quarters which will allow world experts of a subject to gather in Lyon and work together in a stimulating environment." In this context, Compsys organized a thematic quarter on compilation from April 2013 to July 2013, see details in Section 9.1.2 . Compsys also follows or participates to the activities of LyonCalcul (http://lyoncalcul.univ-lyon1.fr/), a network to federate activities on computing in Lyon.

8.2. National Initiatives

8.2.1. CNRS PEPS

Christophe Alias and Laure Gonnord initiated with the DART/Emeraude team at LIFL Laboratory (University of Lille) a CNRS PEPS ("Projets Exploratoire Premier Soutien") called "HLS and real time" (8 Keuros/year, during two years in 2011-2013). The goal of this project is to investigate how to introduce real-time constraints in the high-level synthesis workflow.

8.2.2. Inria AEN MULTICORE

Fabrice Rastello is part of an Inria Large Scale Initiative (AEN: action d'envergure nationale) called MULTICORE, which regroups researchers from seven teams: Camus, Regal, Alf, Runtime, Algorille, Dali, and thus Compsys on "Large scale multicore virtualization for performance scaling and portability". One of the goals of this project is to enable loop transformations by combining dynamic and static analysis/compilation techniques.

8.2.3. French Compiler Community

The french compiler community is now well identified and is visible through its web-page http://compilation.gforge.inria.fr/. The "journées françaises de la compilation" were initiated in 2010 and are still animated by Fabrice Rastello and Laure Gonnord as a biannual event. Their local organization is handled alternately by the different research teams: Lyon (by Compsys) in Summer 2010, Aussois in Winter 2010, Dinard in Spring 2011, St Hippolyte in Autumn 2011, Rennes in Summer 2012, Annecy (by Compsys again) in Spring 2013, Dammarie-les-lys in December 2013.

8.3. European Initiatives

8.3.1. Collaborations with Major European Organizations

Alain Darte, Paul Feautrier, and Fabrice Rastello are members or affiliate members of the European Network of Excellence on High Performance and Embedded Architecture and Compilation (HiPEAC). Fabrice Rastelloattended the computing system week in may 2013 (Paris), and the computing system week in October 2013 (Tallinn). He participated to the organization of two thematic sessions in Paris: Thread Level Speculation (as chair) and Intermediate Representation (as co-organizer). The thematic quarter on compilation (see Section 9.1.2) was presented in HIPEAC info 35 (July 2013), the HIPEAC quarterly newsletter (http://www.hipeac.net/content/hipeacinfo-35-july-2013) and the keynotes on HPC languages (third event) recognized as an HIPEAC event.

8.4. International Initiatives

8.4.1. Inria International Partners

8.4.1.1. Declared Inria International Partners

- Compsys and, in particular Fabrice Rastello, has a regular collaboration with P. Sadayappan from Ohio State University (USA). This year, this collaboration led to several results, see Sections 6.2 , 6.4 , 6.5 , and 6.6 .
- Fabrice Rastello and Laure Gonnord have a regular collaboration with Fernando Magno Quintao Pereira from the University of Mineas Gerais (Brazil). This year, this collaboration led to several results, see Sections 6.1 and 6.3 . Compsys also hosted Raphael Ernani Rodrigues, from the group of F. Pereira, who made part of his master in Lyon supervised by Laure Gonnord and Christophe Alias.
- Compsys and, in particular Christophe Alias, has a regular collaboration with S. Rajopadhye from Colorado State University (CSU). Guillaume Iooss is preparing a PhD through a PhD convention between Ecole normale supérieure de Lyon and Colorado State University, co-advised by Christophe Alias and Sanjay Rajopadhye. In 2013, Guillaume Iooss spent part of the summer at CSU, joined by Christophe Alias for a week. Paul Feautrier and Fabrice Rastello also made regular visits at Colorado State University in the previous years. This year, this collaboration led to several results, see Sections 6.10 , 6.11 , and 6.13 .

8.5. International Research Visitors

8.5.1. Visits of International Scientists

8.5.1.1. Invited Researchers

Fernando Magno Quintão Pereira is visiting Fabrice Rastello for 1.5 month in early 2014. The goal of his visit is to work on dynamic analysis and cloning for loop transformations (so called hybrid compilation).

8.5.1.2. Internships

Raphael Ernani Rodrigues made part of his master Internship in Lyon in June/July 2013 under the supervision of Laure Gonnord and Christophe Alias. He worked on synthesizing preconditions that (may) ensure termination. We are currently pursuing the collaboration with him and his supervisor in Brazil, Fernando Magno Quintao Pereira (Univ. Mineas Gerais).

8.5.2. Visits to International Teams

Fabrice Rastello visited the group of P. Sadayappan (OSU) during two months, in June-July 2013, in addition to shorter stays. He worked on dynamic analysis and generalized tiling.

Alexandre Isoard did an internship at Xilinx, during 2.5 months, from June to September 2013, under the supervision of Stephen Neuendorffer, working on exploring polyhedral tools for Xilinx HLS tool.

CONVECS Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. FSN (Fonds national pour la Société Numérique)

8.1.1.1. OpenCloudware

Participants: Rim Abid, Hugues Evrard, Frédéric Lang, Gwen Salaün [correspondent], Lina Ye.

OpenCloudware [10] is a project funded by the FSN. The project is led by France Telecom / Orange Labs (Meylan, France) and involves 18 partners (among which Bull, OW2, Thalès, Inria, etc.). OpenCloudware aims at providing an open software platform enabling the development, deployment and administration of cloud applications. The objective is to provide a set of integrated software components for: (i) modelling distributed applications to be executed on cloud computing infrastructures; (ii) developing and constructing multi-tier virtualized applications; and (iii) deploying and administrating these applications (PaaS platform) possibly on multi-IaaS infrastructures.

OpenCloudware started in January 2012 for three years and nine months. The main contributions of CONVECS to OpenCloudware (see § 6.5.3) are the formal specification of the models, architectures, and protocols (self-deployment, dynamic reconfiguration, self-repair, etc.) underlying the OpenCloudware platform, the automated generation of code from these specifications for rapid prototyping purposes, and the formal verification of the aforementioned protocols.

8.1.1.2. Connexion

Participants: Hubert Garavel [correspondent], Frédéric Lang, Raquel Oliveira.

Connexion [11] (*COntrôle commande Nucléaire Numérique pour l'EXport et la rénovatION*) is a project funded by the FSN, within the second call for projects "*Investissements d'Avenir — Briques génériques du logiciel embarqué*". The project, led by EDF and supported by the *Pôles de compétitivité* Minalogic, Systematic, and *Pôle Nucléaire Bourgogne*, involves many industrial and academic partners, namely All4Tech, Alstom Power, ArevA, Atos Worldgrid, CEA-LIST, CNRS/CRAN, Corys Tess, ENS Cachan, Esterel Technologies, Inria, LIG, Predict, and Rolls-Royce. Connexion aims at proposing and validating an innovative architecture dedicated to the design and implementation of control systems for new nuclear power plants in France and abroad.

Connexion started in April 2012 for four years. In this project, CONVECS will assist another LIG team, IIHM, in specifying human-machines interfaces formally using the LNT language and in verifying them using CADP (see § 6.5.6).

8.1.2. Competitivity Clusters

8.1.2.1. Bluesky for I-Automation

Participants: Hubert Garavel, Fatma Jebali, Jingyan Jourdan-Lu, Frédéric Lang, Eric Léo, Radu Mateescu [correspondent].

Bluesky for I-Automation is a project funded by the FUI (*Fonds Unique Interministériel*) within the *Pôle de Compétitivité* Minalogic. The project, led by Crouzet Automatismes (Valence), involves the SMEs (*Small and Medium Enterprises*) Mootwin and VerticalM2M, the LCIS laboratory of Grenoble INP, and CONVECS. Bluesky aims at bringing closer the design of automation applications and the Internet of things by providing an integrated solution consisting of hardware, software, and services enabling a distributed, Internet-based design and development of automation systems. The automation systems targeted by the project are networks of programmable logic controllers, which belong to the class of GALS (*Globally Asynchronous, Locally Synchronous*) systems.

[10] http://www.opencloudware.org
[11] http://www.cluster-connexion.fr

Bluesky started in September 2012 for three years. The main contributions of CONVECS to Bluesky (see § 6.5.4) are the definition of GRL, the formal pivot language for describing the asynchronous behaviour of logic controller networks, and the automated verification of the behaviour using compositional model checking and equivalence checking techniques.

8.1.3. Other National Collaborations

Additionally, we collaborated in 2013 with the following Inria project-teams:

- OASIS (Inria Sophia-Antipolis – Méditerranée): Eric Madelaine and Ludovic Henrio,
- TRISKELL (Inria Rennes – Bretagne Atlantique): Kevin Corre and Axel Legay,
- MEXICO (Inria Saclay – Île-de-France): Alban Linard.

Beyond Inria, we had sustained scientific relations with the following researchers:

- Gaëlle Calvary and Sophie Dupuy-Chessa (LIG, Grenoble),
- Fabrice Kordon and Lom Messan Hillah (LIP6, Paris),
- Alexandre Hamez and Jérôme Hugues (ISAE, Toulouse),
- Noël De Palma and Fabienne Boyer (LIG, Grenoble),
- Xavier Etchevers (Orange Labs, Meylan),
- Matthias Güdemann (Systerel, Aix-en-Provence),
- Meriem Ouederni (IRIT, Toulouse),
- Pascal Poizat (LIP6, Paris).

H. Garavel, F. Lang, and R. Oliveira attended two training days on the Scade and Scade Display software (given by Luc Coyette, Esterel Technologies) on March 6 and 24, 2013.

8.2. European Initiatives

8.2.1. FP7 Projects

8.2.1.1. SENSATION

Participants: Hubert Garavel [correspondent], Radu Mateescu, Wendelin Serwe.

SENSATION [12] (*Self ENergy-Supporting Autonomous computaTION*) is a European project no. 318490 funded by the FP7-ICT-11-8 programme. It gathers 9 participants: Inria (TRISKELL and CONVECS project-teams), Aalborg University (Denmark), RWTH Aachen and Saarland University (Germany), University of Twente (The Netherlands), GomSpace (Denmark), and Recore Systems (The Netherlands). The main goal of SENSATION is to increase the scale of systems that are self-supporting by balancing energy harvesting and consumption up to the level of complete products. In order to build such Energy Centric Systems, embedded system designers face the quest for optimal performance within acceptable reliability and tight energy bounds. Programming systems that reconfigure themselves in view of changing tasks, resources, errors, and available energy is a demanding challenge.

SENSATION started on October 1st, 2012 for three years. CONVECS contributes to the project regarding the extension of formal languages with quantitative aspects, studying common semantic models for quantitative analysis, and applying formal modeling and analysis to the case studies provided by the industrial partners.

The case study on rescaling video for handheld devices, proposed initially by STMicroelectronics, was abandoned in 2013 after the departure of this partner from the project. Therefore, we oriented our efforts on the EnergyBus case study (see § 6.5.5), in collaboration with Saarland University.

[12] http://sensation-project.eu/

8.2.2. Collaborations with Major European Organizations

The CONVECS project-team is member of the FMICS (*Formal Methods for Industrial Critical Systems*) working group of ERCIM [13]. R. Mateescu is currently the chairman of the FMICS working group and H. Garavel is member of the FMICS board, in charge of dissemination actions.

H. Garavel was appointed to a new Working Group within Informatics Europe: "*Parallel Computing (Supercomputing) Education in Europe: State-of-Art*". This is a relatively small working group (about 10 people) with the following missions: to show the need for urgent changes in higher education in the area of computational sciences, to compose a survey of the current landscape of parallel computing and supercomputing education in Europe with respect to different universities and countries, and to prepare a set of recommendations on how to bring ideas of parallel computing and supercomputing into higher educational systems of European countries.

8.2.3. Other European Collaborations

In addition to our partners in aforementioned contractual collaborations, we had scientific relations in 2013 with several European universities and research centers, including:

- Saarland University (Alexander Graf-Brill and Holger Hermanns),
- RWTH Aachen (Joost-Pieter Katoen),
- Oxford University (Ernst-Moritz Hahn and Marta Kwiatkowska),
- University of Birmingham (Dave Parker),
- Technical University of Eindhoven (Anton Wijs),
- University of Twente (Marieke Huisman and Jaco van de Pol),
- University of Málaga (Francisco Duran and Ernesto Pimentel).

Our partnership with Saarland University was sustained by the Humboldt Forschungspreis received by H. Garavel, who continued his regular visits to Saarland University.

8.3. International Initiatives

H. Garavel is a member of IFIP (*International Federation for Information Processing*) Technical Committee 1 (*Foundations of Computer Science*) Working Group 1.8 on Concurrency Theory chaired successively by Luca Aceto and Jos Baeten.

8.3.1. Other International Collaborations

We had sustained scientific relations with Tevfik Bultan (University of California at Santa Barbara, USA).

We also had scientific exchanges with Gianfranco Ciardo (University of California at Riverside, USA).

8.4. International Research Visitors

8.4.1. Visits of International Scientists

- Loïg Jezequel (Technical University of München, Germany) visited us on March 4–6, 2013. He gave a talk entitled "*Distributed Cost-Optimal Planning*" on March 4, 2013.
- Zhen Zhang (University of Utah, USA) visited us from September 1st to December 31, 2013.
- The annual CONVECS seminar was held in Col de Porte (France) on November 18–20, 2013. The following invited scientists attended the seminar:
  - Jérôme Hugues (Institute for Space and Aeronautics Engineering, Toulouse) gave on November 18, 2013 a talk entitled "*Model-Based, Model Checking: the Missing Bits*".

[13] http://fmics.inria.fr

- Loïg Jezequel (Technical University of München, Germany) gave on November 19, 2013 a talk entitled "*Computation of Summaries using Net Unfoldings*".
- Xavier Etchevers (Orange Labs, Meylan, France) gave on November 19, 2013 a talk entitled "*VAMP: Self-Deployment of Arbitrary Applications in the Cloud*".
- Fabrice Kordon (LIP6, Paris) gave on November 20, 2013 a talk entitled "*Verification Approaches for Distributed Systems in LIP6/MoVe*".
- Zhen Zhang (University of Utah, USA) gave on November 20, 2013 a talk entitled "*Modeling a Fault-Tolerant Wormhole Routing Algorithm using LNT*".

DANTE Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR

- Equipex FIT (Futur Internet of Things) FIt is one of 52 winning projects in the Equipex research grant program. It will set up a competitive and innovative experimental facility that brings France to the forefront of Future Internet research. FIT benefits from 5.8€¨ million grant from the French government Running from 22.02.11 – 31.12.2019. The main ambition is to create a first-class facility to promote experimentally driven research and to facilitate the emergence of the Internet of the future.
- As proposed by initiatives in Europe and worldwide, enabling an open, general-purpose, and sustainable large-scale shared experimental facility will foster the emergence of the Future Internet. There is an increasing demand among researchers and production system architects to federate testbed resources from multiple autonomous organisations into a seamless/ubiquitous resource pool, thereby giving users standard interfaces for accessing the widely distributed and diverse collection of resources they need to conduct their experiments. The F-Lab project builds on a leading prototype for such a facility: the OneLab federation of testbeds. OneLab pioneered the concept of testbed federation, providing a federation model that has been proven through a durable interconnection between its flagship testbed PlanetLab Europe (PLE) and the global PlanetLab infrastructure, mutualising over five hundred sites around the world. One key objective of F-Lab is to further develop an understanding of what it means for autonomous organisations operating heterogeneous testbeds to federate their computation, storage and network resources, including defining terminology, establishing universal design principles, and identifying candidate federation strategies. On the operational side, F-Lab will enhance OneLab with the contribution of the unique sensor network testbeds from SensLAB, and LTE based cellular systems. In doing so, F-Lab continues the expansion of OneLab's capabilities through federation with an established set of heterogeneous testbeds with high international visibility and value for users, developing the federation concept in the process, and playing a major role in the federation of national and international testbeds. F-Lab will also develop tools to conduct end-to-end experiments using the OneLab facility enriched with SensLAB and LTE.

  F-Lab is a unique opportunity for the French community to play a stronger role in the design of federation systems, a topic of growing interest; for the SensLAB testbed to reach an international visibility and use; and for pioneering testbeds on LTE technology.
- ANR RESCUE started in December 2010: Access and metropolitan networks are much more limited in capacity than core networks. While the latter operate in over-provisioning mode, access and metropolitan networks may experience high overload due to evolution of the traffic or failures. In wired networks, some failures (but not all) are handled by rerouting the traffic through a backup network already in place. In developed countries, backup networks are adopted wherever possible (note that this is generally not the case for the links between end users and their local DSLAM). Such a redundant strategy may not be possible in emerging countries because of cost issues. When dedicated backup networks are not available, some operators use their 3G infrastructure to recover some specific failures; although such an alternative helps avoid full network outage, it is a costly solution. Furthermore, availability of 3G coverage is still mainly concentrated in metropolitan zones. When no backup networks are available, it would be interesting to deploy, for a limited time corresponding to the period of the problem (*i.e.*, failure or traffic overload), a substitution network to help the base network keep providing services to users.

In the RESCUE project (2010-2013), we investigate both the underlying mechanisms and the deployment of a substitution network composed of a fleet of dirigible wireless mobile routers. Unlike many projects and other scientific works that consider mobility as a drawback, in RESCUE we use the controlled mobility of the substitution network to help the base network reduce contention or to create an alternative network in case of failure. The advantages of an on-the-fly substitution network are manifold: Reusability and cost reduction; Deployability; Adaptability.

The RESCUE project addresses both the theoretical and the practical aspects of the deployment of a substitution network. From a theoretical point of view, we will propose a two-tiered architecture including the base network and the substitution network. This architecture will describe the deployment procedures of the mobile routing devices, the communication stack, the protocols, and the services. The design of this architecture will take into account some constraints such as quality of service and energy consumption (since mobile devices are autonomous), as we want the substitution network to provide more than a best effort service. From a practical point of view, we will provide a proof of concept, the architecture linked to this concept, and the necessary tools (*e.g.*, traffic monitoring, protocols) to validate the concept and mechanisms of on-the-fly substitution networks. At last but not least, we will validate the proposed system both in laboratory testbeds and in a real-usage scenario.
http://rescue.lille.inria.fr/

- ANR PETAFLOW (Appel Blanc International) started in march 2010 and ended in october 2013. It is a collaborative project between the GIPSA Lab (Grenoble), MOAIS (Inria Grenoble), DANTE (Inria Grenoble), the University of Osaka (the Cybermedia Center and the Department of Information Networking) and the University of Kyoto (Visualisation Laboratory).
  The aim of this collaboration was to propose network solutions to guarantee the Quality of Service (in terms of reliability level and of transfer delay properties) of a high speed, long-distance connection used in an interactive, high performance computing application. Another specificity of this application was the peta-scale volume of the treated data corresponding to the upper airway flow modelling.
  http://petaflow.gforge.inria.fr/
- ANR CONTINT CODDDE accepted in December 2013: It is a collaborative project between the ComplexNetwork team at LIP6/UPMC; Linkfluence and Inria Dante. The CODDDE project aims at studying critical research issues in the field of real-world complex networks study:
  - How do these networks evolve over time?
  - How does information spread on these networks?
  - How can we detect and predict anomalies in these networks?

  In order to answer these questions, an essential feature of complex networks will be exploited: the existence of a community structure among nodes of these networks. Complex networks are indeed composed of densely connected groups of that are loosely connected between themselves.

  The CODDE project will therefore propose new community detection algorithms to reflect complex networks evolution, in particular with regards to diffusion phenomena and anomaly detection.

  These algorithms and methodology will be applied and validated on a real-world online social network consisting of more than 10 000 blogs and French media collected since 2009 on a daily basis (the dataset comprises all published articles and the links between these articles).
- ANR FETUSES: The goals of this ANR project consist in the development of statistical signal processing tools dedicated to per partum fetal heat rate characterisation and acidosis detection, and are organised as follows: – construction of a large dataset of per partum fetal heart rate recordings, which is well documented and of significant clinical value; – Developments of adaptive (*e.g.* data driven) algorithms to separate data into trend (deceleration induced by contractions) and fluctuation (cardiac variability) components; – Developments of algorithms to characterise the non stationary and multifractal properties of per partum fetal heart rate ; – Acidosis detection and assessment using

the large datasets; – Algorithm implementation for performing tests in real clinical situations. ANR is a joint project between DANTE, the Physics Lab of ENS Lyon (SiSyPhe team) and the *Hôpital Femme-Mère-Enfant* of Bron (Lyon). Fetuses started in january 2012.

- ANR INFRA DISCO (DIstributed SDN COntrollers for rich and elastic network services) project: the DANTE team will explore the way SDN (Software Designed Network) can change network monitoring, control, urbanisation and abstract description of network resources for the optimisation of services. More specifically, the team will address the issues regarding the positioning of SDN controllers within the network, and the implementation of an admission control that can manage IP traffic prioritisation.

8.2. International Initiatives

8.2.1. Inria International Partners

8.2.1.1. Declared Inria International Partners

- LNCC - Laboratório Nacional de Computação Científica (several collaboration, *e.g.*, STIC AMSUD and Inria/FAPERJ)
- Academy of Science and Technology, Vietnam (collaboration via CNSR PEPS)
- Department of Mathematics/Naxys, University of Namur, Belgium (Student exchanges)
- Department of Biomedical Engineering and Computational Science, Aalto University, Finland

8.2.2. Participation In other International Programs

DANTE is part of a FAPERJ/Inria collaborative project: Complex Dynamic Networks Acronym (CoDyN). The collaboration is done with the Mechanisms and ARchitectures for TeleINformatics (MARTIN) team (http://martin.lncc.br), a R&D group at the National Laboratory for Scientific Computing (LNCC), a research unit of the Brazilian Ministry of Science and Technology. MARTIN houses staff working in Information and Communication Technologies (ICT), with a particular focus on computer networks. Currently, the main activities of the group are on Network Measurements, Mobile Computing, and Network Software Architecture and Modelling. In particular, the group promotes research and development in inter- and multidisciplinary applications based on the above-mentioned areas and their intersections (e.g. mobile health applications).

8.3. International Research Visitors

8.3.1. Visits of International Scientists

- Artur Ziviani and Klaus Wehmuth from LNCC spent several weeks at IXXI.
- Dr. Gerardo Iñiguez from Aalto University (Finland) spent time in the DANTE team and was hosted by IXXI.

8.3.1.1. Internships

- **Arashpreet Singh Mor** master student from Indian Institute of Technology Dehli (India) did his M1 internship with DANTE from May to August 2013.
- **Thibaud Trolliet** L3 student at the department of physics of ENS Lyon did a 2 months internship with the team DANTE (june-july 2013).
- **ANH Ha Pham The** Master student at IFI (Institut de la Francophonie pour l'Informatique - Hanoi Vietnam) did his M2 internship with DANTE from May to November 2013.

8.3.2. Visits to International Teams

- Christophe Crespelle, 2 months in January-February 2013, Vietnam Institute for Advanced Study in Mathematics (VIASM), Hanoï.
- Christophe Crespelle, 1 month in June-July 2013, Institute of Mathematics, Vietnam Academy of Science and Technology, Hanoï.
- Eric Fleury visited the team of Jose Ignacio Alvarez-Hamelin at Buenos Aeres, Argentina in collaboration with Artur Ziviani.

DICE Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

Dice is involved in a regional project of the Rhône-Alpes region, ARC6 "Innovative Services for Social Networks", with Telecom Saint Etienne.

8.2. National Initiatives

8.2.1. ANR

Dice is involved in two new ANR projects, to start at the end of 2013,

- C3PO, on Collaborative Creation of Contents and Publishing using Opportunistic networks, with LT2C Telecom Saint-Etienne, INSA LYON, IRISA, ChronoCourse, et Ecole des Mines de Nantes.
- Socioplug, Social Cloud over Plug Networks, Enabling Symmetric Access to Data and Preserving Privacy, with LINA / Université de Nantes, Université de Rennes 1, INSA Lyon.

8.3. European Initiatives

8.3.1. FP7 Projects

Dice is involved in the CSA project "Big data roadmap and cross-disciplinarY community for addressing socieTal Externalities (BYTE)", Objective ICT-2013.4.2 Scalable data analytics (c) Societal externalities of Big Data roadmap.

DRACULA Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR

Projects coordination by a member of Dracula

- ANR (jeunes chercheurs) ProCell "Mathematical Methods for Erythropoiesis Modelling: from Proteins to Cell Populations", 2009-2013.
  Participants: Samuel Bernard, Fabien Crauste [Coordinator], Olivier Gandrillon, Laurent Pujo-Menjouet, Vitaly Volpert.
- ANR (jeunes chercheurs) MADCOW "Modelling amyloid dynamics and computation output work: applications to Prion and Alzheimer's disease", 2008-2013.
  Participants: Samuel Bernard, Fabien Crauste, Laurent Pujo-Menjouet [Coordinator], Vitaly Volpert.
- ANR BIMOD "Hybrid models of cell populations. Application to cancer modelling and treatment", 2010-2014.
  Participants: Mostafa Adimy, Fabien Crauste, Vitaly Volpert [Coordinator].
- ANR STOCHAGENE "Role of the chromatin dynamics on the stochasticity in gene expression in higher eukaryotic cells", 2011-2015.
  Participant: Olivier Gandrillon [Coordinator].

Collaboration in other projects

- ANR RPIB PrediVac "Innovative modeling tools for the prediction of CD8 T cell based vaccine efficacy", 2013-2015. Partners: U1111 Inserm (J. Marvel, coordinator), Dracula, Altrabio (small company), CoSMo (small company). For Dracula, the budget in 2013 is 88 keuros, including two one-year post-doc positions, recruited in February (Floriane Lignet) and in April (Sotiris Prokopiou).
- Thomas Lepoutre participates in the ANR (jeunes chercheurs) MODPOL (head Vincent Calvez (ENS Lyon)) "Cell polarization modeling", 2011-2015.
- Thomas Lepoutre is a member of the ANR KIBORD (head L. Desvillettes) dedicated to "kinetic and related models in biology". 2012-2016.
- Olivier Gandrillon participates in the ANR (Investissement d'Avenir) Iceberg (head Gregory Batt (Inria)) "From population models to model populations: single cell observation, modeling, and control of gene expression".

8.2. European Initiatives

8.2.1. Collaborations with Major European Organizations

- University of Valladolid (Spain). Collaboration with Oscar Angulo, Juan Carlos Lopez-Marcos and Miguel Ange Lopez-Marcos, on the analysis of an age-structured model describing erythropoiesis, and its numerical resolution.
- Karolinska University Hospital of Stockholm (Sweden). Collaboration with Peter Arner, Mats Eriksson, Erik Arner, Mikael Rydén and Kirsty L. Spalding, on the study of dynamics of human adipose lipid turnover in health and metabolic disease.

8.3. International Initiatives

8.3.1. Inria Associate Teams

8.3.1.1. Modeling leukemia

Title: Modeling quiescence and drug resistance in Chronic Myeloid Leukemia

Inria principal investigator: Thomas Lepoutre

International Partner (Institution - Laboratory - Researcher):

University of Maryland (United States), Center for Scientific Computation and Mathematical Modeling.

Leukemia is the most famous disease of the blood cell formation process (hematopoiesis). Chronic myeloid leukemia results in a uncontrolled proliferation of abnormal blood cells. As the hematopoiesis involves stem cells (not accessible to observations), mathematical modeling is here a great tool to test hypothesis. We will join the expertise of Inria team DRACULA specialized on the modeling of blood cell formation and the Center for Scientific Computation and Applied Mathematical Modeling (CSCAMM, University of Maryland, College Park). The theoretical and modeling experience of team DRACULA and the numerical expertise combined with the links with experimentalists of members of CSCAMM will allow us to study deeply evolution of leukemia. We will especially focus on the behavior of leukemic stem cells and their possibility of becoming quiescent (dormant). Then we will study (using the knowledge obtained on leukemic stem cells) the phenomenon of drug resistance and its propagation over time and finally the mechanisms of multidrug resistance.

8.3.2. Participation In other International Programs

8.3.2.1. M3CD

Program: Euromediterranean 3+3

Title: Mathematical Models and Methods in Cell Dynamics

Inria principal investigator: Mostafa Adimy

International Partners (Institution - Laboratory - Researcher):

Institut Pasteur de Tunis (Tunisia) - Slimane Ben Miled

Consiglio Nazionale delle Ricerche- Istituto per le Applicazioni del Calcolo Mauro Picone (Italy) - Istituto per le Applicazioni del Calcolo Mauro Picone - Roberto Natalini

Cadi Ayyad University (Morocco) - Populations Dynamics Laboratory - Moulay Lhassan Hbid

Duration: Jan 2012 - Dec 2015

The aim of this project is to establish a network working on mathematical and computational models in cell dynamics. This network consists of five groups which have already established close bilateral relations. Those are the Inria teams Bang and Dracula in Paris and Lyon, France, the team IAC-CNR in Rome, Italy, the laboratory of Mathematical Population Dynamics (LMDP) from the university of Marrakech in Morocco, and the team of Mathematical Modelling and Computing in Biology (MoMinBi) from the Pasteur Institute in Tunis. Modelling cell dynamics and related processes is one of the main subjects of interest for the partners for many years. The issues addressed in the present project can be divided into five parts:

1) Analysis of structured models in cell population dynamics ;

2) Dynamics of normal and pathological haematopoiesis ;

3) Dynamics of Darwinian adaptation, in particular by drug resistance in competing cell or parasite populations, healthy and pathological / pathogenic (cancer, bacteria, parasites) ;

4) Dynamics of chemical and physical determinants of filament formation and intracellular spatial organisation of the cytoskeleton conformation ;

5) Coupling of the molecular mechanisms of control of the cell division cycle and cell proliferation.

The first part has been developed for many years by all the partners in this project. It tackles issues related to cell dynamics and biological mechanisms, physiological and chemical properties of cells and cell populations. The other four aspects of the project have been studied in the past by the Inria teams "Bang" and "Dracula" (**2**, **4**, **5**) and the IAC-CNR team (Rome), or are a rapidly emergent theme in Bang (**3**, cell Darwinism) with possible and natural connections with the other teams, in particular IAC-CNR and MoMinBi in Tunisia. Themes (**2**, **4**, **5**) have also been initiated (for their fundamental part) in a recent collaboration between Dracula and the teams from Morocco and Tunisia. The objectives of the present project are to pursue and deepen the study of cell proliferation dynamics and cellular mechanisms using structured models that take into account some new structure variables. The development of computer models will also be investigated in this project. Training and research activities related to these topics are currently underway between the Inria teams and the teams from Marrakech and Tunis, and between the Italian team and Bang. Two co-supervised theses are currently in progress, a Spring school on this subject will be organised by the partners in 2012. This program comes at the right time to give a new impetus to this collaboration. It will lead to the establishment of a multi-site laboratory expertise in population dynamics modelling, especially in cellular dynamics. This project will also allow the teams from Morocco and Tunisia to use their knowledge on mathematics applied to cell dynamics.

8.4. International Research Visitors

8.4.1. Visits of International Scientists

8.4.1.1. Internships

Evgenia Babushkina

Subject: Numerical simulations of blood flows and blood coagulation

Date: from Apr 2013 until Jul 2013

Institution: St. Petersburg State University (Russia (Russian Federation))

8.4.1.2. Visits of other international scientists

- Malay Banerjee - Kanpur, India - from May 2013 until June 2013.
- Dana-Adriana Botesteanu - University of Maryland, USA - from May 2013 until June 2013
- Peter Kim - University of Sydney, Australia - from January 2013 until February 2013
- Nemanja Kosovalic - York University, Canada - March 2013
- Michael Mackey - McGill University, Canada - February 2013
- Jianhong Wu - York University, Canada - March 2013

E-MOTION Project-Team

7. Partnerships and Cooperations

7.1. European Initiatives

7.1.1. FP7 Projects

European Project (Strep) Bambi (Bottom-up Approaches to Machines dedicated to Bayesian Inference). The Bambi project started January 1st 2014 for a period of three years. The participant to this project are CNRS, HUJI (ISRAEL), ULG (Belgique), ISR(Portugal) ProbaYes(France). We propose a theory and a hardware implementation of probabilistic computation inspired by biochemical cell signaling. We will study probabilistic computation following three axes: algebra, biology, and hardware. In each case, we will develop a bottom-up hierarchical approach starting from the elementary components, and study how to combine them to build more complex systems. We propose Bayesian gates operating on probability distributions on binary variables as the building blocks of our probabilistic algebra. These Bayesian gates can be seen as a generalization of logical operators in Boolean algebra. We propose to interpret elementary cell signalling pathways as biological implementation of these probabilistic gates. In turn, the key features of biochemical processes give new insights for new probabilistic hardware implementation. We propose to associate conventional electronics and novel stochastic nano-devices to build the required hardware elements. Combining them will lead to new artificial information processing systems, which could, in the future, outperform classical computers in tasks involving a direct interaction with the physical world. For this purpose, this project associates research in Bayesian probability theory, molecular biology, nanophysics, computer science and electronics. The e-motion team is mainly concerned by : The development of Stochastic temporal coding of probabilistic information and the adaptation and learning in probabilisitc machines

7.1.2. Major European Organizations with which you have followed Collaborations

Department of Electrical & Computer Engineering: University of Thrace, Xanthi (GREECE)

Subject: 3D coverage based on Stochastic Optimization algorithms

BlueBotics: BlueBotics Company, Lausanne (Switzerland)

Subject: Implementation of self-calibration strategies for wheeled robots and SLAM algorithms for industrial purposes

Autonomous System laboratory: ETHZ, Zurich (Switzerland)

Subject: Vision and IMU data Fusion for 3D navigation in GPS denied environment.

Robotics and Perception Group: University of Zurich (Switzerland)

Subject: Vision and IMU data Fusion for 3D navigation in GPS denied environment.

Universidade de Aveiro (Portugal)

Subject: Leader following. Co-directed phD.

Centro De Automatica y Robotica, UPM-CSIC, Madrid (Spain)

Subject: Target interception.

Social Robotics Laboratory, Freiburg (Germany)

Subject: Human behavior understanding.

7.2. International Initiatives

7.2.1. "PRETIV"

[November 2011- October 2014]

Multimodal Perception and REasoning for Transnational Intelligent Vehicles" (PRETIV) is a three-year ANR project accepted in the framework of the Blanc International II Programme with participants from France (e-Motion of Inria, Heudiasyc of CNRS, PSA Peugeot Citroen DRIA in Velizy) and China (Peking University, PSA Peugeot Citroen Technical Center in Shanghai). The project aims at developing of an online multimodal perception system for a vehicle and offline reasoning methods, dealing with incompleteness and uncertainties in the models and sensor data, as well as at conducting experiments in typical traffic scenarios in France and China to create an open comparative dataset for traffic scene understanding. The perception system will incorporate vehicle localization, mapping of static environmental objects, detecting and tracking of dynamic objects in probabilistic frameworks through multimodal sensing data and knowledge fusion. The reasoning methods are based on sensor data to learn semantics, activity and interaction patterns (vehicle - other objects, vehicle - infrastructure) to be used as a priori information to devise effective online perception algorithms toward situation awareness. The comparative dataset will contain experimental data of typical traffic scenarios with ground-truth, which will be used to learn country-specific traffic semantics and it will be open to the public.

7.2.2. Visits of International Scientists

Mario Garzon, phD at Universidade de Madrid was in our team from february 2013 to april 2013.

7.2.3. Inria International Labs

7.2.3.1. "iCeiRA"

[Jan 2013- Jan 2018] The e-Motion project-team has won (in cooperation with the CNRS laboratories LAAS and ISIR) a major partnership with Taiwan in the scope of the call "International Excellence Laboratories" (I-RiCE program) launched by the National Science Council (NSC) of Taiwan. The laboratory is hosted by the National University of Taiwan, it is supported for 5 years, and the collaborative research is focusing on Human centered Robotics.

7.2.4. Participation In other International Programs

7.2.4.1. "ict-PAMM"

[September 2011 - September 2013]
ict-PAMM is an ICT-ASIA project accepted in 2011 for 2 years. It is funded by the French Ministery of Foreign Affair and Inria. This project aims at conducting common research activities in the areas of robotic mobile service and robotic assistance of human in different contexts of human life. French partners are Inria-emotion from Grenoble, Inria-IMARA from Rocquencourt and Institut Blaise Pascal from Clermont-Ferrand. Asian Partners are IRA-Lab from Taiwan, ISRC-SKKU from Suwon in Korea, ITS-Lab from Kumamoto in Japan and Mica Institute from Hanoi in Vietnam.

7.2.4.2. "Predimap"

[September 2011 - September 2013]
Predimap is an ICT-ASIA project accepted in 2011 for 2 years. It is funded by the French Ministery of Foreign Affair and Inria. This project aims at conducting common research activities in the area of perception in road environment. The main objective is the simultaneous use of local perception and Geograpical Information Systems (GIS) in order to reach a global improvement in understanding road environment. Thus the research topics included in the project are: local perception, precise localization, map-matching and understanding of the traffic scenes. French partners are Inria-emotion from Grenoble, Heudiasyc team from CNRS/UTC, and Matis team from IGN. Foreign partners are Peking University and Shanghai Jiao Tong University in China, CSIS lab from Tokyo University in Japan and AIT Geoinformatics Center in Thailand.

7.3. International Research Visitors

7.3.1. Visits to International Teams

- In relation with the Bambi project, Emmanuel Mazer visited Dr. Vickash Masinghka at the Mit Computer science department to establish an academic collaboration around probabilistic computation (Bambi Project). On the same subject but more related to the industrial side, Emmanuel Mazer visited the research center of AMAZON in Berlin and the Microsoft research center in Cambridge to evaluate future collaboration.
- Chiara Troiani spent 6 month at the University of Zurich, in the Robotics and Perception Group (Switzerland).
- Gregoire Vignon spent 2 month at the iCeiRA lab (Taiwan).

EXMO Project-Team

7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. ANR Datalift

Program: ANR-ContInt

Project acronym: Datalift

Project title: DATALIFT

Instrument: platform

Duration: September 2010 - March 2014

Coordinator: Inria EXMO/François Scharffe

Participants: Jérôme Euzenat, Zhengjie Fan, Jérôme David

See also: http://www.datalift.org

Abstract: EXMO coordinates with LIRMM the DATALIFT project whose goal is to produce a platform for publishing governmental data as linked data. EXMO is particularly involved in the generation of links between datasets (see §6.2).

7.1.2. ANR Lindicle

Program: ANR-Blanc international 2

Project acronym: LINDICLE

Project title: Linking data in cross-lingual environment

Duration: January 2013 - December 2016

Coordinator: Inria EXMO/Jérôme David

Participants: Jérôme Euzenat, Manuel Atencia Arcas, Jérôme David, Tatiana Lesnikova, Adam Sanchez Ayte

Other partners: Tsinghua university (CN)

See also: http://lindicle.inrialpes.fr

Abstract: The LINDICLE project investigates multilingual data interlinking between French, English and Chinese data sources (see §6.2).

7.2. European Initiatives

7.2.1. FP7 Projects

7.2.1.1. Ready4SmartCities

Type: CAPACITIES

Defi: ICT-2013.6.4 - Optimising Energy Systems in Smart Cities

Instrument: Coordination and Support Action

Project acronym: Ready4SmartCities

Project title: ICT Roadmap and Data Interoperability for Energy Systems in Smart Cities

Duration: October 2013 - September 2015

Coordinator: D'appolonia Spa (Italy)

Partner: D'appolonia (Italiy) Universidad Politecnica de Madrid (Spain) CSTB (France), CERTH (Grèce), VTT (Finland), Inria (France), AIT (Austria), AEC3 (UK), Politecnico di Torino (Italy), Empirica (Germany)

Inria contact: Jérôme Euzenat

Participants: Jérôme Euzenat, Luz Maria Priego-Roche, Jérôme David

See also: http://www.ready4smartcities.eu

Abstract: The READY4SmartCities project intends to increase awareness and interoperability for the adoption of ICT and semantic technologies in energy system to obtain a reduction of energy consumption and CO2 emission at smart cities community level through innovative relying on RTD and innovation outcomes and ICT-based solutions.

7.3. International Research Visitors

7.3.1. Visits of International Scientists

- **Esther Lozano (Universidad Politecnica de Madrid)** visited EXMO from January 8th to May 8th, 2013 working on the combination of context-based matching with semantic modelling systems;
- **Jorge Gracia (Universidad Politecnica de Madrid)** visited EXMO from May 1st to July 27th, 2013, working on multilingual ontology/instance matching and expressive ontology matching;
- **Daniel Vila (Universidad Politecnica de Madrid)** visited EXMO from June 2nd to July 23rd, 2013 working on data interlinking and ontology inference;
- **Angela Locoro (Universita deggli Studi di Genova)** visited EXMO from June 1st to 29th, 2013 working on context-based ontology matching and generalised the notion of context;
- **Lihua Zhao (NII, Tokyo)** visited EXMO from August 17th to September 21st, 2013 on combining data interlinking from ontology matching with ontology matching from links.

7.3.2. Visits to International Teams

- Jérôme David Visited Tsinghua University (Juanzi Li group), Beijing, China. 5/11 – 21/11/2013. He worked in the framework of the LINDICLE project on the refinement of ontologies extracted from online encyclopedia.

IBIS Project-Team

7. Partnerships and Cooperations

7.1. Regional initiatives

Project name	Identification structurelle et paramétrique des réseaux de régulation bactériens
Coordinator	E. Cinquemani
IBIS participants	E. Cinquemani, J. Geiselmann, H. de Jong, D. Stefan
Type	Funding PhD grant, Cluster ISLE, Région Rhône-Alpes
Web page	http://cluster-isle.grenoble-inp.fr/

Project name	Motilité ou adhésion : comment les entérobactéries choisissent entres ces deux états physiologiques déterminants pour la virulence
Coordinator	S. Lacour
IBIS participants	J. Demol, J. Geiselmann, S. Lacour, C. Pinel
Type	Grant, Cluster Infectiologie, Région Rhône-Alpes

Project name	Séminaire grenoblois des systèmes complexes
Coordinators	S. Achard, O. François, A. Maignan, E. Prados, S. Rafai, D. Ropers
IBIS participants	D. Ropers
Type	Funding by Institut des Systèmes Complexes de Lyon (IXXI)
Web page	http://www.ixxi.fr/?page_id=114&lang=fr

Project name	Séminaire de modélisation du vivant
Coordinators	O. Gandrillon
IBIS participants	D. Ropers
Type	Funding by GdR BIM
Web page	http://cgphimc.univ-lyon1.fr/CGphiMC/Semovi/Semovi.php

7.2. National initiatives

Project name	ColAge – Lifespan control in bacteria: Natural and engineering solutions
Coordinator	H. Berry
IBIS participants	E. Cinquemani, J. Geiselmann, H. de Jong, S. Lacour, C. Pinel, D. Ropers
Type	Inria-Inserm Project Lab (2009-2013)
Web page	http://colage.saclay.inria.fr

Project name	AlgeaInSilico: Prédire et optimiser la productivité des microalgues en fonction de leur milieu de croissance
Coordinator	O. Bernard
IBIS participants	H. de Jong
Type	Inria Project Lab (2013-)

Project name	GeMCo – Model reduction, experimental validation, and control for the gene expression machinery in *E. coli*
Coordinator	M. Chaves
IBIS participants	E. Cinquemani, J. Geiselmann, C. Gomez Balderas-Barillot, E. Grac, H. de Jong, S. Lacour, C. Pinel, D. Ropers
Type	ANR Blanc (2010-2014)
Web page	http://www-sop.inria.fr/members/Madalena.Chaves/ANR-GeMCo/main.html

Project name	RESET – Arrest and restart of the gene expression machinery in bacteria: from mathematical models to biotechnological applications
Coordinator	H. de Jong
IBIS participants	E. Cinquemani, J. Geiselmann, C. Gomez Balderas-Barillot, E. Grac, H. de Jong, S. Lacour, Y. Markowicz, C. Pinel, D. Ropers
Type	Bioinformatics call, Investissements d'Avenir program (2012-2016)
Web page	https://project.inria.fr/reset/

Project name	Fonction du système de régulation post-transcriptionnel CSR dans la dynamique de l'adaptation métabolique chez la bactérie modèle Escherichia coli
Coordinators	M. Cocaign-Bousquet (Inra, LISBP), B. Enjalbert (INSA, LISBP), D. Ropers
IBIS participants	M. Morin, D. Ropers
Type	Contrat Jeune Scientifique Inra-Inria (2012-2016)
Web page	http://www.inra.fr/les_hommes_et_les_femmes/rejoignez_nous/completer_sa_formation/le_recrutement_de_doctorants/cjs__1/inra_inria

7.3. International projects

Project name	French bioinformatics contribution to ICGC
Coordinator	G. Thomas
IBIS participants	F. Rechenmann
Type	International Cancer Genome Consortium (ICGC)
Web page	http://www.icgc.org/

The goal of ICGC (International Cancer Genome Consortium) is to obtain a comprehensive description of genomic, transcriptomic and epigenomic changes in 50 different cancer types. In France, INCa (French

National Cancer Institute) contributes to this project and focuses on two types of cancer. The main idea is to sequence the human genome of normal and tumoral cells of a large set of patients and to compare these genomic sequences to identify the mutations which may explain the development of the cancers. Bioinformatics is clearly involved in the management, the analysis and the visualization of the huge sets of data and results. Bioinformatics of the French contribution is carried out at Lyon, in the context of the Synergie Lyon Cancer Foundation. Until this year, François Rechenmann was part of the bioinformatics team and contributed to the organization of the data management and analysis workflow, under the leadership of prof. Gilles Thomas.

7.4. International collaborations

IBIS has strong collaborations with the group of Giancarlo Ferrari-Trecate at the Computer Engineering & Systems Science Department of the University of Pavia (Italy) and the group of John Lygeros at the Automatic Control Lab at ETH Zürich (Switzerland). This collaboration started with the FP6 project Hygeia, in which the above groups and IBIS (then HELIX) participated. Over the years, it has resulted in a dozen of co-authored papers and the co-supervision of a PhD thesis by Hidde de Jong and Giancarlo Ferrari-Trecate. Eugenio Cinquemani was a post-doctoral fellow at ETH in the framework of the Hygeia project, and joined the IBIS group as a research scientist in the fall of 2009. Andres Gonzales-Vargas, PhD student of Giancarlo Ferrari-Trecate, will spend six months in IBIS in 2014.

7.5. International research visitors

Invited professor	Andreas Kremling (Technische Universität Münich)
Subject	Modeling of carbon catabolite repression in *E. coli*

Invited professor	Alberto Soria-Lopéz (Centro de Investigación y de Estudios Avanzados of Instituto Politécnico Nacional (IPN), Mexico)
Subject	Development of an automatically-controlled system of parallel mini-bioreactors

IMAGINE Project-Team

7. Partnerships and Cooperations

7.1. Regional Initiatives

7.1.1. Scenoptique (12/2012 - 03/2014)

Participant: Rémi Ronfard.

In October 2011, we started a collaboration with Theatre des Celestins in Lyon on the topic of interactive editing of rehearsals. This research program is funded by the Region Rhone Alpes as part of their CIBLE project, with a budget for a doctoral thesis (Vineet Gandhi) and three large sensor video cameras. Theatre des Celestins is interested in novel tools for capturing, editing and browsing video recordings of their rehearsals, with applications in reviewing and simulating staging decisions. We are interested in building such tools as a direct application and test of our computational model of film editing, and also for building the world's first publicly available video resource on the creative process of theatre rehearsal. Using state-of-the-art video analysis methods, this corpus is expected to be useful in our future work on procedural animation of virtual actors and narrative design. The corpus is also expected to be shared with the LEAR team as a test bed for video-based action recognition.

7.1.2. Labex Persyval

Participants: Rémi Ronfard, Olivier Palombi, Armelle Bauer.

We received a doctoral grant from LABEX PERSYVAL, as part of the research program on authoring augmented reality (AAR) for PhD student Adela Barbelescu. Her thesis is entitled *directing virtual actors by imitation and mutual interaction - technological and cognitive challenges*. Her advisors are Rémi Ronfard and Gérard Bailly (GIPSA-LAB).

Additionally, this project funds the PhD thesis of Armelle Bauer which has started in October, co-advised by François Faure, Olivier Palombi, and Jocelyne Troccaz from TIMC-GMCAO. The goal is to tackle the scientific challenges of visualizing one's self anatomy in motion using Augmented Reality techniques.

7.1.3. TAPIOCA, Persyval Grant (11/2013 - 11/2015)

Participants: Damien Rohmer, Jean-Claude Léon, Marie-Paule Cani.

Tapioca (Tangibilité Physiologique Instrumentée: Outil mixte redimensionnable pour la conception d'artefact) is a *projet exploratoire* of the Persyval Grant. This project aim to study the use of resizable interactive interface to ease the generation of virtual models. This project is in collaboration with LIG, Gipsa-lab and GSCOP.

7.2. National Initiatives

7.2.1. ANR ROMMA (01/2010-12/2013)

Participants: François Faure, Jean-Claude Léon, Stefanie Hahmann.

The ANR project ROMMA has been accepted in 2009 and started in January 2010. The partners of this project are academic and industry experts in mechanical engineering, numerical simulation, geometric modeling and computer graphics. There are three academic members in the consortium: the LMT in Cachan, G-SCOP and LJK (EVASION and MGMI teams) in Grenoble. There are four industrial members: EADS, which coordinates the project, SAMTECH, DISTENE and ANTECIM. The aim of the project is to efficiently and robustly model very complex mechanical assemblies. We are working on the interactive computation of contacts between mechanical parts using GPU techniques. We will also investigate the Visualization of data with uncertainty, applied in the context of the project.

7.2.2. ANR SOHUSIM (10/2010-09/2014)

Participants: Ali Hamadi Dicko, François Faure.

Sohusim (Soft Human Simulation) is a ANR Project which started on October 1st 2010. It is done in collaboration between: EVASION (Inria), Fatronik France (TECNALIA), DEMAR (Inria), HPC PROJECT and the CHU de Montpellier.

This project deals with the problem of modeling and simulation of soft interactions between humans and objects. At the moment, there is no software capable of modeling the physical behavior of human soft tissues (muscles, fat, skin) in mechanical interaction with the environment. The existing software such as LifeMod or OpenSim, models muscles as links of variable length and applying a force to an articulated stiff skeleton. The management of soft tissues is not taken into account and does not constitute the main objective of this software.

A first axis of this project aims at the simple modeling and simulation of a passive human manipulated by a mecatronics device with for objective the study and the systems design of patient's manipulation with very low mobility (clinic bed). The second axis concentrates on the detailed modeling and the simulation of the interaction of an active lower limb with objects like orthesis, exoskeleton, clothes or shoes. The objective being there also to obtain a tool for design of devices in permanent contact with the human who allows determining the adequate ergonomics in terms of forms, location, materials, according to the aimed use.

Dicko Ali Hamadi is a Ph.D. student within EVASION team. His works turns around the problems in SOHUSIM project. He is co-tutored Olivier Palombi in IMAGINE. A part of this work was presented at Siggraph Asia [5].

7.2.3. ANR CORPUS SPECTABLE EN LIGNES (01/2013-01/2015)

Participant: Rémi Ronfard.

Spectacle En Ligne(s) amplifies our collaboration with the Theatre des Celetins in Lyon, which was started with the Scenoptique project in 2011. Scenoptique investigates novel techniques for recording ultra-high definition video, reframing them and editing them into interactive movies. Spectacle En Ligne(s), is targeted on the creation and diffusion of an original data set of integral vídeo recordings of theatre and opera rehearsals. The data set is naturally suited to researchers interested in the creation process and the genetic analysis of dramatic art and mise en scene. To support research in this area, we are extending the audio and visual analysis tools developed in the Scenoptique project.

7.2.4. FUI Dynam'it (01/2012 - 02/2014)

Participant: Francois Faure.

2-year contract with two industrial partners: TeamTo (production of animated series for television) and Artefacts Studio (video games). The goal is to adapt some technologies created in SOFA, and especially the frame-based deformable objects [34], [33] to practical animation tools. This contract provides us with the funding of two engineers and one graphical artist during two years.

7.2.5. FUI Collodi (October 2013 - October 2016)

Participants: Francois Faure, Romain Testylier.

This 3-year contract with two industrial partners: TeamTo and Mercenaries Engineering (software for production rendering), is a follow-up and a generalization of Dynamit. The goal is to propose an integrated software for the animation and final rendering of high-quality movies, as an alternative to the ever-ageing Maya. It will include dynamics similarly to Dynamit, as well as innovative sketch-based kinematic animation techniques invented a Imagine by Martin Guay and Rémi Ronfard. This contract, started in October, funds 2 engineers for 3 years.

7.2.6. ANR CHROME (01/2012 - 08/2015)

Participant: Rémi Ronfard.

Chrome is a national project funded by the French Research Agency (ANR). The project is coordinated by Julien Pettré, member of MimeTIC. Partners are: Inria-Grenoble IMAGINE team (Remi Ronfard), Golaem SAS (Stephane Donikian), and Archivideo (Francois Gruson). The project has been launched in september 2012. The Chrome project develops new and original techniques to massively populate huge environments. The key idea is to base our approach on the crowd patch paradigm that enables populating environments from sets of pre-computed portions of crowd animation. These portions undergo specific conditions to be assembled into large scenes. The question of visual exploration of these complex scenes is also raised in the project. We develop original camera control techniques to explore the most relevant part of the animations without suffering occlusions due to the constantly moving content. A long-term goal of the project is to enable populating a large digital mockup of the whole France (Territoire 3D, provided by Archivideo). Dedicated efficient human animation techniques are required (Golaem). A strong originality of the project is to address the problem of crowded scene visualisation through the scope of virtual camera control, as task which is coordinated by Imagine team-member Rémi Ronfard.

Three phd students are funded by the project. Kevin Jordao is working on interactive design and animation of digital populations and crowds for very large environments. His advisors are Julien Pettré and Marie-Paule Cani. Quentin Galvanne is working on automatic creation of virtual animation in crowded environments. His advisors are Rémi Ronfard and March Christie (Mimetic team, Inria Bretagne). Julien Pettre. Chen-Kin Lim is working on crowd simulation and rendering of the behaviours of various populations using crowd patches. Her advisors are Rémi Ronfard and March Christie (Mimetic team, Inria Bretagne). Julien Pettre.

7.2.7. Action3DS (Caisse des dépôts) (10/2011 - 09/2014)

Participant: Rémi Ronfard.

Action3DS is a national project funded by Caisse des Dépots, as part of the *projet Investissements d'avenir ACTION3DS* research program entitled *Technologies de numérisation et de valorisation des contenus culturels, scientifiques et éducatifs*.

The project is coordinated by Thales Angénieux (Patrick Defay). Partners are Inria (Rémi Ronfard), Lutin Userlab (Chrles Tijus), LIP6 (Bernadette Bouchon-Meunier), GREYC (David Tschumperlé), École nationale supérieure Louis Lumière (Pascal Martin), Binocle (Yves Pupulin), E2V Semiconductors and Device-Alab.

The goal of the project is the developpement of a compact professional stereoscopic camera for 3D broadcast and associated software. Rémi Ronfard is leading a work-package on real-time stereoscopic previsualization, gaze-based camera control and stereoscopic image quality.

The project is funding our new postdoc researcher Christophe Lino who is working on learning-based camera control for stereoscopic 3D cinematography with Rémi Ronfard.

7.2.8. AEN MorphoGenetics (10/2012 - 09/2015)

Participant: François Faure.

3-year collaboration with Inria teams Virtual Plants and Demar, as well as INRA (Agricultural research) and the Physics department of ENS Lyon. The goal is to better understand the coupling of genes and mechanical constraints in the morphogenesis (creation of shape) of plants. Our contribution is to create mechanical models of vegetal cells based on microscopy images. This project funds the Ph.D. thesis of Richard Malgat, who started in October, co-advised by François Faure (IMAGINE) and Arezki Boudaoud (ENS Lyon).

7.2.9. PEPS SEMYO (10/2012 - 09/2014)

Participant: François Faure.

2-year collaboration with Inria team DEMAR (Montpellier) and Institut de Myologie (Paris) to simulate 3D models of pathological muscles, for which no standard model exist. The main idea is to use our mesh-less frame-based model to easily create mechanical models based on segmented MRI images.

7.2.10. MSTIC Adamo (03/2012 - 12/2013)

Participant: Olivier Palombi.

7.3. European & International Initiatives

7.3.1. ERC Grant Expressive (04/2012-03/2017)

Participants: Marie-Paule Cani, Stefanie Hahmann, Jean-Claude Léon.

To make expressive and creative design possible in virtual environments, the goal is to totally move away from conventional 3D techniques, where sophisticated interfaces are used to edit the degrees of freedom of pre-existing geometric or physical models: this paradigm has failed, since even trained digital artists still create on traditional media and only use the computer to reproduce already designed content. To allow creative design in virtual environments, from early draft to progressive refinement and finalization of an idea, both interaction tools and models for shape and motion need to be revisited from a user-centred perspective. The challenge is to develop reactive 3D shapes – a new paradigm for high-level, animated 3D content – that will take form, refine, move and deform based on user intent, expressed through intuitive interaction gestures inserted in a user-knowledge context. Anchored in Computer Graphics, this work reaches the frontier of other domains, from Geometry, Conceptual Design and Simulation to Human Computer Interaction.

7.3.2. PhD grant from USM (University Sains Malaysia) (08/2012 - 07/2015)

This grand from USM funds one PhD student: Chen Kim Lim who is supervised in IMAGINE my Marie-Paule Cani. The subject of the thesis is about crowd modeling and animation.

7.3.3. Piper

The main objective of this European FP7 project is to develop new tools to position and personalize advanced human body models for injury prediction in car crashes. Our partners are automobile constructors and biomechanics research labs. Our main task is to provide tools for the interactive positioning of the models in the cockpits prior to the crash simulation, using our real-time simulation software SOFA. This 42-month contract funds one engineer in Imagine, and we plan to hire post-doc students next year.

7.4. International Research Visitors

7.4.1. Visits of International Scientists

- Bedrich Benes: Inverse Procedural Modeling. University of Purdue (12/12/2013).
- Paul Kry: Preserving Topology and Elasticity for Embedded Deformable Models. University of Toronto (14/11/2013).
- James Gain: Better Interfaces to Procedural Modelling. University of Cape Town (31/11/2013).
- Joaquim Jorge: Adding More Than Two Dimensions to Tabletop Interfaces. Is Tony Stark home? Universidade de Lisboa (23/09/2013).
- Frédéric Cordier: Inferring 3D curves from sketches, Université de Haute Alsace (11/07/2013)
- Karan Singh: Pose centric animation: support for a primitive artform, Université de Toronto (04/07/2013)
- Julien Pettre: Velocity-based Models for Microscopic Crowd Simulation, Inria Rennes (20/06/2013)
- Ladislav Kavan: Elasticity-Inspired Deformers for Character Articulation University of Pennsylvania (06/06/2013)
- Yotam Gingold: Rescuing Computers from Hard Problems, George Mason University (30/05/2013)
- Eftychios Sifakis: Detailed Functional Simulation of Human Anatomy: Design Challenges, Performance Considerations and Emerging Applications, University of Winsconsin-Madison (23/05/2013)
- Marc Christie: Directors Lens: an intelligent assistant for virtual cinematography, IRISA/Inria Rennes (05/04/2013)
- Loic Barthe: Models for Intuitive Modeling, Université de Toulouse (IRIT) (07/03/2013).

LEAR Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. QUAERO Project

Participants: Matthijs Douze, Dan Oneata, Danila Potapov, Jerome Revaud, Cordelia Schmid, Franck Thollard, Heng Wang.

Quaero is a French-German search engine project supported by OSEO. It runs from 2008 to 2013 and includes many academic and industrial partners, such as Inria, CNRS, the universities of Karlsruhe and Aachen as well as LTU, Exalead and INA. LEAR/Inria is involved in the tasks of automatic image annotation, image clustering as well as large-scale image and video search. See http://www.quaero.org for more details.

8.1.2. ANR Project Qcompere

Participants: Guillaume Fortier, Cordelia Schmid, Jakob Verbeek.

This three-and-a-half year project started in November 2010. It is aimed at identifying people in video using both audio (using speech and speaker recognition) and visual data in challenging footage such as news broadcasts, or movies. The partners of this project are the CNRS laboratories LIMSI and LIG, the university of Caen, Inria's LEAR team, as well as two industrial partners Yacast and Vecsys Research.

8.1.3. ANR Project Physionomie

Participants: Frédéric Jurie [University of Caen], Jakob Verbeek, Shreyas Saxena.

Face recognition is nowadays an important technology in many applications ranging from tagging people in photo albums, to surveillance, and law enforcement. In this 3-year project (2013–2016) the goal is to broaden the scope of usefulness of face recognition to situations where high quality images are available in a dataset of known individuals, which have to be identified in relatively poor quality surveillance footage. To this end we will develop methods that can compare faces despite an asymmetry in the imaging conditions, as well as methods that can help searching for people based on facial attributes (old/young, male/female, etc.). The tools will be evaluated by law-enforcement professionals. The participants of this project are: Morpho, SensorIT, Université de Caen, Université de Strasbourg, Fondation pour la Recherche Stratégique, Préfecture de Police, Service des Technologies et des Systèmes d'Information de la Sécurité Intérieure, and LEAR.

8.1.4. PEPS CNRS BMI (Biology - Mathematics - Computer Science), Project FlipFlop

Participants: Elsa Bernard [Institut Curie, Ecoles des Mines-ParisTech], Laurent Jacob [CNRS, LBBE Laboratory], Julien Mairal, Jean-Philippe Vert [Institut Curie, Ecoles des Mines-ParisTech], Anne-Hélène Monsoro-Burq [Institut Curie].

Several inverse problems in genomics involve retrieving meaningful DNA sequences from observed data. This is for example the case of the isoform deconvolution problem of RNA-Seq data, which is currently of utmost importance in genomics. The problem can be cast as a sparse feature selection problem, where the features are mapped to the paths of a graph called "splicing graph". Even though the number of paths is exponential in the graph size, we investigate network flow optimization techniques to efficiently solve the inverse problem in polynomial time [36]. The project involves researchers in machine learning, optimization, bio-informatics, and biology, from Inria Rhone-Alpes, Institut Curie in Paris, and the LBBE laboratory in Lyon.

8.1.5. MASTODONS Program CNRS - Project Gargantua

Participants: Zaid Harchaoui, Julien Mairal.

The project is concerned with machine learning and mathematical optimization for big data. The partners are from LJK (Grenoble), LIG (Grenoble), LIENS (ENS, Paris), Lab. P. Painleve (Lille). Principal investigator/leader: Zaid Harchaoui. Dates: May 2013-Dec. 2013

8.1.6. Equipe-action ADM du Labex Persyval (Grenoble) "Khronos"

Participant: Zaid Harchaoui.

The partners of this project are from the laboratories LJK, LIG, GIPSA, TIMC, CEA. The principal investigators/leaders are Zaid Harchaoui (Inria and LJK), Massih-Reza Amini (LIG). The project will start in Jan. 2014 and end in Dec. 2016.

8.1.7. Project Math-STIC "Gauge"

Participant: Zaid Harchaoui.

The project is concerned with statistical learning with gauge regularization penalty, a project funded by the Math-STIC "pôle" of the Université Joseph Fourier (Grenoble University). The partners are Inria Rhone-Alpes, CREST-ENSAE, Université Paris-Est. Principal investigator/leader: Zaid Harchaoui
Dates: Jan 2012-Dec 2013.

8.2. European Initiatives

8.2.1. FP7 European Project AXES

Participants: Ramazan Cinbis, Matthijs Douze, Zaid Harchaoui, Dan Oneata, Danila Potapov, Cordelia Schmid, Jakob Verbeek, Clement Leray.

This 4-year project started in January 2011. Its goal is to develop and evaluate tools to analyze and navigate large video archives, eg. from broadcasting services. The partners of the project are ERCIM, Univ. of Leuven, Univ. of Oxford, LEAR, Dublin City Univ., Fraunhofer Institute, Univ. of Twente, BBC, Netherlands Institute of Sound and Vision, Deutsche Welle, Technicolor, EADS, Univ. of Rotterdam. See http://www.axes-project.eu/ for more information.

8.2.2. FP7 European Network of Excellence PASCAL 2

Participants: Zeynep Akata, Adrien Gaidon, Zaid Harchaoui, Cordelia Schmid, Jakob Verbeek.

PASCAL (Pattern Analysis, Statistical Modeling and Computational Learning) is a 7th framework EU Network of Excellence that started in March 2008 for five years. It has established a distributed institute that brings together researchers and students across Europe, and is now reaching out to countries all over the world. PASCAL is developing the expertise and scientific results that will help create new technologies such as intelligent interfaces and adaptive cognitive systems. To achieve this, it supports and encourages collaboration between experts in machine learning, statistics and optimization. It also promotes the use of machine learning in many relevant application domains such as machine vision. The project ended in February 2013.

8.2.3. ERC Advanced grant Allegro

Participants: Cordelia Schmid, Karteek Alahari, Jerome Revaud.

The ERC advanced grant ALLEGRO started in April 2013 for a duration of five years. The aim of ALLEGRO is to automatically learn from large quantities of data with weak labels. A massive and ever growing amount of digital image and video content is available today. It often comes with additional information, such as text, audio or other meta-data, that forms a rather sparse and noisy, yet rich and diverse source of annotation, ideally suited to emerging weakly supervised and active machine learning technology. The ALLEGRO project will take visual recognition to the next level by using this largely untapped source of data to automatically learn visual models. We will develop approaches capable of autonomously exploring evolving data collections, selecting the relevant information, and determining the visual models most appropriate for different object, scene, and activity categories. An emphasis will be put on learning visual models from video, a particularly rich source of information, and on the representation of human activities, one of today's most challenging problems in computer vision.

8.3. International Initiatives

8.3.1. Inria Associate Teams

- **HYPERION: Large-scale statistical learning for visual recognition.** Inria principal investigator: Zaid Harchaoui. International Partner (Institution - Laboratory - Researcher): University of California Berkeley (United States) - Electrical Engineering and Computer Science Department. Duration: 2012 - 2014. The goal of the associated team “Hyperion” is to take up the challenges of large-scale statistical learning for image interpretation and video understanding. Despite the ever-increasing number of large annotated image and video datasets, designing principled and scalable statistical learning approaches from such big computer vision datasets remains a major scientific challenge.

  The associated team consists of researchers from the LEAR project team of Inria and two teams of University of California Berkeley (resp. the Pr. Jitendra Malik and the Pr. Nourredine El Karoui teams). It allows the three teams to effectively combine their respective strengths in areas such as large-scale learning theory and algorithms, high-level feature design for computer vision, and high-dimensional statistical learning theory. It will result in significant progress in domains such as large-scale image classification, weakly-supervised learning for classification into attributes, and transfer learning.

8.3.2. Inria International Partners

- **UC Berkeley:** This collaboration between Bin Yu, Jack Gallant, Yuval Benjamini, Adam Bloniarz (UC Berkeley), Ben Willmore (Oxford University) and Julien Mairal (Inria LEAR) aims to discover the functionalities of areas of the visual cortex. We have introduced an image representation for area V4, adapting tools from computer vision to neuroscience data. The collaboration started when Julien Mairal was a post-doctoral researcher at UC Berkeley and is still ongoing. Adam Bloniarz, who is pursuing his PhD under the supervision of Prof. Bin Yu, visited LEAR duing the summer 2013.
- **University of Edinburgh:** C. Schmid collaborates with V. Ferrari, associate professor at university of Edinburgh. Our initial collaboration (co-supervision of A. Prest 2009-2012) was renewed this year. Vicky Kalogeiton started a co-supervised PhD in September 2013; she is bi-localized between Uni. Edinburgh and Inria. Her subject is the automatic learning of object representations in videos.
- **MPI Tübingen:** C. Schmid collaborates with M. Black, a research director at MPI. In 2013, she spent one month at MPI and worked with a PhD student, S. Zuffi, and a postdoctoral researcher, H. Jhuang. This resulted in two ICCV’13 publications: one on modeling pose with flexible human puppets [32] and one on measuring the impact of low, intermediate and high-level descriptions on action recognition [22]. C. Schmid plans to continue this collaboration in 2014.

8.3.3. Participation In other International Programs

- **France-Berkeley fund:** The LEAR team was awarded in 2012 a grant from the France-Berkeley fund for the project with Pr. Jitendra Malik (EECS, UC Berkeley) on "Large-scale learning for image and video interpretation". The award amounts to 10,000 USD for a period of one year, from September 2012 to September 2013. The funds are meant to support scientific and scholarly exchanges and collaboration between the two teams.

8.4. International Research Visitors

8.4.1. Visits of International Scientists

- Jitendra Malik, Professor in UC Berkeley, visited LEAR during the summer 2013 as part of the associated team "Hyperion" and a project from the France-Berkeley fund. The goal of his visit was to develop new approaches for human action classification and localization in videos.

8.4.2. Internships

- Georgia Gkioxari, a PhD student from UC Berkeley, visited LEAR during the summer 2013 as part of the associated team "Hyperion" and a project from the France-Berkeley fund. The goal of her visit was to develop new approaches for human action localization in videos.
- Hyun Oh Song, a PhD student from UC Berkeley, visited LEAR during the fall 2013 as part of the associated team "Hyperion". The goal of his visit was to develop efficient approaches for part-based models in computer vision.
- Miles Lopes, a PhD student from UC Berkeley, visited LEAR during the spring 2013 as part of the associated team "Hyperion". The goal of his visit was to develop efficient approaches for estimating statistical functionals using convex optimization.
- Adam Bloniarz, a PhD student from UC Berkeley, visited LEAR during the summer 2013 as part of the associated team "Hyperion". The goal of his visit was to develop video representations adapted to neuroscience, based upon computer vision principles.

MAVERICK Project-Team

7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. ANR BLANC: ALTA

Participants: Nicolas Holzschuch, Cyril Soler.

We are funded by the ANR research program "Blanc" for a joint research project with two other Inria research teams, REVES in Sophia-Antipolis and iPARLA in Bordeaux. The goal of this project is studying light transport operators for global illumination, both in terms of frequency analysis and dimensional analysis. The grant started in October 2011, for 48 months.

7.1.2. ANR CONTINT: Galaxy/veRTIGE

Participants: Eric Bruneton, Jean-Dominique Gascuel, Nicolas Holzschuch, Fabrice Neyret.

RTIGE stands for Real-Time and Interactive Galaxy for Edutainment. This is an ANR CONTINT (Contents and Interactions) research program, for a joint research project with the EVASION Inria project-team, the GEPI and LERMA research teams at Paris Observatory, and the RSA Cosmos company. The goal of this project is to simulate the quality multi-spectral real-time exploration of the Galaxy with Hubble-like images, based on simulation data, statistical data coming from observation, star catalogs, and procedural amplification for stars and dust clouds distributions. RSA-Cosmos aims at integrating the results in digital planetariums. The grant started in December 2010, for 48 months.

7.1.3. ANR COSINUS: ROMMA

Participants: Georges-Pierre Bonneau, François Jourdes.

The ANR project ROMMA has been accepted in 2009. It started in january 2010 for a duration of 4 years. The partners of this project are academic and industry experts in mechanical engineering, numerical simulation, geometric modeling and computer graphics. The aim of the project is to efficiently and robustly model very complex mechanical assemblies. We work on the interactive computation of contacts between mechanical parts using GPU techniques. We also investigate the Visualization of data with uncertainty, applied in the context of the project.

7.1.4. ANR CONTINT: MAPSTYLE

Participants: Joëlle Thollot, Hugo Loi.

The MAPSTYLE project aims at exploring the possibilities offered by cartography and expressive rendering to propose original and new cartographic representations. Through this project, we target two types of needs. On the one hand, mapping agencies produce series paper maps with some renderings that are still derived from drawings made by hand 50 years ago: for example, rocky areas in the series TOP25 (to 1/25000) of the French Institut Géographique National (IGN). The rendering of these rocky areas must be automated and its effectiveness retained to meet the requirements of hikers safety. On the other hand, Internet mapping tools allow any user to become a cartographer. However, they provide default styles that cannot be changed (GeoPortal, Google Maps) or they are editable but without any assistance or expertise (CloudMade). In such cases, as in the case of mobile applications, we identify the need to offer users means to design map styles more personalised and more attractive to meet their expectations (decision-making, recreation, etc.) and their tastes. The grant started on October 2012, for 48 months.

7.2. International Initiatives

7.2.1. Informal International Partners

We have a continuing collaboration with Professor Kavita Bala, from Cornell University, USA, on the subject of global illumination and simulation of light scattering in participating media. Our work has been accepted at ACM transaction on graphics in 2014.

We currently have a very fruitful collaboration with Derek Nowrouzhezarai, from University of Montreal, Canada, dealing with isotropic filter decomposition in the spherical domain, based on zonal harmonic basis.

7.3. International Research Visitors

7.3.1. Visits to International Teams

Fabrice Neyret is visiting WETA Digital (New-Zeland) since November 23, 2013. Eric Heitz visited WETA Digital (New-Zeland) from November 23, 2013 to December 12, 2013..

MESCAL Project-Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

8.1.1. CIMENT

The CIMENT project (Intensive Computing, Numerical Modeling and Technical Experiments, https://ciment.ujf-grenoble.fr/) gathers a wide scientific community involved in numerical modeling and computing (from numerical physics and chemistry to astrophysics, mechanics, bio-modeling and imaging) and the distributed computer science teams from Grenoble. Several heterogeneous distributed computing platforms were set up (from PC clusters to IBM SP or alpha workstations) each being originally dedicated to a scientific domain. More than 600 processors are available for scientific computation. The MESCAL project-team provides expert skills in high performance computing infrastructures.

The Digitalis and IDPot clusters and the Bull Machine are integrated in the CIMENT Grid. More precisely, their unused resources may be exploited to execute jobs from partners of the CIMENT project. Mescal is also involved in CIMENT through the development or OAR and CiGri.

8.2. National Initiatives

8.2.1. Inria Large Scale Initiative

- *HEMERA, 2010-2012* Leading action "Completing challenging experiments on Grid'5000 (Methodology)" (see https://www.grid5000.fr/Hemera).

  Experimental platforms like Grid'5000 or PlanetLab provide an invaluable help to the scientific community, by making it possible to run very large-scale experiments in controlled environment. However, while performing relatively simple experiments is generally easy, it has been shown that the complexity of completing more challenging experiments (involving a large number of nodes, changes to the environment to introduce heterogeneity or faults, or instrumentation of the platform to extract data during the experiment) is often underestimated.

  This working group explores different complementary approaches, that are the basic building blocks for building the next level of experimentation on large scale experimental platforms.

8.2.2. ARC Inria

- *Meneur 2011-2013*: Partners: EPI Dionysos, EPI Maestro, EPI MESCAL, EPI Comore, GET/Telecom Bretagne, FTW, Vienna (Forschungszentrum Telekommunikation Wien), Columbia University, USA, Pennsylvania State University, USA, Alcatel-Lucent Bell Labs France, Orange Labs.

  The goal of this project is to study the interest of network neutrality, a topic that has recently gained a lot of attention. The project aims at elaborating mathematical models that will be analyzed to investigate its impact on users, on social welfare and on providers' investment incentives, among others, and eventually propose how (and if) network neutrality should be implemented. It brings together experts from different scientific fields, telecommunications, applied mathematics, economics, mixing academy and industry, to discuss those issues. It is a first step towards the elaboration of a European project.

8.2.3. ANR

- *Clouds@home, 2009-2013*. Partners: Inria Grenoble (MESCAL, MOAIS), Inria Lyon (GRAAL), Inria Saclay (GRAND-LARGE).

  The overall objective of this project is to design and develop a cloud computing platform that enables the execution of complex services and applications over unreliable volunteered resources over the Internet. In terms of reliability, these resources are often unavailable 40% of the time, and exhibit frequent churn (several times a day). In terms of "real, complex services and applications", we refer to large-scale service deployments, such as Amazon's EC2, the TeraGrid, and the EGEE, and also applications with complex dependencies among tasks. These commercial and scientific services and applications need guaranteed availability levels of 99.999% for computational, network, and storage resources in order to have efficient and timely execution.

- *ANR SONGS, 2012-2015*. Partners: Inria Nancy (Algorille), Inria Sophia (MASCOTTE), Inria Bordeaux (CEPAGE, HiePACS, RunTime), Inria Lyon (AVALON), University of Strasbourg, University of Nantes.

  The last decade has brought tremendous changes to the characteristics of large scale distributed computing platforms. Large grids processing terabytes of information a day and the peer-to-peer technology have become common even though understanding how to efficiently exploit such platforms still raises many challenges. As demonstrated by the USS SimGrid project funded by the ANR in 2008, simulation has proved to be a very effective approach for studying such platforms. Although even more challenging, we think the issues raised by petaflop/exaflop computers and emerging cloud infrastructures can be addressed using similar simulation methodology.

  The goal of the SONGS project (Simulation of Next Generation Systems) is to extend the applicability of the SimGrid simulation framework from grids and peer-to-peer systems to clouds and high performance computation systems. Each type of large-scale computing system will be addressed through a set of use cases and led by researchers recognized as experts in this area.

  Any sound study of such systems through simulations relies on the following pillars of simulation methodology: Efficient simulation kernel; Sound and validated models; Simulation analysis tools; Campaign simulation management.

- *ANR MARMOTE, 2013-2016*. Partners: Inria Sophia (MAESTRO), Inria Rocquencourt (DIOGEN), PRiSM laboratory from University of Versailles-Saint-Quentin, Telecom SudParis (SAMOVAR), University Paris-Est Créteil (*Spécification et vérification de systèmes*), Université Pierre-et-Marie-Curie/LIP6.

  The project aims at realizing a software prototype dedicated to Markov chain modeling. It gathers seven teams that will develop advanced resolution algorithms and apply them to various domains (reliability, distributed systems, biology, physics, economy).

- *ANR NETLEARN, 2013-2015*. Partners: PRiSM laboratory from University of Versailles-Saint-Quentin, Telecom ParisTech, Orange Labs, LAMSADE/University Paris Dauphine, Alcatel-Lucent, Inria (MESCAL).

  The main objective of the project is to propose a novel approach of distributed, scalable, dynamic and energy efficient algorithms for managing resources in a mobile network. This new approach relies on the design of an orchestration mechanism of a portfolio of algorithms. The ultimate goal of the proposed mechanism is to enhance the user experience, while at the same time to better utilize the operator resources. User mobility and new services are key elements to take into account if the operator wants to improve the user quality of experience. Future autonomous network management and control algorithms will thus have to deal with a real-time dynamicity due to user mobility and to traffic variations resulting from various usages. To achieve this goal, we focus on two central aspects of mobile networks (the management of radio resources at the Radio Access Network level and the management of the popular contents users want to get access to) and intend to design distributed learning mechanisms in non-stationary environments, as well as an orchestration mechanism that applies the best algorithms depending on the situation.

8.2.4. National Organizations

Jean-Marc Vincent is member of the scientific committees of the CIST (Centre International des Sciences du Territoire).

8.3. European Initiatives

8.3.1. FP7 Projects

8.3.1.1. Mont-Blanc project: European scalable and power efficient HPC platform based on low-power embedded technology

Type: FP7 Programme

Objectif: ICT-2011.9.13 Exa-scale computing, software and simulation

Duration: October 2011 - October 2014

Coordinator: Alex Ramirez

Partner: BSC (Barcelone), Bull, ARM (UK), Julich (Germany), Genci, CINECA (Italy), CNRS (LIRMM, LIG)

Inria contact: Arnaud Legrand

Abstract: There is a continued need for higher computing performance: scientific grand challenges, engineering, geophysics, bioinformatics, etc. However, energy is increasingly becoming one of the most expensive resources and the dominant cost item for running a large supercomputing facility. In fact, the total energy cost of a few years of operation can almost equal the cost of the hardware infrastructure. Energy efficiency is already a primary concern for the design of any computer system and it is unanimously recognized that Exascale systems will be strongly constrained by power.

The analysis of the performance of HPC systems since 1993 shows exponential improvements at the rate of one order of magnitude every 3 years: One petaflops was achieved in 2008, one exaflops is expected in 2020. Based on a 20 MW power budget, this requires an efficiency of 50 GFLOPS/Watt. However, the current leader in energy efficiency achieves only 1.7 GFLOPS/Watt. Thus, a 30x improvement is required.

In this project, the partners believe that HPC systems developed from today's energy-efficient solutions used in embedded and mobile devices are the most likely to succeed. As of today, the CPUs of these devices are mostly designed by ARM. However, ARM processors have not been designed for HPC, and ARM chips have never used in HPC systems before, leading to a number of significant challenges.

8.3.1.2. Network of Excellence in Wireless COMmunications

Type: FP7 Programme

Objectif: 1.1 Future Networks

Duration: November 2012 - October 2015

Coordinator: Marco Louise

Partner: CNIT (IT), Aalborg University (DK), Bilkent University (TK), CNRS (FR), CTTC (ES), IASA (GR), INOV (P), Poznan University of Technology (PL), Technion (IL), Technische Universitaet Dresden (D), University of Cambridge (UK), Université de Louvain (BE), OulunYliopisto (FIN), Technische Universitaet Wien (A).

Inria contact: Panayotis Mertikopoulos

Abstract: The NEWCOM researchers will pursue long-term, interdisciplinary research on the most advanced aspects of wireless communications like Finding the Ultimate Limits of Communication Networks, Opportunistic and Cooperative Communications, Energy- and Bandwidth-Efficient Communications and Networking.

8.3.2. Collaborations in European Programs, except FP7

8.3.2.1. ESPON

Program: ESPON

Project acronym: HyperATLAS

Duration: 2007-2013

Coordinator: European Community

Abstract: The MESCAL project-team participates to the ESPON (European Spatial Planning Observation Network) http://www.espon.lu/ It is involved in the action 3.1 on tools for analysis of socio-economical data. This work is done in the consortium hypercarte including the laboratories LIG, Géographie-cité (UMR 8504) and RIATE (UMS 2414). The Hyperatlas tools have been applied to the European context in order to study spatial deviation indexes on demographic and sociological data at nuts 3 level.

8.3.2.2. CROWN

Program: European Community and Greek General Secretariat for Research and Technology

Project acronym: CROWN

Project title: Optimal Control of Self Organized Wireless Networks

Duration: 2012-2015

Coordinator: Tassiulas Leandros

Other partners: Thales, University of Thessaly, National and Kapodistrian University of Athens, Athens University of Economics and Business

Abstract: Wireless networks are rapidly becoming highly complex systems with large numbers of heterogeneous devices interacting with each other, often in a harsh environment. In the absence of central control, network entities need to self-organize to reach an efficient operating state, while operating in a distributed fashion. Depending on whether the operating criteria are individual or global, nodes interact in an autonomic or coordinated way. Despite recent progress in autonomic networks, the fundamental understanding of the operational behaviour of large-scale networks is still lacking. This project will address these emergent network properties, by introducing new tools and concepts from other disciplines.

We will first analyze how imperfect network state information can be harvested and distributed efficiently through the network using machine learning techniques. We will design flexible methodologies to shape the competition between autonomous nodes for resources, with aim to maintain robust social optimality. Both cooperating and non-cooperating game-theoretic models will be used. We also consider networks with nodes coordinating to achieve a joint task, e.g., global optimization. Using algorithms inspired from statistical physics, we will address two representative paradigms in the context of wireless ad hoc networks, namely connectivity optimization and the localization of a network of primary sources from a sensor network.

Finally, we will explore delay tolerant networks as a case study of an emerging class of networks that, while sharing most of the characteristics of traditional autonomic or coordinated networks, they present unique challenges, due to the intermittency and constant fluctuations of the connectivity. We will study tradeoffs involving delay, the impact of mobility on information transfer, and the optimal usage of resources by using tools from information theory and stochastic evolution theory.

8.3.3. Collaborations with Major European Organizations

University of Athens: Panayotis Mertikopoulos was an invited professor for 4 months.

EPFL: Laboratoire pour les communications informatiques et leurs applications 2, Institut de systèmes de communication ISC, Ecole polytechnique fédérale de Lausanne (Switzerland). We collaborate with Jean-Yves Leboudec and Nicolas Gast on fluid limits.

BCAM: Basque Center for Applied Mathematics, Bilbao (Spain). Bruno gaujal was invited to teach several time and collaborates with Jonatha Anselmi on perfect simulation.

TU Wien: Research Group Parallel Computing, Technische Universität Wien (Austria). We collaborate with Sascha Hunold on experimental methodology and reproducibility of experiments in HPC.

8.4. International Initiatives

8.4.1. Inria Associate Teams

8.4.1.1. CLOUDSHARE

Title: Guaranteed Application Performance on Idle Data Center Resources

Inria principal investigator: Arnaud Legrand

International Partner (Institution - Laboratory - Researcher):

Walfredo Cirne (Google Inc. (United States))

David P. Anderson (University of California Berkeley - Space Sciences Laboratory)

Duration: 2009 - 2014

See also: http://mescal.imag.fr/membres/derrick.kondo/ea/ea.html

Data centers are often 85% idle as they must over-provision to ensure service level agreements. At the same time, high data center utilization is essential for efficient resource usage and optimal revenue. One way to improve utilization is for low-priority applications to use the idle resources of data centers, allowing high-priority applications to preempt them at any time. While users benefit from the lower costs of using these idle resources, parallel applications such as Map-Reduce can suffer severe overheads and unpredictable performance due to unexpected preemption and unavailability. The goal of this project is to enable complex applications to utilize idle data center resources with guaranteed performance. Our approach will be as follows. First, we will investigate novel statistical methods to predict the execution time of complex batch applications. Second, we will apply machine learning methods to predict idleness in data centers. Third, we will craft fair scheduling algorithms for multiple applications that compete for idle data center resources. The collaboration bridges experts in statistical modeling and simulation from the Inria MESCAL team with system and scheduling experts in the Berkeley BOINC team and the Google Infrastructure team.

8.4.2. Inria International Partners

8.4.2.1. Declared Inria International Partners

- MESCAL has strong connections with both UFRGS (Porto Alegre, Brazil) and USP (Sao Paulo, Brazil). The creation of the LICIA common laboratory (see next section) has made this collaboration even tighter.
- MESCAL has strong bounds with the University of Illinois Urbana Champaign, within the (Joint Laboratory on Petascale Computing (see next section).
- MESCAL also has long lasting collaborations with University of California in Berkeley and a new one with Google. Arnaud Legrand visited Berkeley and the Inria Grenoble hosted the yearly BOINC workshop in 2013.

8.4.3. Inria International Labs

8.4.3.1. North America

- JLPC (Joint Laboratory on Petascale Computing) with University of University of Illinois Urbana Champaign. Several members of MESCAL are partners of this laboratory, and have done several visits to Urbana-Champaign or NCSA. One Mescal Postdoc (Slim Bougherra) spent one year in Urbana-Champaign.
- Associated Team with Berkeley. MESCAL is thus involved in the Inria@SiliconValley program.

8.4.4. Participation In other International Programs

8.4.4.1. South America

- LICIA. The CNRS, Inria, the Universities of Grenoble, Grenoble INP and Universidade Federal do Rio Grande do Sul have created the LICIA (*Laboratoire International de Calcul intensif et d'Informatique Ambiante*). On the French side, the laboratory is co-directed by Yves Denneulin and Jean-Marc Vincent, both from the MESCAL team.

  The main themes are artificial intelligence, high performance computing, information representation, interfaces and visualization as well as distributed systems.

  More information can be found at http://www.ufrgs.br/sisinfo/?ai1ec_event=terceira-reuniao-do-licia&instance_id=.

8.5. International Research Visitors

8.5.1. Visits of International Scientists

- Wenjing Wu (Chinese Academy of Science) visited MESCAL for two weeks in September.
- Sergio Gelvez Cortes (Universidad Industrial de Santander Bucaramanga, Colombia) visited MESCAL for two months.

8.5.1.1. Internships

- Wagner Kolberg (MSc UFRGS) made a 4 months internship in MESCAL.

8.5.2. Visits to International Teams

- Panayotis Mertikopoulos was invited to work for 3 weeks at Universidade de Chile (14/01 -> 2/02)
- Panayotis Mertikopoulos was invited to work for 4 months at University of Athens (01/03 -> 30/06)
- Jean-Marc Vincent was invited to work for 3 weeks at UFRGS and PUC-RS, Porto Alegre

MISTIS Project-Team

7. Partnerships and Cooperations

7.1. Regional Initiatives

- MISTIS is involved in three regional initiatives: PEPS (funded by CNRS and the PRES of Grenoble), AGIR (funded by Université Grenoble 1 and Grenoble-INP) and the MOTU project (funded by UPMF). The first two projects focus on the modelling of the extreme risk and its application in social science. The partners include the LTHE (Laboratoire d'étude des Transferts en Hydrologie et Environnement) and the 3S-R lab (Sols, Solides, Structures - Risques). The third project focuses on the use of statistical techniques for transportation data analysis and involves the GAEL laboratory (Grenoble Applied Economics Laboratory).
- MISTIS participates in the weekly statistical seminar of Grenoble. Jean-Baptiste Durand is in charge of the organization and several lecturers have been invited in this context.
- S. Girard is at the head of the probability and statistics department of the LJK since september 2012.

7.2. National Initiatives

7.2.1. Competitivity Clusters

MISTIS was a partner in a three-year MINALOGIC project (I-VP for Intuitive Vision Programming) supported by the French Government. The project was led by VI Technology (http://www.vitechnology.com), a world leader in Automated Optical Inspection (AOI) of a broad range of electronic components. The other partners involved were the CMM (Centre de Morphologie Mathématiques) in Fontainebleau, and Pige Electronique in Bourg-Les-Valence. The overall goal was to exploit statistical and image processing techniques more intensively to improve defect detection capability and programming time based on existing AOI principles so as to eventually reach a reliable defect detection with virtually zero programming skills and efforts. The final review of this project was held in March 2013 with live demos of our tools at VIT.

7.2.2. Inria project HEROES

The 2-year Inria ARC project AINSI (2011-12) coordinated by F. Forbes (http://thalie.ujf-grenoble.fr/ainsi) was followed with the same partners by a project entitled HEROES. HEROES stands for "HEmodynamics-infoRmed atlas of brain functiOnal and vascular territoriES from multimodal MR images". The goal, based on ASL and BOLD fMRI and advanced models, is to 1) provide individual brain maps of hemodynamic characteristics useful as biomarkers and 2) extend the use of functional MRI (BOLD or ASL) in the clinic through an improved characterization of the impact of vascular alterations under pathological conditions. The partners involved are Visages and Panama teams from Inria in Rennes and Parietal in Saclay, the INSERM Unit U594 (Grenoble Institute of Neuroscience) and CEA NeuroSpin.

7.3. European Initiatives

7.3.1. FP7 Projects

7.3.1.1. HUMAVIPS

Title: Humanoids with audiovisual skills in populated spaces

Type: COOPERATION (ICT)

Defi: Cognitive Systems and Robotics

Instrument: Specific Targeted Research Project (STREP)

Duration: February 2010 - January 2013

Coordinator: Inria (France)

Others partners: CTU Prague (Czech Republic), University of Bielefeld (Germany), IDIAP (Switzerland), Aldebaran Robotics (France)

See also: http://humavips.inrialpes.fr

Abstract: Humanoids expected to collaborate with people should be able to interact with them in the most natural way. This involves significant perceptual and interactive skills, operating in a coordinated fashion. Consider a social gathering scenario where a humanoid is expected to possess certain social skills. It should be able to analyze a populated space, to localize people, and to determine whether they are looking at the robot and are speaking to it. Humans appear to solve these tasks routinely by integrating the often complementary information provided by multi-sensory data processing, from 3D object positioning and sound-source localization to gesture recognition. Understanding the world from unrestricted sensorial data, recognizing people?s intentions and behaving like them are extremely challenging problems. The objective of HUMAVIPS has been to endow humanoid robots with audiovisual (AV) abilities: exploration, recognition, and interaction, such that they exhibit adequate behavior when dealing with a group of people. Developed research and technological developments have emphasized the role played by multimodal perception within principled models of human-robot interaction and of humanoid behavior. An adequate architecture has implemented auditory and visual skills onto a fully programmable humanoid robot (the consumer robot NAO). A free and open-source software platform has been developed to foster dissemination and to ensure exploitation of the outcomes of HUMAVIPS beyond its lifetime.

7.4. International Initiatives

7.4.1. Inria International Partners

7.4.1.1. Informal International Partners

The main international collaborations that we are currently trying to develop are with:

- Emma Holian and John Hinde from National University of Ireland, Galway, Ireland.
- K. Qin and D. Wraith from RMIT and Centre for Epidemiology and Biostatistics University in Melbourne, Australia.
- E. Deme and S. Sylla from Saint Louis university and IRD in Saint Louis, Senegal.
- Alexandre Nazin and Russian Academy of Science in Moscow, Russia.
- Alexis Roche and University Hospital Lausanne/Siemens Healthcare, Advanced Clinical Imaging Technology group, Lausanne, Switzerland.

7.5. International Research Visitors

7.5.1. Visits of International Scientists

- Alexander Nazin (Russian Academy of Sciences, Russia) has been an invited researcher in the MISTIS team to work with Stéphane Girard and Anatoli Ioudistki (Université Grenoble 1).
- El Hadji Deme (Université Gaston Berger, Sénégal) has been hosted by the MISTIS team for two months. His stay has been partially funded by the Ibni Oumar Mahamat Saleh price.

7.5.1.1. Internships

Jennifer Sloboda (Master, from May 2013 until Aug 2013)

Subject: Physiologically-inspired Bayesian analysis of BOLD and ASL fMRI data

Institution: University of Michigan, Ann Arbor (United States)

Aina Frau-Pascual (Master, from May 2013 until Aug 2013)

Subject: Hemodynamically informed parcellation of cerebral fMRI data

Institution: University Paris Sud

Pham Van Trung (Master, from Apr 2013 until Sep 2013)

Subject: Implémentation et paquetage d'un modèle statistique des valeurs extrêmes.

Institution: Hanoi, Vietnam.

Seydou-Nourou Sylla (PhD, from October 2013 to December 2013)

Subject: Classification for medical data

Institution: Université Gaston Berger (Sénégal)

MOAIS Project-Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

- Action OCA : Combinatorial Optimization on Accelerator. Funding by Labex PERSYVAL Grenoble.

8.2. National Initiatives

8.2.1. ANR

- **ANR grant REPDYN (2010-2013).** High performance computing for structure and fluid computing. Partners: Inria Rhône-Alpes, CEA, ONERA, EDF, LaMSID lab from CNRS and LaMCoS lab from INSA Lyon.
- **ANR/JST grant PETAFLOW (2010-2013).** France/Japan international program. Peta-scale data intensive computing with transnational high-speed networking: application to upper airway flow. Inria Rhône-Alpes, Gipsa-lab from UJF, NITC (Japan), Cyber Center of Osaka, DITS (Osaka) and the Visualization Lab of Kyoto.
- **ANR grant EXAVIZ (2011-2015).** Large Scale Interactive Visual Analysis for Life Science. Partners: Inria Rhône-Alpes, Université d'Orléans, the LBT lab from IBPC, the LIMSI from Université d'Orsay, and the CEMHTI labs from CNRS.
- **ANR HPAC (2012-2015)**. High Performance Algebraic Computing. Coordinator: UJF (LJK/CASYS team). Partners: project-team MOAIS (Grenoble), project-team ARENAIRE (LIP, Lyon), project-team SALSA (LIP6, Paris), the ARITH group (LIRMM lab, Montpellier).
- **Equipex Kinovis (2012-2017)**. 2.6 Meuros. Large scale multi-camera platform (extension of the Grimage platform to 60 cameras, depth and X-ray cameras). Coordinator E Boyer, LJK Inria MORPHEO team. Partners: Inria Rhône-Alpes and the LJK, LIG, LADAF and GIPSA labs.
- **ANR-11-LABX-0025 PERSYVAL-Lab** funds the following PhD in collaboration with other labs:
  - in collaboration with Verimag: Multi-objective optimization for resource management on multicore systems, (PhD Abhinav Srivastav, since 9/2012)
  - In collaboration with Gipsa-lab and Inria BiBop: Simulations of Fibrous Materials. (PhD Gilles Daviet, since 9/2013)
  - in collaboration with Inria Privatics and Verimag: Secure Outsourcing (PhD Amrit Kumar, since 11/2013)

8.2.2. Competitivity Clusters

- SoC-Trace, Minalogic 2011-2014 contract. This project aims the development of tools for the monitoring and debug of mumticore systems on chip. Leader: ST-Microelectonic. Partners: Inria (Mescal, Moais); UJF (TIMA, LIG/Hadas); Magilem, ProBayes. Moais contributes with technics and tools for visual aggregation of application traces. The contract funds 1 phD thesis (Damien Dosimont) and 1 year engineer.

8.2.3. National ADT

- ADT K'STAR with cooperation between EPIs MOAIS and RUNTIME (Bordeaux). Coordinator: T. Gautier. https://gforge.inria.fr/projects/kstar. The main objective is to provide OpenMP-3.1 with some extension from OpenMP-4.0 standard to perform OpenMP programs on multi-CPUs multi-GPUs by using Kaapi and StarPU runtimes.

8.2.4. Inria Project Lab

8.2.4.1. C2S@Exa - Computer and Computational Scienecs at Exascale

Participants: Olivier Aumage [RUNTIME project-team, Inria Bordeaux - Sud-Ouest], Jocelyne Erhel [SAGE project-team, Inria Rennes - Bretagne Atlantique], Philippe Helluy [TONUS project-team, Inria Nancy - Grand-Est], Laura Grigori [ALPINE project-team, Inria Saclay - Île-de-France], Jean-Yves L'excellent [ROMA project-team, Inria Grenoble - Rhône-Alpes], Thierry Gautier [MOAIS project-team, Inria Grenoble - Rhône-Alpes], Luc Giraud [HIEPACS project-team, Inria Bordeaux - Sud-Ouest], Michel Kern [POMDAPI project-team, Inria Paris - Rocquencourt], Stéphane Lanteri [Coordinator of the project], François Pellegrini [BACCHUS project-team, Inria Bordeaux - Sud-Ouest], Christian Perez [AVALON project-team, Inria Grenoble - Rhône-Alpes], Frédéric Vivien [ROMA project-team, Inria Grenoble - Rhône-Alpes].

Since January 2013, the team is participating to the C2S@Exa http://www-sop.inria.fr/c2s_at_exa Inria Project Lab (IPL). This national initiative aims at the development of numerical modeling methodologies that fully exploit the processing capabilities of modern massively parallel architectures in the context of a number of selected applications related to important scientific and technological challenges for the quality and the security of life in our society. At the current state of the art in technologies and methodologies, a multidisciplinary approach is required to overcome the challenges raised by the development of highly scalable numerical simulation software that can exploit computing platforms offering several hundreds of thousands of cores. Hence, the main objective of C2S@Exa is the establishment of a continuum of expertise in the computer science and numerical mathematics domains, by gathering researchers from Inria project-teams whose research and development activities are tightly linked to high performance computing issues in these domains. More precisely, this collaborative effort involves computer scientists that are experts of programming models, environments and tools for harnessing massively parallel systems, algorithmists that propose algorithms and contribute to generic libraries and core solvers in order to take benefit from all the parallelism levels with the main goal of optimal scaling on very large numbers of computing entities and, numerical mathematicians that are studying numerical schemes and scalable solvers for systems of partial differential equations in view of the simulation of very large-scale problems.

T. Gautier is coordinator of the Pole 4: Programming Models.

8.3. European Initiatives

8.3.1. FP7 Projects

8.3.1.1. VISIONAIR

Type: CAPACITIES

Defi: INFRA-2010-1.1.29

Instrument: Combination of COLLABORATIVE PROJECTS and COORDINATION and SUPPORT ACTIONS

Objectif: NC

Duration: February 2011 - January 2015

Coordinator: Frédéric Noël (Inpg)

Partner: Inria (France)

Inria contact: G. Dumont

Abstract: Visionair calls for the creation of a European infrastructure for high level visualisation facilities that are open to research communities across Europe and around the world. By integrating existing facilities, Visionair aims to create a world-class research infrastructure for conducting state-of-the-art research in visualisation, thus significantly enhancing the attractiveness and visibility of the European Research Area (ERA). With over 20 members across Europe participating, VISIONAIR offers facilities for Virtual Reality, Scientific Visualisation, Ultra High Definition, Augmented Reality and Virtual Services.

8.4. International Initiatives

8.4.1. Participation In other International Programs

- The MOAIS EPI is activiley participating to the international LICIA lab supporting collaborations with the UFRGG, Brazil. Bruno Raffin is member of the LICIA scientific comittee.
- Moais is also leading a CAPES/COFECUB program (2013-2014) with UFRGS, Brazil.
- Moais is also leading a CAPES/COFECUB program (2013-2014) with USP, Brazil.

8.5. International Research Visitors

8.5.1. Visits of International Scientists

- Jacek Blazewicz (Professor, Polish Academy of Sciences, Poznań), invited prof INP (2 months)
- Afredo Goldman (Professor, USP Sao Paulo) (1 month)
- Daniel Cordeiro (Postdoc, USP Sao Paulo) (1 month)
- Mario Cesar Lopez Loces (UFRGS) (1 month)
- Adel Essafi (ISIG Kairouan, Tunis) (2 month)

8.5.2. Visits to International Teams

- Damien Dosimont, Oct-Dec 2013, UFRGS, Brazil
- Clement Pernet, sabbatical, Sept-Dec 2013, LIP Lyon, Aric Team

MOISE Project-Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

- M. Nodet is responsible for the workpackage "numerical modelling" within the regional project (Région Rhône-Alpes) "**Envirhonalp**" http://www.envirhonalp.fr.
- M. Nodet is involved in E. Maitre MSTIC project MENTOL about Optimal Transport.
- A. Rousseau leads the working group *Couplage Fluide/Vivant* in Montpellier for the study of coupled systems (fluid dynamics and life sciences) in nearshore regions. This research is funded by the Labex NUMEV in Montpellier.
- Clémentine Prieur is a member of the project "Soutien à l'Excellence et à l'Innovation Grenoble INP" MEPIERA (MEthodologies innovantes Pour l'Ingénierie de l'Eau et des Risques Associés) leaded by A.- C. Favre (LTHE).

8.1.1. Collaborations with Various Regional Research Teams

- LGGE, MEOM team : 6.3.2 ,6.2.1 ,6.3.2 ,6.3.6 , 6.3.5 , 6.1.2 .
- LGGE Grenoble, Edge team (C. Ritz, O. Gagliardini, F. Gillet-Chaulet, G. Durand), see paragraphs 6.2.2 and 6.2.3 .
- LTHE, A.C. Favre: hydrological risk assessment.
- LTHE, Thierry Lebel, Théo Vischel: tracking of mesoscale convective systems,
- LTHE, MISTIS, LJK: PEPS (CNRS, PRES Grenoble) project AGREE on multivariate risk assessment. The project was funded in 2013 and leaded by M. Clausel (LJK).
- LTHE, MISTIS, LJK: AGIR project. Clémentine Prieur obtained the funding for a thesis on risk assessment.
- Building energy (G2ELab, Mathilde Grandjacques, Benoît Delinchant). : 6.4.1 ,6.5
- Univ. Lyon 1 collaboration with V. Maume-Deschamps and S. Loisel.

8.2. National Initiatives

8.2.1. Interactions with other Inria Project-Teams or Actions

Participants	Inria Project-Team	Research topic	Link
F. Lemarié	POMDAPI	Coupling methods	6.1.1
A. Rousseau	TOSCA	Stochastic Downscaling Method	5.4
A. Rousseau	MODEMIC	Bioremediation of natural resources	6.10
C.Prieur, P. Tencaliec	MISTIS	hydrological risk assessment	6.6
C. Helbert, C.Prieur, A. Vidard, N. Papadakis	STEEP	Calibration and sensitivity analysis for LUTI models	6.9
A. Vidard M. Nodet F.X. Le Dimet	CLIME, FLUMINANCE	Image assimilation	6.3.2
A. Vidard, M. Nodet, E.Kazantsev	TROPICS	Ocean Adjoint Modelling	6.2.1 ,6.3.6
L.Debreu,	CLIME, FLUMINANCE	Multiscale data assimilation	6.2.1
C.Prieur, L. Viry	GRAAL	Grid deployment for the study of West African Monsoon	6.4

8.2.2. Collaborations with other Research Teams in France

Participants	Research Team	Research topic	Link
L. Debreu, F. Lemarié	IFREMER (Brest), LOCEAN (Paris)	Ocean modelling, Ocean-atmosphere coupling	6.1.2 , 6.1.1
F. Lemarié	CNRM (Toulouse)	Ocean-atmosphere coupling	6.1.1
A. Rousseau	Institut de Mathématiques et de Modélisation de Montpellier (I3M)	Modelling and simulation of coastal flows	6.1
A. Rousseau	Laboratoire de Météorologie Dynamique (Ecole Polytechnique)	Stochastic Downscaling Method	5.4
E.Blayo, A.Rousseau, F. Lemarié	LAMFA (Amiens), LAGA (Paris 13)	Coupling methods	6.1.1 , 6.1.1
A. Rousseau	IFREMER (Sète), UMR Ecosym (Montpellier)	Coupling fluids and life sciences	6.10
C. Prieur	IMT Toulouse, IFP Rueil, EDF, CEA Cadarache	Sensitivity analysis	6.4.1
C. Prieur	ISFA Lyon 1, Université de Bourgogne, CNAM	Multivariate risk indicators	6.6
C. Prieur	IMT Toulouse, Caracas	non parametric estimation for hypoelliptic diffusions	6.7
A. Vidard	Centre Européen de Recherche et de Formation Avancée en Calcul Scientifique (Toulouse), Mercator-Océan (Toulouse), Laboratoire de Physique des Océans (Brest),	Ocean Data Assimilation	6.2.1
A. Vidard	LOCEAN (Paris)	Ocean Adjoint Modelling	6.2.1
A. Vidard	LPO (Brest), CERFACS	Ocean data assimilation	6.2.1
B.Lemieux	LSCE (Laboratoire des Sciences de l'Environnement et du Climat)	DatIce tool	5.3

8.2.3. Other National Initiatives:

- A. Vidard leads a group of projects gathering multiple partners in France and UK on the topic "Variational Data Assimilation for the NEMO/OPA9 Ocean Model", see 6.2.1 .
- C. Prieur chairs GdR MASCOT NUM, in which are also involved M. Nodet, E. Blayo, A. Rousseau, C. Helbert, L. Viry, A. Janon, S. Nanty, L. Gilquin and G. Chastaing. http://www.gdr-mascotnum.fr/doku.php
- M. Nodet is PI of the project "Méthodes inverses en glaciologie" supported by INSU-LEFE.
- A. Rousseau is PI of the project COCOA "Couplages Côtes, Océan, Atmosphère" supported by INSU-LEFE.
- F. Lemarié leads a group of projects gathering multiple partners in France on the topics « ocean-atmosphere coupling » and « numerical analysis of time schemes in ocean models » (funded by CNRS-INSU LEFE).

- E.Kazantsev, E.Blayo, F. Lemarié participate in the project "PACO - Vers une meilleure paramétrisation de la côte et des conditions limites dans les modèles d'océan" supported by LEFE-GMMC and LEFE-MANU .
- M. Nodet is involved in GDR Calcul and GDR Ondes.
- E. Blayo is the chair of the CNRS-INSU research program on mathematical and numerical methods for ocean and atmosphere LEFE-MANU. http://www.insu.cnrs.fr/co/lefe
- L. Debreu is the coordinator of the national group COMODO (Numerical Models in Oceanography)

8.2.4. ANR

- A 4-year ANR contract: ANR COSTA-BRAVA (Complex Spatio-Temporal Dynamics Analysis by Reduced Models and Sensitivity Analysis)http://www.math.univ-toulouse.fr/COSTA_BRAVA/index.html
- A 4-year ANR contract: ANR ADAGe (Adjoint ice flow models for Data Assimilation in Glaciology.
- A 4-year ANR contract: ANR Geo-FLUIDS (Fluid flows analysis and simulation from image sequences: application to the study of geophysical flows, see paragraph 6.3.2) .
- A 4-year ANR contract: ANR TOMMI (Transport Optimal et Modèles Multiphysiques de l'Image), see paragraphs 6.3.3 ,6.3.2 .
- A 4 year ANR contract (2011-2015): ANR COMODO (Communauté de Modélisation Océanographique) on the thematic "Numerical Methods in Ocean Modelling". (coordinator L. Debreu) 6.1.2
- A 3.5 year ANR contract: ANR CITiES (numerical models project selected in 2012). http://steep.inrialpes.fr/?page_id=46

8.3. European Initiatives

8.3.1. FP7 Projects

8.3.1.1. ERA-CLIM2

Type: COOPERATION

Instrument: Specific Targeted Research Project

Program: Collaborative project FP7-SPACE-2013-1

Project acronym: ERA-CLIM2

Project title: European Reanalysis of the Global Climate System

Duration: 01/2014 - 12/2016

Coordinator: Dick Dee (ECMWF, Europe)

Other partners: Met Office (UK), EUMETSAT (Europe), Univ Bern (CH), Univ. Vienne (AT), FFCUL (PT), RIHMI-WDC (RU), Mercator-Océan (FR), Météo-France (FR), DWD (DE), CERFACS (FR), CMCC (IT), FMI (FI), Univ. Pacifico (CL), Univ. Reading (UK), Univ. Versailles St Quentin en Yvelines (FR)

Inria contact: Arthur Vidard

8.3.2. Collaborations with Major European Organizations

Partner: European Centre for Medium Range Weather Forecast. Reading (UK)

World leading Numerical Weather Centre, that include an ocean analysis section in order to provide ocean initial condition fo the coupled ocean atmosphere forecast. They play a significant role in the NEMOVAR project in which we are also partner.

Partner: Met Office (U.K) National British Numerical Weather and Oceanographic service. Exceter (UK).

We do have a strong collaboration with their ocean initialization team through both our NEMO, NEMO-ASSIM and NEMOVAR activities. They also are our partner in the NEMOVAR consortium.

Partner: Marine Hydrographic Institute, Natinal Ac.Sci. Ukraine, Sevastopol.

We have a long term collaboration about data assimilation with the Black Sea. This collaboration is getting to a new level with their plan to adopt NEMO and NEMOVAR for their operational forecasting system. On our side, we will benefit from their expertise on the Black Sea dynamics, that is an excellent test case for our developments and methods.

Partner: GDR-E CONEDP

Subject: Control of Partial Differential Equations.

Partner: University of Reading, Department of Meteorology, Department of Mathematics

Subject: Data assimilation for geophysical systems.

8.4. International Initiatives

8.4.1. Inria International Labs

- A. Rousseau spent 2 weeks in Santiago in April 2013 and started a collaboration with Inria Chile.

8.4.2. Participation In other International Programs

- C. Prieur collaborates with Antonio Galves (University Sao Paulo) and Jose R. Leon (UCV, Central University of Caracas). She is a member of a USP-COFECUB project on the study of stochastic models with variable length memory (2010-2013) with University of Sao Paulo.
- C. Prieur is leader of a project ECOS Nord with Venezuela (2012-2015).
- F.-X. Le Dimet collaborates with the Institute of Mechanics of the Vietnamese Academy of Sciences Ha Noi, and with the Institute of Numerical Mathematics of the Russian Academy of Sciences.
- F. Lemarié collaborates with A.F. Shchepetkin and J.C. McWilliams from the University of California at Los Angeles (UCLA).

8.5. International Research Visitors

8.5.1. Visits of International Scientists

- Angie Pineda (invited 6 weeks in 2013 by C. Prieur through the ECOS Nord project),
- Jose R. León (invited 2 weeks in 2013 by C. Prieur through the ECOS Nord project).
- Victor Shutyaev, Institute of Numerical Mathematics, Russian Academy of Sciences, Moscow (invited for 4 weeks by F.-X. Le Dimet, see 6.4.2 , 6.4.3)
- Igor Gejadze, University of Strathclyde, Glasgow, UK (invited for 4 week by F.-X. Le Dimet, see 6.4.2)
- Nancy Nichols, University of Reading, invited for 1 week by A. Vidard and M. Nodet

8.5.2. Visits to International Teams

- F.-X. Le Dimet was invited to the Florida State University for 6 weeks in May 2013 and to the Institute of Numerical Mathematics Moscow for 2 weeks in June 2013

MORPHEO Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

8.1.1. ARC6 project PADME – Perceptual quality Assessment of Dynamic MEshes and its applications

In this project, we propose to use a new and experimental "bottom-up" approach to study an interdisciplinary problem, namely the objective perceptual quality assessment of 3D dynamic meshes (i.e., shapes in motion with temporal coherence). The objectives of the proposed project are threefold:

1. to understand the HVS (human visual system) features when observing 3D animated meshes, through a series of psychophysical experiments;
2. to develop an efficient and open-source objective quality metric for dynamic meshes based on the results of the above experiments;
3. to apply the learned HVS features and the derived metric to the application of compression and/or watermarking of animated meshes.

This work is funded by the Rhône-Alpes région through an ARC6 grant for the period 2013-2016. The three partners are LIRIS (University Lyon 1, Florent Dupont), GIPSA-Lab (CNRS, Kai Wang) and LJK (University of Grenoble, Franck Hétroy). The PhD thesis of Georges Nader is part of the project.

8.2. National Initiatives

8.2.1. Motion analysis of laboratory rodents

In order to evaluate the scalabililty of previous work on motion analysis of laboratory rodents, a collaboration has been initiated with the Institut Clinique de la Souris (ICS), in Institut de Génétique et de Biologie Moléculaire et Cellulaire (IGBMC). This institute is dedicated to phenotypying of mice and requires reliable motion analysis tools. A multicamera plateform has been deployed at ICS and will be exploited next year for tests ranging from one to two hundreds mice.

8.2.2. ANR

8.2.2.1. ANR project Morpho – Analysis of Human Shapes and Motions

Morpho is aimed at designing new technologies for the measure and for the analysis of dynamic surface evolutions using visual data. Optical systems and digital cameras provide a simple and non invasive mean to observe shapes that evolve and deform and we propose to study the associated computing tools that allow for the combined analysis of shapes and motions. Typical examples include the estimation of mean shapes given a set of 3D models or the identification of abnormal deformations of a shape given its typical evolutions. Therefore this does not only include static shape models but also the way they deform with respect to typical motions. It brings a new research area on how motions relate to shapes where the relationships can be represented through various models that include traditional underlying structures, such as parametric shape models, but are not limited to them. 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. 3 academic partners will collaborate on this project: the Inria Rhône-Alpes with the Morpheo team, the GIPSA-lab Grenoble and the Inria Lorraine with the Alice team. Website: http://morpho.inrialpes.fr/.

8.2.3. Competitivity Clusters

8.2.3.1. FUI project Creamove

Creamove is a collaboration between the Morpheo team of the Inria Grenoble Rhône-Alpes, the 4D View Solution company specialised in multi-camera acquisition systems, the SIP company specialised in multimedia and interactive applications and a choreographer. The objective is to develop new interactive and artistic applications where humans can interact in 3D with virtual characters built from real videos. Dancer performances will be pre-recorded in 3D and used on-line to design new movement sequences based on inputs coming from human bodies captured in real time.

8.3. European Initiatives

8.3.1. FP7 Projects

8.3.1.1. Re@ct

Type: COOPERATION

Challenge: IMMERSIVE PRODUCTION AND DELIVERY OF INTERACTIVE 3D CONTENT

Instrument: Specific Targeted Research Project

Objective: Networked Media and Search Systems

Duration: December 2011 - November 2014

Coordinator: BBC (UK)

Partner: BBC (UK), Fraunhofer HHI (Germany), University of Surrey (UK), Artefacto (France), OMG (UK).

Inria contact: Jean-Sébastien Franco, Edmond Boyer

Abstract: RE@CT will introduce a new production methodology to create film-quality interactive characters from 3D video capture of actor performance. Recent advances in graphics hardware have produced interactive video games with photo-realistic scenes. However, interactive characters still lack the visual appeal and subtle details of real actor performance as captured on film. In addition, existing production pipelines for authoring animated characters are highly labour intensive. RE@CT aims to revolutionise the production of realistic characters and significantly reduce costs by developing an automated process to extract and represent animated characters from actor performance capture in a multiple camera studio. The key innovation is the development of methods for analysis and representation of 3D video to allow reuse for real-time interactive animation. This will enable efficient authoring of interactive characters with video quality appearance and motion. The project builds on the latest advances in 3D and free-viewpoint video from the contributing project partners. For interactive applications, the technical challenges are to achieve another step change in visual quality and to transform captured 3D video data into a representation that can be used to synthesise new actions and is compatible with current gaming technology.

8.4. International Initiatives

8.4.1. Inria Associate Teams

The Morpheo team is associated with the Matsuyama lab. at the University of Kyoto (http://morpheo.inrialpes.fr/Kyoto/). Both entities are working on the capture of evolving shapes using multiple videos and the objective of the collaboration is to make progress on the modeling of dynamic events using visual cues with a particular emphasize on human gesture modeling for analysis purposes. To this aim, the collaboration fosters exchanges between researchers in this domain, in particular young researchers, through visits between the two teams. In the frame of this collaboration, a workshop was organized in November 2013 at the Inria Grenoble (http://morpheo.inrialpes.fr/kyoto/inria-kyoto-workshop-on-4d-modeling/).

8.4.2. Inria International Partners

8.4.2.1. Informal International Partners

8.4.2.1.1. Collaboration with Forest Research, UK

A common work with an ecophysiologist from Forest Research, Eric Casella, is currently carried out to recover useful geometric information from unorganized point clouds of plants and trees, obtained with a terrestrial laser scanning device. Preliminary results have been presented this year at the FSPM conference [4].

8.4.2.1.2. Collaboration with TU Munich

The long term collaboration with TU Munich and Slobodan Ilic on human motion capture is ongoing with the work of Paul Huang [7] that was published at 3DV this year and received a best paper award. The work contributes with an approach that recovers both the shape and the articulated pose of a human body, over time sequences, using multiple videos.

8.5. International Research Visitors

8.5.1. Visits of International Scientists

- Prof. Matsuyama, Kyoto University, Matsuyama Lab, Japan.
- Associate Prof. Shohei Nobuhara, Kyoto University, Matsuyama Lab, Japan
- Assistant prof. Tony Tung, Kyoto University, Matsuyama Lab, Japan.

NANO-D Team

6. Partnerships and Cooperations

6.1. Regional Initiatives

- **ARC 2012**: This grant from the Rhone-Alpes region (http://www.arc.rhonealpes.fr/) has been provided to S. Redon, Jean-François Méhaut (LIG - Laboratoire d'Informatique de Grenoble) and Benjamin Bouvier (IBCP - Institut de Biologie et Chimie des Proteines) to develop adaptive, parallel algorithms for molecular simulation. The grants is for a PhD student.

6.2. National Initiatives

6.2.1. ANR

In 2013, NANO-D had funding from four ANR programs:

- **ANR Jeunes Chercheurs Jeunes Chercheuses (JCJC)**: 340,000 Euros over three years (2011-2014). This grant has been provided to S. Redon by the French Research Agency for being a finalist in the ERC Starting Grant 2009 call, and is for two PhD students and an engineer.
- **ANR Modeles Numeriques (MN)**: 180,000 Euros over four years (2011-2015). This project, coordinated by NANO-D (S. Grudinin), gathers biologists and computer scientists from three research groups: Dave Ritchie at LORIA, Valentin Gordeliy at IBS (total grant: 360,000 Euros).
- **ANR PIRIBio**: 25,000 Euros over four years (2010-2013). We are participating in this project coordinated by Michel Vivaudou at IBS, with Serge Crouzy at CEA/LCBM and Frank Fieschi at IBS.

6.2.2. PEPS

Sergei Grudinin participates in the Cryo-CA PEPS project. Cryo-CA (Computational algorithms for biomolecular structure determination by cryo-electron microscopy) is a 2-years project, supported by the Projets Exploratoires Pluridisciplinaires (PEPS) program in the panel Bio-Maths-Info provided by CNRS (French National Centre for Scientific Research). The project started on the 01/09/2012. Its main goal is to develop computational algorithms for cryo-electron microscopy (cryo-EM).

The partners of the Cryo-CA project are: Inria Nancy / Team Orpailleur (David Ritchie); Inria Grenoble / Team NANO-D (Sergei Grudinin); and INSERM IGBMC/ Team Integrated structural Biology (Annick Dejaegere, Patrick Schultz, and Benjamin Schwarz).

The main scientific aim of this cross-disciplinary project is to develop computational algorithms to help experimentalists and molecular modelers to solve more rapidly and accurately the structures of macromolecular complexes using cryo-electron microscopy (cryo- EM) and integrative structural biomolecular modeling techniques. More specifically, this PEPS initiative aims to address two important challenges in single particle cryo-EM, namely particle picking and multi-dimensional structure fitting. In the longer term, a further driving aim of this project is to develop strong collaborations amongst the participating teams to position ourselves for a larger project proposal to ANR or ERC.

6.3. European Initiatives

6.3.1. FP7 Projects

6.3.1.1. ADAPT

Type: IDEAS

Defi: NC

Instrument: ERC Starting Grant

Objectif: Theory and algorithms for adaptive particle simulation

Duration: September 2012 - August 2017

Coordinator: Stephane Redon

Inria contact: Stephane Redon

6.4. International Initiatives

6.4.1. Inria International Partners

6.4.1.1. Informal International Partners

NANO-D has an ongoing collaboration with the research group of Pr. Dr. Markus Reiher in ETH Zürich, to develop interactive quantum chemistry methods assisted with haptic feedback.

6.5. International Research Visitors

6.5.1. Visits of International Scientists

- Pr. Dr. Markus Reiher, from ETH Zürich, visited NANO-D in January 2013
- Pr. Eric Polizzi, from the University of Massachusetts Amherst, visited NANO-D in March 2013
- PhD students Moritz Haag and Arndt Finkelmann, from the Reiher group at ETH Zürich, visited NANO-D in October 2013

6.5.1.1. Internships

Astha Agarwal

Subject: Development of a Coarse-Grained Potential Function for Protein Folding and De Novo Design

Date: from May 2013 until Jul 2013

Institution: IIT Bombay (India)

NECS Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR VOLHAND

VOLHAND (**VOL**ant pour personne âgée et/ou **HAND**icapée) is a project funded by the ANR (National Research agency). This project, started in October 2009, is a result of collaboration between C. Canudas de Wit and Franck Quaine/Violaine Cahouët (from the biomechanical team of GIPSA-LAB). The project has concerned the development of a new generation of Electrical power-assisted steering specifically designed for disabled and aged people. Our contribution has been to design new assisted laws, taking into account the specific mechanical characteristics of this particular population of drivers. The consortium was composed by: LAMIH, CHRU, Fondation Hopale, GIPSA-LAB, INRETS and JTEKT. More information can be found on-line: http://www.univ-valenciennes.fr/volhand/.

8.1.2. PREDIT MoCoPo

The MOCoPo project (Measuring and mOdelling traffic COngestion and POllution) is funded by the French Ministry in charge of Transport (MEDDTL), through the PREDIT (Research and Innovation in Land Transport Program). The project began in January 2011 and will end up in December 2013. Various research institutes and universities, some teams of the MEDDTL and pollution measurements associations are involved in the project: LICIT (Transport and Traffic Engineering Laboratory, joint unit of IFSTTAR and ENTPE), LTE (Transports and Environment Laboratory, IFSTTAR), LEPSIS (Laboratory for Road Operations, Perception, Simulators and Simulations, IFSTTAR), IM (Infrastructures and Mobility Department, IFSTTAR), MACS (Monitoring, Assessment, Computational Sciences, IFSTTAR), Inria-NECS, Atmo Rhône Alpes, DIR-CE (Center-East Direction of Roads), LRPC Angers (Regional Laboratory of Angers), CERTU (Center for Cities and Urban Transportation), and CEREA (Center of Teaching and Research in Atmospheric Environment, laboratory Ecole des Ponts ParisTech / EDF Research and Development). NECS is particularly involved in tasks devoted to travel-time estimation and prediction. For this purpose one post-doc (Fabio Morbidi) has been hired. More information can be found on-line: http://mocopo.ifsttar.fr/.

8.1.3. PEPS META-TRAM

META-TRAM is a PEPS-CNRS project funded for two years (2013-2015). It aims at studying tensor methods for analyzing traffic data. Indeed, for a better management of mobility in modern cities (avoid or better control episodes of congestion, accurately predict traffic trends, finely analyze urban and suburban trips via multimodal networks), it is necessary to develop appropriate analytic tools that integrate multimodality and heterogeneity of networks from inherently multidimensional measures. Three areas are studied: tensor modeling for estimating origin-destination matrices, dynamic clustering flow and synthesis of distributed algorithms adapted to large volume of data, diversity of sensors, and their spatial dispersion. This project involves also I3S Lab (Sophia Antipolis) and CRAN (Nancy).

8.1.4. Other collaborations

Inertial and magnetic data integration for human movements analysis

The goal of this consortium is to work together on how to deal with inertial data in different or complementary fields. Orange Grenoble lab works on the analysis of inertial data. Orange sells some smart-phones equipped with inertial unit. The goal of Orange is to develop from these data some analysis bricks. The bricks are identified by: a) Monitoring of activity by identifying postures and deduce the activity by a correlation table, b) Prevention of falls by an analysis of walking monitoring, c) Monitoring of indoor and outdoor trajectory, d) Position of the sensor, and e) Identification of the dynamic parts of the signal. Orange offers to provide laboratories participating in the consortium: a) The database created through a 2012 IGS experiment where 7 peoples wore smart-phones for 3 months and the report of the experiment, b) The ability to store the data recorded by the consortium on a server in the capacity limit of the predefined server, c) The loan of smart-phones, and d) A schedule of specifications of a service activity monitoring of remote person. A consortium agreement has been signed by eight laboratories: INSA-INL, UJF-AGIM, UJF-GIPSA, CNRS-LAAS, CNRS-IRIT, Amines- école des mines de Douai, ISFTTAR, UTT et Orange Labs.

8.2. European Initiatives

8.2.1. FP7 Projects

8.2.1.1. Hycon2

Type: COOPERATION

Objective: Engineering of Networked Monitoring and Control Systems

Instrument: Network of Excellence

Objective: Engineering of Networked Monitoring and Control systems

Duration: September 2010 - August 2014

Coordinator: CNRS (France)

Partners: Inria (France), ETH Zurich (Switzerland), TU Berlin (Germany), TU Delft (Netherlands) and many others

Inria contact: C. Canudas de Wit

Abstract: Hycon 2 aims at stimulating and establishing a long-term integration in the strategic field of control of complex, large-scale, and networked dynamical systems. It focuses in particular on the domains of ground and aerospace transportation, electrical power networks, process industries, and biological and medical systems.

See also: http://www.hycon2.eu

8.2.1.2. SPEEDD (Scalable ProactivE Event-Driven Decision making)

Type: STREP

Objective: ICT-2013.4.2a – Scalable data analytics – Scalable Algorithms, software frameworks and viualisation

Duration: Feb. 2014 to Jan. 2017.

Coordinator: National Centre of Scientific Research 'Demokritos' (Greece)

Partners: IBM Israel, ETH Zurich (CH), Technion (Israel), Univ. of Birmingham (UK), NECS CNRS (France), FeedZai (Portugal)

Inria contact: C. Canudas de Wit

Abstract: SPEEDD will develop a prototype for robust forecasting and proactive event-driven decision-making, with on-the-fly processing of Big Data, and resilient to the inherent data uncertainties. NECS will lead the intelligent traffic-management use and show case.

See also: http://speedd-project.eu

8.2.1.3. CPSoS

Carlos Canudas de Wit participates to the working group WG1 "Systems of Systems in transportation and logistics" of the support action CPSoS "Towards a European Roadmap on Research and Innovation in Engineering and Management of Cyber-physical Systems of Systems", led by TU Dortmund (Germany).

8.3. International Initiatives

8.3.1. Inria Associate Teams

NECS has submitted a proposal for the construction of a new associate team: COMFORT, with partner UC Berkeley/PATH. The proposal has been accepted, and the associate team will be funded for the period 2014-2016.

8.3.2. Inria International Partners

H. Fourati has a collaboration with the Kazakhstan National Technical University (KazNTU). He currently co-advises (with Pr. Olga Shiryayeva in KazNTU) Zarina Samigulina, a PhD student in KazNTU.

8.3.3. Participation In other International Programs

8.3.3.1. TeMP

TeMP (Tensor-based information Modelling and Processing) is a project funded in the framework of the French-Brazilian bilateral collaboration program (FUNCAP-Inria). It started from August 2011 and ended in December 2013. It was coordinated for the French part by A. Kibangou and aimed to study, analyze, propose and evaluate new models and techniques for digital communication systems using tensors and multilinear algebra tools, through in-depth theoretical analysis of mathematical models, optimization algorithms, and computational simulations. Distributed and collaborative algorithms have been devised for processing tensors involved in cooperative communications. In addition, new methods for processing very large tensors (big data issue) have been obtained. A special session has been organized in CAMSAP 2013 by A. de Almeida, the coordinator of the Brazilian side of the project.

8.4. International Research Visitors

8.4.1. Visits of International Scientists

- Zarina Samigulina, PhD student, Kazakhstan National Technical University (KazNTU), one-month visit (mid-May to mid-July).
- The following professors from UFC Brazil visited NECS within the framework of the TeMP project: André L. F. de Almeida (Associate Professor) in February and November for one week each stay; Carlos Alexandre Rolim Fernandes (Associate Professor) in May for one week; Carlos Estevao Rolim Fernandes (Associate Professor) in May for three days.
- prof. Antonella Ferrara, from Università di Pavia (Italy), has been visiting NECS regularly, with multiple visit of a few days, for an active collaboration on the traffic application, within Hycon2 project.

8.4.1.1. Internships

- Giulio Bontadini, Master student, Università di Pavia (Italy), from March to August, co-advised by C. Canudas de Wit and A. Ferrara, master thesis: *Modeling and control of traffic systems*
- Yvan Gaudfrin, Master student, University of Bristol (UK), from June to September, co-advised by F. Garin, R. Fabbiano and J. Dumon, master thesis: *Source seeking via Poisson integrals – Practical implementation of a source-localization set-up.*

8.4.2. Visits to International Teams

- D. Pisarski has been a visiting scholar at UC Berkeley, Mechanical Engineering Dept., for three months (Oct.-Dec.). His stay was supported by Inria 'Programme Explorateur' and CMIRA 'Explora Doc'.
- A. Kibangou spent two weeks in UFC, Brazil, in October, within the framework of the TeMP project.

NUMED Project-Team

6. Partnerships and Cooperations

6.1. National Initiatives

6.1.1. ANR

Vincent Calvez is head of on ingoing ANR contract on cell mobility.

6.1.2. Competitivity Clusters

Vincent Calvez organized a special semester on mathematical biology within Lyon mathematical in spring 2013. and computer science LABEX Milion.

6.2. European Initiatives

6.2.1. FP7 Projects

6.2.1.1. DDMoRE

Member: Benjamin Ribba.

OPALE Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR

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

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

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

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

8.1.2. Project "OASIS"

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

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

8.1.3. Project "Memoria"

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

8.2. European Initiatives

8.2.1. FP7 Projects

8.2.1.1. MARS

Title: Manipulation of Reynolds Stress

Type: COOPERATION (TRANSPORTS)

Instrument: Specific Targeted Research Project (STREP)

Duration: October 2010 - September 2013

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

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

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

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

8.2.1.2. GRAIN 2

Type: COOPERATION

Defi: Transport (incl. Aeronautics)

Instrument: Coordination and Support Action (CSA)

Duration: October 2013 - September 2015

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

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

See also: http://www.cimne.com/grain2/

Inria contact: Toan Nguyen

Abstract: The main objective of GRAIN2 is to focus its greening activities following the Flight Path 2050 Vision for Aircraft en route to the very ambitious challenge "Protecting the environment and the energy supply" in three major following lines: i) greening the air vehicle, ii) greening the Air transport System and iii) Reducing the carbon foot print of aviation via sustainable alternative fuels. GRAIN2 will identify innovative R & D methods, tools and HPC environments (supercomputers and GPGPUs) in the different KGTs according to the needs of major aeronautical industries to deeper understand the mechanism of engine exhaust emissions, to improve fuel efficiency and environmental performance, to lower noise for landing gear and high lift surfaces, to introduce new materials with multiple functions, to help significantly the development of biofuels for greenhouse gas emission reduction, etc.

8.2.1.3. TraM3

Type: IDEAS

Title: TRaffic Management by Macroscopic Models

Instrument: ERC Starting Grant

Objectif: NC

Duration: October 2010 - September 2015

Coordinator: Inria

Inria contact: Paola Goatin

Abstract: The project intends to investigate traffic phenomena from the macroscopic point of view, using models derived from fluid-dynamics consisting in hyperbolic conservation laws. The scope is to develop a rigorous analytical framework and fast and efficient numerical tools for solving optimization and control problems, such as queues lengths control or buildings exits design. See also: http://www-sop.inria.fr/members/Paola.Goatin/tram3.html

8.2.2. Collaborations in European Programs, except FP7

Program: KIC EIT ITC Labs, IMTS Intelligent Mobility and Transportation Systems

Project title: Multimodal Mobility

Duration: January 2013 - December 2013

Coordinator: Françoise Baude (Inria/UNS), Birgit Kwella (Fraunhofer Fokus)

Other partners: TU Berlin, U. Bologna, Inria, BME, Fraunhofer Gesellschaft,Telecom Italia,Siemens

Abstract: Identify innovation levers and possible joint developments in IMS

8.3. International Initiatives

8.3.1. Inria Associate Teams

8.3.1.1. ORESTE

Title: Optimal REroute Strategies for Traffic managEment

Inria principal investigator: Paola Goatin

International Partner (Institution - Laboratory - Researcher):

University of California Berkeley (United States) - Electrical Engineering and Computer Science (EECS) - Paola Goatin

Duration: 2012 - 2014

See also: http://www-sop.inria.fr/members/Paola.Goatin/ORESTE/index.html

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

8.3.2. Inria International Partners

8.3.2.1. Informal International Partners

Jean-Antoine Désidéri maintains close links with Prof. Alfio Borzí (Institut für Mathematik - Universität Würzburg, Germany) on theme of PDE-constrained optimization.

Régis Duvigneau maintains active cooperation with Praveen Chandrashkar (formely Opale post-doctoral fellow, now Assistant Professor at Tata Institute for Fundamental Research, Bangalore, Dept. Applicable Mathematics) on the theme of shape optimization in aerodynamics.

Additionally, Abderrahamane Habbal has a long term thorough collaboration with Moez Kallel from ENIT, Tunis, focusing on new applications of game theory to inverse problems and imaging science. We also have a continuing intensive collaboration with Rajae Aboulaich and Rachid Ellaia, from EMI, Rabat, and their collaborators. The themes addressed are multiobjective optimization, and mathematical modeling in life sciences.

8.3.3. Inria International Labs

- LIRIMA Team ANO 2010-2014:

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

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

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

  The themes investigated are biomathematics (Models for plants growth, cardiovascular and cerebral diseases, cardio image segmentation), mathematical finance (optimal portfolio, risk management, Islamic finance), multiobjective optimization in structural mechanics, and vehicle traffic and crowd motion. Refer to the website http://www.lirima.uninet.cm/index.php/en/ for more details on the LIRIMA Africa themes and teams.

8.3.4. Participation In other International Programs

- Inria@SILICONVALLEY :

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

8.4. International Research Visitors

8.4.1. Visits of International Scientists

8.4.1.1. Senior Researchers

Pr. Ellaia Rachid

Subject: Theory and algorithms for global and multiobjective optimization.

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

8.4.1.2. PhD Students

Legesse Lemecha Obsu

Subject: Macroscopic traffic flow optimization on roundabouts.

Institution: University of Addis Ababa (Ethiopia)

8.4.1.3. Internships

Bouthaina Yahyaoui, Asma Ghdami and Marwa Mokni

Subject: Multiobjective optimization of laminated composite Mindlin-Reissner plates

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

PERCEPTION Team

7. Partnerships and Cooperations

7.1. European Initiatives

7.1.1. FP7 Projects

7.1.1.1. HUMAVIPS

Title: Humanoids with audiovisual skills in populated spaces

Type: COOPERATION (ICT)

Defi: Cognitive Systems and Robotics

Instrument: Specific Targeted Research Project (STREP)

Duration: February 2010 - January 2013

Coordinator: Inria (France)

Others partners: CTU Prague (Czech Republic), University of Bielefeld (Germany), IDIAP (Switzerland), Aldebaran Robotics (France)

See also: http://humavips.inrialpes.fr

Abstracrt: Humanoids expected to collaborate with people should be able to interact with them in the most natural way. This involves significant perceptual and interactive skills, operating in a coordinated fashion. Consider a social gathering scenario where a humanoid is expected to possess certain social skills. It should be able to analyze a populated space, to localize people, and to determine whether they are looking at the robot and are speaking to it. Humans appear to solve these tasks routinely by integrating the often complementary information provided by multi-sensory data processing, from 3D object positioning and sound-source localization to gesture recognition. Understanding the world from unrestricted sensorial data, recognizing people's intentions and behaving like them are extremely challenging problems. The objective of HUMAVIPS has been to endow humanoid robots with audiovisual (AV) abilities: exploration, recognition, and interaction, such that they exhibit adequate behavior when dealing with a group of people. Developed research and technological developments have emphasized the role played by multimodal perception within principled models of human-robot interaction and of humanoid behavior. An adequate architecture has implemented auditory and visual skills onto a fully programmable humanoid robot (the consumer robot NAO). A free and open-source software platform has been developed to foster dissemination and to ensure exploitation of the outcomes of HUMAVIPS beyond its lifetime.

7.2. International Initiatives

7.2.1. Inria International Partners

7.2.1.1. Declared Inria International Partners

- Bielefeld University (Germany),
- The Czech Technical University of Prague (Czech Republic),
- IDIAP Institute (Switzerland),
- Aldebaran Robotics (France).
- University of Patras (Greece).

7.2.1.2. Informal International Partners

- The Technion (Israel Institute of Technology),

- Bar Ilan University.

7.3. International Research Visitors

7.3.1. Visits of International Scientists

- Professor Sharon Gannot (Bar Ilan University),
- Professor Yoav Schechner (The Technion),
- Professor Michael Bronstein (University of Lugano),
- Professor Vasek Hlavac (Czech Technical University),
- Professor Geoff McLachlan (University of Queensland, Australia),
- Professor Josep Ramon Casas, (Technical University of Catalonia).

7.3.1.1. Internships

- Dionyssos Kounades-Bastien, University of Patras (Master student),
- Israel Dejene-Gebru, University of Trento (Master student).

Prima Project-Team

7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. EquipEx AmiQual4Home - Ambient Intelligence for Quality of Life

Participants: Stan Borkowski, Sabine Coquillart, Joëlle Coutaz, James Crowley [correspondant], Alexandre Demeure, Thierry Fraichard, Amaury Nègre, Patrick Reignier, Dominique Vaufreydaz, Nicolas Bonnefond, Rémi Pincent, Mayeul de Werbier d Antigneul, Rémi Barraquand, David Lombard.

Ambient Intelligence, Equipment d'Excellence, Investissement d'Avenir

The AmiQual4Home Innovation Factory is an open research facility for innovation and experimentation with human-centered services based on the use of large-scale deployment of interconnected digital devices capable of perception, action, interaction and communication. The Innovation Factory is composed of a collection of workshops for rapid creation of prototypes, surrounded by a collection of living labs and supported by a industrial innovation and transfer service. Creation of the Innovation Factory has been made possible by a 2.140 Million Euro grant from French National programme "Investissement d'avenir", together with substantial contributions of resources by Grenoble INP, Univ Joseph Fourier, UPMF, CNRS, Schneider Electric and the Commune of Montbonnot. The objective is to provide the academic and industrial communities with an open platform to enable research on design, integration and evaluation of systems and services for smart habitats.

The AmiQual4Home Innovation Factory is a unique combination of three different innovation instruments: (1) Workshops for rapid prototyping of devices that embed perception, action, interaction and communication in ordinary objects based on the MIT FabLab model, (2) Facilities for real-world test and evaluation of devices and services organised as open Living Labs, (3) Resources for assisting students, researchers, entrepreneurs and industrial partners in creating new economic activities. The proposed research facility will enable scientific research on these problems while also enabling design and evaluation of new forms of products and services with local industry.

The core of the AmiQual4Home Innovation Factory is a Creativity Lab composed of a collection of five workshops for the rapid prototyping of devices that integrate perception, action, interaction and communications into ordinary objects. The Creativity Lab is surrounded by a collection of six Living Labs for experimentation and evaluation in real world conditions. The combination of fabrication facilities and living labs will enable students, researchers, engineers, and entrepreneurs to experiment in co-creation and evaluation. The AmiQual4Home Innovation Factory will also include an innovation and transfer service to enable students, researchers and local entrepreneurs to create and grow new commercial activities based on the confluence of digital technologies with ordinary objects. The AmiQual4Home Innovation Factory will also provide an infrastructure for participation in education, innovation and research activities of the European Institute of Technology (EIT) KIC ICTLabs.

The AmiQual4Home Innovation Factory will enable a unique new form of coordinated ICT-SHS research that is not currently possible in France, by bringing together expertise from ICT and SHS to better understand human and social behaviour and to develop and evaluate novel systems and services for societal challenges. The confrontation of solutions from these different disciplines in a set of application domains (energy, comfort, cost of living, mobility, well-being) is expected to lead to the emergence of a common, generic foundation for Ambient Intelligence that can then be applied to other domains and locations. The initial multidisciplinary consortium will progressively develop interdisciplinary expertise with new concepts, theories, tools and methods for Ambient Intelligence.

The potential impact of such a technology, commonly referred to as "Ambient Intelligence", has been documented by the working groups of the French Ministry of Research (MESR) [35] as well as the SNRI (Stratégie Nationale de la Recherche et de l'Innovation).

In 2013 our efforts were focused on specifying the requirements for major components of the project, and on finalising contractual issues with ANR. We defined the layout and arrangement of the Creativity Lab workshops, we started the specification of the instrumentation needed for the Living Labs, and developed a first version of a set of easy-deployable wireless sensors for infield data acquisition, that we call the Rapid Deployment Minikit. A set of CNC machines was purchased, including a Fused Filament Fabrication 3D printer, a CO2 Laser cutter and engraver, and a CNC mill.

Following the kickoff meeting of the project held in October 2013, we received positive feedback and interest form local industry and research institutions, and several national project proposals submitted in 2013 identified AmiQual4Home as an important ressource.

7.1.2. FUI PRAMAD

Participants: Claudine Combe, Lucas Nacsa, Maxime Portaz, Amaury Nègre, Dominique Vaufreydaz [correspondant].

Pramad is a collaborative project about *Plateforme Robotique dÁssistance et de Maintien à Domicile*. There are seven partners:

- R&D/industry: Orange Labs (project leader) and Covéa Tech (insurance company),
- Small companies: Interaction games (game designer, note that Wizardbox, the original partner was bought by Interaction games) and Robosoft (robot).
- Academic labs: Inria/PRIMA, ISIR (Paris VI) and Hôpital Broca (Paris).

The objectives of this project are to design and evaluate robot companion technologies to maintain frail people at home. Working with its partners, PRIMA research topics are:

- social interaction,
- robotic assistance,
- serious game for frailty evaluation and cognitive stimulation.

7.1.3. Inria Project-Teams PAL

Participants: Rémi Barraquand, Thierry Fraichard, Patrick Reignier, Amaury Nègre, Dominique Vaufreydaz [correspondant].

The 12 Inria Project-Teams (IPT) participating in a Large-scale initiative action Personally Assisted Living (PAL http://pal.inria.fr) propose to work together to develop technologies and services to improve the autonomy and quality of life for elderly and fragile persons. The goal of this program is to unite these groups around an experimental infrastructure, designed to enable collaborative experimentations.

PAL is organized arround 12 IPT:

> Demar, E-Motion, Flowers, Hephaistos, Lagadic, Lagadic-Sophia, Maia, Madynes, Phoenix, Prima, Stars and Reves.

The role of PRIMA within this project is to develop new algorithms mainly along two research axes:

- assessing frailty degree of the elderly,
- social interaction.

7.2. European Initiatives

7.2.1. Collaborations in European Programs, except FP7

7.2.1.1. CATRENE AppsGate

Participants: Jean-René Courtois, Rémy Dautriche, Alexandre Demeure [correspondant], Cédric Gérard, Camille Lenoir, Kouzma Petoukhov, Patrick Reignier.

AppsGate is a project about End User Development in the context of SmartHomes. There are seven partners:

- R&D/industry:
  - ST Microelectronics, NXP, PACE, Technicolor, ARD, Ripple Motion, 4MOD, HI-HIERIA, VSN+UAB, SoftKinetic, Optrima, Vsonix, Evalan, Vestel, Turkcell, Immotronics.
- Academic labs:
  - Inria/PRIMA, Institut télécom.

The objectives of this project are to design and evaluate a new generation of set-top box, PRIMA is involved in designing End User Development tools dedicated for the Smart Home.

7.3. International Initiatives

7.3.1. Inria International Partners

7.3.1.1. Declared Inria International Partners

The Prima team participates in the project “Visually impaired people assistance using multimodal technologies”. The project leader is the Mica laboratory of Hanoi University of Science and Technology (HUST), the project is financed for three years, starting in july 2012, by the Flemish Interuniversity Council (VLIR UOS http://www.vliruos.be/en). The other partners are Danang University, Ghent University, and Imep-Lahc (Grenoble Inp). The overall objective of the project is to provide visually impaired children (in the Nguyen Dinh Chieu School in Hanoi) with helpful devices. The contact person in the Prima team is Augustin Lux. Prima contributed to the design and testing of a system for Visual Object Recognition.

Since the PERSPOS project (BQR Grenoble INP 2008-2009), the MICA center (UMI 2954 CNRS) and PRIMA has a long time collaboration on the concept of "large-scale" perceptive space. This space is an intelligent environment which will be deployed on a large surface containing several buildings (as a university campus for example). The user is wearing one or many mobile intelligent wireless devices (smartphone or wearable computer). By combining the concepts of large-scale perceptive environments and mobile computing, we can create intelligent spaces to propose services adapted to individuals and their activities, manage energy of building, etc. Our collaboration is focusing on user identification and localization within such a smart space. Tracking people in smart environments remains a challenging fundamental problem when tackling multiple users localization. Whether it is at the scale of a campus, of a building or more simply of a room, we can dynamically combine several localization levels (and several technologies) to allow a more accurate and reliable users localization system. In September 2013, a new co-supervised Ph.D. Thesis started on multiple users localization in large-scale perceptive spaces.

7.4. International Research Visitors

7.4.1. Internships

Participant: Carlos Di Pietro.

Subject: Design of a Robot Companion

Date: from March 2013 until August 2013

Institution: University of Buenos Aires (Argentina)

Participant: Muhamamd Amine Bouguerra.

Subject: Viability and Guaranteed Motion Safety

Date: from Sep. 2013 until Oct. 2013

Institution: University of Annaba (DZ)

Participant: Marceau Thalgott.

Subject: Bibliographical study of Brain Like Artificial Intelligence, Mini-Kit prototype development for a smart home.

Date: from February 2013 until August 2013

Institution: ENSIMAG

Participant: Adrien Czerny.

Subject: Software environment for life long learning and debugging of a cortical learning algorithm.

Date: from February 2013 until August 2013

Institution: ENSIMAG

Participant: Luiza Cicone.

Subject: Tools to support creative and design processes of interactive systems

Date: from March 2013 until August 2013

Institution: ENSIMAG

Participant: Simon Chalumeau.

Subject: Pico-Projector based Interaction

Date: from February 2013 until August 2013

Institution: Grenoble INP, UJF Grenoble

Participant: Maxime Portaz.

Subject: Supervised and unsupervised learning for intention recognition

Date: from March 2013 until August 2013

Institution: Université de Grenoble (Grenoble, France)

Participant: Martin Poirrier.

Subject: Robotics and Multimodal Sensor Fusion for detecting Human Social interaction

Date: from January 2013 until June 2013

Institution: Suppinfo (Grenoble, France)

7.4.2. Visits to International Teams

Dominique Vaufreydaz, June 2013, MICA research center of Hanoi University of Science and Technology (HUST), in Hanoi Vietnam.

PRIVATICS Team

7. Partnerships and Cooperations

7.1. Regional Initiatives

7.1.1. Privamov'

Title: Privamov'

Type: Labex IMU.

Duration: September 2013 - 2015.

Coordinator: LIRIS.

Others partners: EVS-ITUS, Inria Urbanets.

Abstract: The objective of this project is to provide researchers the IMU community traces of urban mobility allowing further their research and validate their assumptions and models. Indeed , many communities need to know the modes of urban transport : sociologists, philosophers , geographers, planners or computer scientists. If these traces are an important feature for researchers or industrial, they are more for users who have helped to build: attacks jeopardize the privacy of users. Anonymization techniques developed within the project will make available to the greatest number of these traces, while ensuring that the entire process (from collection to data analysis) will be made in respect of the privacy of users involved.

7.1.2. SCCyPhy

Title: SCCyPhy

Type: Labex Persyval.

Duration: September 2013 - 2015.

Coordinator: Institut Fourier.

Others partners: Inria MOAIS, Verimag, CEA/LETI, LIG, GIPSA-Lab, TIMA.

Abstract: A main motivation of this action-team is to provide a structure to the Grenoble community in computer security and cryptography in the spirit of the PERSYVAL-lab Labex. Our emphasize, within the PCS workpackage, is around complementary areas of research with high impact for science and technology, with the following target applications: embedded systems (including smartphones and sensors network), at both software and hardware levels, distributed architectures (including "cloud" and "sky"), privacy and protection of information systems against cyberattacks of various origins.

7.2. National Initiatives

7.2.1. ANR

7.2.1.1. BIOPRIV

Title: Application of privacy by design to biometric access control.

Type: ANR.

Duration: April 2013 - March 2017.

Coordinator: Morpho (France).

Others partners: Morpho (France), Inria (France), Trusted Labs (France).

See also: http://planete.inrialpes.fr/biopriv/.

Abstract: The objective of BIOPRIV is the definition of a framework for privacy by design suitable for the use of biometric technologies. The case study of the project is biometric access control. The project will follow a multidisciplinary approach considering the theoretical and technical aspects of privacy by design but also the legal framework for the use of biometrics and the evaluation of the privacy of the solutions.

7.2.1.2. BLOC

Title: Analysis of block ciphers dedicated to constrained environments.

Type: ANR.

Duration: October 2013 - September 2015.

Coordinator: INSA-Lyon (France).

Others partners: CITI Laboratory XLIM Laboratory, University of Limoges, Inria Secret, CryptoExperts (PME).

See also: http://bloc.project.citi-lab.fr/.

Abstract: BLOC aims at studying the design and analysis of block ciphers dedicated to constrained environments. The four milestones of BLOC are: security models and proofs, cryptanalysis, design and security arguments and performance analyzes and implementations of lightweight block ciphers. The aims of the project are the following ones: Security models and proofs Cryptanalysis Design C library of lightweight block ciphers We also aim at providing at the end of the project a lightweight block cipher proposal.

7.2.1.3. pFlower

Title: Parallel Flow Recognition with Multi-Core Processor.

Type: ANR.

Duration: March 2011 - September 2014.

Coordinator: LISTIC Université de Savoie.

Others partners: ICT-CAS Insititute of Computing Technology (China), LISTIC Université de Savoie.

Abstract: The main objective of this project is to take advantage of powerful parallelism of multi-thread, multi-core processors, to explore the parallel architecture of pipelined-based flow recognition, parallel signature matching algorithms.

7.2.2. Other

7.2.2.1. MOBILITICS

Title: MOBILITICS

Type: joint project.

Duration: January 2012 - Ongoing.

Coordinator: CNIL.

Others partners: CNIL.

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

7.2.2.2. MOBILITICS

Title: MOBILITICS

Type: joint project.

Duration: January 2012 - Ongoing.

Coordinator: CNIL.

Others partners: CNIL.

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

Inria Mobilitics (2011-2012): as a joint national project with CNIL (the French national committee of Information freedom).

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

7.3. European Initiatives

7.3.1. FP7 Projects

7.3.1.1. PRIPARE

Title: Preparing industry to privacy-by-design by supporting its application in research.

Type: COOPERATION (ICT).

Instrument: Support Action (SA).

Duration: October 2013 - September 2015.

Coordinator: Trialog (France).

Others partners: American University of Paris (France), Atos (Spain), Fraunhofer SIT (Germany), Galician Research and Development Center in Advanced Telecommunications (Spain), Inria (France), KU Leuven (Belgium), Trialog (France), Trilateral Research (UK), Universidad Politecnica de Madrid (Spain), University of Ulm (Netherlands), Waterford Institute of Technology (UK).

Abstract: the general goal of PRIPARE is to facilitate the application of privacy by design. To this aim, PRIPARE will support the practice of privacy by design by the ICT research community (to prepare for industry practice) and foster risk management culture through educational material targeted to a diversity of stakeholders. The project will specify a privacy by design software and systems engineering methodology combining a multidisciplinary expertise involving legal, engineering and business viewpoints. The project will also provide best practices material and educational material focusing on risk management of privacy for different target audiences (general public, policy makers, users, ICT students and professional). The project will also pave the way for future research by identifying gaps and providing recommendations for a research agenda for privacy by design.

7.3.1.2. PARIS

Title: Privacy preserving infrastructure for surveillance.

Type: COOPERATION (ICT).

Instrument: Specific Targeted Research Project (STREP).

Duration: January 2013 - December 2015.

Coordinator: Trialog (France).

Others partners: AIT (Austria), Inria (France), KU Leuven (Belgium), Trialog (France), Universidad de Malaga (Spain), Université de Namur (Belgium), Thales (France), Visual Tools (Spain).

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

Abstract: PARIS will define and demonstrate a methodological approach for the development of surveillance infrastructure which enforces the right of citizens for privacy, justice and freedom and takes into account the evolving nature of such rights (e.g. aspects that are acceptable today might not be acceptable in the future), and the social and ethical nature of such rights (e.g. perception of such rights varies). The methodological approach will be based on two pillars, first a theoretical framework for balancing surveillance and data protection which fully integrates the concept of accountability, and secondly an associated process for the design of surveillance systems which takes from the start privacy (i.e. Privacy by Design) and accountability (i.e. Accountability by Design).

7.3.2. Collaborations in European Programs, except FP7

7.3.2.1. FI-WARE

Title: Future Internet Ware.

Type: COOPERATION (ICT).

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

Instrument: Integrated Project (IP).

Duration: May 2011 - April 2014.

Coordinator: Telefonica. (Spain)

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

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

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

7.4. International Initiatives

7.4.1. Inria International Labs

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

Inria principal investigator: Claude Castelluccia

International Partners (Institution - Laboratory - Researcher):

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

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

Duration: 2012 - 2014

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

Cloud computing is a form of computing where general purpose clients (typically equipped with a web browser) are used to access resources and applications managed and stored on a remote server. Cloud applications are increasingly relied upon to provide basic services like e-mail clients, instant messaging and office applications. The customers of cloud applications benefit from outsourcing the management of their computing infrastructure to a third-party cloud provider. However, this places the customers in a situation of blind trust towards the cloud provider. The customer has to assume that the "cloud" always remains confidential, available, fault-tolerant, well managed, properly backed-up and protected from natural accidents as well as intentional attacks. An inherent reason for today's limitations of commercial cloud solutions is that end users cannot verify that servers in the cloud and the network in between are hosting and disseminating tasks and content without deleting, disclosing or modifying any content. This project seeks to develop novel technical solutions to allow customers to verify that cloud providers guarantee the confidentiality, availability and fault-tolerance of the stored data and infrastructure.

7.5. International Research Visitors

7.5.1. Visits to International Teams

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

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

ROMA Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR

ANR White Project RESCUE (2010-2014), 4 years. The ANR White Project RESCUE was launched in November 2010, for a duration of 48 months. It gathers three Inria partners (ROMA, Grand-Large and Hiepacs) and is led by ROMA. The main objective of the project is to develop new algorithmic techniques and software tools to solve the *exascale resilience problem*. Solving this problem implies a departure from current approaches, and calls for yet-to-be-discovered algorithms, protocols and software tools.

This proposed research follows three main research thrusts. The first thrust deals with novel *checkpoint protocols*. The second thrust entails the development of novel *execution models*, i.e., accurate stochastic models to predict (and, in turn, optimize) the expected performance (execution time or throughput) of large-scale parallel scientific applications. In the third thrust, we will develop novel *parallel algorithms* for scientific numerical kernels.

ANR Project SOLHAR (2013-2017), 4 years. The ANR Project SOLHAR was launched in November 2013, for a duration of 48 months. It gathers five academic partners (the HiePACS, Cepage, ROMA and Runtime Inria project-teams, and CNRS-IRIT) and two industrial partners (CEA/CESTA and EADS-IW). This project aims at studying and designing algorithms and parallel programming models for implementing direct methods for the solution of sparse linear systems on emerging computers equipped with accelerators.

The proposed research is organized along three distinct research thrusts. The first objective deals with linear algebra kernels suitable for heterogeneous computing platforms. The second one focuses on runtime systems to provide efficient and robust implementation of dense linear algebra algorithms. The third one is concerned with scheduling this particular application on a heterogeneous and dynamic environment.

8.1.2. Inria Project Lab C2S@Exa - Computer and Computational Scienecs at Exascale

Participants: Olivier Aumage [RUNTIME project-team, Inria Bordeaux - Sud-Ouest], Jocelyne Erhel [SAGE project-team, Inria Rennes - Bretagne Atlantique], Philippe Helluy [TONUS project-team, Inria Nancy - Grand-Est], Laura Grigori [ALPINE project-team, Inria Saclay - Île-de-France], Jean-Yves L'excellent [ROMA project-team, Inria Grenoble - Rhône-Alpes], Thierry Gautier [MOAIS project-team, Inria Grenoble - Rhône-Alpes], Luc Giraud [HIEPACS project-team, Inria Bordeaux - Sud-Ouest], Michel Kern [POMDAPI project-team, Inria Paris - Rocquencourt], Stéphane Lanteri [Coordinator of the project], François Pellegrini [BACCHUS project-team, Inria Bordeaux - Sud-Ouest], Christian Perez [AVALON project-team, Inria Grenoble - Rhône-Alpes], Frédéric Vivien [ROMA project-team, Inria Grenoble - Rhône-Alpes].

Since January 2013, the team is participating to the C2S@Exa http://www-sop.inria.fr/c2s_at_exa Inria Project Lab (IPL). This national initiative aims at the development of numerical modeling methodologies that fully exploit the processing capabilities of modern massively parallel architectures in the context of a number of selected applications related to important scientific and technological challenges for the quality and the security of life in our society. At the current state of the art in technologies and methodologies, a multidisciplinary approach is required to overcome the challenges raised by the development of highly scalable numerical simulation software that can exploit computing platforms offering several hundreds of thousands of cores. Hence, the main objective of C2S@Exa is the establishment of a continuum of expertise in the computer science and numerical mathematics domains, by gathering researchers from Inria project-teams whose research and development activities are tightly linked to high performance computing issues

in these domains. More precisely, this collaborative effort involves computer scientists that are experts of programming models, environments and tools for harnessing massively parallel systems, algorithmists that propose algorithms and contribute to generic libraries and core solvers in order to take benefit from all the parallelism levels with the main goal of optimal scaling on very large numbers of computing entities and, numerical mathematicians that are studying numerical schemes and scalable solvers for systems of partial differential equations in view of the simulation of very large-scale problems.

8.2. European Initiatives

8.2.1. FP7 Projects

8.2.1.1. SCORPIO

Type: COOPERATION
Instrument: Specific Targeted Research Project
Duration: June 2013 - May 2016
Coordinator: Nikolaos Bellas
Partners: CERTH, Greece; EPFL, Switzerland; RWTH Aachen University, Germany; The Queen's University of Belfast, UK; IMEC, Belgium
Inria contact: Frédéric Vivien
Abstract: A new computing paradigm that exploits uncertainty to design systems that are energy-efficient and scale gracefully under hardware errors by operating below the nominal operating point, in a controlled way, without inducing massive or fatal errors.

8.3. International Initiatives

8.3.1. Inria Associate Teams

The ALOHA associate-team is a joint project of the ROMA team and of the Information and Computer science Department of the University of Hawai'i (UH) at Mānoa, Honolulu, USA. Building on a vast array of theoretical techniques and expertise developed in the field of parallel and distributed computing, and more particularly application *scheduling*, we tackle database questions from a fresh perspective. To this end, this proposal includes:

- a group that specializes in database systems research and who has both industrial and academic experience, the group of Lipyeow Lim (UH);
- a group that specializes in practical aspects of scheduling problems and in simulation for emerging platforms and applications, and who has a long experience of multidisciplinary research, the group of Henri Casanova (UH);
- a group that specializes in the theoretical aspects of scheduling problems and resource management (the ROMA team).

The research work focuses on the following three thrusts:

1. Online, multi-criteria query optimization
2. Fault-Tolerance for distributed databases
3. Query scheduling for distributed databases

8.4. International Research Visitors

8.4.1. Visits of International Scientists

Ana Gainaru (from UIUC and Argonne National Laboratory) has visited our team for three weeks in October and November 2013. She initiated a collaboration with Guillaume Aupy, Anne Benoit, Franck Cappello and Yves Robert on scheduling I/O activity to avoid congestion and increase performance when executing several scientific applications on large-scale platforms.

8.4.2. Visits to International Teams

Yves Robert has been appointed as a visiting scientist by the ICL laboratory (headed by Jack Dongarra) at the University of Tennessee Knoxville. He collaborates with several ICL researchers on high-performance linear algebra and resilience methods at scale.

SOCRATE Project-Team

8. Partnerships and Cooperations

8.1. National Actions

8.1.1. Equipex FIT- Future Internet of Things (2011-..., 1.064 k€)

The FIT projet is a national equipex (*equipement d'excellence*), headed by the Lip6 laboratory. As a member of Inria, Socrate is in charge of the development of an Experimental Cognitive Radio platform that should be used as test-bed for SDR terminals and cognitive radio experiments. This platform will be operational in 2013 for a duration of 7 years. To give a quick view, the user will have a way to configure and program through Internet several SDR platforms (MIMO, SISO, and baseband processing nodes).

8.1.2. ANR - Cormoran - "Cooperative and Mobile Wireless Body Area Networks for Group Navigation" (2012-2015, 150 keuros)

The Cormoran project targets to figure out innovative communication functionalities and radiolocation algorithms that could benefit from inter/intra-BAN cooperation. More precisely, the idea is to enable accurate nodes/body location, as well as Quality of Service management and communications reliability (from the protocol point of view), while coping with inter-BAN coexistence, low power constraints and complying with the IEEE 802.15.6 standard. The proposed solutions will be evaluated in realistic applicative scenarios, hence necessitating the development of adapted simulation tools and real-life experiments based on hardware platforms. For this sake, Cormoran will follow an original approach, mixing theoretical work (e.g. modelling activities, algorithms and cross-layer PHY/MAC/NWK design) with more practical aspects (e.g. channel and antennas measurement campaigns, algorithms interfacing with real platforms, demonstrations).

8.1.3. ANR - Idefix - "Intelligent DEsign of Future mobile Internet for enhanced eXperience" (2013-2016, 55 keuros)

The aim of IDEFIX project is to radically revisit the way technologies are evaluated and benchmarked by proposing novel performance evaluation tools, based on the latest developments in queuing theory, that are able to tackle the complexity of traffic profiles in future mobile networks. These tools are to be carefully adapted to the different technologies discussed within 3GPP, and then used to benchmark these technologies and perform pertinent choices among them. Furthermore, IDEFIX will not adopt a passive behavior limited to performance evaluation of technologies. It will, on the contrary, propose service and network control mechanisms that enforce Quality of Service (QoS) and Quality of Experience (QoE) of users of different services. For this aim, this project puts together experts on performance evaluation tools and traffic engineering, whose world class research results are recognized in the telecommunication community. This expertise is complemented by another internationally recognized expertise on service and network control mechanisms and, for the first time in this field, by an expertise on network economy and decision-making in strategic investments. These academic and industrial experts will help two top actors in the world telecommunications industry, Alcatel Lucent and Orange, in their perpetual quest for producing the most efficient technologies and deploying networks with the best QoS.

8.1.4. ADR Green - "Green Networking" (2013-2015, 70 keuros)

This action is a part of the common lab of Inria and Alcatel Lucent Bell Labs. This action groups Urbanet and Socrate teams of Inria with the Bell Labs Vx team and adresses different aspects of Green Networking. Socrate works on the 'virtual cell concept' which deals with mobile centric cells in dense small cells networks.

8.1.5. Greentouch GTT project- "Interference Alignment" (2013-2014, 63 keuros)

The Greentouch GTT (Green transmission technology) project aims at proposiing new energy efficient transmission techniques, and focus specifically on the Energy efficiency - spectral efficiency (EE-SE) trade-off. Interference management is a critical issue and socrate aims at designing a dynamic and distributed approach allowing to cancel strong interfers by combining control theory and interference alignment principles.

8.1.6. FUI ECONHOME - "Energy efficient home networking" (2010-2014, 309 keuros)

The project aims at reducing the energy consumption of the home (multimedia) data networks, while maintaining the quality requirements for heterogeneous services and flows, and preserving, or even enhancing the overall system performance. the equipments under concern are residential gateways, set-top-boxes , PLC modules, Wifi extenders, NAS. The user equipment, such as smartphones, tablets or PCs are not concerned. The approach relies on combining both individual equipments IC and system level protocols that have to be eco-designed.

8.1.7. FUI SMACS - "SMart And Connected Sensors" (2013-2016, 267 keuros)

The SMACS projet targets the deployement of an innovating wireless sensor network dedicated to many domains sport, health and digital cities. The projet involves Socrate (Insavalor), HIKOB and wireless broadcasting company Euro Media France. The main goal is to develop a robust technology enabling real-time localization of mobile targets (like cyclists for instance), at a low energy (more generally low cost). The technology will be demonstrated at real cycling races (Tour de France 2013 and 2014). One of the goals is to include localisation information with new radio technology. Another subject of study is distributed wireless consensus algorithms for maintaining a neighborhood knowledge with a low energy budget that scales (more than 200 cycles together)

8.2. International Research Visitors

Jean-Marie Gorce is currently spending a sabbatical year at Vincent Poor's lab in Princeton university. Following the Post-Doc of Samir Perlaza, Socrate is developping a regular collaboration with Princeton on network information theory and distributed radio resource allocation algorithms.

SPADES Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR Projects

8.1.1.1. PiCoq (ANR project)

Participants: Barbara Petit, Jean-Bernard Stefani.

The goal of the PiCoq project is to develop an environment for the formal verification of properties of distributed, component-based programs. The project's approach lies at the interface between two research areas: concurrency theory and proof assistants. Achieving this goal relies on three scientific advances, which the project intends to address:

- Finding mathematical frameworks that ease modular reasoning about concurrent and distributed systems: due to their large size and complex interactions, distributed systems cannot be analysed in a global way. They have to be decomposed into modular components, whose individual behaviour can be understood.
- Improving existing proof techniques for distributed/modular systems: while behavioural theories of first-order concurrent languages are well understood, this is not the case for higher-order ones. We also need to generalise well-known modular techniques that have been developed for first-order languages to facilitate formalisation in a proof assistant, where source code redundancies should be avoided.
- Defining core calculi that both reflect concrete practice in distributed component programming and enjoy nice properties *w.r.t.* behavioural equivalences.

The project partners include Inria (CELTIQUE and SPADES teams), LIP (PLUME team), and Université de Savoie. The project runs from November 2010 to October 2014.

8.1.1.2. REVER (ANR project)

Participants: Barbara Petit, Jean-Bernard Stefani.

The REVER project aims to develop semantically well-founded and composable abstractions for dependable distributed computing on the basis of a reversible programming model, where reversibility means the ability to undo any program execution and to revert it to a state consistent with the past execution. The critical assumption behind REVER is that by combining reversibility with notions of compensation and modularity, one can develop systematic and composable abstractions for dependable programming.

The REVER work program is articulated around three major objectives:

- To investigate the semantics of reversible concurrent processes.
- To study the combination of reversibility with notions of compensation, isolation and modularity in a concurrent and distributed setting.
- To investigate how to support these features in a practical (typically, object-oriented and functional) programming language design.

The project partners are Inria (FOCUS and SPADES teams), Université de Paris VII (PPS laboratory), and CEA (List laboratory). The project runs from December 2011 to November 2015.

8.2. International Initiatives

8.2.1. Inria Associate Teams

8.2.1.1. RIPPES

Title: RIgorous Programming of Predictable Embedded Systems

Inria principal investigator: Alain Girault

International Partner (Institution - Laboratory - Researcher):

University of California Berkeley (USA) – EECS Department, PTOLEMY group – Prof. Edward Lee.

University of Auckland (New Zealand) – ECE Department – Prof. Partha Roop.

Duration: January 2013 – December 2015

See also: https://wiki.inria.fr/rippes/Main_Page

The RIPPES associated team gathers the SPADES team from Inria Grenoble, the Ptolemy group from UC Berkeley (EECS Department), and the Embedded Systems Research group from U. of Auckland (ECE Department). The planned research seeks to reconcile two contradictory objectives of embedded systems, more predictability and more adaptivity. We propose to address these issues by exploring two complementary research directions: (1) by starting from a classical concurrent C or Java programming language and enhancing it to provide more predictability, and (2) by starting from a very predictable model of computation (SDF) and enhancing it to provide more adaptivity.

8.3. International Research Visitors

8.3.1. Visits of International Scientists

- January and February 2013: Ismail Assayad (Ass. Prof. U. Casablanca) visited Inria Grenoble to work on multi-criteria optimisation and scheduling for embedded system.
- March 2013: Eugene Yip (PhD student, U. Auckland) visited Inria Grenoble to work on the semantics of the FOREC PRET programming language (RIPPES associated team).
- March 2013: Hokeun Kim (PhD student, UC Berkeley) visited Inria Grenoble to work on the RIPPES associated team.
- March 2013: Partha Roop (Senior Lecturer, U. Auckland) visited Inria Grenoble to work on the FOREC PRET programming language (RIPPES associated team).
- July 2013: Eugene Yip (PhD student, U. Auckland) visited Inria Grenoble to work on the semantics of the FOREC PRET programming language (RIPPES associated team).
- July 2013: Matthew Kuo (PhD student, U. Auckland) visited Inria Grenoble to work on tickpad memories for PRET programs (RIPPES associated team).
- December 2013: Chris Shaver (PhD student, UC Berkeley) visited Inria Grenoble to work on parametric data-flow models of computation (RIPPES associated team).

8.3.2. Visits to International Teams

- Vagelis Bebelis visited the University of California Berkeley (USA) in October 2013 to work on a parametric dataflow models of computation and on its implementation within the Ptolemy II framework.

8.3.3. Inria International Partners

8.3.3.1. Informal International Partners

We have a long lasting informal collaboration with Prof. Ivan Lanese (U. Bologna, Italy) on component programming and reversability. He visits the team regularly.

We have a long lasting informal collaboration with Prof. Ismail Assayad (U. Casablanca, Morocco) and Prof. Hamoudi Kalla (U. Batna, Algeria) on fault-tolerant embedded systems, multi-criteria optimization, reliability, and power consumption. They both visit the team regularly.

STEEP Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

In 2012, we started an informal collaboration with Serge Fenet from the University of Lyon (LIRIS lab), which among others accompanied Brindusa Smaranda's MSc thesis. In 2013, a project we submitted to the IXXI Complex Systems Institute of the Rhône-Alps region, together with the CERAG lab, was accepted. The project is about modeling and data mining applied to territorial ecology.

8.2. National Initiatives

8.2.1. ANR

CITiES (*Calibrage et valIdation de modèles Transport - usagE des Sols*)
Program: "*Modèles Numériques*" 2012, ANR
Duration: 2013 – 2016
Coordinator: Emmanuel Prados (STEEP)
Other partners: LET, IDDRI, IRTES-SET ("Systemes and Transports" lab of Univ. of Tech. of Belfort-Montbéliard), IFSTTAR-DEST Paris (formerly INRETS), LVMT ("*Laboratoire Ville Mobilité Transport*", Marne la Vallée), VINCI (Pirandello Ingenierie, Paris), IAU Île-De-France (Urban Agency of Paris), AURG (Urban Agency of Grenoble), MOISE (Inria project-team)
Abstract: Calibration and validation of transport and land use models.

8.2.2. FRB (Fondation pour la Recherche sur la Biodiversité)

ESNET (Futures of ecosystem services networks for the Grenoble region)
Program: "Modeling and Scenarios of Biodiversity" flagship program, Fondation pour la Recherche sur la Biodiversité (FRB). This project is funded by ONEMA (*Office National de l'Eau et des Milieux Aquatiques*).
Duration: 2013 – 2016
Coordinator: Sandra Lavorel (LECA)
Other partners: EDDEN (UPMF/CNRS), IRSTEA Grenoble (formerly CEMAGREF), PACTE (UJF/CNRS), ERIC (Lyon 2/CNRS)
Abstract: This project explores alternative futures of ecosystem services under combined scenarios of land-use and climate change for the Grenoble urban area in the French Alps. In this project, STEEP works in particular on the modeling of the land use and land cover changes, and to a smaller extent on the interaction of these changes with some specific services.

8.3. International Initiatives

8.3.1. Participation In other International Programs

TRACER (*TRANUS, analyse de la calibration et des erreurs, retours sur Grenoble et Caracas*)
Program: Ecos-NORD
Duration: 2012 – 2014
Coordinator: Mathieu Saujot (IDDRI)
Other partners: University of Caracas (Venezuela)

8.4. International Research Visitors

8.4.1. Visits of International Scientists

In July 2013, we received a one week visit by Professor Tomás de la Barra (University of Caracas and Modelistica) and by Dr. Brian Morton (University of North Carolina), the two leading experts of the TRANUS model (de la Barra developed the model). We organized a 3-day training course on the TRANUS model around these visits, with attendees from various labs in France and Belgium as well as an extended visit to the urban planning agency of the Grenoble region.

8.4.2. Internships

Participant: Thomas Capelle.

Subject: Calibration of the TRANUS land use module

Date: from Apr 2013 until Aug 2013

Institution: Universidad de Chile, Santiago

Participant: Lara Antonela Colombo.

Subject: Optimization based formulation of local material flow assessment

Date: from Mar 2013 until Aug 2013

Institution: Universidad National de Rosario (Argentina)

Participant: Martin Crespo.

Subject: Parameter optimization algorithm for a Transport/land use model via adjoint method.

Date: from Jul 2012 until Jan 2013

Institution: Universidad National de Rosario (Argentina)

Participant: Laurent Gilquin.

Subject: Sensitivity analysis of TRANUS

Date: from Mar 2013 until Aug 2013

Institution: ENS Lyon

Participant: Jakub Krzywda.

Subject: Data mining for ecological accounting and material flow analysis

Date: from Mar 2013 until Aug 2013

Institution: Poznan University of Technology (Poland)

Participant: Brindusa Smaranda.

Subject: Data mining for ecological accounting and material flow analysis

Date: from Mar 2013 until Aug 2013

Institution: Erasmus Mundus on Data Mining Knowledge Management (Lyon and Barcelona)

Participant: Pablo Virgolini.

Subject: Optimization based formulation of local material flow assessment

Date: from Mar 2013 until Aug 2013

Institution: Universidad National de Rosario (Argentina)

TYREX Team

7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. Investissements d'avenir

CLAIRE

Title: Community Learning through Adaptive and Interactive multichannel Resources for Education

Call: Technologies for e-education

Duration: March 2012 - February 2014

Coordinator: OpenClassrooms, ex-SimpleIT

Others partners: LIRIS

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

Abstract: Project CLAIRE aims at developing an open-source tool for collaborative authoring in an e-learning environment (Learning Content Management System), targeting teachers and students in high-school and universities. Its innovative features include:

- a platform for collaborative structured editing of rich meda and "semantic" content, e.g.: tools for chaptering video, and for generating interactive evaluation tests
- processes for continuous enhancement of content, e.g.: social annotation, behaviour analysis, accessible multi-support publishing, e.g.: web, PDF, ODT, LaTeX, smartphones, tablets.

Datalyse

Title: Entrepôt Intelligent pour Big Data hétérogènes. Investissements d'Avenir Développement de l'Economie Numérique.

Call: Cloud Computing, num 3 – Big Data.

Duration: May 2013 - November 2016

Coordinator: Business & Decision Eolas

Others partners: Groupement des Mousquetaires, Inria Saclay (OAK EPC), LIG (Hadas and Erods teams), LIRMM (Montpellier), LIFL (Lille).

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

Abstract: Project Datalyse aims at designing and deploying an infrastructure for big data storage, collection, certification, integration, categorization, enrichment and sharing over very large heterogeneous data sets. It relies on an industrial platform, to be made available on the cloud, and focuses on three flagship applications, showcasing three uses of big data over different data sets:

- Data Center Monitoring: The goal of this application is to provide features such as traceability, reporting, optimization and analysis of abnormal behaviour regarding energy efficiency and security issues. The application will be built with an existing application called ScopeBR (Eolas) and will be deployed in two different green data centers, those of Eolas and GDF SUEZ.
- "Territoire de données ouvertes et liées": This application aims at extracting and provisioning public open data collected from the city of Grenoble and its suburbs. The goal is to make public data available to third-party application developers and to federate local actors around a single platform.
- Real-time Business Intelligence for the management and processing of points of sale: this application will focus on real-time data analytics and will be deployed within "Groupement des Mousquetaires" in support of their business intelligence platforms.

7.1.2. ANR

Typex

Title: Typeful certified XML: integrating language, logic, and data-oriented best practices

Call: Programme Blanc

Duration: January 2012 - December 2014

Coordinator: PPS (CNRS - Paris 7 Diderot)

Others partners: LRI (Orsay)

See also: http://typex.lri.fr

Abstract: The highly ambitious and final goal of this project is to produce a new generation of XML programming languages stemming from the synergy of integrating three approaches into a unique framework:

- a logical approach based on solvers
- a programming language (PL) approach
- a data-oriented approach

These languages will feature precise and polymorphic type systems that merge PL typing techniques with logical-solver-based type inference. They will be implemented efficiently using the latest research on tree automata and formally certified using modern theorem prover technology. They will offer the capacity to specify and formally verify invariants, business rules, and data integrity, and will have a direct and immediate impact on standardization processes.

7.2. European Initiatives

7.2.1. FP7 Projects

7.2.1.1. VENTURI

Title: immersiVe ENhancemenT of User-woRld Interactions

Type: Cooperation (ICT)

Call: FP7-ICT-20111.5 Networked Media and Search Systems

Instrument: Specific Targeted Research Project (STREP)

Duration: October 2011 - September 2014

Coordinator: Fondazione Bruno Kessler (Italy)

Others partners: Fraunhofer Heinrich Hertz Institute (Germany), ST Microelectronics (Italy), ST-Ericsson (France), Metaio (Germany), e-Diam Interactive (Spain), Sony-Ericsson (Sweden)

See also: https://venturi.fbk.eu/

Abstract: Venturi aims to create a pervasive Augmented Reality paradigm, where available information will be presented in a user- rather than device-specific way. The goal is to create an experience that is always present whilst never obstructing. Venturi will exploit, optimize and extend current and next generation mobile platforms; verifying platform and QoE performance through life-enriching use cases and applications to ensure device-to-user continuity.

URBANET Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

- BQR INSA CROME 12/2013-12/2016
  Participants: Fabrice Valois
  The partners in this project are the CITI DynaMid team and LIRIS. The project studies the coordination of a fleet of mobile robots for the multi-view analysis of complex scenes.
- BQR INSA ARBRE 12/2011-12/2013
  Participants: Hervé Rivano, Fabrice Valois
  The partners in this project are the LIRIS (database), EVS-ITUS (social science) and CETHIL (energetic models for buildings) . The project studies wireless sensor networks deployments from different perspectives. An objective is to provide enough data to calibrate energetic models for buildings with human activity. Another is to study the behavior of people working in monitored zones, in particular with respect to the way data are accessible, represented and navigated. Last is to obtain link quality statistics from a practical deployment with real traffic.
- Labex IMU Priva'Mov 10/2013-10/2016
  Participants: Djamel Benferhat, Razvan Stanica, Hervé Rivano
  The partners in this project are DRIM LIRIS, Inria Privatics, INSA EVS, and LET ENTPE. The aim of this project is to develop and deploy a crowdsensing platform to collect mobility traces from a sample of real users equipped with android devices, while carrying research on privacy preservation issues. Our contribution consists on developing the platform and using the collected data to analyze cellular network offloading strategies.
- ARC 7 animation action "Smart Cities Days" 12/2013
  UrbaNet organized the Smart Cities Days are on the 17th and 18th of December 2013 - http://www.citi-lab.fr/seminar/journees-reseaux-et-smart-cities-17-et-18-decembre-2013/.

8.2. National Initiatives

8.2.1. ANR

- ANR Verso ECOScells 10/2009-12/2012
  Participants: Anis Ouni, Hervé Rivano, Fabrice Valois
  The objective of ECOScells is to study energy efficient microcells networks. Hervé Rivano is leader for Inria side and of the work package focusing on energy efficient wireless backhauling.
- ANR ARESA2 03/2010-08/2013.
  Participants: Alexandre Mouradian, Isabelle Augé-Blum, Fabrice Valois
  The partners in the ANR ARESA2 project are: Orange Labs, Coronis, Inria, LIG, Télécom Bretagne, VERIMAG. Our contributions focus on: resiliency of routing protocols in WSN; how to exploit the heterogeneity in wireless multi-hop network; real-time and QoS support in routing protocols for WSN. This project will end in August 2013. Alexandre Mouradian (Ph.D student) is funded by ARESA2.

- ANR ABCD 10/2013-04/2017.
  Participants: Diala Naboulsi, Marco Fiore, Razvan Stanica
  The partners in the ANR ABCD project are: Orange Labs, Ucopia, Inria UrbaNet, UPMC LIP6 PHARE, Telecom ParisTech. The objective of ABCD is to characterize large-scale user mobility and content consumption in urban areas via mobile data mining, so as to achieve efficient deployment and management of cloud resources via virtual machines. Our contribution in the project consists on the characterization of human mobility and service consumption at a city scale, and the design of appropriate resource allocation techniques at the cellular network level.
- ANR IDEFIX 10/2013-04/2017.
  Participants: Soukaina Cherkaoui, Hervé Rivano, Fabrice Valois
  The partners in the ANR IDEFIX project are: Orange Labs, Alcatel Lucent - Bell Labs, Telecom Paris Tech, Inria UrbaNet, Socrate and Dyogene.

8.2.2. Pôle ResCom

- Ongoing participation (since 2006)
  Communication networks, working groups of GDR ASR, CNRS (http://rescom.inrialpes.fr). Hervé Rivano is member of the scientific committee of ResCom.
  UrbaNet organized the ResCom non-thematic days 18-19th of december 2013 - http://www.citi-lab.fr/seminar/journees-scientifiques-rescom/.

8.2.3. Common Laboratory Inria/Alcatel-Lucent Bell Labs

- ADR Green
  UrbaNet is part of the ADR Green of the common laboratory Inria/Alcatel-Lucent Bell Labs. This ADR provides the PhD grant of Soukaina Cherkaoui on the adaptation of wireless sensor network control protocols for optimizing the energy consumption of heterogeneous cellular LTE networks.

8.3. International Initiatives

8.3.1. Inria International Partners

8.3.1.1. Declared Inria International Partners

- **CNR - IEIIT (Italy)**. The informal cooperation with CNR - IEIIT, consisting on joint publications on mobile crowdsensing and mobile data mining, evolved this year into a strong partnership, following Dr. Marco Fiore's departure from INSA Lyon to CNR - IEIIT. Dr. Fiore remains an external collaborator of the Inria UrbaNet team, actively involved in several research projects.

8.3.1.2. Informal International Partners

- **Politecnico di Torino (Italy)**. Multiple publications co-authored with members of the Telecommunication Networks Group.
- **Universidade Federal de Minas Gerais (Brazil)**. Collaboration with Pedro Vaz de Melo and Antonio F. Loureiro on social mobility analysis.
- **Universitat Politecnica de Catalunya (Spain))**. Cooperation and joint publications on mobile malware propagation.
- **University of Waterloo (Ontario, Canada)**. Cooperation and joint publications on the optimization of wireless mesh networks.

8.4. International Research Visitors

8.4.1. Visits of International Scientists

- **Artur Ziviani**, LNCC, Brazil, 11/2013 (one week)

8.4.1.1. Internships

Sarah Allali

Subject: Network management of Floating Car Data

Date: from Feb 2013 until Jun 2013

Institution: University Claude Bernard Lyon 1 (France)

Silvia Ancona

Subject: Offloading Floating Car Data

Date: from Oct 2013 until Feb 2014

Institution: Politecnico di Bari (Italy)

Egert-Priit Arus

Subject: Integrating Electric Vehicles with Smart Grids

Date: from Oct 2012 until Jan 2013

Institution: Tallinn University of Technology (Estonia)

Julien Delaborde

Subject: From theory to experimentation: the missing link in protocols conception in WSN

Date: from Feb 2013 until Sep 2013

Institution: University Claude Bernard Lyon 1 (France)

Ibrahima Fall

Subject: Topologies des re´seaux urbains: Proprie´te´s et Impacts

Date: from Feb 2013 until Jun 2013

Institution: University Claude Bernard Lyon 1 (France)

Mohammad Irfan Khan

Subject: Information Dissemination in Vehicular Networks

Date: from Mar 2013 until Oct 2013

Institution: INSA Lyon (France)

Yufei Li

Subject: Evaluating energy saving protocols for LTE micro-cell infrastructure

Date: from Sep 2013 until Dec 2013

Institution: INSA Lyon (France)

Sorin Serban Marc

Subject: Signal propagation for vehicular communications in a large-scale urban scenario

Date: from Feb 2013 until Jun 2013

Institution: University of Oradea (Romania)

Soukaina Merzouk

Subject: Radio Propagation in an Urban Vehicular Environment

Date: from Jul 2013 until Aug 2013

Institution: EMSI Rabat (Morocco)

Keijiro Nakagawa

Subject: Multicommodity flow in delay tolerant networks

Date: from Sep 2012 until Jan 2013

Institution: Tokyo University (Japan)

Xuan Linh Nguyen

Subject: Agrégation de données temps-réel et fiable dans les réseaux de capteurs sans fil

Date: from Feb 2013 until Sep 2013

Institution: INSA Lyon (France)

Duc Khoa Pham

Subject: Characterization of Congestion Problems in Vehicular Networks

Date: from Oct 2013 until Dec 2013

Institution: INSA Lyon (France)

Stine Sondergaard

Subject: Vehicular Mobility Simulation

Date: from Oct 2013 until Jan 2014

Institution: Technical University of Denmark (Denmark)

Hamadoun Tall

Subject: Optimizing energy consumption of RPL

Date: from Apr 2013 until Oct 2013

Institution: Institution de la Francophonie pour l'Informatique (Vietnam)

Ionut Radu Toma

Subject: Signal propagation for vehicular communications in a large-scale urban scenario

Date: from Feb 2013 until Jun 2013

Institution: University of Oradea (Romania)

8.4.2. Visits to International Teams

- **Diala Naboulsi** was a visiting scholar within the Telecommunication Networks Group at Politecnico di Torino (Italy), between Sep 2013 and Jan 2014, under the CMIRA Explora'Doc programme.
- **Hervé Rivano** was a visiting researcher at University of Waterloo (Ontario, Canada), in September 2013.