Activity Report 2011

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8. Partnerships and Cooperations

8.1. Local Initiatives

8.1.1. BQR - Design Methods for Energetic Optimisation in Wireless Sensor Networks

Participants: Nicolas Stouls [Project leader], Antoine Fraboulet, Lionel Morel, Guillaume Salagnac.

Glossary

BQR (Bonus Qualité Recherche) project funded by an academic institution.

This project, funded by INSA Lyon, is a collaboration between three research laboratories: CITI (Center of Innovation in Telecommunications and Integration of services), LIRIS (Computer Science, Image and Information Systems Laboratory) and CETHIL (Lyon Thermal Center). The project aims at proposing a practical instrumentation technique for measuring energetic efficiency of buildings by means of using a wireless network of sensor nodes (WSN). In order to make it feasible to scale both space-wise (instrumenting a whole building will require tens or hundreds of nodes) as well as duration-wise (the experiments we envision in this project will span over several months), we adopt a software architecture based on a dedicated streaming database technology [39]. Finally, this whole system is also a case-study for another goal of this project, that of proposing new metrics to characterize energy consumption on embedded devices (in particular we aim at somehow relating energy consumption to a high-level view of the software running on the nodes).

8.1.2. BQF - Smart Chappe Building: A Context-aware Service Platform

Participants: Frédéric Le Mouël [Project leader], Julien Ponge, Stéphane Frénot.

Glossary

BQF (Bonus Qualité Formation) project funded by an academic institution.

This project, funded by INSA Lyon, is leaded by the Telecommunication Department with the participation of two research laboratories: CITI (Center of Innovation in Telecommunications and Integration of services) and LIRIS (Computer Science, Image and Information Systems Laboratory).

Computers and Information Systems are now all around us (Ubiquitous Computing) with a great number of portable and mobile devices (Mobile Computing) that have to adapt to highly changing environments (Context-aware Computing) and that even disappear in our every life in small, active and smart objects (Ambient Intelligence). Smart Houses and Buildings is now an emerging research topic with power managing, security monitoring, .... We think that mobile phones will be the universal remote controller for a user-personalized access to services of such buildings.

Build in 2008, the Claude Chappe Building - hosting the Telecommunication Department and the CITI Lab - is the perfect experimentation place. The Smart Chappe Building proposes a Context-aware Service Platform integrating (i) devices: static ones (large display screens, interactive terminal), mobile phones (iPod with iOS, Samsung with Android, HTC with Windows Mobile), sensors (temperature, hydrometry), RFID, (ii) wireless connectivity: Bluetooth, WIFI and (iii) context-aware and user-personalized services: building guidance, news broadcasting, lecture agenda. This plateform is bothly used for teaching and doing research, for instance, by allowing to develop and integrate new innovative services.

8.1.3. INRIA ADT ORSI

Participants: Antoine Fraboulet [Project leader], Julien Carpentier.

ORSI (Outil de Raffinement de la Simulation à l’Implantation) is an INRIA ADT project started in November 2010.
The ORSI ADT is in the context of programming tools for constrained embedded systems applications. This ADT is the continuation and extension of techniques and tools developed in the scope of wireless sensor networks. Projects like RECAP, SensLab, WASP and Mosar have demonstrated the value and contribution of WSIM and WSNet software simulation tools which are now used outside of their original projects frames. Dissemination and software use in academic and industrial projects can consider their evolution in order to take into account new types of uses and new development paths. The ORSI ADT aims to extend the models used in these software to prepare them for next generation applications hardware and software targets.

8.2. Regional Initiatives

8.2.1. SEmba - Embedded Systems

Participants: Nicolas Stouls [Co-leader], Stéphane Frénot, Antoine Fraboulet, Lionel Morel, Guillaume Salagnac, Yufang Dan.

SEmba, standing for Embedded Systems ("Systèmes Embarqués" in French), is a project funded by the ISLE cluster of the Rhône-Alpe department. This project aims at animating and structuring regional research activities, in order to give more visibility of our results, and at promoting collaborations between academic and industrial teams of the regions. Current academic labs of the project are:

- TIMA, GIPSA-Lab, INRIA Grenoble, LIG, VERIMAG (Grenoble),
- CITI, INL, LIP (Lyon),
- LHC (Saint-Etienne),
- LAMA (Savoie),
- LCIS (Valence).

To produce enhanced embedded systems is a non-stopping effort, due to constant technologies evolutions in nano and micro-electronic. Locks lie in the low cost, low electrical consumption, fast conception and development processes and the quality of systems, as well for the hardware as for the software parts. Project is managed by Dominique Borrione (TIMA Lab) and Nicolas Stouls (CITI Lab), and is organized with three themes:

1. Architectures and conception (software/hardware, components, synthesis)
2. Evaluation of embedded systems quality (validation, test, reliability, performance, quality of service)
3. Communicating infrastructures (protocols, OS, middleware, sensors networks, security, networks on chip)

8.3. National Initiatives

8.3.1. Ubiquest

ANR Ubiquest, Ubiquitous Quest: declarative approach for integrated network and data management in wireless multi-hop networks, with Grenoble Institute of Technology (Christine Collet, Christophe Bobineau), 2009-2012

8.3.2. ANR LISE

Participant: Stéphane Frénot.

Software quality and patterns of security frauds are directly related to legal liability patterns but, so far, software providers have succeeded in limiting their legal liability for their products. The increasing dependence of society on software changes the situation however, and calls for stronger liability rules.
The precise definition of the expected functionalities of software products is quite a challenge, not to mention the use of such definition as a basis for a liability agreement. Taking up this challenge is precisely the objective of the LISE project. To achieve this goal, software liability is addressed both from the legal and the technical points of view with the aim to put forward methods (1) to define liability in a precise and legally sound way and (2) to establish liability in case of incident. http://licit.inrialpes.fr/lise/

8.3.3. ANR TLCOM Senslab

**Participant:** Antoine Fraboulet.

The purpose of the SensLAB project is to deploy a very large scale open wireless sensor network platform. SensLAB’s main and most important goal is to offer an accurate and efficient scientific tool to help in the design, development, tuning, and experimentation of real large-scale sensor network applications. Amazones contributes to the Senslab project through the participation of Antoine Fraboulet who was involved in the early project design phases and through the use of the software simulation suite WSNet, WSim and eSimu in the Senslab project.

8.3.4. ADT SensTools

**Participant:** Antoine Fraboulet.

SensTools is a national INRIA ADT. The project ended in 2010, the final review was held in Lyon on December, 15th. SensTools provides a set of hardware and software tools for the WSN430 platform. Some basic drivers and several OSes are provided.

8.3.5. ADT SensAS

**Participants:** Antoine Fraboulet, Guillaume Salagnac.

SensAS is an INRIA national ADT project started in December 2010.

The SENSAS project’s ambition is to support the development of innovative applications from INRIA EPIS involving several networks of sensors / actuators and / or fleets of robots. From the strong experience in sensor networks, the idea is to build and pool equipment and software in order to have a leverage at the application level. The target applications are selected monitoring / intrusion detection by a fleet robot, self organizing fleets of drones flying biologging applications in the field of health and supervision of large networks of sensors. The SENSAS ADT will amplify skills transfer and facilitate access to implementation of sensor networks technology. In deploying demonstrators at the forefront of technology, the SENSAS ADT showcases the technological expertise and scientific excellence of INRIA who established his reputation in this field.

Amazones is leader of the WP4: SensBOX : software suite for sensor and actuator networks.

8.4. European Initiatives

8.4.1. EU Project Wasp (FP6 IP project)

**Participant:** Antoine Fraboulet.

The WASP project (Wirelessly Accessible Sensor Populations, European Project IST-034963) ended in November 2010. The final review took place in London on October, 21th and 22th 2010. The general goal of the project was the provision of a complete system view for building large populations of collaborating objects. The system incorporates networking protocols for wireless sensor nodes to hide the individual nodes from the application.

Amazones was involved in the project through the participation of Antoine Fraboulet. Antoine Fraboulet was responsible for several deliverables for precompilation tools and software support. He was also member of the project’s architecture team.

8.4.2. EU Project Mosar (LSH European Project)

**Participant:** Antoine Fraboulet.
The goal of the MOSAR project is to study the dynamics of neighborhood people using networks of sensors in a hospital. Amazones was involved in MOSAR through the participation of Antoine Fraboulet. Involvement: implementation of hardware and software support for the project, large scale deployment of a full wireless sensor network and study of dynamic graph patterns.
8. Partnerships and Cooperations

8.1. Regional Initiatives

8.1.1. Cible Grant from Région Rhône-Alpes


Since October 2008, we have obtained a 3-year grant from Région Rhône-Alpes. That grant has funded a PhD student, Mioara Joldeș, who defended her PhD thesis on September 26, 2011. The project consists in automating as much as possible the generation of code for approximating functions. Instead of calling functions from libraries, we wish to elaborate approximations at compile-time, in order to be able to directly approximate compound functions, or to take into account some information (typically, input range information) that might be available at that time. In this project, we collaborate with the STMicroelectronics’ Compilation Expertise Center in Grenoble (C. Bertin, H. Knochel, and C. Monat). STMicroelectronics is funding another PhD grant on these themes.

8.2. National Initiatives

8.2.1. ANR HPAC Project

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

“High-performance Algebraic Computing” (HPAC) is a four year ANR project that will start in January 2012. HPAC is headed by Jean-Guillaume Dumas (CASYS team, LJK laboratory, Grenoble); it involves Arénaire as well as the INRIA project-team MOAIS (LIG, Grenoble), the INRIA project-team SALSA (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 cryptography and algebraic cryptanalysis. HPAC will conduct 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 and innovative high performance solutions for cryptology challenges.

8.2.2. ANR TaMaDi Project

Participants: Nicolas Brisebarre, Florent de Dinechin, Guillaume Hanrot, Vincent Lefèvre, Érik Martin-Dorel, Micaela Mayero, Jean-Michel Muller, Andrew Novocin, Ioana Pasca, Damien Stehlé, Serge Torres.

The TaMaDi project (Table Maker’s Dilemma, 2010-2013) is funded by the ANR and headed by Jean-Michel Muller. It was submitted in January 2010, accepted in June, and started in October 2010. 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 is 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.

There was a meeting in Sophia-Antipolis in February 2011, and two other ones in Lyon in June and December 2011. The various documents can be found at http://tamadiwiki.ens-lyon.fr/tamadiwiki/index.php/Main_Page.

8.2.3. ANR TCHATER Project

Participants: Florent de Dinechin, Honoré Takeugming, Gilles Villard.

The TCHATER project (Terminal Cohérent Hétérodyne Adaptatif TEmps Réel, 2008-2010) is a collaboration between Alcatel-Lucent France, E2V Semiconductors, GET-ENST and the INRIA Arénaire and ASPI project/teams. Its purpose is to demonstrate a coherent terminal operating at 40Gb/s using real-time digital signal processing and efficient polarization division multiplexing. In Lyon, we studied the FPGA implementation of specific algorithms for polarization demultiplexing and forward error correction with soft decoding. TCHATER was extended by the ANR until 9/06/2011, which allowed us to finalize the demonstrator.

8.2.4. ANR LaRedA Project

Participants: Fabien Laguillaumie, Adeline Langlois, Ivan Morel, Xavier Pujol, Damien Stehlé.

The LaRedA project (Lattice Reduction Algorithms, 2008-2011) is funded by the ANR and headed by Brigitte Vallée (CNRS/GREYC) and Valérie Berthé (CNRS/LIRMM). The aim of the project is to finely analyze lattice reduction algorithms such as LLL, by using experiments, probabilistic tools and dynamic analysis. Among the major goals are the average-case analysis of LLL and its output distribution. In Lyon, we concentrate on the experimental side of the project (by using fpLLL and MAGMA) and the applications of lattice reduction algorithms to cryptography.
8.3. European Initiatives

8.3.1. Other European Initiatives

- Guillaume Hanrot and Damien Stehlé collaborate with Cong Ling (Imperial College London, UK) on lattices and communication theory. The collaboration is jointly funded by the CNRS and the Royal Society, from January 2011 to December 2012.

8.4. International Initiatives

8.4.1. INRIA International Partners


8.4.2. Visits of International Scientists

- San Ling (Nanyang Technological University, Singapore) visited for two months (March and April), for collaborating on lattice-based cryptography. Visit partly funded by NTU and Inria Rhône-Alpes (invited researcher).
- Xiao-Wen Chang (McGill University, Canada) visited for one month (July), for collaborating on the numerical aspects of lattice reduction algorithms. Visit funded by ENS de Lyon (invited professor).
- Ron Steinfeld (Macquarie University, Australia) visited for one month (August), for collaborating on lattice-based cryptography. Visit funded by the French Embassy in Australia.

8.4.3. Participation In International Programs

- Guillaume Hanrot and Damien Stehlé participate in the LaBaCry project (Lattice-Based Cryptography), with San Ling and Huaxiong Wang (Cryptography and Coding group of Nanyang Technological University, Singapore). Project jointly funded by NTU and the MERLION program from the French Embassy in Singapore.
- Damien Stehlé is a Partner Investigator in the Australian Research Council Discovery Grant *Lattices as a Constructive and Destructive Tool in Cryptography*, with Christophe Doche, Igor Shparlinski and Ron Steinfeld (Macquarie University).
- Florent de Dinechin was invited 4 months by Nizhniy Novgorod State University (Russia).
8. Partnerships and Cooperations

8.1. ANR Blanc: ALTA

Participants: Nicolas Holzschuch [contact], 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.

8.2. ANR MDCO: ATROCO

Participants: Nicolas Holzschuch, Charles de Rousiers.

We are funded by the MDCO (Large Datasets and Knowledge) research program of the ANR, for a joint research project with the LIRIS research laboratory (Lyon) and the LSII research laboratory (Strasbourg), on acquisition, rendering and relighting of real objects for their inclusion in virtual scenes. This grant started in September 2007, for 36 months, and has been extended for 12 additional months.

8.3. ANR RIAM: CHEVEUX

Participant: Joëlle Thollot.

We are funded by the ANR research program RIAM (grants in multimedia projects) for a joint industrial project with two production studios: Neomis Animation and BeeLight, two other INRIA project-teams: Bipop and Evasion and a CNRS lab (Institut Jean Le Rond d’Alembert de l’Université Pierre et Marie Curie). The goal of this project is to provide rendering and animating tools of hairs for movie making. The grant started in September 2007, for 36 month.

8.4. ANR jeune chercheur: Animaré

Participants: Pierre Bénard, Pierre-Edouard Landes, Joëlle Thollot.

We are funded by the ANR research program “jeune chercheur” (grants for young research leaders) for a joint research project with the iPARLA INRIA project-team in Bordeaux. The goal is to develop expressive rendering models for 2D and 3D animations. The grant started in September 2007, for 36 month.

8.5. ANR jeune chercheur: SimOne

Participants: Fabrice Neyret, Cyril Soler, Manuel Vennier.

We are funded by the ANR research program “jeune chercheur” (grants for young research leaders) for a joint research project with the Evasion INRIA project-team. The goal of this project is to develop “Scalable Interactive Models Of Nature on Earth” (including shape, motion and illumination models for ocean, clouds, and vegetation). The grant started in December 2010, for 36 months.

8.6. ANR CONTINT: RTIGE

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. We aim at integrating our results for digital planetariums. The grant started in December 2010, for 48 months.
8.7. 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.

8.8. LIMA

LIMA (Loisirs et Images Numériques) is a project from the Cluster ISLE (Informatique, Signal et Logiciel Embarqué). The ARTIS team is part of the LIMA project, and cooperates with other teams in the project for Numerical Images.

8.9. Exploradoc grant at Cornell University

Participant: Laurent Belcour.

The Région Rhône-Alpes has established a program to help PhD students initiating international collaboration during their PhD, with support for a six-months stay in a lab in foreign university.

Laurent Belcour was funded for a six-months stay at Cornell University, to work on real-time lighting and rendering algorithms.

8.10. International Initiatives

8.10.1. INRIA Associate Teams

8.10.1.1. CIPRUS

Title: Challenges in Photorealistic Rendering
INRIA principal investigator: Nicolas Holzschuch
International Partner:
  - Institution: Cornell University (United States)
  - Laboratory: Program of Computer Graphics Cornell University
International Partner:
  - Institution: Massachusetts Institute of Technology (United States)
  - Laboratory: Computer graphics group CSAIL Lab
Duration: 2009 - 2011
See also: [http://artis.imag.fr/Projets/Cornell-EA/](http://artis.imag.fr/Projets/Cornell-EA/) Photorealistic rendering deals with the production of pictures of virtual worlds that are as close as possible to what a real photograph of this virtual world would look like. Considerable progress has been made in recent years, and photorealistic pictures are being used in several sectors of the industry: virtual prototyping, special effects for motion picture, video games... However, truly photorealistic pictures of a virtual world are still difficult to get. There are multiple difficulties to overcome: model acquisition, model representation, scalability, sampling and perceptual issues. Our goal in this project is to address all these issues simultaneously, targeting the production of high-quality photographic like pictures that are capable of passing a "Turing-test": they are impossible to separate from photographs of the real world, with all its complexity.
Our goal in this project is to address the many hard challenges remaining in Photorealistic Rendering, especially dealing with the inclusion of real-world objects in virtual scenes and modelling complex materials, such as low-order scattering or high-reflectance materials. The challenges we selected have two points in common: they’re regarded as difficult research challenges, and they would greatly enhance the realism of the pictures generated. Both teams stand to gain from a joint work in this area. This joint work should result in several scientific breakthroughs, with the production of photorealistic pictures of highly complex virtual worlds.

8.10.2. Visits of International Scientists

- Professor Charles Hansen has started in November 2011 a visit of six month in the ARTIS team. His six-months visit is funded by the University of Grenoble. Charles D. Hansen received a BS in computer science from Memphis State University in 1981 and a PhD in computer science from the University of Utah in 1987. He is a professor of computer science at the University of Utah and an associate director of the SCI Institute. From 1989 to 1997, he was a Technical Staff Member in the Advanced Computing Laboratory (ACL) located at Los Alamos National Laboratory, where he formed and directed the visualization efforts in the ACL. He was a Bourse de Chateaubriand PostDoc Fellow at INRIA, Rocquencourt France, in 1987 and 1988. His research interests include large-scale scientific visualization and computer graphics.

- Professor Vijay Natarajan visits the ARTIS and EVASION teams for one month in November 2011. Following a visit of G.-P. Bonneau and S. Hahmann (from EVASION), in February 2010, he collaborated with these two faculties on the topic of topology-based visualization algorithms. A common paper was already published by these authors at IEEE TVCG in 2010. Vijay Natarajan is an professor in the Department of Computer Science and Automation and the Supercomputer Education and Research Centre at the Indian Institute of Science, Bangalore. He received the Ph.D. degree in computer science from Duke University in 2004 and holds the B.E. degree in computer science and M.Sc. degree in mathematics from Birla Institute of Technology and Science, Pilani, India. His research interests include scientific visualization, computational geometry, computational topology, and meshing.
BAMBOO Team

7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. Adaphtanthrophe
- Title: Adaptation des insectes aux anthroposystèmes
- Coordinator: M. Harry
- BAMBOO participant(s): C. Vieira
- Type: ANR Génoplante (2009-2012)
- Web page: Not available

7.1.2. Alcovna
- Title: ALgorithms for COmparing and Visualizing Non Assembled data
- Coordinator: Pierre Peterlongo
- BAMBOO participant(s): J. Kielbassa, V. Lacroix, G. Sacomoto, M.-F. Sagot
- Type: ARC INRIA (2010-2011)
- Web page: http://alcovna.genouest.org/

7.1.3. AphiCible
- Title: Impact de la recombinaison et de la conversion génique biaisée sur l’évolution de génomes
- Coordinator: Y. Rahbé
- BAMBOO participant(s): Y. Rahbé and H. Charles
- Type: ANR Génoplante (2008-2011)
- Web page: Not available

7.1.4. Cogebi
- Title: Symbiosis, digestion and reproduction as aphid physiological processes to identify new targets for insecticides
- Coordinator: L. Duret (LBBE)
- BAMBOO participant(s): C. Gautier, E. Tannier
- Type: ANR Génomique Animale (2008-2011)
- Web page: Not available

7.1.5. ImmunSymbArt
- Title: Immunity and Symbiosis in Arthropods
- Coordinator: D. Bouchon
- BAMBOO participant(s): F. Vavre
- Type: ANR Blanc (2010-2014)
- Web page: Not available
7.1.6. 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: none

7.1.7. NeMo

- Title: Network Motifs
- Coordinator: S. Robin (AgroParisTech, Paris)
- BAMBOO participant(s): V. Lacroix, M.-F. Sagot
- Type: ANR Blanc (2008-2011)
- Web page: http://nemo.ssbgroup.fr/

7.1.8. MIRI

- Title: Mathematical Investigation of "Relations Intimes"
- Coordinator: M.-F. Sagot
- BAMBOO participant(s): V. Acuña, C. Baudet, C. Gautier, V. Lacroix, P. Milreu, C. Klein, I. Nor, M.-F. Sagot, P. Simões
- Type: ANR Blanc (2009-2012)

7.2. European Initiatives

7.2.1. FP7 Project

7.2.1.1. SISYPHE

- 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 Network (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

- 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)
7.2.2. Collaborations in European Programs, except FP7

7.2.2.1. METNET4SysBio
- Title: System level analysis of animal metabolism by multicompartment graph- and constraint-based modelling
- Coordinator: H. Charles (INSA Lyon, France)
- BAMBOO participant(s): V. Acuña, H. Charles, C. Gautier, V. Lacroix, Y. Rahbé, M.-F. Sagot
- European Partner: Angela Douglas, York University, UK

7.2.2.2. SIMBOSI
- Title: Mathematical and algorithmic investigation of symbiosis
- Coordinators: M.-F. Sagot (France), A. Marchetti-Spaccamela (Italy), L. Stougie (the Netherlands)
- BAMBOO participant(s): Whole BAMBOO Team
- Type: Associated Team INRIA (2009-2011)

7.2.3. Major European Organizations with which you have followed Collaborations

Partner 1: Pierluigi Crescenzi, Univ. Florence, Italy
Algorithmic (graphs, trees, sequences), complexity

Partner 2: Ana Teresa Freitas, INESC-ID, IST Lisbon, Portugal
NGS, metabolism, small RNAs, motifs

Partner 3: Alberto Marchetti-Spaccamela, Univ. Rome La Sapienza, Italy
Algorithmic (graphs, trees), complexity

Partner 4: Nadia Pisanti and Roberto Grossi, Univ. Pisa, Italy
Algorithmic (graphs, trees, sequences)

Partner 5: Leen Stougie, Free Univ. Amsterdam and CWI, the Netherlands
Algorithmic (graphs, trees), complexity

7.3. International Initiatives

7.3.1. INRIA International Partners: AMICI
- Title: Algorithms and Mathematics for Investigating Communication and Interactions intra- and inter-organisms
- Coordinators: M.-F. Sagot (France), A. Marchetti-Spaccamela (Univ. Rome, Italy), L. Stougie (Free Univ. Amsterdam and CWI, the Netherlands), P. Crescenzi, Univ. Florence, Italy), N. Pisanti (Univ. Pise, Italy)
- BAMBOO participant(s): Whole BAMBOO Team
- Type: INRIA International Partner
- Web page: http://piluc.dsi.unifi.it/amici/

7.3.2. INRIA-Faperj (Brazil) project: RAMPA
• Title: Bioinformatics for the Reconstruction and Analysis of the Metabolism of PArasites
• Coordinators: M.-F. Sagot (France), A. T. Vasconcelos (LNCC, Brazil)
• BAMBOO participant(s): Whole BAMBOO Team
• Type: Faperj-INRIA
• Web page: not yet available

7.4. Exterior research visitors

Etienne Birmelé, Associate Professor, University of Évry, France, various visits of 1 week until délégation in Sept. 2011
Pierluigi Crescenzi, Professor, University of Florence, Italy, various visits of 1-2 weeks
Roberto Grossi, Professor, University of Pisa, Italy, various visits of 1 week
Alberto Marchetti-Spaccamela, Professor, University La Sapienza, Rome, Italy, visit of 1 week
Andrea Marino, PhD student (Supervisor: Pierluigi Crescenzi), University of Florence, Italy, various visits of 1-2 weeks
Eduardo Moreno, Associate Professor, University Adolfo Ibañez, Chile, visit of 1 week
Nadia Pisanti, Associate Professor, University of Pisa, Italy, various visits of 1 week
Gianluca Rossi, Associate Professor, University of Rome Tor Vergata, Italy, visit of 1 week
Leen Stougie, Free University Amsterdam and CWI, Amsterdam, the Netherlands, visit of 1 week
Ana Tereza Vasconcelos, CNPq Grant, Lab Nacional de Computação Científica, Petrópolis, Brazil, visit of 1 year from Sept. 1st, 2010 until Aug. 31st, 2011
Susana Vinga, Professor, INESC-ID, IST Lisbon, Portugal, visit of 1 week
Maria Emilia Walter Telles, University of Brasília, Brazil, visit of 3 months
6. Partnerships and Cooperations

6.1. Regional Initiatives

6.1.1. Evolution of endosymbiont genomes

Participants: Guillaume Beslon, Stephan Fischer, Carole Knibbe, David P. Parsons, Bérénice Batut.

Endosymbiotic organisms always own shorter genomes than free living ones. This particularly the case in the prokaryotic kingdom. Many hypothesis have been proposed in the literature to explain this observation but it is very difficult to disentangle the effect of the proposed mechanisms and to assess whether they lead – or not – to genome reduction. We have received a BQR grant from INSA-Lyon to investigate this question by a joint work with aevol (to test in silico the different hypothesis) and with comparative genomic approaches (to better characterize the structural difference between short and long genomes). Total amount funded: 15,000 euros.

6.2. National Initiative

6.2.1. Evolution of bacterial genomes

Participants: Guillaume Beslon, Stephan Fischer, Carole Knibbe, David P. Parsons, Bérénice Batut.

Our work on the Aevol software has received two interdisciplinary grants from the CNRS: an inter-institute grant (PEPII) and a grant from the INS2I institute (PEPS). In both cases, the objective is to trigger collaborations with other computer science teams, life science teams or mathematicians. In the case of the PEPS project, our collaborators are the LIP (Lyon) and LAPM (Grenoble). In the case of the PEPII project, we collaborate with the LIP (Lyon), LAPM (Grenoble), LBBE (Lyon) and ICJ (Lyon).

6.2.2. ColAge

Participants: Hugues Berry, Anne-Sophie Coquel.

ColAge is a 4-year research project launched in early 2009 as a Large-Scale Initiative Action co-funded by the French national research institutes INRIA (computer science) and Inserm (medicine and health). We search for natural and engineering solutions to the control of bacterial growth and aging using both systems biology and synthetic biology approaches. Our main strategy is to leverage synergies resulting from day-to-day collaborations between computer scientists and cell biologists. The research topics on aging in bacteria above is one of the ColAge workpackages. Supervisor: H. Berry, EPI Beagle. Total amount funded (for 2009-2010): 330,000 euros. Further information available at http://colage.saclay.inria.fr/.

In 2010, ColAge fostered the emergence of two other grants/funding by the French national agency for research, ANR: Pagdeg (led by A. Lindner, see below) and GeMCo (led by M. Chaves, http://www-sop.inria.fr/members/Madalena.Chaves/).

6.2.3. PAGDEG

Participants: Hugues Berry, Anne-Sophie Coquel, Ariel Lindner, Y. Chen, L. Moisan.

A three-year project (2010-2012) funded by the French National Agency for Research (ANR), Call “PIRIBIO 2009” (Programme interdisciplinaire de recherche sur les systèmes moléculaires et cellulaires et d’innovation biomédicale). We study the causes and consequences of protein aggregation in cellular degeneration in bacteria combining innovative experimental (microfluidics, quantitative biology) and computer simulation (individual based-modeling, ODEs) approaches. Supervisor: A. Lindner (INSERM, Paris). Total amount funded: 450,000 euros.
6.2.4. **Stochagene**  
**Participants:** Hugues Berry, Guillaume Beslon, Gaël Kaneko.  
Stochagene is a four-year project (2011-2015) funded by the French National Agency for Research (ANR), Call “Blanc 2011”. The objective of the project is to identify the molecular causes of stochasticity in gene expression by experimental and modeling approaches. Supervisor: O. Gandrillon (CNRS, Lyon). Total amount funded: 466,000 euros.

6.2.5. **NéoBG (pour une théorie biologiquement réaliste de l’apprentissage par renforcement)**  
**Participants:** Hugues Berry, Jules Lallouette.  
NéoBG is an interdisciplinary project funded by the CNRS (Appel Projets exploratoires pluridisciplinaires inter-instituts – PEPII – 2011-2012). Total amount funded for Beagle: 6 000 €

6.2.6. **Partnership with F. Taddei’s group, INSERM U1001, Cochin hospital Paris**  
**Participants:** Guillaume Beslon, Carole Knibbe, David P. Parsons, Hugues Berry, Anne-Sophie Coquel.  
Strong collaboration links exist between Beagle and F. Taddei’s and A. Lindner’s group, in Paris: First, A. Lindner and H. Berry collaborate on the study of aging in bacteria. Both co-supervise A.S. Coquel’s PhD within grants ColAge and Pagdeg (see above). Moreover, Aevol, a software developed by our team (see above), is used by the INSERM experimentalist group in Paris: with our help, D. Misievic and F. Taddei use it to study the evolution of cooperation in bacteria: Under which conditions can cooperation emerge? What kind of genetic architecture evolves when cooperation arises?

6.2.7. **Partnership with D. Schneider’s group, LAM, Univ. Joseph Fourier, Grenoble**  
**Participants:** Guillaume Beslon, Stephan Fischer, Carole Knibbe, David P. Parsons, Bérénice Batut.  
The team of Dominique Schneider is composed of life scientists developing experimental evolution strategies with micro-organisms. We are engaged in a close collaboration with this team since the methodology they use is very similar to the one we develop with aevol (though they are studying real organisms). Several projects have been submitted this year (ANR, Labex, Investissement d’avenir en bioinformatique) and we are waiting for the results.

6.2.8. **Astrocytic regulation of neuronal network activity**  
**Participants:** Hugues Berry, Jules Lallouette.  
Research Networks Program in Computational Neurosciences and Computational Cognitive Sciences of the High Council for Scientific and Technological Cooperation between France-Israel. Total amount funded for Beagle: 80 000 €.  
Healthy functionality of the central nervous system (CNS) relies on intricate neuron-glia networks. Recent data suggest that glial cells, including astrocytes, play a crucial role in the way information is processed and stored by the brain. In particular, synapses should not be considered bipartite, but rather tripartite structures, comprised of the pre-synaptic terminal, the post-synaptic one and the surrounding astrocyte. Moreover, glial cells, like neurons, also form intricate networks of cells and are linked by gap junctions to afford long-range communication via the propagation of calcium waves. Therefore, neurons and astrocytes form intertwined neuron-glia networks supporting active partnership between the two cell populations. Hence, understanding the nature of the neuron-glia interaction is essential to fully understand how the brain functions, and will serve as a stepping stone for deciphering disorders of the CNS. Our long-term goal is to reveal the underlying mechanism that controls 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 calcium wave propagation and (2) to reveal how astrocyte signals dynamically affect synaptic information transfer, thus regulating neuronal network activity. To achieve these objectives we will employ a methodology that combines corresponding theoretical and experimental investigations of small neuron-glia networks. We will use unique cortical cultures made of several hundred well-identified cells, thus facilitating very systematic investigation in a manner that is fully compatible with our analytical tools. 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 ataxia-telangiectasia (A-T), a progressive neurodegenerative disorder induced by mutations in the ATM gene encoding the protein kinase ATM, a key player in the DNA damage response. Leveraging the possibilities offered by our joint experimental and theoretical approach, we will be able to investigate heterogeneous neuron-glial networks where one element comes from a diseased mouse model and the other from healthy (WT) animals. This novel approach will provide us with a unique opportunity to uncover the cellular origin of these pathologies.
8. Partnerships and Cooperations

8.1. European Initiatives

8.1.1. FP7 Projet

8.1.1.1. FlexibleRobotBehav

Title: FlexibleRobotBehavior
Type: FP7-PEOPLE-2007-4-1-IOF
Instrument: Marie Curie International Outgoing Fellowships for Career Development (IOF)
Duration: June 2008 - May 2011
Coordinator: INRIA (France)
Others partners: Japanese Advanced Institute for Science and Technology (AIST)
Abstract: The main objective of this research and training project is to enhance the algorithms and control laws of existing humanoid robots in order to obtain a walking behavior versatile and safe enough to be integrated into higher level tasks such as manipulation, vision, tele-operation, interaction with humans, which all require a strong capacity to face unforeseen events in an efficient way. And the objective is to solve this problem with a solution general enough to be applied also to the case of manipulator robots.

8.2. International Initiatives

8.2.1. INRIA Associate Teams

- 2009 -2011: SHARE associated team between INRIA (BiPop and EVASION) and the University of British Columbia (Canada).
8. Partnerships and Cooperations

8.1. National Initiatives

- 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”, initiated in 2010 and officially animated by Fabrice Rastello and Laure Gonord, are now well-established as a biannual event. Their local organization is handled alternately by the different research teams (Lyon in summer 2010, Aussois in Winter 2010, Dinard in Spring 2011, St Hippolyte in Autumn 2011).

- Christophe Alias and Paul Feautrier have been active participants in an effort to structure the french high-level synthesis community, including both actors from academia (TIMA, IRISA, LaSTIC, ASIM) and industry (Thales, Bull). The aim of this effort was to submit an ANR proposal for the Arpege initiative. A first version was submitted in 2010, but was rejected mostly on the ground that the project leader should have been from industry rather than academia. A revised proposal, under the leadership of the Magillem company, was submitted in March 2011 and rejected too. It seems evident in retrospect that the HLS community has yet to find a clearer balance between new research and industrial development, and that a new submission must wait for a more mature approach.

8.2. Participation in International Programs

- Fabrice Rastello has obtained a FAPEMIG-INRIA (Brazil-France) funding to collaborate with Mariza A. S. Bigonha, Fernando M. Q. Pereira, and Roberto S. Bigonha from the Federal University of Mina Gerais (UFMG) in Brazil. The work on static single information form described in Section 6.7, and the work on register allocation to handle aliasing described in Section 6.5 are part of this collaboration.

- From July 2010 till July 2011, Fabrice Rastello was in a sabbatical year at Colorado State University within the group of Sanjay Rajopadhye, and in connection with the PathScale compiler company.

8.3. Informal Contacts

- Compsys has regular contacts with Sebastian Hack at Saarland University (Saarbrücken, Germany), Philip Brisk at University of California, Riverside (Riverside, USA), and Benoît Dupont de Dinechin (Kalray, Grenoble) on back-end code optimizations.

- Compsys has regular contacts with P. Sadayappan (Ohio State University), J. (Ram) Ramanujam (Louisiana State University), and Sanjay Rajopadhye (Colorado State University), on polyhedral code transformations. Fabrice Rastello was in sabbatical in 2010-2011 in Sanjay Rajopadhye’s group. Christophe Alias is co-advising a PhD with Sanjay Rajopadhye, with an agreement to be signed between ENS-Lyon and Colorado State University.

- In France, Compsys is particularly linked with researchers such as Albert Cohen (Parkas team, Inria), Steven Derrien (Cairn team, Inria), Alain Greiner (LIP6, Paris), Alain Ketterlin (Camus team, Inria), Benoît Dupont de Dinechin (Kalray), Christophe Guillon (STMicroelectronics).

- Compsys, as some other Inria projects, is involved in the network of excellence HiPEAC (High-Performance Embedded Architecture and Compilation, http://www.hipeac.net/). Compsys is also a (distant) partner of the network of excellence Artist2 to keep an eye on the developments of MPSoC.
• Florian Brandner is collaborating with the group of Andreas Krall at the Vienna University of Technology on topics related to the processor description language xADL and on compilation for explicitly parallel processors (EPICOpt, http://www.complang.tuwien.ac.at/epicopt/). He is additionally working with Martin Schöberl from the Technical University of Denmark (DTU) on topics evolving around time-predictable computing.

• Alain Darte is in contact with Yann Orlarey from the Grame team (Lyon, “Centre National de Création Musicale”). They co-advice a Master 1 internship on some features in the development of Faust, a compiled language for real-time audio signal processing.

8.4. Visits of Research Scientists

Since Autumn 2010, several researchers visited Compsys and gave talks in our working groups.

• Amir Ben Amram (Tel Aviv University, Israël).
• Sebastian Hack (Saarland University, Germany).
• Andreas Krall and Gergő Barany (Vienna University, Austria).
• J. Ramanujam (Baton Rouge University, Louisiana)
• Antoniu Pop (Ecole des Mines, Paris).
• Benoît Dupont de Dinechin (Kalray, Grenoble).
• Alain Ketterlin (Camus Inria team, Strasbourg).
• Albert Cohen (Parkas Inria team, Paris).

8.5. Internships

In Spring 2011, three internships were advised in Compsys.

• Guillaume Andrieu (Polytech’Lille engineering school, Master level): termination of big programs.
• Alexandre Isoard (ENS-Lyon, M1 Master level): retiming for Faust.
• François Gindraud (ENS-Lyon, M1 Master level): ψ-SSA, gated-SSA, and variants.
8. Partnerships and Cooperations

8.1. Regional Initiatives

8.1.1. ESPAD (FEDER)

Participants: Guillaume Chelius, Sandrine Avakian, Guillaume Roche.

The ESPAD (Embedded Sport Performance Analysis Data) is a bio-mechanics / physiology logging project funded by FEDER. The goal is to contribute to the design of a distributed multi-sensor architecture that can be worn by an individual and that records bio-mechanical, physiological and environmental data.

8.2. National Initiatives

8.2.1. Complex Networks Metrology (RNSC)

Participants: Christophe Crespelle.

D-NET is a member of the project Complex Networks Metrology involving LIP6 (Université Paris 6), LSIIT (Université de Strasbourg) and LIP (ENS de Lyon, Université Lyon 1). The project, funded by RNSC (Réseau National des Systèmes Complexes), started in January 2011 and ended in December 2011. Its goal is to design rigorous methods for measuring complex networks. The originality of our approach is to lead measurements dedicated to a specific property instead of trying to get a complete view of the network, which has been showed to lead to significant biases in the obtained view. Its major domain of application is Internet measurements.

8.2.2. SensLAB (ANR)

Participants: Eric Fleury [Prime Investigator], Guillaume Chelius.

The purpose of the SensLAB project is to deploy a very large scale open wireless sensor network platform. SensLAB’s main and most important goal is to offer an accurate and efficient scientific tool to help in the design, development, tuning, and experimentation of real large-scale sensor network applications. The sensLAB platform is distributed among 4 sites and is composed of 1,024 nodes. Each location hosts 256 sensor nodes with specific characteristics in order to offer a wide spectrum of possibilities and heterogeneity. The four test beds are however part of a common global testbed as several nodes will have global connectivity such that it will be possible to experiment a given application on all 1K sensors at the same time.

8.2.3. F-Lab (ANR)

Participants: Eric Fleury, Sandrine Avakian.

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 organizations 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, mutualizing 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 organizations 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.

8.2.4. SensAS (INRIA ADT)

**Participants:** Eric Fleury [Prime Investigator], Guillaume Chelius [scientific correspondent of the SENSIBIO work package].

The ambition of SensAS is to deploy wireless sensor and actuator applications. From the strong expertise gather in MOSAR, SensLAB and SensTOOLS, the goal is to transfer and help other INRIA research team to deploy their own application, not in the restricted networking area: flying drones, robots fleet, biologging, health, management?

8.2.5. DyVi (INRIA ARC)

**Participants:** Eric Fleury [Prime Investigator], Qinna Wang, Adrien Friggeri.

The goal of the ARC DyVi is to build a foundation for dynamic graph theory in order to be able to describe properties and design efficient and specific algorithmic for dynamic graph and overlapping communities. The goal is to be able to tackle multi time scale visualization tools based on TULIP, to implement data structure / handling / time scale aggregation / browsing within the TULIP software developed by the INRIA GRAVITE team. We also target epidemic process visualization in order to be able to run and "see" dynamic processes on dynamic networks.

8.3. European Initiatives

8.3.1. Collaborations in European Programs, except FP7

Program: FP6 - LSH

Project acronym: MOSAR

Project title: Mastering hOSpital Antimicrobial Resistance and its spread into the community

Duration: 2008 – 2012

Coordinator: INSERM

Other partners: University of Antwerp (Belgium), National Medicines Institute (Poland), August Pi i Sunyer biomedical research Institute (Spain), University Medical Center Utrecht (Netherlands), University of Geneva Hospitals (Swisslands), Tel Aviv Medical Center (Israel), Health Protection Agency (UK), Medical school of Paris 12 University (France), Pasteur Institute (France), Inserm-Transfert (France), Ingen Biosciences (France), BiologischeAnalyseSystemGmbH (Germany), AmpTec GmbH (Germany), Array-On GmbH (Germany)

Abstract: MOSAR is an Integrated Project supported for 5 years by the European Commission under the Life Science Health Priority of the Sixth Framework Program. Infections caused by antimicrobial-resistant bacteria (AMRB) account for an increasing proportion of healthcare-associated infections, particularly in high-risk units such as intensive care units and surgery; patients discharged to rehabilitation units often remain carriers of AMRB, contributing to their dissemination into longer-term care areas and within the community. The overall objective of MOSAR is to gain breakthrough knowledge in the dynamics of transmission of AMRB, and address highly controversial issues by testing strategies to combat the emergence and spread of antimicrobial resistance,
focusing on the major and emerging multi-drug antimicrobial resistant microorganisms in hospitals, now spreading into the community. Microbial genomics and human response to carriage of AMRB will be integrated with health sciences research, including interventional controlled studies in diverse hospital settings, mathematical modeling of resistance dynamics, and health economics. Results from MOSAR will inform healthcare workers and decision-makers on strategies for anticipating and mastering antimicrobial resistance.

8.4. International Initiatives

8.4.1. Visits of International Scientists

- Thi Ha Duong Phan, Academy of Science and Technology in Vietnam, was in visit in the D-NET team for one month in June 2011.
- Renaud Lambiotte, University of Namur in Belgium, was in visit in the D-NET team in November 2011.
- Mariano Beiro, Universidad de Buenos Aires, was in visit in the DNET team for 4 months.
- Duc Thinh Nguyen, Intitut de la Francophonie pour l’Informatique in Hanoï (Vietnam), made his Master internship in the D-NET team for six months from March to September 2011.

8.4.2. Participation In International Programs

8.4.2.1. STIC AMSUD

Project 09STIC04, Dynamics of Layered Complex Networks, between the LNCC in Brazil (Prime Investigator is Artur Ziviani), UFMG in Brazil, Universidad de Buenos Aires in Argentina, UPMC in France and INRIA. The goal is to develop a better understanding of the issues involved in dealing with dynamic graphs and their applicability to real-world complex networks. We also establish a thematic and collaborative research network between the partners of this project involving complementary backgrounds to deal with the challenges of investigating complex network systems.

8.4.2.2. Inria/FAPERJ

Project CoDyN (Complex Dynamic Networks) between LNCC and DNET/INRIA. The main goal of the CoDyN project is to lay solid foundations to the characterization of dynamically evolving networks, and to the field of dynamical processes occurring on large scale dynamic interaction networks.

8.4.2.3. PICS CNRS – Combinatorial Structures for Complex Network Modeling

Participant: Christophe Crespelle.

D-NET is a member of a PICS project of the CNRS between the Academy of Science and Technology in Vietnam and the Laboratoire d’Informatique de Paris 6 (LIP6) and Université Claude Bernard Lyon 1 in France. The project started on January 2010 and will end in December 2012. Its goal is to design models of complex networks that are able to capture at the same time two of their most relevant properties: their heterogeneous degree distribution and their high local density. The goal is to provide very general models that do not make stronger assumptions on the structure of the graphs to be modeled. Our approach is based on the overlapping structure of cliques in complex networks and uses mainly tools coming from combinatorics, graph theory and statistics.
8. Partnerships and Cooperations

8.1. Regional Initiatives

- Collaboration with the Immune Lab of Jacqueline Marvel in Lyon (Immunité, Infection et Virus), one paper published together in 2011.
- Our team is a partner of the recently accepted ANR project MODPOL (head Vincent Calvez, CNRS member of Inria Numed).

8.2. European Initiatives

- Collaboration with Oscar Angulo Torga, from the math department of the University of Valladolid (Spain), on the analysis of a age-structured model describing erythropoiesis, and its numerical resolution.

8.3. International Initiatives

8.3.1. INRIA International Partners

Two weeks of Thomas Lepoutre in Santiago (Chile) by Salome Martinez (CMM) for a joint work on cross diffusion models.

Programme explorateur: five weeks collaboration with Pr Doron Levy (College Park, Maryland, USA).

8.3.2. Visits of International Scientists

8.3.2.1. Internships

Vsevolod Salnikov (from May 2011 until Sep 2011)
- Subject: Hybrid models of cell population dynamics
- Institution: Laboratoire Poncelet (Russia (Russian Federation))

8.3.2.2. Visits of International Scientists

- Glenn Webb (June 2011)
  - Subject: Analysis of a model for transfer phenomena in biological populations
  - Institution: Vanderbilt University, Nashville, USA
- Marc Chaplain (24-25 November 2011)
  - Subject: Mathematical modelling of intracellular negative feedback systems
  - Institution: Division of Mathematics, University of Dundee, Scotland
- Grégoire Altan-Bonnet (16-17 November 2011)
  - Subject: Enforcing a reliable immune response with unreliable lymphocytes
  - Institution: ImmunoDynamics Group, Programs in Computational Biology and Immunology, Memorial Sloan-Kettering Cancer Center, New York NY, USA
- Marc-Thorsten Hutt (08-09 September 2011)
  - Subject: How few elements can systematically shape large-scale patterns
  - Institution: Jacobs University, Bremen, Germany

- Pal Westermark (22-23 June 2011)
  - Subject: Descriptive analysis of cellular circadian rhythms, and some scenarios for coupling and synchronization
  - Institution: Institute for Theoretical Biology, Berlin, Germany

- Philip Maini (25-27 May 2011)
  - Subject: Mathematical modelling of tumour dynamics
  - Institution: Oxford University, United Kingdom

- Ingmar Glauche (25-26 May 2011)
  - Subject: Systems biology of stem cell fate decisions
  - Institution: TU Dresden, Germany

- Peter Swain (04-05 December 2011)
  - Subject: Noise and fluctuations in gene expression
  - Institution: Center for Systems Biology at Edinburgh, United Kingdom

- Roeland M.H. Merks (29-30 March 2011)
  - Subject: Cell-based computer modeling of angiogenesis and vasculogenesis
  - Institution: Life Science Group, CWI, and NCSB-NISB, Amsterdam, The Netherlands

- Thomas Stiehl (02-03 March 2011)
  - Subject: A Mathematical Model for Cell Differentiation and its Applications to Hematopoiesis and Stem Cell Transplantation
  - Institution: Heidelberg University, Germany

8.3.3. Participation In International Programs

  **Participants**: Samuel Bernard, Fabien Crauste, Polina Kurbatova, Laurent Pujo-Menjouet, Vitaly Volpert [Coordinator].
E-MOTION Project-Team (section vide)
8. Partnerships and Cooperations

8.1. Regional Initiatives

8.1.1. BQR Intuactive (2011-2014)

**Participants:** Rémi Brouet, Marie-Paule Cani, Jean-Claude Léon.

The Intuactive project is a collaboration between our research group, the conception group of G-scop lab, and the HCI group of LIG lab. The goal is to develop and compare 2D vs 3D interaction for selecting, placing and editing 3D shapes. The project is funded by Grenoble-INP and provides the grant for Rémi Brouet’s PhD.

8.1.2. BQR INP IDEAL (04/2009 - 03/2012)

**Participants:** Dobrina Boltcheva, Jean-Claude Léon.

3D models, coming for instance from engineering fields, are often ‘idealized’, or ‘simplified’ (topologically speaking), in order to be used for simulation. The goal of this project IDEAL, funded by Grenoble-INP, is to study these models, in particular the most general ones which are called ‘non-manifolds’ and which are not handled by current software. We collaborate in this project with the University of Genova in Italy (Leila De Florian).

8.1.3. BQR INP "Modèles multi-résolutions de fissures" (04/2009 - 09/2012)

**Participants:** Marie Durand, François Faure.

A project on the simulation of fracture propagation in concrete structures has started, funded by INP Grenoble. The purpose is to develop a mixed, dynamic model of structures, using finite elements everywhere except near crack fronts, where a discrete model is applied. This goes beyond the ANR Vulcain project (section 8.2.1) because we want to dynamically switch between finite element and discrete models. Bui Huu Phoc has started a Ph.D. in October, co-tutored by Frederic Dufour and Vincent Richefeu, from the L3S-R CNRS laboratory, and François Faure from EVASION.

8.1.4. LIMA "Loisirs et Images" (2007 - 2011)

**Participants:** Marie-Paule Cani, François Faure, Damien Rohmer.

LIMA (Loisirs et Images) was a Rhône-Alpes project in the ISLE cluster (Informatique, Signal, Logiciel Embarqué) focussed on classification and computer graphics. This project founded the PhD for Lucian Stanculescu with Raphaëlle Chaine (LIRIS) and Marie-Paule Cani. It led to the generation of a new free form sculpture tool [11]. A research seminar in July had been organised to end the project in July. It gathers scientist from computer graphics and computer vision, and Bob Sumner presented the recent work from Disney Research Zurich to the community. An other project from the ISLE cluster will start in the future on a similar topic in order to pursue gathering scientists from Rhône-Alpes region and continue on the promising results of LIMA.

8.1.5. Scenoptique

**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.

8.2. National Initiatives

8.2.1. ANR Vulcain (06/2008-06/2011)
Participants: Marie Durand, François Faure.

We participate to the ANR Vulcain project (http://vulcain.ujf-grenoble.fr/), which purpose is to evaluate the vulnerability of buildings such as industrial facilities undergoing explosions of projectile impacts. Marie Durand has implemented discrete element models in GPU in order to speed up concrete fracturing simulations, and an article has been submitted to the European Journal of Environmental and Civil Engineering.

8.2.2. ANR RepDyn (01/2010-12/2012)
Participants: Marie Durand, François Faure.

We participate to the ANR RepDyn project, started at the beginning of 2010, in collaboration with CEA, EDF, Laboratoire de Mécanique des Structures Industrielles Durables (LaMSID), and ONERA. The purpose of this project is to enhance the performance of discrete elements and fluid computations, for the simulation of cracks in nuclear reactors or planes. Our task is to propose GPU implementations of particle models, as well as load balancing strategies in the context of multi-core, multi-GPU hardware. Marie Durand is doing a PhD thesis on this task.

8.2.3. ANR ROMMA (01/2010-12/2013)
Participants: François Faure, 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.

8.2.4. ANR SOHUSIM (01/2010-12/2013)
Participants: Ali Hamadi Dicko, François Faure.

Sohusim (Soft Human Simulation) 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 mechatronics device with the objective of studying and designing the systems for patient manipulation with very low mobility (clinical bed). The second axis focuses on the detailed modeling and simulation of the interaction of an active lower limb with objects like orthosis, exoskeleton, clothes, or shoes. The objective being to obtain a tool for design of devices in permanent contact with the human who allows determining the adequate ergonomics in terms of forms, locations, materials, according to the intended use.

Dicko Ali Hamadi is a Ph.D. student within EVASION team. His works revolve around the problems in the SOHUSIM project. He is co-tutored by Olivier Palombi in EVASION, in collaboration with Benjamin Gilles in DEMAR.

8.2.5. PlantScan3D (ARC INRIA 09/2009-09/2011)

Participants: Dobrina Botecha, Marie-Paule Cani, Cédric Zanni.

This project is in collaboration with Vitual Plants and Galaad teams. Its objective is to develop the use of laser scanner for plant geometry reconstruction, in partnership with biologists-agronomists from several teams in France and Europe. Our last contributions include the development of new representation for the plant enabling to use the skeleton and thickness information computed by the other teams from scanner data.

8.3. European & International Initiatives

8.3.1. PASSPORT (06/2008-05/2011)

Participants: Guillaume Bousquet, François Faure.

The PASSPORT for Liver Surgery project (http://www.passport-liver.eu/Homepage.html) deals with the objectives of the Virtual Physiological Human ICT-2007.5.3 objective. PASSPORT’s aim is to develop patient-specific models of the liver which integrates anatomical, functional, mechanical, appearance, and biological modelling. To these static models, PASSPORT will add dynamics liver deformation modelling and deformation due to breathing, and regeneration modelling providing a patient-specific minimal safety standardized FLR. These models, integrated in the Open Source framework SOFA, will culminate in generating the first multi-level and dynamic Virtual patient-specific liver allowing not only to accurately predict feasibility, results and the success rate of a surgical intervention, but also to improve surgeons’ training via a fully realistic simulator, thus directly impacting upon definitive patient recovery suffering from liver diseases.

The final review was held in December in Strasbourg. Our deliverables were delivered in time.

8.3.2. IRIS Network of Excellence (2009-2011)

Participant: Rémi Ronfard.

The IRIS (Integrating Research in Interactive Storytelling) Network of Excellence (NoE) started its work in January 2009, as a new EC-funded initiative (under FP7’s Intelligent Content and Semantics). The IRIS network includes work packages on Narrative Formalisms; Artificial Intelligence Tools and Techniques; Authoring Tools and Creation Methods; Hybrid Intelligent Virtual Actors; Cinematography; Interaction and Dialogue. As part of the work package on cinematography, we proposed a computational framework for film editing suitable for interactive storytelling applications. The model has been implemented in collaboration with the Bunraku/Mimetic team and demonstrated to IRIS project members.

8.3.3. SHARE INRIA Associate Teams (2009-2011)

Participants: Adrien Bernardt, Marie-Paule Cani, François Faure, Damien Rohmer.

SHARE is a joint associate with the INRIA project BIPOP, which funds collaborations with the University of Vancouver. It brings together researchers with complementary expertise in geometric modeling, computer graphics, mechanics, robotics, control, neuroscience and perception, and who aim to jointly tackle key elements of modeling and animation of humans and animals interacting with their environment. The project had three foci: 1) designing enriched geometric and mechanical models for the shape and motion of soft tissues, skin, cloth and hair; 2) improving existing models of human and animal motion; and 3) modeling interaction between moving creatures and complex, realistic environments.
8.3.4. Visits of International Scientists

- Alla Scheffer visited EVASION team for 6 months.
EXMO Project-Team

8. Other Grants and Activities

8.1. National grants and collaborations

8.1.1. Datalift ANR content platform

Participants: Zhengjie Fan, Jérôme David, Jérôme Euzenat [Contact].

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 [22][19].

More information on Datalift can be found at http://www.datalift.org.

8.1.2. DataRing ANR Verso Project

Participants: Manuel Atencia [Contact], Jérôme Euzenat.

Exmo participates, as part of the LIG partner, in the DataRing project about peer-to-peer data sharing for online communities. We work more directly with Marie-Christine Rousset on trust in semantic peer-to-peer networks.

More information on DataRing can be found at http://www.lina.univ-nantes.fr/projets/DataRing/.

8.2. European initiatives

8.2.1. SEALS infrastructure project: Evaluating semantic technologies

Participants: Cássia Trojahn dos Santos [Contact], Jérôme Euzenat.

Exmo is a partner of the SEALS European commission infrastructure project whose goal is to provide the infrastructure for evaluating semantic technologies. Jérôme Euzenat is vice-coordinator in charge of the research area.

More particularly, Exmo is in charge of providing an infrastructure for evaluating ontology matching systems and algorithms, to be aggregated in the SEALS platform. This task involves:

- designing evaluation campaigns, including identifying criteria, metrics, datasets, and tools to be used in each campaign,
- designing and implementing services for automatic evaluation of systems and algorithms,
- analysing the results of evaluation campaigns and using them to produce a detailed report on both the effectiveness of the testing methodologies, and the systems that have been tested.

This year we have prepared the second SEALS evaluation campaign and designed a fully automated evaluation process [20][23][24]. We have also organised the OAEI 2011 campaign (§ 6.1.1) [9].

More information on SEALS can be found at http://www.seals-project.eu/.

8.3. International Initiatives

8.3.1. Collaborative and Automatic Methods for the Multilingualisation of Lexica and Ontologies (Cameleon)

Participants: Cássia Trojahn dos Santos [Contact], Jérôme Euzenat.

The Cameleon project is a 4 years joint CAPES-COFECUB project. It aims at creating, reinforcing and continuing academic exchanges between French and Brazilian researchers in the domain of multilingual lexica and ontologies. Exmo’s main tasks is to contribute to multilingual matching and interfacing ontologies and lexica.

More information on Cameleon can be found at http://cameleon.imag.fr/.
7. Partnerships and Cooperations

7.1. Regional Initiatives

7.1.1. Projet “Calcul Hautes Performances et Informatique Distribuée”

Participants: Yves Caniou, Eddy Caron, Frédéric Desprez, Christian Pérez.

E. Caron leads (with C. Prudhomme from LJK, Grenoble) the “Calcul Hautes Performances et Informatique Distribuée” project of the cluster “Informatique, Signal, Logiciels Embarqués”. Together with several research laboratories from the Rhône-Alpes region, we initiate collaborations between application researchers and distributed computing experts.

7.2. National Initiatives

7.2.1. ANR White Project Rescue, 4 years, 2010-2014

Participants: Anne Benoit, Loris Marchal, Yves Robert, Frédéric Vivien, Dounia Zaidouni.

The ANR White Project RESCUE was launched in November 2010, for a duration of 48 months. It gathers three INRIA partners (Graal, Grand-Large and Hiepac) and is led by Graal. 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.

7.2.2. ANR grant SPADES, 3 years, 08-ANR-SEGI-025, 2009-2012

Participants: Eddy Caron, Florent Chuffart, Frédéric Desprez, Haiwu He.

Today’s emergence of Petascale architectures and evolutions of both research grids and computational grids increase a lot the number of potential resources. However, existing infrastructures and access rules do not allow to fully take advantage of these resources. One key idea of the SPADES project is to propose a non-intrusive but highly dynamic environment able to take advantage of the available resources without disturbing their native use. In other words, the SPADES vision is to adapt the desktop grid paradigm by replacing users at the edge of the Internet by volatile resources. These volatile resources are in fact submitted via batch schedulers to reservation mechanisms which are limited in time or susceptible to preemption (best-effort mode).

One of the priorities of SPADES is to support platforms at a very large scale. Petascale environments are therefore particularly considered. Nevertheless, these next-generation architectures still suffer from a lack of expertise for an accurate and relevant use. One of the SPADES goal is to show how to take advantage of the power of such architectures. Another challenge of SPADES is to provide a software solution for a service discovery system able to face a highly dynamic platform. This system will be deployed over volatile nodes and thus must tolerate failures. SPADES will propose solutions for the management of distributed schedulers in Desktop Computing environments, coping with a co-scheduling framework.

7.2.3. ANR grant: COOP (Multi Level Cooperative Resource Management), 3 years, ANR-09-COSI-001-01, 2009-2012

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

The project is led by Christian Pérez.

7.2.4. ANR JCJC: Clouds@Home (Cloud Computing over Unreliable, Shared Resources), 4 years, ANR-09-JCJC-0056-01, 2009-2012

Participants: Gilles Fedak, Bing Tang.

Recently, a new vision of cloud computing has emerged where the complexity of an IT infrastructure is completely hidden from its users. At the same time, cloud computing platforms provide massive scalability, 99.999% reliability, and speedy performance at relatively low costs for complex applications and services. This project, lead by D. Kondo from INRIA MESCAL investigates the use of cloud computing for large-scale and demanding applications and services over unreliable resources. In particular, we target volunteered resources distributed over the Internet. In this project, G. Fedak leads the Data management task (WP3).

7.2.5. 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: Julien Bigot, Frédéric Desprez, Gilles Fedak, Sylvain Gault, Christian Pérez, 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 Map-Reduce model is its inherently high degree of potential parallelism.

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

7.2.6. ADT MUMPS, 3 years, 2009-2012

Participants: Maurice Brémond, Guillaume Joslin, Jean-Yves L’Excellent.

ADT-MUMPS is an action of technological development funded by INRIA. Tools for experimentation, validation, and performance study of MUMPS are being developed; one of the goals was also to efficiently use and benefit from the common porting, testing and compilation cluster from INRIA, pipol.

7.2.7. ADT ALADDIN

Participants: Frédéric Desprez, Matthieu Imbert, Christian Pérez.

ALADDIN is an INRIA action of technological development for “A LArge-scale DIstributed and Deploymable INfrastructure” which aim is to manage the Grid’5000 experimental platform. Frédéric Desprez is leading this project (with David Margery from Rennes as the Technical Director).

7.2.8. ADT BitDew, 2 years, 2010-2012

Participants: Gilles Fedak, José Saray.

ADT BitDew is an INRIA support action of technological development for the BitDew middleware. Objectives are several fold : i/ provide documentation and education material for end-users, ii/ improve software quality and support, iii/ develop new features allowing the management of Cloud and Grid resources. The ADT BitDew, leaded by G. Fedak, allows to recruit a young engineer for 24 months.
7.2.9. **HEMERA Large Wingspan Inria Project, 2010-2013**  
**Participants:** Daniel Balouek, Christian Pérez, Frédéric Vivien.

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. Christian Pérez is leading the project that involves more than 20 teams located in 9 cities of France.

C. Pérez is leading the project and D. Balouek is managing scientific challenges on Grid’5000.

7.2.10. **Action Interfaces Recherche en grille – Grilles de production. Institut des Grilles du CNRS – Action Aladdin INRIA**  
**Participant:** Yves Caniou.

This action addresses economical issues concerning green-ness in scientific and production grids. Different issues are addressed like the confrontation of energy models in place in experimental grids versus the operational realities in production grids, the study of new energy prediction models related to real measures of energy consumption in production grids, and the design of energy aware scheduling heuristics.

7.2.11. **FastExpand: Regional Grant**  
**Participant:** Eddy Caron.

The FastExpand start’up asked to take benefit of the knowledge of the GRAAL research team on distributed systems and middleware systems. The aim of this company is to create games of new generation using a new distributed architecture. E. Caron and F. Desprez participate to this action. In 2011, a distributed prototype to work on burst requests from the MMORPG (Massively Multiplayer Online Role Playing Games) was successfully designed. The required performance has been reached.

7.3. **European Initiatives**

7.3.1. **FP7 Projects**

7.3.1.1. **BonFIRE**

Title: Building service testbeds on FIRE BonFIRE  
Type: COOPERATION (ICT)  
Def: Future Internet Experimental Facility and Experimentally-driven Research  
Instrument: Integrated Project (IP)  
Duration: June 2010 - November 2013  
Coordinator: ATOS Origin (Spain)  
Others partners: ATOS (coordinator, Spain), EPCC (UK), SAP (Germany), USTUTT (Germany), FRAUNHOFER (Germany), IBBT (Belgium), UCM (Spain), I2CAT (Spain), HP (UK), 451G (UK), TUB (Germany), IT-Innovation (UK), INRIA.  
See also: [http://www.bonfire-project.eu/](http://www.bonfire-project.eu/)  
Abstract: BonFIRE will design, build and operate a multi-site Cloud prototype FIRE facility to support research across applications, services and systems at all stages of the R&D lifecycle, targeting the services research community on Future Internet. The BonFIRE vision is to give researchers in these areas access to a facility that supports large scale multi-disciplinary experimentation of their systems and applications addressing all aspects of research across all layers. We will develop and support a framework which allows service-based computing practitioners to experiment with their latest ideas in service orientation and distributed computing. We have elaborated 3 usage scenarios. Our overall goal is to encourage new communities of experimenters to take advantage of the opportunities offered by the FIRE infrastructure to guide the development of the Future Internet from
a service-based applications standpoint. The facility will be demand-driven, open, standards-based and dynamic. It will provide additional functionality to that currently available. It will adopt the principle of “open coordinated federation of testbeds” and will provide innovative usage scenarios. We will stimulate research through 2 open calls to establish a methodology of experimentally driven research. The facility shall be open not only to the researchers selected and funded by BonFIRE through the open calls but also to a wider researcher community in order to encourage the usage and involvement of a significant number of end users.

7.3.1.2. EDGI

Title: EDGI: European Desktop Grid Initiative
Type: CAPACITIES (Infrastructures)
Instrument: Combination of COLLABORATIVE PROJECTS and COORDINATION and SUPPORT ACTIONS (CPCSA)
Duration: June 2010 - May 2012
Coordinator: MTA SZTAKI (Hungary)
Others partners: CIEMAT, ES; Fundecyt, ES; University of Westminster, UK; Cardiff University, UK; University of Coimbra, PT; CNRS, FR, AlmerGrid, NL
See also: http://edgi-project.eu/

Abstract: The project EDGI will develop middleware that consolidates the results achieved in the EDGeS project concerning the extension of Service Grids with Desktop Grids in order to support EGI and NGI user communities that are heavy users of DCIs and require extremely large number of CPUs and cores. EDGI will go beyond existing DCIs that are typically cluster Grids and supercomputer Grids, and will extend them with public and institutional Desktop Grids and Clouds. EDGI will integrate software components of ARC, gLite, Unicore, BOINC, XWHEP, 3G Bridge, and Cloud middleware such as OpenNebula and Eucalyptus into SG→DG→Cloud platforms for service provision and as a result EDGI will extend ARC, gLite and Unicore Grids with volunteer and institutional DG systems. Our partners in EDGI are: SZTAKI, INRIA, CIEMAT, Fundecyt, University of Westminster, Cardiff University, University of Coimbra. In this project, G. Fedak is the INRIA representative and lead the JRA2 work package which is responsible for providing QoS to Desktop Grids.

7.3.1.3. PRACE 2IP

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 2013
Coordinator: Thomas Lippert (Germany)
Others partners: Jülich GmbH, GCS, GENCI, EPSRC, BSC, CSC, ETHZ, NCF, JKU, Vetenskapsrådet, CINECA, PSNC, SIGMA, GRNET, UC-LCA, NUI Galway, UYBHM, CaSToRC, NCSA, Technical Univ. of Ostrava, IPB, NIF
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.
7.3.2. Collaborations in European Programs, except FP7

Program: ERCIM WG
Project acronym: CoreGRID
Project title: ERCIM WG CoreGRID
Coordinator: Frédéric Desprez
Other partners: Many partners from several european countries
Abstract: Following the success of the NoE CoreGRID, an ERCIM WG was started in 2009, leaded by F. Desprez. This working group gathers 31 research teams from all over Europe working on Grids, service oriented architectures and Clouds.
A workshop on Grids, Clouds, and P2P Computing was organized in conjunction with EuroPAR 2011, Bordeaux, August, 2011.

7.4. International Initiatives

7.4.1. INRIA International Partners

Henri Casanova, Information and Computer Sciences Department, University of Hawai‘i at Mānoa: application resilience on failure-prone platforms, scheduling multiple workflows over grids.
Jack Dongarra, Computer Science Department, University of Tennessee Knoxville: linear algebra kernels for multicore and GPGPUs, exscale algorithms.
Rami Melhem, Computer Science Department, University of Pittsburgh: energy-aware scheduling algorithms.

7.4.2. Visits of International Scientists

7.4.2.1. Internship

• Lu LU, Huazong University of Science and Technology, 6 months internship

7.4.3. Participation In International Programs

7.4.3.1. INRIA-UIUC-NCSA Joint Laboratory for Petascale Computing
Participants: Julien Bigot, Mathias Jacquelin, Cristian Klein, Loris Marchal, Christian Pérez, Yves Robert, Frédéric Vivien.
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.

7.4.3.2. French-Japanese ANR-JST FP3C project
This project federates INRIA Saclay, CNRS IRIT, CEA Saclay, INRIA Bordeaux, CNRS Prism, INRIA Rennes on the French side and the University of Tokyo, The University of Tsukuba, Titech, Kyoto University on the Japanese side. The main goal of the project is to develop a programming chain and associated runtime systems which will allow scientific end-users to efficiently execute their applications on post-petascale, highly hierarchical computing platforms making use of multi-core processors and accelerators.
Y. Caniou and J.-Y. L’Excellent participate to this project.
7.4.3.3. **CNRS délégation of Yves Caniou (2010-2011)**

Yves Caniou obtained a CNRS delegation for the scholar year 2009-2010, and this delegation has been prolonged for the scholar year 2010-2011. He worked until 2011/09 at the CNRS Japan-French Laboratory in Informatics (JFLI) supervised by Philippe Codognet. The JFLI is located in Tokyo, Japan, and is composed of the Tokyo University, Université Pierre et Marie-Curie (UPMC), the Keio University, the CNRS, the NII partnership.

7.4.3.4. **CADENCED (2009-2012)**

The CADENCED project corresponds joint research activities between KAUST (King Abdullah University of Science and Technology), IFPEN (Institut Français du Pétrole Energie Nouvelle) and its partners, Ecole Normale Supérieure de Lyon (ENS-Lyon) and National Center for Scientific Research (CNRS). ENS de Lyon is funded to a total of 1000k€ supporting 6 years of post-doc salary, 2 years of senior researchers and the afferent side-costs. The CADENCED project will address designing a new catalyst for chemistry/petrochemistry. In view of the extensive use of computing required, a challenging subproject on accelerated high performance computing (HPC) applied to catalysis is also proposed. This latest project deals with porting the VASP software to GPU and developing new QM/MM approaches.
## IBIS Project-Team

### 7. Partnerships and Cooperations

#### 7.1. National projects

<table>
<thead>
<tr>
<th>Project name</th>
<th>Description</th>
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</table>
| ColAge – Lifespan control in bacteria: Natural and engineering solutions | Coordinator: H. Berry  
Participants: G. Baptist, E. Cinquemani, J. Geiselmann, H. de Jong, J. Izard, S. Lacour, C. Pinel, D. Ropers  
Action d’Envergure INRIA-INSERM (2008-2012)  
Web page: [http://colage.saclay.inria.fr](http://colage.saclay.inria.fr) |
| GeMCo – Model reduction, experimental validation, and control for the gene expression machinery in *E. coli* | Coordinator: M. Chaves  
Participants: G. Baptist, E. Cinquemani, J. Geiselmann, H. de Jong, J. Izard, S. Lacour, C. Pinel, D. Ropers  
Type: ANR Blanc (2010-2013)  
| Identification structurelle et paramétrique des réseaux de régulation bactériens | Coordinator: E. Cinquemani  
Participants: E. Cinquemani, J. Geiselmann, H. de Jong, D. Stefan  
Type: Funding PhD grant, Cluster ISLE, Région Rhône-Alpes  
| Motilité ou adhésion : comment les entérobaclères choisissent entre ces deux états physiologiques déterminants pour la virulence | Coordinator: S. Lacour  
Participants: J. Demol, O. Dudin, J. Geiselmann, J. Izard, S. Lacour, C. Pinel  
Type: Grant, Cluster Infectiologie, Région Rhône-Alpes  
| Séminaire grenoblois des systèmes complexes | Coordinators: S. Achard, O. François, A. Girard, E. Prados, S. Rafai, D. Ropers  
Participants: D. Ropers  
Type: Funding by Institut des Systèmes Complexes de Lyon (IXXI)  
| Séminaire de modélisation du vivant | Coordinators: O. Gandrillon, D. Ropers  
Participants:  
Type: Funding by GdR BIM  
### 7.2. International projects

<table>
<thead>
<tr>
<th>Project name</th>
<th>French bioinformatics contribution to ICGC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coordinator</td>
<td>G. Thomas</td>
</tr>
<tr>
<td>IBIS participants</td>
<td>F. Rechenmann</td>
</tr>
<tr>
<td>Type</td>
<td>International Cancer Genome Consortium (ICGC)</td>
</tr>
<tr>
<td>Web page</td>
<td><a href="http://www.icgc.org/">http://www.icgc.org/</a></td>
</tr>
</tbody>
</table>

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. François Rechenmann has joined this bioinformatics team and contributes to the organization of the data management and analysis workflow, under the leadership of prof. Gilles Thomas.

### 7.3. 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.
LEAR Project-Team

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. QUAERO

Participants: Mohamed Ayari, Matthijs Douze, Dan Oneata, Danila Potapov, Alessandro Prest, Cordelia Schmid.

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. Qcompere

Participants: Guillaume Fortier, Cordelia Schmid, Jakob Verbeek.

This three 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 GAIA

Participants: Cordelia Schmid, Jakob Verbeek.

GAIA is an ANR (Agence Nationale de la Recherche) “blanc” project that is running for 4 years starting October 2007. It aims at fostering the interaction between three major domains of computer science—computational geometry, machine learning and computer vision—, for example by studying information distortion measures. The partners are the INRIA project-teams GEOMETRICA and LEAR as well as the University of Antilles-Guyane and Ecole Polytechnique.

8.1.4. ANR Project SCARFACE

Participants: Frédéric Jurie [University of Caen], Cordelia Schmid, Gaurav Sharma.

Video surveillance systems are currently installed in many public areas. As their number increases, the manual analysis becomes impossible. The three-year project SCARFACE (2009-2011) develops tools to automatically access large volumes of video content in order to help investigators solve a crime. These tools will search videos based on human attributes, which describe the suspect. The participant of the project are: the university of Lille the INRIA Imedia team, SpikeNet, EADS, the University of Caen, and LEAR.

8.2. European Initiatives

8.2.1. FP7 European Project AXES

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

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


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.

8.3. International Initiatives

8.3.1. INRIA International Partners

- **NICTA**: In 2010 we initiated a collaboration with the Statistical Machine Learning group at NICTA, Canberra, Australia, i.e., Tiberio Caetano visited LEAR for 4 months. This year PhD student Thomas Mensink spent three months at NICTA, March ’11 – June ’11, and Jakob Verbeek spent 3 weeks at NICTA in May ’11. Results of the collaboration were presented in [16] at the NIPS ’11 workshop on Discrete Optimization in Machine Learning.

- **UC Berkeley**: Z. Harchaoui visited UC Berkeley twice in 2011, resp. in January and September 2011. This led to a research collaboration with N. El Karoui on the theoretical analysis of learning algorithms in high-dimensional settings and the influence of the marginal density of the examples on the generalization performance. This collaboration will continue in 2012.

- **ETH Zürich**: We collaborate with V. Ferrari, junior professor at ETH Zürich since his postdoctoral fellowship with the LEAR team in 2006. V. Ferrari and C. Schmid are currently co-supervising a PhD student (A. Prest) on the subject of automatic learning of objects in images and videos [7], [26]. A. Prest is bi-localized between ETH Zürich and INRIA Grenoble.

8.3.2. Visits of International Scientists

8.3.2.1. Internship

- Luca Scarnato, PhD student at Bern University, Switzerland, visited LEAR from July ’11 until August ’11. He worked on combining color and texture features for image categorization with Jakob Verbeek.

- Bo Geng, PhD student at Peking University, China, is visiting LEAR from November ’11 until April ’12. He works on attribute-based image retrieval.
7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. Lise (ANR)

The LISE\(^5\) project started in 2008 and is funded by the ANR SESUR programme. LISE is coordinated by LICIT and involves the AMAZONES and POP ARTINRIA project-teams, the Law Faculty of Versailles Saint-Quentin, the Law Faculty of Caen, VERIMAG and SUPELEC.

One of the motivations of the LISE project is the fact that, as observed by several authors, software quality and patterns of security frauds are directly related to legal liability patterns. But the precise definition of the expected functionalities of software systems is quite a challenge, not to mention the use of such definition as a basis for a liability agreement. Taking up this challenge was precisely the objective of LISE. To achieve this goal, the project has studied liability issues both from the legal and the technical points of view with the aim to put forward methods (1) to define liability in a precise and unambiguous way and (2) to establish liability in case of disagreement \[5\], \[12\], \[11\].

7.1.2. Fluor (ANR)

The FLUOR\(^6\) project started in 2008 and is funded by the ANR SESUR programme. FLUOR is coordinated by ENSTB and involves the CNRS (IODE), INRIA (LICIT), the LIUPPA (University of Pau), SWID and the University of Polynésie Française.

The context of the FLUOR project is the protection of corporate documents circulating within companies. The main objectives of the project are (1) to unify information flow models and usage control models and (2) to analyse the legal issues raised by the use of these documents. Emphasis is put by LICIT on the specification of obligations within organizations \[10\].

7.2. European Initiatives

7.2.1. FP7 Projet

7.2.1.1. FI-WARE

Title: Future Internet Ware.
Type: COOPERATION (ICT).
Defi: PPP Fi: Technology Foundation: Future Internet Core Platform.
Duration: May 2011 - April 2014.
Coordinator: Telefonica. (Spain)
Others partners: SAP (Germany), IBM (Israel, Switzerland), Thales Communications (France), Telecom Italia (Italy), France Telecom (France), Nokia Siemens Networks (Germany, Hungary, Finland), Deutsche Telekom (Germany), Technicolor (France), Ericsson (Sweden), Atos Origin (Spain), Ingeneria Informatica (Italy), Alcatel-Lucent (Italy, Germany), Siemens (Germany), Intel (Ireland), NEC (United Kingdom), Fraunhofer Institute (Germany), University of Madrid (Spain), University of Duisburg (Germany), University of Roma La Sapienza (Italy), University of Surrey (United Kingdom).

\(^5\) http://licit.inrialpes.fr/lise/
\(^6\) http://fluor.no-ip.fr/
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.

7.3. International Initiatives

7.3.1. Visits of International Scientists

Visiting scientist (one month): Gerardo Schneider from the university of Chalmers (Gothenburg, Sweden).
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.

8.1.2. High Performance Computing Center

- The ICluster2, the IDPot and the new Digitalis Platforms

The MESCAL project-team manages a cluster computing center on the Grenoble campus. The center manages different architectures: a 48 bi-processors PC (ID-POT), and the center is involved with a cluster based on 110 bi-processors Itanium2 (ICluster-2) and another based on 34 bi-processor quad-core XEON (Digitalis) located at Inria. The three of them are integrated in the Grid’5000 grid platform.

More than 60 research projects in France have used the architectures, especially the 204 processors Icluster-2. Half of them have run typical numerical applications on this machine, the remainder has worked on middleware and new technology for cluster and grid computing. The Digitalis cluster is also meant to replace the Grimage platform in which the MOAIS project-team is very involved.

- The Bull Machine

In the context of our collaboration with Bull the MESCAL project-team exploits a Novascale NUMA machine. The configuration is based on 8 Itanium II processors at 1.5 Ghz and 16 GB of RAM. This platform is mainly used by the Bull PhD students. This machine is also connected to the CIMENT Grid.

- GRID 5000 and CIMENT

The MESCAL project-team is involved in development and management of Grid’5000 platform. The Digitalis and IDPot clusters are integrated in Grid’5000. Moreover, these two clusters take part in CIMENT Grid. More precisely, their unused resources may be exploited to execute jobs from partners of CIMENT project.

8.2. National Initiatives

8.2.1. "Action d’envergure"

- HEMERA, 2010-2012

Leading action "Completing challenging experiments on Grid’5000 (Methodology)"

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. This encompasses several aspects.

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. ADT Inria (2)

- **SimGrid for Human Beings, 2009-2011:**

  Partners: Inria Grand Est. Two young engineers have been allotted by the Inria to the SimGrid project to help with the software maintenance and with the transfer of research ideas and prototypes from the ANR USS SimGrid to public stable versions.

- **Aladdin-G5K, 2008-2011**

  Partners: Inria FUTURS, Inria Sophia, IRISA, LORIA, IRIT, LABRI, LIP, LIFL.

  After the success of the Grid’5000 project of the ACI Grid initiative led by the French ministry of research, Inria is launching the ALADDIN project to further develop the Grid’5000 infrastructure and foster scientific research using the infrastructure.

  ALADDIN built on Grid’5000’s experience to provide an infrastructure enabling computer scientists to conduct experiments on large scale computing and produced scientific results that can be reproduced by others.

  MESCAL members are particularly involved in efficient large scale system utilization, providing confidence to the user about the infrastructure and modeling of large scale systems and validation of their simulators.

8.2.4. NANO 2012

Rapid advances in multi-core technologies have been incorporated in general-purpose processors from Intel, IBM, Sun, and AMD, and special-purpose graphics processors from NVIDIA and ATI. This technology will soon be introduced to the next generation of processors in embedded systems. The increase in the number of cores per processor will introduce critical challenges for the access of data stored in memory. The synchronization of memory accesses is often done using the use of locks for shared variables. As the number of threads increases, the cost of synchronization also increases due to increased access to these shared variables. Transactional memory is currently an approach being actively investigated. The goal of this project is to improve the programability and performance of parallel systems using the approach of transactional memory in the context of embedded systems.

8.2.5. ANR Jeunes Chercheurs et Jeunes Chercheuses (2)

- **DOCCA, 2007-2011**

  The race towards the design and development of scalable distributed systems offers new opportunities to applications, in particular as far as scientific computing, databases, and file sharing are concerned. Recently many advances have been done in the area of large-scale file-sharing systems, building upon the peer-to-peer
paradigm that somehow seamlessly responds to the dynamicity and resilience issues. However, achieving a fair resource sharing amongst a large number of users in a distributed way is clearly still an open and active research field. For all previous issues there is a clear gap between:

1. widely deployed systems as peer-to-peer file-sharing systems (KaZaA, Gnutella, EDonkey) that are generally not very efficient and do not propose generic solutions that can be extended to other kind of usage;
2. academic work with generally smart solutions (probabilistic routing in random graphs, set of node-disjoint trees, Lagrangian optimization) that sometimes lack a real application.

Up to now, the main achievements based on the peer-to-peer paradigm mainly concern file-sharing issues. We believe that a large class of scientific computations could also take advantage of this kind of organization. Thus our goal is to design a peer-to-peer computing infrastructure with a particular emphasis on the fairness issues. In particular, the objectives of the ANR DOCCA(Design and Optimization of Collaborative Computing Architectures) project are the following:

First, we want to combine theoretical tools and metrics from the parallel computing community and from the network community, and to explore algorithmic and analytical solutions to the specific resource management problems of such systems.

We also want to design a P2P architecture based on the algorithms designed in the second step, and to create a novel P2P collaborative computing system.

- **Clouds@home, 2009-2013**

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.

### 8.2.6. ANR COSI

- **PROHMPT, 2009-2011**

Partners: Bull SAS, CAPS entreprise, CEA CESTA, CEA INAC, Inria RUNTIME, UVSQ PriSM

Processor architectures with many-core processors and special-purpose processors such as GPUS and the CELL processor have recently emerged. These new and heterogeneous architectures require new application programming methods and new programming models. The goal of the ProHMPT project is to address this challenge by focusing on the immense computing needs and requirements of real simulations for nanotechnologies. In order for nanosimulations to fully leverage heterogeneous computing architectures, project members will novel technologies at the compiler, runtime, and scientific kernel levels with proper abstractions and wide portability. This project brings experts from industry, in particular HPC hardware expertise from Bull and nanosimulation expertise from CEA.

### 8.2.7. ANR ARPEGE

- **PEGASE, 2009-2011**

Partners: RealTimeAtWork, Thales, ONERA, ENS Cachan

The goal of this project to achieve performance guarantees for communicating embedded systems. Members will develop mathematical methods that give accurate bounds on maximum network delays in both space and aviation systems. The mathematical methods will be based on Network Calculus theory, which is type of queuing theory that deals with worst-case performance evaluation. The expected results will be novel models and software tools validated in mission-critical real-time embedded networks of the aerospace industry.
8.2.8. ANR SEGI (2)

- **USS Simgrid, 2009-2011**

  Partners: Inria Nancy, Inria Sophia, Inria Bordeaux, University of Reims, IN2P3, University of Hawaii at Manoa

  The goal of the USS-SimGrid project is to enable scalable and accurate simulations by means of the SimGrid simulation toolkit. This toolkit is widely used for simulation of Grid systems. We aim to extend the functionality of the toolkit to enable the simulation of heterogeneous systems with more than tens of thousands of nodes.

  There are three main thrusts in this project. First, we improve the models used in SimGrid, increasing their scalability and easing their instantiation. Second, we develop tools that ease the analysis of detailed and large simulation results, and aid the management of simulation deployments. Third, we improve the scalability of simulations using parallelization and optimization methods. A mid-term report summarizing our findings has been published in [59].

- **SPADES, 2009-2012**

  Partners: Inria GRAAL, Inria GRAND-LARGE, CERFACS, CNRS, Inria PARIS, LORIA

  Petascale systems consisting of thousands to millions of resources have emerged. At the same, existing infrastructure are not capable of fully harnessing the computational power of such systems. The SPADES project will address several challenges in such large systems. First, the members are investigating methods for service discovery in volatile and dynamic platforms. Second, the members creating novel models of reliability in PetaScale systems. Third, the members will develop stochastic scheduling methods that leverage these models. This will be done with emphasis on applications with task dependencies structured as graph.

8.3. European Initiatives

8.3.1. FP7 EDGI (European Desktop Grid Initiative)

  Partners: SZTAKI institute (Hungary), CIEMAT (Spain), Univ. Coimbra (Portugal), Univ Cardi (UK), Univ Westminster (UK), AlmereGrid (NL), IN2P3 (FR), Inria (GRAAL, MESCAL)

  Years: 2010-2012

  EDGI is an FP7 European project whose goal is to build a Grid infrastructure composed of "Desktop Grids", such as BOINC or XtremWeb, where computing resources are provided by Internet volunteers, and "Service Grids", where computing resources are provided by institutional Grid such as EGEE, gLite, Unicore and "Clouds systems" such as OpenNebula and Eucalyptus, where resources are provided on-demand. The EDGI infrastructure will consist of Service Grids that are extended with public and institutional Desktop Grids and Clouds.

8.3.2. FP7 Mont-Blanc project: European scalable and power efficient HPC platform based on low-power embedded technology

  FP7 Programme: ICT-2011.9.13 Exa-scale computing, software and simulation

  Mont-Blanc Partners: BSC (Barcelona), Bull, ARM (UK), Julich (Germany), Genci, CINECA (Italy), CNRS (LIRMM, LIG)

  Duration: 3 Years from 1/10/2011

  There is a continued need for higher compute 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 1.7n 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.

8.3.3. HPC-GA project: High Performance Computing for Geophysics Applications

FP7 programme: Marie Curie Actions, International Research Staff Exchange Scheme (IRSES)
Partners: Inria (Grenoble, Bordeaux, Pau), BCAM (Bilbao), UFRGS (Brazil), UNAM (Mexico), BRGM (France), UJF (France)
Duration: 3 years from 1/1/2012
PI: Inria (Grenoble and Bordeaux)

Simulating large-scale geophysics phenomenon represents, more than ever, a major concern for our society. Recent seismic activity worldwide has shown how crucial it is to enhance our understanding of the impact of earthquakes. Numerical modeling of seismic 3D waves obviously requires highly specific research efforts in geophysics and applied mathematics, leveraging a mix of various schemes such as spectral elements, high-order finite differences or finite elements. But designing and porting geophysics applications on top of nowadays supercomputers also requires a strong expertise in parallel programming and the use of appropriate runtime systems able to efficiently deal with heterogeneous architectures featuring many-core nodes typically equipped with GPU accelerators. The HPC-GA project aims at evaluating the functionalities provided by current runtime systems in order to point out their limitations. It also aims at designing new methods and mechanisms for an efficient scheduling of processes/threads and a clever data distribution on such platforms.

8.3.4. Collaborations in European Programs, except FP7

- ESPON:
  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.

- European Exascale Software Initiative (EESI)
  The objective of this Support Action, co-funded by the European Commission is to build a European vision and road-map to address the challenges of the new generation of massively parallel systems composed of millions of heterogeneous cores which will provide Petaflop performances in 2010 and Exaflop performances in 2020 (the speed of a supercomputer is measured in "FLOPS" (FLoating Point Operations Per Second)), "Petascale" supercomputers can process one quadrillion (1015) (1000 trillion) FLOPS. Exascale is computing performance is one quintillion (1018) FLOPS (one million teraflops) http://www.eesi-project.eu/pages/menu/homepage.php .

8.4. International Initiatives

8.4.1. Inria Associate Teams

8.4.1.1. Cloud Computing at Home

Title: Cloud Computing over Internet Volunteer Resources
Inria principal investigator: Derrick Kondo

International Partner:

   Institution: University of California Berkeley (United States)
   Laboratory: Space Sciences Laboratory
   Researcher: David P.

Duration: 2009 - 2011

See also: http://abenaki.imag.fr/cloudcomputing/pmwiki.php

Recently, a new vision of cloud computing has emerged where the complexity of an IT infrastructure is completely hidden from its users. At the same time, cloud computing platforms provide massive scalability, 99.999% reliability, and speedy performance at relatively low costs for complex applications and services. In this proposed collaboration, we investigate the use of cloud computing for large-scale and demanding applications and services over the most unreliable but also most powerful resources in the world, namely volunteered resources over the Internet. The motivation is the immense collective power of volunteer resources (evident by FOLDING@home’s 3.9 PetaFLOPS system), and the relatively low cost of using such resources. We will address these challenges drawing on the experience of the BOINC team which designed and implemented BOINC (a middleware for volunteer computing that is the underlying infrastructure for SETI@home), and the MESCAL team which designed and implemented OAR (an industrial-strength resource management system that runs across France’s main 5000-node Grid called Grid’5000).

8.4.1.2. DIODEA

Title: France/Brazil Associated research team on Parallel Computing

Inria principal investigator: Bruno Raffin

International Partner:

   Institution: Universidade Federal do Rio Grande do Sul (Brazil)
   Laboratory: UFRGS
   Researcher: Philippe Olivier Alexandre Navaux

Duration: 2009 - 2011

See also: http://diodea.imag.fr/

Associate Team funded by Inria with the MOAIS project-team of Inria, and the Brazilian University UFRGS. The goal of this project is to design and develop programming tools for grid and clusters for virtual reality. This collaboration was initiated 10 years ago, and has greatly affected the activities (doctoral, publications and joint production software) of the Apache project-team, from which MOAIS and MESCAL were formed. In particular, four PhD Brazilian students have joined the MESCAL project-team as a result of this long-standing collaboration. In this year, 3 members of the MESCAL project-team visited Brazil (Jean-François Méhaut, Arnaud Legrand, Jean-Marc Vincent) to enhance the existing collaborations and to form new ones.

8.4.2. Inria International Partners

- MESCAL has strong connections with both UFRGS (Porto Alegre, Brazil) and USP (Sao Paulo, Brazil). This year, Jean-François Méhaut visited both laboratories in July. The creation of the LICIA common laboratory (see next section) will make 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. Derrick Kondo is being visiting them in October and November.
- Vania Martin has been visiting the Pontifícia Universidade Catolica de Minas Gerais (Belo Horizonte, Brazil).

### 8.4.3. Participation In International Programs

#### 8.4.3.1. Africa

- **SARIMA and IDASCO / LIRIMA (Cameroon)**
  
  MESCAL takes part in the SARIMA (Soutien aux Activités de Recherche Informatique et Mathématiques en Afrique [http://www-direction.inria.fr/international/AFRIQUE/sarima.html](http://www-direction.inria.fr/international/AFRIQUE/sarima.html)) project and more precisely with the University of Yaoundé 1. Cameroon student Blaise Yenké completed his PhD under the joint supervision of Professor Maurice Tchuenté. SARIMA also funded Adamou Hamza to prepare his Master Thesis during three months in the MESCAL project-team. SARIMA proposed J-F Méhaut to give a course on Operating System and Networks at Master Research Students. In addition, MESCAL participates in the IDASCO joint project with the University of Yaoundé 1. This is part of the international LIRIMA laboratory, whose goal to develop novel methods and tools for collecting and analyzing massive data sets from biological or environmental domains.

#### 8.4.3.2. North America

- **Google** Derick Kondo has received a Google Research Award in 2011 for his proposal on predicting idleness in data centers. The technical goal of the proposed work is to give probabilistic guarantees on when data centers are idle. The implication of such predictions is improved data center utilization, while reducing and amortizing monetary costs. The general goal of this award is to facilitate collaboration between Google Inc. and academic researchers. Google Inc. provides the award as an unrestricted gift without constraints on intellectual property.

- **Amazon (2010-2011)** The overall goal is to integrate G5K with Amazon Inc’s Elastic Compute Cloud (EC2), such that workload, especially during peak periods, can be rerouted to EC2. So we would like to adapt OAR for an on-demand cloud infrastructure. We envision an OAR server, running within G5K, that manages sites within G5K and remote instances in EC2.

- **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 paid several visits to Urbana-Champaign. The latest workshop of the laboratory has been organized by Jean-François Méhaut in Grenoble.

#### 8.4.3.3. 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 Ambiente](http://www.inf.ufrgs.br/licia/)). On the French side, the laboratory is co-directed by Yves Denneulin and Jean-Marc Vincent.

  The grand opening workshop has taken place in Porto Alegre, Brazil from Oct. 31st to Nov. 1st. The main themes are artificial intelligence, high performance computing, information representation, interfaces and visualization as well as distributed systems.

  More information can be found on [http://www.inf.ufrgs.br/licia/](http://www.inf.ufrgs.br/licia/).
MISTIS Project-Team

6. Partnerships and Cooperations

6.1. National Actions

MISTIS is a partner in a three-year MINALOGIC project (I-VP for Intuitive Vision Programming) supported by the French Government. The project is 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 are the CMM (Centre de Morphologie Mathématiques) in Fontainebleau, and Pige Electronique in Bourg-Les-Valence. The NOESIS company, which is a leader in the field of image processing and analysis software, in Crolles, is also involved to provide help with software development. The overall goal is 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.

MISTIS is also involved in another three-year MINALOGIC project, called OPTYMIST-II. The goal is to address variability issues when designing electronic components.

MISTIS got, for the period 2008-2011, Ministry grants for two projects supported by the French National Research Agency (ANR):

- MDCO (Masse de Données et Connaissances) program. This three-year project is called "Visualisation et analyse d’images hyperspectrales multidimensionnelles en Astrophysique" (VAHINE). It aims at developing physical as well as mathematical models, algorithms, and software able to deal efficiently with hyperspectral multi-angle data but also with any other kind of large hyperspectral dataset (astronomical or experimental). It involves the Observatoire de la Côte d’Azur (Nice), and two universities (Strasbourg I and Grenoble I). For more information please visit the associated web site: http://mistis.inrialpes.fr/vahine/dokuwiki/doku.php.

- VMC (Vulnérabilité : Milieux et climats) program. This three-year project is called "Forecast and projection in climate scenario of Mediterranean intense events: Uncertainties and Propagation on environment" (MEDUP) and deals with the quantification and identification of sources of uncertainties associated with forecasting and climate projection for Mediterranean high-impact weather events. The propagation of these uncertainties on the environment is also considered, as well as how they may combine with the intrinsic uncertainties of the vulnerability and risk analysis methods. It involves Météo-France and three universities (Paris VI, Grenoble I and Toulouse III). (http://www.cnrm.meteo.fr/medup/).

Florence Forbes is coordinating the 2-year INRIA ARC project AINSI (http://thalie.ujf-grenoble.fr/ainsi). AINSI stands for "Modeles statistiques pour l’Assimilation d’Informations de Neuroimage fonctionnelle et de perfusIion cerebrale". The goal is to propose an innovative statistically well-based solution to the joint determination of neural activity and brain vascularization by combining BOLD constrast images obtained in functional MRI and quantitative parametric images (Arterial Spin Labelling: ASL). The partners involved are Visages team from INRIA in Rennes and Parietal in Saclay, the INSERM Unit U594 (Grenoble Institute of Neuroscience) and the LNAO laboratory from CEA NeuroSpin.

6.2. Regional Initiatives

MISTIS participates in the weekly statistical seminar of Grenoble. F. Forbes is one of the organizers and several lecturers have been invited in this context.
6.3. European Initiatives

6.3.1. FP7 Projet

6.3.1.1. 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, communication, and motor processes, 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 explore a populated space, to localize people and to determine their status, to decide to join one or two persons, to synthetize appropriate behavior, and to engage in dialog with them. Humans appear to solve these tasks routinely by integrating the often complementary information provided by multi sensory data processing, from low-level 3D object positioning to high-level gesture recognition and dialog handling. Understanding the world from unrestricted sensorial data, recognizing people’s intentions and behaving like them are extremely challenging problems. The objective of HUMAVIPS is 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. Proposed research and technological developments will emphasize the role played by multimodal perception within principled models of human-robot interaction and of humanoid behavior. An adequate architecture will implement auditory and visual skills onto a fully programmable humanoid robot. An open-source software platform will be developed to foster dissemination and to ensure exploitation beyond the lifetime of the project. The MISTIS contribution will consist in developing statistical machine learning techniques for interactive robotic applications.

6.4. International Initiatives

6.4.1. Visits of International Scientists

6.4.1.1. Internships

Federico Raimondo (from Jul 2011 until Dec 2011)
Subject: Parallel Self-Adaptive Evolutionary Optimization Framework on GPU
Institution: Universidad de Buenos Aires (Argentina)

El Hadji DEME (from Apr 2011 until Dec 2011)
Subject: Estimation de copules extremaux, de la densite spectrale multivariee et applications : Biologie et changements climatiques
Institution: Universite Gaston Berger (Senegal)
MOAIS Project-Team

8. Partnerships and Cooperations

8.1. Regional Initiatives

- CILOE, 2008-2011, Minalogic: This project is to develop tools and high level interfaces for compute-intensive applications for nano and micro-electronic design and optimizations. The partners are: two large companies CS-SI (leader), Bull; three small size companies EDXACT, INFINISCAL, PROBAYES, and four research units INRIA, CEA-LETI, GIPSA-LAB, TIMA. For Moais, the contract funds the phD thesis of Jean-Noel Quintin.

- HiPeComp, NANO 2008-2012 contract. The project HiPeCoMP (High Performance Components for MPSoC) consists in the development an coupling of: on the one hand, wait-free scheduling techniques (pre-partitioning and mapping, on-line work stealing) of component based multimedia applications on MPSoC architectures; and on the other hand, monitoring, debug and performance software tools for the programming of MPSoC with provable performances. For Moais, the contract funds the phD thesis of Christophe Laferrière who started on 1/9/2009.

- SHIVA, Minalogic 2009-2012 contract. This project aims at the development of a high throughput backbone ciphering that ensures a high level of security for intranet and extranet communications over internet. The partners are: CS-SI (leader); 1 small size companies: Easii-IC (support for Xilinx FPGA) IWall-Mataru (key management), Netheos (customizable FPGA for ciphering); INRIA; CEA-LETI (security certification); Grenoble-INP (TIMA lab, integration of cryptography on FPGA); UJF (LJK and Institut Fourier: open cryptographic protocols and handshake; VERIMAG: provable security). Within INRIA, the MOAIS and the PLANET teams provide the parallel implementation on a multicore platform of IP-Sec and coordination with hardware accelerators (Frog’s and GPUs). The contract funds the phD thesis of Ludovic Jacquin, coadvised by PLANET and MOAIS and a 1 year engineer (Fabrice Schuler, from 11/2010).

- SOC-TRACE, Minalogic 2011-2014 contract. This project aims the development of tools for the monitoring and debug of multicore systems on chip. Leader: ST-Microelectonic. Partners: Inria (Mescal, Moais); UJF (TIMA, LIG/Hadas); Magilem, ProBayes. The contract funds 1 phD thesis and 1 year engineer.

8.2. National Initiatives

- ANR EXAVIZ (2011-2015). Large-scale interactive visual analysis for life sciences and materials. Partners: project-team INRIA MOAIS, LIFO-lab Université d’Orléans, Laboratoire de Biochimie Théorique de l’IBPC, the LIMSI lab and the CEMHTI.


• New accepted ANR HPAC (2012-2015). High Performance Algebraic Computing. Coordinator: Jean-Guillaume Dumas (CASY team, LJJK, Grenoble). Partners: project-team MOAIS (Grenoble), team CASYS (LJK, Grenoble), project-team ARENAIRE (LIP, Lyon), project-team SALSA (LIP6, Paris), the ARITH group (LIRMM lab, Montpellier).

8.3. European Initiatives

8.3.1. FP7 Projet

8.3.1.1. VISIONAIR

Title: VISIONAIR
Type: CAPACITIES (Infrastructures)
Instrument: Combination of COLLABORATIVE PROJECTS and COORDINATION and SUPPORT ACTIONS (CPCSA)
Duration: February 2011 - January 2015
Coordinator: Grenoble-INP (France)
VISIONAIR European platform. With the Grimage platform, we participate to the European project Visionair which objective is to provide an infrastructure that gathers advanced visualization and interaction infrastructures. Visionair is leaded by Grenoble-INP (Frédéric Noel, G-Scop lab) and gathers 25 international partners from 12 countries; it has been funded in 2010 and start in Q1 2011.

8.4. International Initiatives

8.4.1. INRIA Associate Teams

8.4.1.1. DIODEA

Title: Parallel and distributed computing, scalability and visualization
INRIA principal investigator: Bruno Raffin
International Partner:
  Institution: Federal University of Rio Grande del Sul (Brazil)
  Laboratory: Instituto de Informática
  Researcher: Philippe Navaux
Duration: 2006 - 2011
See also: http://diodea.imag.fr/
The French research teams MOAIS and MESCAL, Grenoble, INRIA, and the Brazilian University UFRGS, Porto Alegre closely collaborate since 1992. This collaboration is centered on: Grid computing tools related to system and application deployment, job scheduling, execution monitoring and visualisation ; Modeling, evaluating and experimenting on large scale computer systems (performance evaluation, experimentations, simulation, emulation) ; New parallel programming paradigms: work stealing, fault tolerance, processor and cache oblivious algorithms, multi-core and multi-GPU programming. Frequent visits between partners and numerous co-advised Master and Ph.D. students make it a really fruitful collaboration. It as a strong influence on the development of many of our software tools, including KAAPI, OAR, Kadeploy, Taktuk. We also share some of our computing resources. The cluster from UFRGS was integrated in 2009 as the first non european non of the Grid5000 french experimental grid.
The success of the associated team leads to the creation of the first Laboratoire International Associé (LIA) in computer science between the French CNRS and the Brazil.
8.4.2. Brazil

CAPES/COFECUB n° Ma660/10 (2010-2013) on the management of resources for parallel computing on a grid. Partners: University of Sao Paulo, project MOAIS.

8.5. Hardware Platforms

8.5.1. The GRIMAGE platform

The GrImage platform (http://grimage.inrialpes.fr) gathers a network of cameras and a PC cluster. It is dedicated to interactive applications. GrImage is co-led by the Moais and Perception projects. It is the milestone of a strong and fruitful collaboration between Moais and Perception (common publications, software and application development).

GrImage (Grid and Image) aggregates commodity components for high performance video acquisition, computation and graphics rendering. Computing power is provided by a PC cluster, with some PCs dedicated to video acquisition and others to graphics rendering. A set of digital cameras enables real time video acquisition. The main goal is to rebuild in real time a 3D model of a scene shot from different points of view. Visualization can be performed using a head mounted display for first-person interactions or on a multi-projector display-wall for high resolution rendering.

Since July 2009, the computing cluster was upgraded through grants from INRIA and CNRS-LIG. Grimage uses some specific nodes from the Digitalis machine capable of hosting several daughter boards (mainly video acquisition and graphics cards). It relies on Intel Nehalem processors and a high speed Infiniband network. This integrated approach will enable to test interactive applications using a very high number of processing resources as other nodes from the Digitalis machine can be reserved if needed.

8.5.2. The Digitalis machine

Digitalis is a 780 cores cluster based on Intel Nehalem processors and Infiniband network located at INRIA Rhône-Alpes. Digitalis has been designed to suit both the needs for batch computations and interactive applications. As mentioned before, one rack is dedicated to nodes hosting video acquisition boards and graphics cards. These nodes are mainly used for the Grimage platform, but can also be used for batch computing. Additional nodes with Nvidia Tesla GPUs have been installed.

By having a single unified machine for batch and interactive computing we expect to better use the available resources, favor the emergence of high performance applications integrating interactive steering and vice versa enable the development of a new generation of interactive 3D applications using a significantly larger number of CPUs and GPUs that what has been done so far on the Grimage platform.

8.5.3. Multicore Machines

MOAIS invested in 2006 on two multicore architectures

- A 8-way 16-cores machine equipped with Itanium processors.
- A 8-way 16-cores machine equipped with dual core processors (total of 8 sockets) and 2 GPUs.

These set of machines have been extended in 2010 with a new machines:

- A 8-way, 48-cores machine equipped with 12-core AMD processors (total of 4 sockets)
- A 6-cores machine equipped with 8 GPUs

These machines enables us to keep-up with the evolution of parallel architectures and in particular today’s availability of large multi-core machines. They are used to develop and test parallel adaptive algorithms taking advantage of the processing power provided by the multiple CPUs and GPUs available.
8. Partnerships and Cooperations

8.1. Regional Initiatives

- Nicolas Papadakis is responsible of the ASIOME project (Assimilation de Structures d'Images Océanographiques et Modélisation d’Erreurs) funded by the Pôle Mathématiques Sciences et Technologies de l’Information et de la Communication (MSTIC) of the Joseph Fourier University, Grenoble. 6.4.2
- E.Blayo, M. Nodet are responsible for the workpackage "numerical modelling" within the regional project (Région Rhône-Alpes) "Envirhonalp" http://www.envirhonalp.fr.
- 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.
- E. Blayo is a member of the scientific committee of the regional Institut des Sciences Complexes (IXXI) http://www.ixxi.fr.
- E. Blayo is a member of the scientific committee of the Pôle Alpin Risques Naturels http://www.risknat.org.

8.1.1. Collaborations with Various Regional Research Teams

- LGGE Grenoble, Edge team (C. Ritz, O. Gagliardini, F. Gillet-Chaulet), see paragraphs 6.6.2 and 6.6.3.
- LEGI, MEOM team: 6.4.2, 6.1.2, 6.2.3, 6.3.1, 6.4.1.
- LTHE: 6.5.2, 6.5.3

8.2. National Initiatives

8.2.1. Interactions with other INRIA Project-Teams or Actions

<table>
<thead>
<tr>
<th>Participants</th>
<th>INRIA Project-Team</th>
<th>Research topic</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>N. Papadakis</td>
<td>MC2</td>
<td>Image segmentation and assimilation for tumor growth modeling</td>
<td>6.7.1</td>
</tr>
<tr>
<td>C. Prieur</td>
<td>GRAAL</td>
<td>Grid deployment for the study of West African Monsoon</td>
<td>6.5</td>
</tr>
<tr>
<td>A. Rousseau</td>
<td>TOSCA</td>
<td>Stochastic Downscaling Method</td>
<td>6.9</td>
</tr>
<tr>
<td>A. Rousseau</td>
<td>CALVI</td>
<td>Coupled systems in nearshore regions</td>
<td>6.10</td>
</tr>
<tr>
<td>A. Rousseau</td>
<td>MODEMIC</td>
<td>Bioremediation of natural resources</td>
<td>6.10</td>
</tr>
<tr>
<td>A. Vidard M. Nodet F.X. Le Dimet</td>
<td>CLIME, FLUMINANCE</td>
<td>Image assimilation</td>
<td>6.4</td>
</tr>
<tr>
<td>A. Vidard, M. Nodet, E. Kazantsev</td>
<td>TROPICS</td>
<td>Ocean Adjoint Modelling</td>
<td>6.3.1, 6.2.2</td>
</tr>
<tr>
<td>L. Debreu, E. Blayo</td>
<td>CLIME, FLUMINANCE</td>
<td>Multiscale data assimilation</td>
<td>6.3.1</td>
</tr>
</tbody>
</table>
### 8.2.2. Collaborations with other Research Teams in France

<table>
<thead>
<tr>
<th>Participants</th>
<th>INRIA Project-Team</th>
<th>Research topic</th>
<th>Link</th>
</tr>
</thead>
<tbody>
<tr>
<td>N. Papadakis</td>
<td>(Labri, IMB, Bordeaux)</td>
<td>image processing problems (histogram equalization and image inpainting)</td>
<td>6.7</td>
</tr>
<tr>
<td>M. Nodet</td>
<td>Laboratoire Dieudonné (Université de Nice)</td>
<td>BFN data assimilation scheme</td>
<td>6.2.3</td>
</tr>
<tr>
<td>C. Prieur</td>
<td>IMT Toulouse, IFP Rueil, EDF, CEA Cadarache</td>
<td>Sensitivity analysis</td>
<td>6.5.2</td>
</tr>
<tr>
<td>C. Prieur</td>
<td>ISFA Lyon 1, Université de Bourgogne</td>
<td>Multivariate risk indicators</td>
<td>6.8</td>
</tr>
<tr>
<td>C. Prieur</td>
<td>LGGE</td>
<td>Statistical methodology</td>
<td>6.5.2</td>
</tr>
<tr>
<td>C. Helbert</td>
<td>Ecole des Mines St-Etienne, Universit de Berne, Telecom St-Etienne, EDF, CEA, IRSN, IFP, RENAULT</td>
<td>Computer Experiments</td>
<td>6.5.5</td>
</tr>
<tr>
<td>C. Helbert</td>
<td>Ecole des Mines St-Etienne</td>
<td>Quantification of Uncertainties in CO2 storage</td>
<td>6.5.6</td>
</tr>
<tr>
<td>A. Rousseau</td>
<td>Institut de Mathématiques et de Modélisation de Montpellier (I3M)</td>
<td>Modelling and simulation of coastal flows</td>
<td>6.1</td>
</tr>
<tr>
<td>A. Rousseau</td>
<td>Laboratoire de Méteorologie Dynamique (Ecole Polytechnique), Centre d’Etudes Techniques de l’Équipement (Clermont-Ferrand)</td>
<td>Stochastic Downscaling Method</td>
<td>6.9</td>
</tr>
<tr>
<td>E.Blayo, A.Rousseau</td>
<td>LAMFA (Amiens), LAGA (Paris 13), IFREMER (Brest)</td>
<td>Coupling methods</td>
<td>6.1.2</td>
</tr>
<tr>
<td>A. Vidard</td>
<td>Centre Européen de Recherche et de Formation Avancée en Calcul Scientifique (Toulouse), Mercator-Océan (Toulouse), Laboratoire de Physique des Océans (Brest),</td>
<td>Ocean Data Assimilation</td>
<td>6.3.1</td>
</tr>
<tr>
<td>A. Vidard</td>
<td>LOCEAN (Paris)</td>
<td>Ocean Adjoint Modelling</td>
<td>6.3.1</td>
</tr>
<tr>
<td>A. Vidard</td>
<td>LPO (Brest), CERFACS</td>
<td>Ocean data assimilation</td>
<td>6.3.1</td>
</tr>
</tbody>
</table>

### 8.2.3. MOISE team is implied in:

- A 4-year ANR contract: ANR ADAGe (Adjoint ice flow models for Data Assimilation in Glaciology, see paragraph 6.6).
- 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 6.4).
- A 4-year ANR contract: ANR TOMMI (Transport Optimal et Modèles Multiphysiques de l’Image), see paragraphs 6.7.2, 6.4.
• A 3 years ANR contract: ANR MSDAG (Multiscale Data Assimilation in Geophysics) see paragraph 6.2.4
• Nicolas Papadakis is involved in the SWOT-Ocean group in charge of the use of the high resolution data that will be provided by the future SWOT satellite (CNES/NASA mission). This work is realized in collaboration with Jacques Veron of the Laboratoire des Écoulements Géophysique et Industriels. 6.4.2
• M. Nodet is PI of the project "Méthodes inverses en glaciologie" supported by INSU-LEFE.
• 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 6.3.1. This project is granted by two INSU-LEFE and a Mercator-Ocean calls for proposals.
• A. Vidard is coordinator of the ANR VODA (Variational Ocean Data Assimilation for multi-scales applications) 4-year contract.
• DATICE simulations are currently performed at LSCE (Laboratoire des Sciences de l’Environnement et du Climat) in the framework of a PhD thesis (Lucie Bazin supervised by Amaelle Landais), and at LGGE (Laboratoire de Glaciologie et de Géophysique de l’Environnement) in the framework of a postdoctoral work (Daniel Véres, supervised by Patricia Martinerie). Both works will contribute to calculate AICC2012, the future unified Antarctic ice core age scales (Special Issue in preparation in the Climate of the Past journal, Eric Wolff, CP co-editor-in-chief, British Antarctic Survey, Cambridge). An ANR proposal in preparation "Datation multi-archives" (where LGGE and LSCE are partners, and MOISE members intervene as experts) aims in particular at extending the mathematical method to marine sediment cores.
• E. Blayo is the co-chair (with M. Bocquet, EPI CLIME) of the CNRS-INSU research program on mathematical and numerical methods for ocean and atmosphere LEFE-MANU. http://www.insu.cnrs.fr/co/lefe
• E. Blayo was a member of the 2011 ANR evaluation panel "Earth, Environment, Space".
• L. Debreu is the coordinator of the national group COMODO (Numerical Models in Oceanography)
• L. Debreu organized a 3-day meeting on numerical ocean modelling (Villard de Lans, November 2011)

8.2.4. Participation to National Research Groups (GdR) CNRS

• M. Nodet is involved in GDR Calcul and GDR Ondes.

8.3. European Initiatives

8.3.1. Major European Organizations with which Moise has followed Collaborations

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 for the coupled ocean atmosphere forecast. They play a significant role in the NEMOVAR project in which we are also partner.
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.

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.

Partners: David Vaughan, British Antarctic Survey (UK). Tony Payne, University of Bristol (UK) Subject: Ice-sheet inverse modelling to assess sea-level change.

Partners: V. Shutyaev (Institute of Numerical Mathematics, Russian Academy of Sciences), I. Gejadze (Dept. of Civil Engineering, University of Strathclyde, Scotland) Subject: propagation and control of the error in data assimilation and on evaluation of error covariance by deterministic method.

Partner: GDR-E CONEDP Subject: Control of Partial Differential Equations.

Partner: Vicent Caselles of the Pompeu Fabra University, Barcelona Spain Subject: Image processing problems such as 3D reconstruction [13], histogram transfer [15] or image inpainting [29].

8.4. International Initiatives

- 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.
- F.-X. Le Dimet was invited in Jet Propulsion Laboratory, NASA, Pasadena, USA, 1 week, (1 conference)
- F.-X. Le Dimet was invited in CICESE, Ensenada Mexique 2 weeks, février 2011 (2 conférences)
- F.-X. Le Dimet was invited in Ewu University, Seoul Korea, August 2011, 2 weeks.
- F.-X. Le Dimet was invited in Florida State University : 6 weeks.
- F.-X. Le Dimet was invited in Caltech, Pasadena, California 1 week, 1 conference.
- F.-X. Le Dimet was invited in NASA (JPL) 1 week.

8.4.1. Visits of International Scientists

- Professor Robert Miller (College of Oceanic and Atmospheric Sciences, Oregon State University) has been visiting our team from October 2010 to September 2011. He worked in particular with us on Ensemble Kalman filtering and on error filtering in variational data assimilation.
8. Partnerships and Cooperations

8.1. Regional Initiatives

8.1.1. BQR Grenoble INP IDEAL

Participants: Dobrina Boltcheva, Franck Hétroy.

3D models, coming for instance from engineering fields, are often “idealized”, or “simplified” (topologically speaking), in order to be used for simulation. The goal of this project IDEAL, funded by Grenoble INP, is to study these models, in particular the most general ones which are called “non-manifolds” and which are not handled by current softwares. We collaborate in this project with the University of Genova in Italy (Leila De Florian).

8.2. National Initiatives

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

Participants: Franck Hétroy, Lionel Reveret, Edmond Boyer.

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 analyses 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 Perception team and the Evasion team, the GIPSA-lab Grenoble and the INRIA-Lorraine with the Alice team.


8.2.2. ANR project MADRAS

Participants: Romain Arcila, Franck Hétroy.

This 3-year and half project, funded by ANR, started on January 1st, 2008. Its goal is threefold:

- create a repository of 3D and 3D+t mesh models, together with ground truth segmentations (either done manually or automatically)
- use human perception to enhance conception and evaluation of segmentation algorithms
- develop new segmentation techniques for 3D and 3D+t meshes, using human perception and results of subjective experiments

On this project, Morpheo focuses on sequences of meshes evolving through time. Other partners are LIFL in Lille and LIRIS in Lyon.
8.2.3. Quaero Project

Participants: Benjamin Petit, Edmond Boyer.

Quaero is a program promoting research and industrial innovation on technologies for automatic analysis and classification of multimedia and multilingual documents. The partners collaborate on research and the realisation of advanced demonstrators and prototypes of innovating applications and services for access and usage of multimedia information, such as spoken language, images, video and music. The consortium is composed of French and German public and private research organisations. It is coordinated by Technicolor. The Morpheo team is participating in the project for the development of visual gesture interfaces with the objective to ease access to multimedia information.

8.2.4. ADT Vgate

Participants: Jean-Sébastien Franco, Edmond Boyer.

The ADT (Action de Développement Technologique) Vgate was proposed in the context of the Grimage interactive and immersive platform. The objective of Vgate is to manage the evolution of the Grimage platform both on the hardware and software sides to ensure improvements, reusability and durations of the Grimage platform perception and immersion capabilities. Vgate was proposed in collaboration with the EPI Moais from the INRIA Grenoble Rhône-Alpes.

8.2.5. PlantScan3D project

Participants: Dobrina Boltcheva, Franck Hétroy.

This project is in collaboration with Virtual Plants and Galaad teams. Its objective is to develop the use of laser scanner for plant geometry reconstruction, in partnership with biologists-agronomists from several teams in France and Europe.

8.3. European Initiatives

8.3.1. Collaborations in FP7 European Programs

8.3.1.1. Project RE@CT

Participants: Jean-Sébastien Franco, Edmond Boyer.

Program: FP7 ICT STREP
Project acronym: RE@CT
Project title: IMMERSIVE PRODUCTION AND DELIVERY OF INTERACTIVE 3D CONTENT
Duration: 12/2011 - 12/2013
Coordinator: BBC (UK)
Other partners: Fraunhofer HHI (Germany), University of Surrey (UK), Artefacto (France), OMG (UK).

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.
8.3.2. Collaborations in European Programs, except FP7

8.3.2.1. Project iGlance

Participants: Gaëtan Janssens, Edmond Boyer.

Program: MEDEA
Project acronym: iGlance
Duration: 09/2008 - 09/2011
Coordinator: ST Micro Electronics

Other partners: Philips research (Holland), the university of Eindhoven (Holland), 4D View solutions (France), Silicon Hive (Holland), Logica (France), Task 24 (Holland), Verum (Holland), Tima (France).

Abstract: The primary goal of the iGlance project is to define a complete end-to-end 3D image chain for both consumer 3DTV applications and healthcare applications. The project includes the study and the realization of a 3DTV receiver that will be compliant with the consumer market requirements in term of cost, time to market, and interoperability.

The secondary goal of the project is to take benefits of the received 3D data to make interactive free viewpoint selection possible in 3D TV broadcasted media. This means that the viewer can select and interactively change the viewpoint of a stereoscopic streamed video. The interactivity is enabled by broadcasting a number of video streams from several viewpoints, consisting of a traditional 2D video and additionally depth information for each frame. Any desired view location in-between is generated by free viewpoint interpolation, using the depth information. The interpolated images are then displayed on a stereoscopic screen, giving a 3D impression to the audience.

8.3.3. Major European Organizations with which you have followed Collaborations

8.3.3.1. Università di Genova, Dipartimento di Informatica e Scienze dell’Informazione (Italy)

In the context of the IDEAL project (jointly with the IMAGINE Inria team), we investigate with Leila de Florianì the topological decomposition of simplicial shapes, in order to classify of non-manifold singularities.

8.3.3.2. Forest Research, Centre for Forestry and Climate Change (UK)

As part of the PlantScan3D project, we work with Eric Casella on processing laser scans of trees and plants. More specifically, we try to recover global and local information about the plant from a single point cloud, without normals nor color information.

8.4. International Initiatives

8.4.1. INRIA Associate Teams

From the previous EVASION project, Franck Hetroy and Lionel Reveret were involved into the Associate Team SHARE. This project targets 3D modeling and animation of complex shapes such as animals in motion. It gathered the INRIA project EVASION and the Computer Graphics Department of UBC (University of British Columbia, Canada). Works have been done on the visual perception of 3D animation and its application in compression of 3D animation (Franck Hetroy and Ron Rensink). Another collaboration has been done on video motion capture and physical simulation of quadrupeds (Stelian Coros, Michiel van de Panne, Lionel Reveret). This last works has been published at SIGGRAPH 2011 [6].

8.4.2. Participation In International Programs

8.4.2.1. PHC project Temporally Consistent 3D Reconstruction and Action Recognition with a Multiple-Camera System

This is a “Partenariat Hubert Curien” (PHC) between the Technical University of Munich, Germany and MORPHEO (2010-11). The scientific objectives of this collaboration aim at the advancement of temporal aspects of the 3D reconstruction of dynamic scenes and the human action recognition in multiple-camera systems.
NANO-D Team

7. Partnerships and Cooperations

7.1. National Initiatives

NANO-D is currently receiving funding from four ANR programs:

- **ANR 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 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 COSINUS**: 85,000 Euros over four years (2009-2012). This project, coordinated by NANO-D (S. Redon), gathers physicists, biologists and computer scientists from five research groups: Xavier Bouju and Christian Joachim at CEMES, Martin J. Field at IBS, Serge Crouzy at CEA/LCBM, Thierry Deutsch and Frederic Lançon at CEA/SP2M (total grant: 380,000 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.

7.2. International Initiatives

7.2.1. Visits of International Scientists

7.2.1.1. Professors


7.2.1.2. Internship

Petrus Popov

Subject: Conformational sampling strategies for macromolecules
Institution: M.M. Shemyakin & Yu.A. Ovchinnikov Institute of Bioorganic Chemistry (Russia (Russian Federation))
8. Partnerships and Cooperations

8.1. Regional Initiatives

8.1.1. Pôle de compétitivité Minalogic/ARAVIS

ARAVIS (Architecture reconfigurable et asynchrone intégrée sur puce) is a project sponsored by the Minalogic Pole, started in October 2007 for 3 years (http://www.minalogic.com/PAR_TPL_IDENTIFIANT/903/TPL_CODE/TPL_PROJET/31-recherche.htm). The project has been extended to December 2011. The innovation key deals with bringing architecture and design solutions to calculation platform problems for embedded systems at the 32-nm and 22-nm scales by combining three core technologies: - ST’s DSPfabric coarse-grain structure, which aims to implement several dozen identical data paths on the same System-on-Chip (SoC) and to reconfigure them according to the needs of the application - Techniques based on asynchronous logic (in other words, without a clock) to resolve issues arising from the variability of physical characteristics within each processing node - Advanced automatic techniques for dynamic power and activity management according to often contradictory demands such as low voltage and calculation power. The project is headed by STMicroelectronics, the other partners are CEA-Leti, TIMA laboratory and the SARDES and NeCS teams at INRIA. Previous works on a high-performance controller development for a novel discrete DVS converter were done within this project [14].

8.2. National Initiatives

8.2.1. ANR CONNECT

CONNECT (CONtrol of NEtworked Cooperative sysTeMs) is a project funded by the ANR (National Research agency). The project deals with the problem of controlling multi-agent systems, i.e. systems composed of several sub-systems interconnected between them by an heterogeneous wireless communication network. In particular the project target the control of a cluster of agents composed of autonomous underwater vehicles and marine surface vessels. The main challenge here is to learn how to design collaborative controllers accounting for marine communication constraint, but also on the possibility to share computational resources during the system operation. Questions on control architecture in terms of the level of control distribution and control coordination are addressed as well. A generic and open simulation tool able to integrate the various kinds of component’s models found in such a networked multi-agents system are developed and used to assess the related theoretical studies. Potential missions that can be effectuated by this control approach include: 1) Undersea mapping and monitoring via fleets of autonomous underwater vehicles (AUVs), 2) Relocate an aircraft’s black box after crashing into the sea, 3) Detection of industrial or military garbage or mines and 4) Source detection by gradient search (fresh water, chemical source, methane vent, . . . ). The partners are the NeCS team, Ifremer robotics lab. and the ROBOSOFT and Prolexia companies. It started in May 2007, for a duration of 3 and a half years. The project end was in March 2011. More information can be found on-line: http://www.gipsa-lab.inpg.fr/projet/connect/.

8.2.2. ANR VOLHAND

VOLHAND (VOLant pour personne âgée et/ou HANicapée) 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 aims at developing a new generation of Electrical power-assisted steering specifically designed for disabled and aged people. Our contribution is to work out new assisted laws that accomodate to the specific mechanical characteristics of this particular driver population. The consortium is composed by: LAMiH, CHRU, Fondation Hopale, GIPSA-Lab, INRETS and JTEKT. More information can be found on-line: http://www.univ-valenciennes.fr/volhand/.
8.3. European Initiatives

8.3.1. FeedNetBack

The FeedNetBack proposal has been accepted as a STREP project at the FP7-ICT-2007-2 call in October 2007, for a duration of three years and will end in January 2012. It is coordinated by C. Canudas de Wit and gathers researchers from academia (INRIA-NeCS, ETH Zurich, Universidad de Sevilla, KTH Stockholm, Universita di Padova) and from industry (Ifremer, Videotec and OMG). The main objective of the FeedNetBack project is to generate a rigorous co-design framework that integrates architectural constraints and performance trade-offs from control, communication, computation, complexity and energy management. The goal is to master complexity, temporal and spatial uncertainties such as delays and bandwidth in communications and node availability. This approach enabled the development of more efficient, robust and affordable networked control systems that scale and adapt with changing application demands. The project extend the current scientific state-of-the-art in networked control and develop a set of software tools to support the co-design framework. To demonstrate the potential and limitations of the new technology, FeedNetBack applies it on two industrial test cases of realistic complexity and scale: underwater inspection systems based on fleets of Autonomous Underwater Vehicles (AUVs), and surveillance systems using a network of smart cameras. The control component is essential in both test cases as they require cooperation of distributed objects to achieve a common goal (http://feednetback.eu/). Specific issues are addressed in the project:

- Heterogeneity: The sensor hardware and the communication means may be of different natures (different noises, bandwidths, resolution characteristics, etc.).
- Mobility: Sensor location may not be fixed. Dynamic location of sensors will lead to varying topologies.
- Resource management: The energy and computation capabilities of each node are generally limited.
- Scalability: Wireless sensor networks may comprise hundreds or thousands of nodes. It is therefore crucial that the complexity of the design procedures and the resulting controllers scale slowly with the number of nodes.
- Asynchrony: Information exchange between sensor/control units may not be synchronous in time.

Since in NCS the goal is to ensure satisfactory performance of the overall closed loop system, these problems are treated holistically through sets of performance constraints. The co-design framework aims at controlling more complex systems with a fraction of the effort, while increasing availability and reliability. The framework will enable application developers, programmers and systems integrators to fully use the potential of networked control in a wide set of industrial domains. Examples of areas where an impact is expected are the fields of factory automation, public infrastructure safety and security, transport and building maintenance. New technologies have been developed and applied in FeedNetBack to areas of society where they protect the environment and improve people’s safety, security and ultimately quality of life.

8.3.2. HYCON2

HYCON2 (Highly-Complex and Networked Control Systems) is a Network of Excellence, within the European Union’s FP7. It has started on September 2010, for a duration of three years. Coordinated by Françoise Lamnabhi-Lagarrigue (L2S-CNRS), it involves 26 academic institutions from all over Europe. ICT developments both enable and enforce large-scale, highly-connected systems in society and industry, but knowledge to cope with these emerging systems is still lacking. HYCON2 will stimulate and establish the long-term integration of the European research community, leading institutions and industry in the strategic field of control of complex, large-scale, and networked dynamical systems. HYCON2 will assess and coordinate basic and applied research, from fundamental analytical properties of complex systems to control design methodologies with networking, self-organizing and system-wide coordination. HYCON2 has identified several applications domains to motivate, integrate, and evaluate research in networked control. These domains are ground and aerospace transportation, electrical power networks, process industries, and biological and medical systems. Benchmarking will serve as a tool for testing and evaluating the technologies developed in HYCON2 and for
stimulating and enforcing excellence by the identification and adoption of best practices. In particular, two show-case applications corresponding to real-world problems have been selected in order to demonstrate the applicability of networked control and the need for research in control. The proposed research, integration and dissemination program will make Europe both the prominent scientific and the industrial leader in the area of highly complex and networked control systems, therefore posing Europe in an extraordinary position to exploit their impact in economy and society.

The NeCS team is mainly involved in the first show case application, which corresponds to the operation of the **freeway network around the Grenoble area**. The recent advent of new vehicle sensing technologies provides an opportunity for innovative control applications in traffic management. The Grenoble Traffic Lab (GTL) initiative, lead by the NeCS team, has the ambition to equip massively the Grenoble south beltway with wireless magnetometers. The availability of such a reliable sensor network, designed primarily with control applications in mind, will allow to see control systems used in the field of freeway management.

Control systems in road transportation are primarily involved in the management of traffic lights in urban (city corridors), and inter-urban sectors (rings highways). The target of most of the efforts in the domain is to improve the freeway efficient in an equal way to all drivers. The goal of this show case is to provide a rich set of field traffic data to the control community in order to test their algorithms on a practical real-world problem. These data will be available through a web server administered by INRIA along with all the maps describing finely the freeway under study. Historical and real time data will be available. All these data will be ready for experiments and the outcomes can be provided to the road operators to judge the relevance and efficiency of the results for operational use.

### 8.3.3. 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 for a duration of two years and is coordinated for the French part by A. Kibangou. This project aims 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. Indeed, new models should be developed for generalizing existing tensor models in order to allow the modeling of a wider class of communication systems for more realistic propagation channels including the cooperation among multiple nodes of a communication network (users or sensors). Due to dynamic change of parameters, tensor-based filtering algorithms need to be developed for information retrieval systems in cooperative communication. These algorithms should be distributed for avoiding network vulnerability and for a better management of computation and storage resources.

### 8.4. National and International Initiatives

#### 8.4.1. INRIA Associate Teams

- The NeCS team is a partner in the Sensas A.D.T. (started in December 2010), where it is involved in the coordinated control of a networked swarm of mobile robots.

#### 8.4.2. INRIA National and International Partners

Long term collaboration does exist with the University of Sevilla along several different topics including: coding and control co-design, Power control in NCS, energy-aware control in SoC, and control of DC/AC converters. Scientific collaborations inside the IST FeedNetBack project have been initialized with ETH Zurich and University of Sevilla about the integration of control and scheduling on distributed architectures, in particular focusing on the robustness and predictive control point of views. The ANR SafeNecs project provided support and collaboration along the three past years with teams from both the computing side (LORIA Trio team about control and (m,k)-firm scheduling) and from the fault tolerant control side (CRAN Nancy and GIPSA-LAB, about the integration of real-time control, diagnosis and flexible scheduling). Strong collaborations have been established with KTH (Stockholm), ETH (Zurich), University of Sevilla and Padova as core partners of the FeedNetBack European project.
• C. Canudas de Wit has collaborations with University of Sevilla, Spain (F. Gomez-Estern, F. R. Rubio, F. Gordillo, J. Aracil).
• A. Seuret has collaborations with LAGIS, Lille (J.-P. Richard), Leicester University, UK (C. Edwards), University of Kent, UK (S.K. Spurgeon), Tel Aviv University, Israel (E. Fridman), Universidade Federal do Rio Grande do Sul, Brasil (J.M. Gomes da Silva Jr.), KTH, Sweden (K.H. Johansson, D.V. Dimarogonas, C. Briat), Illinois Institute of Technology, USA (M.M. Peet) and Cinevstav, Mexico (S. Mondié).
• D. Simon spent one week in the Department of Automatic Control and Systems Engineering, University of Sevilla (25-29/04/2011), working with David Muñoz on the integration of MPC based schedulers and LPV varying sampling control loops.
• A. Kibangou has collaborations with I3S, Nice (G. Favier) and Universidade Federal do Ceara, Brazil (A.L.F. De Almeida).
• F. Garin has collaborations with Università di Padova, Italy (R. Carli, E. Lovisari, S. Zampieri) and Politecnico di Torino, Italy (P. Frasca, F. Fagnani) and with MIT, USA (G. Como).
• H. Fourati has started a new collaboration with the Kazakhstan National Technical University (KazNTU). He currently co-advises with Pr. Syzdikov Dastan Jacanovich in KazNTU, Zarina Samigulina PhD student in KazNTU. He has also some collaborations with CReSTIC/University of Reims Champagne Ardenne (N. Manamanni) and DEPE/IPHC/University of Strasbourg (Y. Hendrich).

8.4.3. Visits of International Scientists

• Dr. Daniel Quevedo from the University of Newcastle (Australia) has visited the NeCS team for one week in September 2011.
• Enrico Lovisari, PhD student at Università di Padova has visited the NeCS team for one week in July 2011.
• Fabio Gomez-Estern from University of Sevilla has visited the NeCS team for 3 weeks in January 2011.
• Pr. Sabine Mondie from PCinvestav, Mexico has visited the NeCS team in September 2011.
• Pr. Valter Leite from CEFET–MG, Campus Divinopolis, Brasil has visited the NeCS team during 2011.
NUMED Project-Team (section vide)
8. Partnerships and Cooperations

8.1. International Initiatives

8.1.1. INRIA International Partners

Montreal University, Centre de Recherches Mathématiques CRM, Canada.
Shape and geometries (M. Delfour and J.-P. Zolésio).

8.1.2. Visits of International Scientists

8.1.2.1. Internship

Jihed Joobeur (from Mar 2011 until Aug 2011)
Subject: Crowd data collection from video recordings
Institution: Ecole Nationale d’Ingénieurs de Tunis (ENIT) (Tunisia)

8.1.3. Participation In International Programs

- Euromed 3+3 Project SCOMu 2009-2011:
  Opale is the French coordinator for the project "Scientific Computing and Multidisciplinary Optimization" (SCOMU), a Euro-Mediterranean Euromed 3+3 program. The project SCOMU involves institutions from France (INRIA, Opale Project, Nice Sophia Antipolis University), Italy (University of Genova), Spain (University of Corogna), Tunisia (ENIT, Tunis) and Morocco (Ecole Mohamed V, Rabat). The project is a three-year financed action. The SCOMu project has successfully allowed researchers from the Maghreb and Euro-Mediterranean regions to exchange their modeling and analysis skills in the fields of numerical analysis, optimization and game theory. The partner teams developed applications of game theory in new areas which have strategic interests such as imaging, mathematical finance, structural mechanics and mathematics for life sciences.

- LIRIMA Team ANO 2010-2013:
  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 Aboulaich, EMI.
8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR Project

8.1.1.1. ROM

Program: ANR CONTINT
Project acronym: ROM
Project title: Realtime Onset Matchmoving
Duration: 2008 – 2011
Coordinator: Duran Duboi SA
Other partners: VORTEX (IRI Toulouse, France)

Abstract: This industrial R&D project concerns the generation of special effects for movie or other film productions. In particular, the goal is to provide tools for successful onset matchmoving, that is the estimation of camera trajectories during acquisition, with immediate pre-visualization of special effects superimposed on acquired sequences. Besides this real-time aspect of matchmoving, the project also addresses the problem of preparing a shooting, by analyzing if matchmoving with natural features is possible and if not, by instrumenting the scene with artificial markers in appropriate positions.

8.2. European Initiatives

8.2.1. FP7 Project

8.2.1.1. 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, communication, and motor processes, 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 explore a populated space, to localize people and to determine their status, to decide to join one or two persons, to synthetize appropriate behavior, and to engage in dialog with them. Humans appear to solve these tasks routinely by integrating the often complementary information provided by multi sensory data processing, from low-level 3D object positioning to high-level gesture recognition and dialog handling. Understanding the world from unrestricted sensorial data, recognizing people’s intentions and behaving like them are
extremely challenging problems. The objective of HUMAVIPS is 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. Proposed research and technological developments will emphasize the role played by multimodal perception within principled models of human-robot interaction and of humanoid behavior. An adequate architecture will implement auditory and visual skills onto a fully programmable humanoid robot. An open-source software platform will be developed to foster dissemination and to ensure exploitation beyond the lifetime of the project.

8.2.2. ESA project

8.2.2.1. ITI 3D

Program: ESA ITI (European Space Agency Triangular Initiatives)
Project acronym: ITI 3D
Project title: Multi-View 3D Reconstruction of Asteroids
Duration: 2010 – 2011
Coordinator: EADS Astrium
Abstract: The goal of the project is to implement and validate algorithms for image-based 3D modeling of asteroids. The algorithms combine multi-view stereo and shape-from-shading.
8. Partnerships and Cooperations

8.1. Regional Initiatives

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

8.2. National Initiatives

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

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

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

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

Collaborative Action CAPRIS (2011-2014): the Collaborative Action on the Protection of Privacy Rights in the Information Society (CAPRIS), is an Inria national project, which goal is to tackle privacy-related challenges and provide solutions to enhance the privacy protection in the Information Society. His main tasks are the identification of existing and future threats to privacy, and the design of appropriate measures to assess and quantify privacy.
ANR CMON (2009-2012): This project involves, in addition to INRIA, Technicolor Paris Lab, LIP6, ENS and the Grenouille.com association. CMON stands for collaborative monitoring. It is an industrial research project that develops the technology needed to allow end-users to collaborate in order to identify the origin and cause of Internet service degradation. The main differentiating assumptions made in this project are that (i) ISPs do not cooperate together, and (ii) one cannot rely on any information they provide in order to diagnose service problems. Even more, CMON considers that these ISP will try to masquerade the user observations in order to make their service look better. The software designed in this project will be added to the toolbox currently provided by the Grenouille architecture. The hope is that such a project will encourage ISPs to improve their quality of service and will contribute to improve customer satisfaction.

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

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

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

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

8.3. European Initiatives

8.3.1. FP7 Projects

8.3.1.1. ECODE

Title: Experimental COgnitive Distributed Engine
Type: COOPERATION (ICT)
Defi: New paradigms and experimental facilities
Instrument: Specific Targeted Research Project (STREP)
Duration: September 2008 - August 2011
Coordinator: Alcatel Lucent (Belgium)
Others partners: UCL (Belgium), ULg (Belgium), IBBT (Belgium), ULANC (UK), CNRS (France).

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

Abstract: The goal of the ECODE project is to develop, implement, and validate experimentally a cognitive routing system that can meet the challenges experienced by the Internet in terms of manageability and security, availability and accountability, as well as routing system scalability and quality. By combining both networking and machine learning research fields, the resulting cognitive routing system fundamentally revisits the capabilities of the Internet networking layer so as to address these challenges altogether. For this purpose, the project investigates and elaborates novel
semi-supervised, on line, and distributed machine learning techniques kernel of the cognitive routing system. During the building phase, the cognitive routing system is both designed and prototyped. In the second phase, three sets of use cases are experimented to evaluate the benefits of the developed machine learning techniques. The experimentation and the validation of these techniques are carried out on physical (iLAB) and virtual (e.g., OneLab) experimental facilities.

8.3.1.2. NOVI

Title: Networking innovations Over Virtualized Infrastructures
Type: COOPERATION (ICT)
Defi: CAPACITIES programme.
Instrument: Specific Targeted Research Project (STREP)
Duration: September 2010 - February 2013
Coordinator: NTUA (Greece)
Others partners: 13 european partners including GARR, ELTE, Cisco, etc.
See also: http://www.fp7-novi.eu/
Abstract: NOVI (Networking innovations Over Virtualized Infrastructures) research concentrates on efficient approaches to compose virtualized e-Infrastructures towards a holistic Future Internet (FI) cloud service. Resources belonging to various levels, i.e. networking, storage and processing are in principle managed by separate yet interworking providers. NOVI will concentrate on methods, information systems and algorithms that will enable users with composite isolated slices, baskets of resources and services provided by federated infrastructures.

8.3.1.3. OPENLAB

Title: OpenLab: extending FIRE testbeds and tools
Type: COOPERATION (ICT)
Defi: ICT 2011.1.6 Future Internet Research and Experimentation (FIRE)
Instrument: Integrated Project (IP)
Duration: September 2011 - January 2014
Coordinator: Université Pierre et Marie Curie (France)
Others partners: 18 European partners (including ETH Zurich, Fraunhofer, IBBT, TUB, UAM, etc.) and Nicta from Australia.
See also: http://www.ict-openlab.eu/
Abstract: OpenLab brings together the essential ingredients for an open, general purpose and sustainable large scale shared experimental facility, providing advances to the early and successful prototypes serving the demands of Future Internet Research and Experimentation. OpenLab partners are deploying the software and tools that allow these advanced testbeds to support a diverse set of applications and protocols in more efficient and flexible ways. OpenLab’s contribution to a portfolio that includes: PlanetLab Europe (PLE), with its over 200 partner/user institutions across Europe; the NITOS and w-iLab.t wireless testbeds; two IMS telco testbeds that can connect to the public PSTN, to IP phone services, and can explore merged media distribution; an LTE cellular wireless testbed; the ETOMIC high precision network measurement testbed; the HEN emulation testbed; and the ns-3 simulation environment. Potential experiments that can be performed over the available infrastructure go beyond what can be tested on the current internet. OpenLab extends the facilities with advanced capabilities in the area of mobility, wireless, monitoring, domain interconnections and introduces new technologies such as OpenFlow. These enhancements are transparent to existing users of each facility. Finally, OpenLab will finance and work with users who propose innovative experiments using its technologies and testbeds, via the open call mechanism developed for FIRE facilities.
8.3.1.4. WSN4CIP

Title: Wireless Sensor Networks for critical infrastructures Protection
Type: COOPERATION (ICT)
Defi: FP7 Security area, Objective 1.7 Critical Infrastructure Protection
Instrument: Specific Targeted Research Project (STREP)
Duration: 2009 - 2011
Coordinator: Eurescom (Germany)
Others partners: 11 European partners (including IHP, NEC, BUTE, etc.)
See also: http://www.wsan4cip.eu/home.html

Abstract: The goal of WSAN4CIP is to advance the technology of Wireless Sensor and Actuator Networks (WSANs) beyond the current state of the art, in order to improve the protection of Critical Infrastructures (CIs). By advancing WSAN technology, the project contributes to networked information and process control systems which are more secure and resilient. The distributed nature of WSANs enables them to survive malicious attacks as well as accidents and operational failures. It makes them dependable in critical situations, when information is needed to prevent further damage to CIs.

8.3.2. EIT KIC funded activities

Our project team was involved in 2011 in two activities funded by the EIT ICT Labs KIC: FITTING on Future InterneT (of ThiNGs) facility and Information centric and device clouds (11901). In 2012, we will be involved in three additional activities on Software-Defined Networking (SDN) (11634), Information-centric networking (ICN) experimentation (12191) and Seamless P2P video streaming for the web (12199). The FITTING activity is mentioned as a “success story” by the EIT ICT Labs KIC. In fact, after an initial funding in 2010, the French partners succeeded to get the FIT Equipment of Excellence project accepted with a total budget of 5.8 MEuros to develop a testbed federation in France.

8.3.2.1. FITTING

Title: Future InterneT (of ThiNGs) facility
Activity Number: 10340
Duration: 2011-2012
Coordinator: UPMC (France)
Others partners: Alcatel Lucent, Fraunhofer FOKUS, BME, IT, U. Paris XI.

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

8.4. International Initiatives

8.4.1. INRIA Associate Teams

COMMUNITY Associated team  (2009-2011): Planète is an associated team with the UC Santa Cruz’s Jack Baskin School of Engineering. The collaborative project is about communication in heterogeneous networks prone to episodic connectivity, see URL http://inrg.cse.ucsc.edu/community/ . Our initial scientific objective throughout the project was to design efficient message delivery mechanisms for challenged and heterogeneous networks, and targeted:

- The design of a unifying solution to enable message delivery over heterogeneous networks with varying degrees of connectivity.
- The design of error- and congestion control techniques in episodically connected networks.
- The exploration of different mechanisms for quality-of-service (QoS) support in such environments.

We have re-oriented some of the initial proposed research. In particular, rather than investigating error and congestion control techniques for DTNs, we focused on the development of efficient routing strategies that take into account the utility of nodes to relay messages. Furthermore, we developed a naming scheme that supports message delivery over heterogeneous networks prone to connectivity disruptions, see further details in Section 1.

### 8.4.2. Visits of International Scientists

Luigi Alfredo Grieco, Visiting Professor (one week in December 2011)

Subject: On Evaluating Fairness in Content Centric Networks
Institution: University of Bari (Italy)

Katia Braczka, Visiting Professor (one week in January 2011 and one week in November 2011)

Subject: Communication in Heterogeneous Networks Prone to Episodic Connectivity
Institution: University of California at Santa Cruz (United States)

Marc Mendonca, Visiting PhD student (from Sep 2011 until Dec 2011)

Subject: Efficient Communication Mechanisms for Episodically Connected and Heterogeneous Networks
Institution: University of California at Santa Cruz (United States)

### 8.4.3. Visits to International teams

Thierry Turletti, Visiting researcher to University of California at Santa Cruz (one week in June 2011)

Subject: Efficient Communication Mechanisms for Episodically Connected and Heterogeneous Networks

### 8.4.4. Participation In International Programs

- **WELCOME (STIC AmSud):** This project (2010-2011) aims to design realistic models of the physical layer in order to be used in both simulations and experimentation of wireless protocols. In addition to the Planète Project-Team, the partners are Universidad de Valparaiso, Chile, Universidad de Córdoba, Argentina and Universidad Diego Portales, Chile.

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

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR AutoChem: Chemical Programming
Participants: Pascal Fradet [contact person], Marnes Hoff.

The AutoChem project aims at investigating and exploring the use of chemical languages (see Section 6.7.3) to program complex computing infrastructures such as grids and real-time deeply-embedded systems. The consortium includes INRIA Rennes – Bretagne Atlantique (PARIS team, Rennes), INRIA Grenoble – Rhône-Alpes (POP ART team, Montbonnot), IBISC (CNRS/Université d’Evry) and CEA List (Saclay). The project started at the end of 2007 and ended in November 2011.

8.1.2. ANR Asopt: Analyse Statique et OPTimisation
Participants: Bertrand Jeannet [contact person, coordinator], Lies Lakhdar-Chaouch, Pascal Sotin, Peter Schrammel.

The ASOPT (Analyse Statique et OPTimisation) project [end of 2008-2011] brings together static analysis (INRIA-POP ART, VERIMAG, CEA LMeASI), optimisation, and control/game theory experts (CEA LMeASI, INRIA-MAXPLUS) around some program verification problems. POP ART is the project coordinator.

Many abstract interpretations attempt to find “good” geometric shapes verifying certain constraints; this not only applies to purely numerical abstractions (for numerical program variables), but also to abstractions of data structures (arrays and more complex shapes). This problem can often be addressed by optimisation techniques, opening the possibility of exploiting advanced techniques from mathematical programming.

The purpose of ASOPT is to develop new abstract domains and new resolution techniques for embedded control programs, and in the longer run, for numerical simulation programs.

8.1.3. ANR Vedecy: Verification and Design of Cyber-physical Systems
Participants: Gregor Goessler [contact person], Bertrand Jeannet, Sebti Mouelhi.

The VEDECY project brings together hybrid systems and formal methods experts. Three partners are involved: Laboratoire Jean Kuntzmann (LJK), INRIA POP ART, and VERIMAG.

VEDECY aims at pursuing fundamental research towards the development of algorithmic approaches to the verification and design of cyber-physical systems. Cyber-physical systems result from the integration of computations with physical processes: embedded computers control physical processes which in return affect computations through feedback loops. They are ubiquitous in current technology and their impact on lives of citizens is meant to grow in the future (autonomous vehicles, robotic surgery, energy efficient buildings, ...).

Cyber-physical systems applications are often safety critical and therefore reliability is a major requirement. To provide assurance of reliability, model based approaches and formal methods are appealing. Models of cyber-physical systems are heterogeneous by nature: discrete dynamic systems for computations and continuous differential equations for physical processes. The theory of hybrid systems offers a sound modeling framework for cyber-physical systems. The purpose of VEDECY is to develop hybrid systems techniques for the verification and the design of cyber-physical systems.

8.1.4. INRIA Large Scale Action Synchronics: Language Platform for Embedded System Design
Participants: Gwenaël Delaval, Alain Girault [contact person, co-coordinator], Bertrand Jeannet, Xavier Nicollin, Peter Schrammel.
The SYNCHRONICS (Language Platform for Embedded System Design) project [mid-2008 to mid-2012] gathers 9 permanent researchers on the topic of embedded systems design: B. Caillaud (INRIA Rennes – Bretagne Atlantique), A. Cohen, L. Mandel, and M. Pouzet (INRIA-Saclay and ENS Ulm), G. Delaval, A. Girault, and B. Jeannet (INRIA Grenoble – Rhône-Alpes), E. Jahier and P. Raymond (VERIMAG). SYNCHRONICS capitalizes on recent extensions of data-flow synchronous languages, as well as relaxed forms of synchronous composition or compilation techniques for various platform, to address two main challenges with a language-centered approach: (i) the co-simulation of mixed discrete-continuous specifications, and more generally the co-simulation of programs and properties (either discrete or continuous); (ii) the ability, inside the programming model, to account for the architecture constraints (execution time, memory footprint, energy, power, reliability, etc.).

8.1.5. Collaborations inside INRIA

- VERTECS at INRIA Rennes – Bretagne Atlantique is working with us on applications of discrete controller synthesis, and in particular on the tool SIGALI.
- P. Fradet cooperates with R. Douence (ASCOLA, École des Mines de Nantes) on aspect-oriented programming.
- G. Goessler cooperates with D. Le Métayer (LICT, INRIA Grenoble – Rhône-Alpes) on logical causality and with G. Salaün (VASY, INRIA Grenoble – Rhône-Alpes) on realizability of choreographies with asynchronous communication.
- B. Jeannet cooperates with A. Miné and X. Rival (ABSTRACTION, INRIA Paris – Rocquencourt) and X. Allamigeon (MAXPLUS, INRIA Saclay – Île-de-France) on static analysis and abstract interpretation.
- G. Delaval cooperates with H. Marchand (VERTECS, INRIA Rennes – Bretagne Atlantique) and É. Rutten (SARDES, INRIA Grenoble – Rhône-Alpes) on modular controller synthesis and its applications.
- G. Delaval, A. Girault and B. Jeannet collaborate with the PARKAS team of ENS Ulm (INRIA Paris – Rocquencourt) on the distribution of higher-order synchronous data-flow programs and on static analysis of hybrid programs.

8.1.6. Cooperations with other laboratories

- P. Fradet cooperates with J.-L. Giavitto (CNRS/Ircam) on refinement of chemical programs.
- A. Girault collaborates with P. Roop, Z. Salcic, and S. Andalam (University of Auckland, New Zealand) and A. Malik (IBM Watson, USA) in the context of the AFMES associated team, with H. Kalla (University of Batna, Algeria) and I. Assayad (University of Casablanca, Morocco) on multicriteria scheduling.
- G. Goessler collaborates with A. Girard (LJK, Grenoble) on multi-scale controller synthesis, with J. Sifakis (EPFL) on distribution under real-time constraints, with J.-B. Raclet (IRIT, Toulouse) on modal contracts, with I. Lee and O. Sokolsky (U. of Pennsylvania) on causality analysis for medical devices, and with M. Bozga (VERIMAG) and B. Bonakdarpour (U. of Waterloo, Canada) on fault tolerance in component-based systems.
- A. Girault and G. Goessler collaborate with P. Roop (University of Auckland, New Zealand) on incremental converter synthesis.
• B. Jeannet collaborates with N. Halbwachs and M. Péron (VERIMAG), E. Goubault and S. Putot (CEA Saclay) on static analysis and abstract interpretation.
• G. Delaval and A. Girault collaborate with X. Nicollin (VERIMAG) on the automatic distribution of synchronous programs.

8.2. European Initiatives

8.2.1. Collaborations in European Programs, except FP7

Program: ARTEMISIA.
Project acronym: CESAR
Project title: Cost-efficient methods and processes for safety relevant embedded systems.
Duration: January 2009 – April 2012.
Partners: There are 59 partners from academia and industry (both SMEs and large companies).
Abstract: We are particularly involved in the following sub-programs:

SP1: Task Force Safety 1.5.1 (State of the art survey on safety and diagnosability for cost-efficient safety critical embedded systems) and 1.5.2 (Identification of requirements for common cross domain core safety and diagnosability techniques and methods).

SP2: Requirements Engineering, along with two other INRIA teams (S4 and TRISKELL, from INRIA Rennes). We shall work on contracts based design for traceability.

8.3. International Initiatives

8.3.1. INRIA Associate Teams

8.3.1.1. AFMES

Title: Advanced Formal Methods for Embedded Systems.
INRIA principal investigator: Alain Girault.
International Partner:
Institution: University of Auckland (New Zealand).
Laboratory: Department of Electrical and Computer Engineering.
Principal investigator: Zoran Salcic.
Duration: January 2010 – December 2012.
See also: http://pop-art.inrialpes.fr/~girault/Projets/Afmes/
Embedded systems are characterized by several constraints, such as determinism and bounded reaction time. Accordingly, design methods for embedded systems should, when possible, guarantee these properties by construction. This allows the shifting of the burden of checking these constraints from the programmer to the design method and the associated compilers and code generation tools. In order to achieve this, our goal is to improve the existing design methods in several key directions: (1) Incremental converter synthesis. (2) Programming language for adaptive computing (SystemJ and beyond). (3) Time predictable programming language and execution architectures. Together, these advanced methods will provide a higher level of safety in the design of embedded systems.

8.3.2. Visits of International Scientists

• Hamoudi Kalla, assistant professor at University of Batna, Algeria, September 2011.
• Ismail Assayad, assistant professor at University of Casablanca, Morocco, September 2011.

8.3.2.1. Internship

• Emmanouil Komninos, 02-07/2011, co-advised by Pascal Fradet and Alain Girault, Power consumption optimization of data-flow applications on many-core systems, MSc at KTH, Sweden.

32 http://www.cesarproject.eu
8. Partnerships and Cooperations

8.1. European Initiatives

8.1.1. Major European Organizations with which you have followed Collaborations

EIT KIC ICTlabs

ICTLabs is the KIC for ICT (http://eit.ictlabs.eu/ict-labs/) ICTlabs is set up as a network of 5 "co-location" centers in Helsinki, Stockholm, Berlin, Paris, Eindhoven. The Paris node is run by INRIA with partners Alcatel Lucent, Orange, University Paris Sud and Institut Telecom. PRIMA actively participates in the thematic actions: Smart Spaces, Smart Energy Systems and Health and Well Being.

8.2. International Initiatives

8.2.1. INRIA International Partners

Since the PERSPOS project (BQR Grenoble INP 2008-2009), the MICA center (UMI 2954 CNRS) and PRIMA has a long time collaboration. We wish to develop the concept of "large-scale" perceptive space that 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 (telephone, Smartphone, PDA, notebook). Using all these devices, one can use many different applications (read emails, browse the Internet, file exchange, etc.). 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. Our collaboration is focussing the user location within such a smart space. Tracking people in smart environments remains a challenging fundamental problem. 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 user localization system. This collaboration was concrete with the Ph.D. thesis from Han Yue (started in November 2008). This thesis was co-supervised between Grenoble INP and Hanoi Polytechnical Institute.

8.2.2. Visits of International Scientists

8.2.2.1. Internships

Ch. A. V. Vijay

Subject: Visual fatigue assessment on stereoscopic movies based on image processing: will this 3-D movie give you a headache?

Institution: IIT Bombay (India)
8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ARC MISSION

Participants: Isabelle Guérin Lassous, Thomas Begin, Paulo Gonçalves.

The project Mobile SubstitutIOn Networks (MISSION) is focused on the performance study, the possibilities and the feasibility to deploy a fleet of mobile wireless routers to help a wired network that can not offered its services anymore. This project deals with the theoretical aspects as the practical aspects of such a deployment. From a theoretical point of view, one problem is to minimize the number of used routers while rebuilding the network to replace. The main difficulty lies in the possibility to offer the services provided by the wired network in a transparent way. The controlled mobility allows a redeployment or an adaptation of the built network according to the needs or to the on-going traffic on the network. This controlled mobility should improve the network performance.

8.1.2. GRID5000: ADT Aladdin

Participants: Laurent Lefèvre, Gelas Jean-Patrick, Olivier Glück, Paulo Gonçalves, Matthieu Imbert, Armel Soro, Olivier Mornard, Jean-Christophe Mignot, Diouri Mohammed, Orgerie Anne-Cécile.

ENS Lyon is involved in the GRID’5000 project, which is an experimental Grid platform gathering ten sites geographically distributed in France. ENS Lyon hardware contribution is done for now by two distinct set of computers. The Grid5000 of Lyon comprises now around 300 processors interconnected with the 10 Gbit per second network. Lyon site is nationally recognized to gather the "networking expertise" with skilled researchers and engineers and dedicated networking equipments (Metroflux, GNET10...). Lyon site also hosts an important part of the Green Grid5000 infrastructure by hosting a set of 1500 wattmeters and exposing energy measurements to the Grid5000 community.

RESO is strongly involved in the choices of Grid5000’s network components and architecture. Laurent Lefèvre is member of the national committee (comité de direction) of GRID’5000, of the Aladdin scientific committee and responsible of the Lyon site.

8.1.3. ANR RESCUE

Participants: Isabelle Guérin Lassous, Thomas Begin, Paulo Gonçalves, Thiago Abreu.

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 will 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/

8.1.4. FUI CompatibleOne Project

Participants: Laurent Lefèvre, Jean-Patrick Gelas, Olivier Mornard, Maxime Morel.

The project CompatibleOne (Nov 2010-Nov 2012) funded by the Fonds Unique Interministériel (FUI) is dealing with the building of a Cloud architecture open software stack.

In this project, RESO is focused on the design and provisioning of energy aware and energy efficient components in order to include energy aspects in QoS, SLAs and billing in clouds architectures. RESO is leading the task T3.4 on energy management and will participate in activities on virtual machines design and migration.

CompatibleOne is an open source project with the aim of providing inter-operable middle-ware for the description and federation of heterogeneous clouds comprising resources provisioned by different cloud providers. Services provided by INRIA RESO participation (module COEES) should allow to act on the system’s core by offering a scenario for the broker using energy constraints. These constraints should allow virtual machines placement and displacement using energy profile. Collected data must be available for CO and other systems for future researches. INRIA RESO took part in the analysis of the specification of the system. Mainly, we are in charge of the energy efficiency module. We also had participation in several modules like COMONS (monitoring module), ACCORDS (brokering module), EZVM (virtualization module) and CONETS (networking module). To make energy measurement, we used hardware probes and we studied software probes too. We evaluated several probes providers like Eaton and Schleifenbauer which provide smart PDU (Power Distribution Unit). We also evaluated IPMI board provided by DELL, our computers manufacturer, and OmegaWatt, a small company which provides custom hardware for energy measurement. To allow the exploitation of these probes, we made a first version of a software library and file format for data and monitoring daemon. To allow the use of this system outside of CompatibleOne, we developed a complete monitoring system, which is now in use in IN2P3 data center. To make our tests and developments, we specified, bought, installed and deployed our cluster of 12 nodes. Finally, we participated in international manifestations like SuperComputing 2011 (Poster and demonstration on INRIA booth), Cloud and Green Computing 2011[46].

8.1.5. FSN Magellan Project

Participants: Laurent Lefèvre, Jean-Patrick Gelas.

The project Magellan has been accepted in December 2011. The official beginning will be mid-february 2012.

8.1.6. ANR PETAFLOW

Participants: Paulo Gonçalves, Matthieu Imbert, Anne-Cécile Orgerie, Ashley Chonka.
This ANR (Appel Blanc International) started in October 2009 and will end in September 2012. It is a collaborative project between the GIPSA Lab (Grenoble), MOAIS (INRIA Grenoble), RESO (INRIA Grenoble), the University of Osaka (the Cybermedia Center and the Department of Information Networking) and the University of Kyoto (Visualization Laboratory).

We aim at proposing 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 is the peta-scale volume of the treated data corresponding to the upper airway flow modeling.

http://petaflow.gforge.inria.fr/

8.1.7. ANR DMASC

Participant: Paulo Gonçalves.

Started in October 2008, this ANR project, leaded by J. Barral (Univ. Paris 13), is a partnership between INRIA (Sisyphe and Reso), university of Paris 12 and Paris 13 and Paris Sud (équipe d’accueil EA 4046 Service de Réanimation Médicale CHU de Bicêtre).

Its main objective is to develop advanced multifractal analysis tools, from mathematically ground results to efficient estimators. We apply these methods to the analysis, to the modeling and to the classification (for non invasive diagnoses) of cardio-vascular systems.

http://www-rocq.inria.fr/~barral/DMASC.html

8.2. European Initiatives

8.2.1. FP7 Projects

8.2.1.1. GEYSERS

Title: Generalised Architecture for dynamic infrastructure services
Type: COOPERATION (ICT)
Defi: The Network of the Future
Instrument: Integrated Project (IP)
Duration: January 2010 - December 2012
Coordinator: Interoute (Italy)

Others partners: Interoute (Italy), martel Martel GmbH (Switzerland), ADVA AG Optical Networking (Germany), SAP AG (Germany), Alcatel-Lucent Italia S.p.A. (Italy), Telefónica I+D (Spain), Telekomunikacja Polska S.A. (Poland), Instytut Chemii Bioorganicznej PAN, Poznan Supercomputing and Networking Centre (Poland), Nextworks s.r.l (Italy), Fundacíó i2CAT, Internet i Innovació Digital a Catalunya (Spain), Universiteit van Amsterdam (The Netherlands), University of Essex (UK), Research and Education Society in Information Technologies (Greece), Technical University of Braunschweig (Germany), Interdisciplinary Institute for BroadBand Technology VZW (belgium), Indian Institute of Technology (India), LYaTiss (France), ADVA Optica Networking Sp.zo.o. (Poland)

Abstract: GEYSERS’s vision is to qualify optical infrastructure providers and network operators with a new architecture, to enhance their traditional business operations. Optical network infrastructure providers will compose logical infrastructures and rent them out to network operators; network operators will run cost-efficient, dynamic and mission-specific networks by means of integrated control and management techniques. GEYSERS’s concept is that high-end IT resources at users’ premises are fully integrated with the network services procedures, both at the infrastructure-planning and connection-provisioning phases. Following this vision, GEYSERS will specify and implement a novel optical-network architecture able to support ‘Optical Network + Any-IT’ resource provisioning seamlessly and efficiently. Energy-consumption metrics for the end-to-end service routing are part of this efficiency. GEYSERS proposes to:
• Specify and develop mechanisms that allow infrastructure providers to partition their resources (optical network and/or IT), compose specific logical infrastructures and offer them as a service to network operators. This will be done overcoming the current limitations of networks/domain segmentation, and will support dynamic and on-demand changes in the logical infrastructures.

• Specify and develop a Network Control Plane for the optical infrastructure, by extending standard solutions (ASON/GMPLS and PCE), able to couple optical network connectivity and IT services automatically and efficiently, and provide them in 1 step, dynamically and on-demand, including infrastructure re-planning mechanisms.

These achievements will enable infrastructure providers, network operators and application providers to participate in new business scenarios where complex services with complex attributes and strict bandwidth requirements can be offered economically and efficiently to users and applications. GEYSERS’s outcomes will be validated in an EU-wide optical network test-bed.

8.2.1.2. SAIL

Title: Scalable and Adaptive Internet Solutions
Type: COOPERATION (ICT)
Def: The Network of the Future
Instrument: Integrated Project (IP)
Duration: August 2010 - January 2013
Coordinator: Ericsson (Sweden)

Others partners: Ericsson AB (Sweden), Alcatel-Lucent Deutschland (Germany), Nokia Siemens Networks OY (Finland), NEC Europe LTD (United Kingdom), France Telecom SA (France), Telefónica Investigacion y Desarrollo (Spain), Telecom Italia (Italy), Portugal Telecom Inovação (Portugal), Swedish institute of Computer science (Sweden), Instituto Superior Técnico Address (Portugal), Universitaet Paderborn (Germany), Aalto-Korkeakoulusäätiö (Finland), Kungliga Tekniska Högskolan (Sweden), Fraunhofer Gesellschaft zur Förderung der angewandten Forschung (Germany), Universitaet Bremen (Germany), Hewlett-Packard Limited (United Kingdom), Fundación Tecnalia Research and Innovation (Spain), Institut Telecom (France), Technion – Israel Institute of Technology (Israel), DOCOMO Communication Laboratoties Europe (Germany), The Provost Fellows & Scholars of the College of the Holy and undivided Trinity of Queen Elizabeth (Ireland), National ICT Australia Limited (Australia), Universidad de Cantabria (Spain), Lyatiss (France)

See also: https://twiki.verkstad.net/bin/view/Main/WebHome

Abstract: SAIL’s objective is the research and development of novel networking technologies using proof-of-concept prototypes to lead the way from current networks to the Network of the Future. SAIL leverages state of the art architectures and technologies, extends them as needed, and integrates them using experimentally-driven research, producing interoperable prototypes to demonstrate utility for a set of concrete use-cases. SAIL reduces costs for setting up, running, and combining networks, applications and services, increasing the efficiency of deployed resources (e.g., personnel, equipment and energy). SAIL improves application support via an information-centric paradigm, replacing the old host-centric one, and develops concrete mechanisms and protocols to realize the benefits of a Network of Information (NetInf). SAIL enables the co-existence of legacy and new networks via virtualization of resources and self-management, fully integrating networking with cloud computing to produce Cloud Networking (CloNe). SAIL embraces heterogeneous media from fibre backbones to wireless access networks, developing new signaling and control interfaces, able to control multiple technologies across multiple aggregation stages, implementing Open Connectivity Services (OConS). SAIL also specifically addresses cross-cutting themes and non-technical issues, such as socio-economics, inclusion, broad dissemination, standardization and network migration, driving new markets, business roles and models, and increasing opportunities for both competition
and cooperation. SAIL gathers a strong industry-led consortium of leading operators, vendors, SME, universities and research centers, with a valuable experience acquired in previous FP7 projects, notably 4WARD. The impact will be a consensus among major European operators and vendors on a well-defined path to the Network of the Future together with the technologies required to follow that path.

8.2.1.3. PrimeEnergyIT

Title: SPEC on “Security and Privacy Concerns in Energy Efficient Computing”
Type: COOPERATION (ICT)
Defi: Future Internet Experimental Facility and Experimentally-driven Research
Instrument: Intelligent Energy in Europe
Duration: 2010-2012
Coordinator: Electricity of Austria

Others partners: Berlin Energy Agency, Berlin Institute of Technology, BIO Intelligence Service, Politecnico di Milano, GAIA, ICLEI, University of Coimbra, Seven

Abstract:
The fast development of IT services and IT performance in many areas of the public and private service sector (e.g. administration, health services, entertainment etc.) has led to a rapid increase of energy consumption and energy costs for central IT equipment. EU and US studies (IEE E-Server project 2007, EPA 2007) have shown a strong increase of energy consumption of central IT-hardware and infrastructure during the last years and a growing trend is expected for the future. For EU-27 the energy consumption of central IT hardware and infrastructure (incl. servers, storage, network equipment, cooling) was calculated to 40TWh/a which is equal to 1.5% of the EU electricity consumption. If business-as-usual is continued in the next years a doubling of energy consumption to 80 TWh/a is expected to occur by 2012 already. A broad implementation of energy efficient technology in the EU however would allow a reduction of energy demand of about 60% compared to the business as usual scenario. Energy efficient technology is available but needs to be broadly implemented in the demand side market. To exploit the enormous saving potentials concerted action is needed across the EU member states. Measures to support energy efficient market development for central IT equipment have been started only recently in 2007. Thus compared to many other areas of technology (lighting, heating, client side IT etc.) activities to support sustainable solutions are quite new and more concerted action is needed to reach a good market impact. The major first initiatives at EU-level were The Green Grid, the Energy Star for servers, the Code of Conduct and the IEE E-Server project. These programmes started to develop guidelines, tools and criteria to support energy efficiency in data centres. However so far only part of the relevant products and technologies could be covered and energy efficiency criteria as well as market supporting instruments are still at an early stage of development and implementation. The proposed project is designed to further enforce energy efficient market development for central IT equipment based on the previous initiatives and with a focus on so far largely uncovered IT hardware including storage and network equipment as well as new power management technologies. The longer term objectives to be supported by the project are to avoid an annual energy consumption of 70TWh in the EU by 2015 compared to business as usual, to support the development of internationally accepted energy efficiency criteria and standards for central IT equipment and to implement energy efficiency as a key target for the major supply and demand side target groups. These goals shall be supported by the further development of energy efficiency criteria to be considered by the demand and supply side market, by the evaluation and demonstration of most energy efficient technology in best practise and by the development and implementation of education, certification and procurement concepts as major instruments to drive the market. The PrimeEnergyIT project deals with:
- The development and implementation of hardware and service based energy efficiency criteria as major tools to support IT and infrastructure managers in the selection and management of IT hardware and cooling equipment
- The demonstration and evaluation of energy efficient IT solutions in best practise
- Education and training of IT managers and experts to support energy efficient procurement and management
- Implementation of energy efficiency criteria for central IT equipment and cooling in public procurement

INRIA RESO has been mainly involved in energy efficiency criteria in the context of storage for small and medium datacenters.

8.2.1.4. EuroNF JRA.S.1.44 project SPEC

Title: SPEC on “Security and Privacy Concerns in Energy Efficient Computing”
Type: JRA
Defi: Future Internet Experimental Facility and Experimentally-driven Research
Instrument: EuroNef Project
Duration: 2011
Coordinator: University of Passau (Germany)
Others partners: University of Vienna, CERTH (Greece)

Abstract: To design highly energy efficient systems is one of the most important design goals which are under investigation currently. The underlying motifs to design such systems are economical as well as environmental in nature. However, it has been identified that while focusing solely on energy efficiency mechanisms, the other design parameters must also be considered to achieve a well balanced system. Security and privacy aspects are among those very important parameters. This SJRP focuses on the security and privacy aspects involved in the application of modern energy efficiency mechanisms. We focus on two of the key technologies including virtualization for energy efficiency and smart metering. In first part of the project, we investigate the security issues within virtualized environments for energy efficiency while the second part focus on the end user privacy concerns when monitoring physical resources in clouds.

8.2.1.5. COST Action IC804

Title: IC804 COST ACtion on “Energy efficiency for large scale distributed systems”
Type: European COST Action
Duration: 2009-2013
Coordinator: University of Toulouse
Others partners: 20 countries

Abstract: The main objective of the Action is to foster original research initiatives addressing energy awareness/saving and to increase the overall impact of European research in the field of energy efficiency in distributed systems. The goal of the Action is to give coherence to the European research agenda in the field, by promoting coordination and encouraging discussions among the individual research groups, sharing of operational know-how (lessons-learned, problems found during practical energy measurements and estimates, ideas for real-world exploitation of energy aware techniques, etc.). The Action objectives can be summarized on scientific and societal points of view: sharing and merging existing practices will lead the Action to propose and disseminate innovative approaches, techniques and algorithms for saving energy while enforcing given Quality of Service (QoS) requirements. Laurent Lefèvre is Management Committee member and French representative in this COST action.
8.3. International Initiatives

8.3.1. Visits of International Scientists

In the context of EuroNef project Spec Action, INRIA RESO has hosted Thomas Treutner from University of Vienna (Austria) during 2 weeks in July 2011. With RESO researchers, he has explored the topic of privacy in clouds when energy monitoring is performed. This collaboration has resulted in an international publication [26].
7. Partnerships and Cooperations

7.1. Regional Initiatives

7.1.1. Aravis (ANR-Minalogic)

**Participants:** Vivien Quéma, Renaud Lachaize, Fabien Gaud, Sylvain Genevès, Fabien Mottet, Baptiste Lepers.

The ARAVIS project aims at addressing the challenges raised, both at the hardware and software levels, by the production of highly integrated multiprocessor systems on chip (MPSoCs) designed for demanding applications such as video encoding/decoding and software-defined radio communications. Due to the complexity of the manufacturing process, the latest generations of chips exhibit peculiar features that must be taken into account: (i) massively parallel processing units, (ii) irregular behavior and aging of the processing units due to unavoidable defects of the manufacturing process. The ARAVIS project strives to provide a hardware and software platform suited to the adaptation requirements raised by the needs of such emerging hardware technologies and applications. The proposed approach encompasses three contributions: (i) a symmetric hardware architecture based on an asynchronous interconnect with integrated voltage/frequency scaling, (ii) a set of regulation algorithms based on control theory to optimize quality of service and energy consumption, (iii) a component-based runtime environment and related software tools to ease the dynamic management of applications and execution resources.

The project partners are STMicroelectronics, CEA-LETI, TIMA and INRIA (Necs and Sardes project teams). The project runs from October 2007 to September 2011.

7.1.2. MIND (ANR-Minalogic)

**Participants:** Eric Rutten, Jean-Bernard Stefani, Tayeb Bouhadiba, Cinzia di Giusto.

The MIND project aims to develop an industrial technology for component-based construction of embedded systems, based on the Fractal component model. This includes the development of programming languages (extended C, ADL, IDL), a chain for compiling software architecture descriptions and generating code, and a graphical IDE integrated to Eclipse. In addition, the project aims to study extensions and refinements to the Fractal model suitable for dealing with non-functional aspects such as real-time and priority constraints, the model-based control of dynamic reconfiguration of components, and its integration with the BIP component model developed at the Verimag laboratory.

The project partners include STMicroelectronics, CEA, INRIA (Adam and Sardes project teams), Schneider. The project runs from October 2008 to May 2011.

7.2. National Initiatives

7.2.1. ASR Network

The Sardes team is a member of the CNRS research network GDR 725 ASR “Architecture, Système et Réseau”. See http://asr.univ-perp.fr/.

7.2.2. Automatique pour l’informatique autonomique (CNRS PEPS)

**Participant:** Eric Rutten.

This project is lead by Eric Rutten and funded by CNRS in the programme Projet Exploratoire-Premier(s) Soutien(s) PEPS Rupture de l’INS2I 2011. It concerns Control Techniques for Autonomic Computing, and intends to group researchers of different backgrounds (Architectures and FPGA, distributed systems and adaptive software, programming languages for reconfiguration, and control theory) to gather experiences and points of view on this multi-disciplinary topic.
7.2.3. **Cogip (CNRS PEPS)**

**Participant:** Damien Pous.

This project is lead by Filippo Bonchi (LIP, Lyon), and it includes two researchers from Paris: Samuel Mimram (CEA), and Paul-André Melliès (PPS). This project focuses on semantics of concurrent programming languages, by working at the interface between coalgebraic methods and game semantics.

http://perso.ens-lyon.fr/daniel.hirschkoff/cogip/

7.2.4. **SocEDA (ANR Arpege project)**

**Participants:** Vivien Quéma, Baptiste Lepers.

The goal of SocEDA is to develop and validate an elastic and reliable federated SOA architecture for dynamic and complex event-driven interaction in large highly distributed and heterogeneous service systems. Such architecture will enable exchange of contextual information between heterogeneous services, providing the possibilities to optimize/personalize the execution of them, according to social network information.

The main outcome of the SocEDA project will be a platform for event-driven interaction between services, that scales at the Internet level based on the proposed architecture and that addresses Quality of Service (QoS) requirements.

The project partners are INRIA (ADAM in Lilles), EBM WebSourcing (FR), ActiveEon (FR), ARMINES (FR), France Telecom R&D (FR), CNRS (I3S and LIG), INSA Lyon, Thales Communications.

The project runs from October 2010 to September 2013.

7.2.5. **PiCoq (ANR project)**

**Participants:** Damien Pous, Alan Schmitt, Jean-Bernard Stefani, Thomas Braibant.

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 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 (Sardes), LIP (Plume team), and Université de Savoie. the project runs from November 2010 to October 2014.

The ANR PiCoq is in the programme ANR 2010 BLAN 0305 01: http://sardes.inrialpes.fr/collaborations/PiCoq/.

7.2.6. **Project MyCloud (ANR project)**

**Participants:** Amit Sangroya, Sara Bouchenak, Dàmian Serrano.
The objective of the MyCloud project is to define and implement a novel cloud model: SLAaaS (SLAware Service). The SLAaaS model enriches the general paradigm of Cloud Computing, and enables systematic and transparent integration of service levels and SLA to the cloud. SLAaaS is orthogonal to IaaS, PaaS and SaaS clouds and may apply to any of them. The MyCloud project takes into account both the cloud provider and cloud customer points of view. From cloud provider’s point of view, MyCloud proposes autonomic SLA management to handle performance, availability, energy and cost issues in the cloud. An innovative approach combines control theory techniques with distributed algorithms and language support in order to build autonomic elastic clouds. Novel models, control laws, distributed algorithms and languages will be proposed for automated provisioning, configuration and deployment of cloud services to meet SLA requirements, while tackling scalability and dynamics issues. On the other hand from cloud customer’s point of view, the MyCloud project provides SLA governance. It allows cloud customers to be part of the loop and to be automatically notified about the state of the cloud, such as SLA violation and cloud energy consumption. The former provides more transparency about SLA guaranties, and the latter aims to raise customers’ awareness about cloud’s energy footprint.

The project partners are INRIA (Sardes is the project coordinator), Grenoble; LIP6, Paris; EMN, Nantes; We Are Cloud, Montpellier; Elastic Grid LLC, USA.

The project runs from November 2010 to October 2013.

### 7.2.7. Famous (ANR project)

**Participants:** Eric Rutten, Xin An.

The FAMOUS project (FAst Modeling and Design FlOw for Dynamically ReconfigUrable Systems) intends to make reconfigurable hardware systems design easier and faster, by introducing a complete methodology that takes the reconfigurability of the hardware as an essential design concept and proposes the necessary mechanisms to fully exploit those capabilities at runtime. The tool under development in this project is expected to be used by both industrial designers and academic researchers, especially for modern application system specific design such as smart cameras, image and video processing, etc.

The project partners are INRIA (Sardes in Grenoble and DaRT in Lille), Université de Bretagne Sud, Université de Bourgogne, Sodius.

The project runs from December 2009 to November 2013.

### 7.3. European Initiatives

#### 7.3.1. FP7 ICT Project

#### 7.3.1.1. PLAY

- **Title:** Pushing dynamic and ubiquitous interaction between services Leveraged in the Future Internet by ApplYing complex event processing
- **Type:** COOPERATION (ICT)
- **Defi:** Internet of Services, Software & Virtualisation
- **Instrument:** Specific Targeted Research Project (STREP)
- **Duration:** October 2010 - September 2013
- **Coordinator:** FZI (Germany)
- **Others partners:** INRIA (Oasis in Sophia), FZI (Germany), ICCS (Greece), EBM WebSourcing (FR), ARMINES (FR), France Telecom R&D (FR), CIM Grupa DOO (RS)

See also: [http://www.play-project.eu/](http://www.play-project.eu/)
Abstract: The goal of PLAY is to develop and validate an elastic and reliable federated SOA architecture for dynamic and complex, event-driven interaction in large highly distributed and heterogeneous service systems. Such architecture will enable exchange of contextual information between heterogeneous services, providing the possibilities to optimize/personalize the execution of them, resulting in the so called situational-driven adaptivity.

The main outcome will be a FOT (federated open trusted) Platform for event-driven interaction between services, that scales at the Internet level based on the proposed architecture and that addresses Quality of Service (QoS) requirements. The platform consists of:

Federated middleware layer: a peer-to-peer overlay network combined with a publish/subscribe mechanism, that has the task to collect events coming from the heterogeneous and distributed services,

Distributed complex event processor: an elastic, distributed computing cloud based engine for complex processing/combining of events coming from different services in order to detect interesting situations a service should react on

Situational-aware business adapter: a recommender engine for proposing adaptation and changes in running business processes and services in a non-predefined (ad-hoc) way, by ensuring the consistency of the whole instance

The system will be tested in two use cases: crisis management and telecom industry, showing the advantages of such an architecture for Future Internet. Indeed, PLAY aims to revolutionize the Future Internet by making it situational-aware, which leads to the event-aware services that are able to proactively adapt themselves to the changes in the environment.
7. Partnerships and Cooperations

7.1. Regional Initiatives

**Project acronym: MUTERA**

Project title: Modèles Urbanisme-Transport-Environnement en Rhône-Alpes
Starting date: 2012
Coordinator: Emmanuel Raoult (AURG)

Other potential partners: IAU-IDF, LET, IDDRI, INRIA, EDDEN, AURG, SMTC, Urba Lyon, Sytral, La Métro, etc.

Abstract: The rich and diverse activity in modeling in Rhône-Alpes region, the need of more technical expertise of the various actors and the necessity for decision makers to be able to project into an uncertain future via innovative tools developed by the research are three elements that push the creation the MUTERA project. MUTERA aims then to gather the main actors in urban planning and transport of Rhône-Alpes region to work on the issues regarding land-use and transport models. This group includes technicians, politicians and researchers. MUTERA kick-off meeting is foresaw in the beginning of 2012.

**Project acronym: SOCLE3**

Project title: Sustainability, Local Collective Organisation, Energy, Economy and Environment
Coordinator: Pierre-Yves Longaretti (STEEP)

Other partners: LECA (UJF/CNRS), EDDEN (UPMF/CNRS), PACTE (UJF/CNRS), ERIC (Lyon 2/CNRS)

The SOCLE3 interdisciplinary group and project has two major aims:

- Analyzing and modelling the environmental, economic and social interactions at the urban to regional (sub-national) level, and their coupled trajectories under given global and local macroeconomic trends, and climate change constraints.
- Providing decision-makers with policy analysis and evaluation tools, and other researchers with methodological tools, based in particular (but not exclusively) on simulations under relevant global/local scenarios, to identify and characterize possible sustainability transition pathways at the local and regional scales.

http://socle3.obs.ujf-grenoble.fr/

7.2. National Initiatives

**Program: "Modelling and Scenarios of Biodiversity" flagship program, Fondation pour la Recherche sur la Biodiversité**

**Project acronym: ESNET (submitted)**

Project title: Ecosystem services networks futures for the Grenoble region
Duration: 2012 - 2014
Coordinator: Sandra Lavorel (LECA)

Other partners: LECA (UJF/CNRS), STEEP(INRIA/LJK), EDDEN (UPMF/CNRS), CEMAGREF Grenoble, PACTE (UJF/CNRS), ERIC (Lyon 2/CNRS)
Abstract: Ecosystem services are underpinned by fundamental ecological properties and processes interacting with society, both through human dependence on these services, and the use and management of ecosystems. Our hypothesis is that ecosystem services can thus be modelled as networks of interacting ecological and societal processes, at multiple spatial and temporal scales. Our interdisciplinary research team proposes to explore this network hypothesis by assessing alternative futures of ecosystem services under combined scenarios of land-use and climate change for the Grenoble urban area in the French Alps. We will capitalize on existing statistical and mechanistic methods to build and integrate models of the relevant ecosystem services and land-use change. Our assessment will benefit from our detailed understanding of how biodiversity and different ecosystem services are interconnected. Trade-offs and synergies will be quantified by a specifically designed spatial multi-criteria analysis. Besides the urban area, we will focus on two case study sub-systems: the intensively farmed valley upstream of the city and a mixed landscape of forests and grasslands in a mountain range south of the city. As beneficiaries of ecosystem services, local and regional stakeholders will be involved in formulating the project working hypotheses and scenarios. These scenarios will build on current urban planning exercises by public authorities and research teams, and downscaling of land-use and climate change projections. We will engage stakeholders in the comparison of scenarios and the assessment of trade-offs in order to foster a dialog on development pathways and mitigation options.

In other respects, we are also strongly connected to the AETIC project. Initially we were not members of this project. But we follow it very closely and we already build on it via our collaboration with EDDEN laboratory and IDDRI. In particular our project of modeling and implementing transport-land use-energy integrated model for the city of Grenoble uses the data and analysis which are generating in the context of AETIC project.

**Program: ANR project (Ville durable)**

**Project acronym: AETIC**

Project title: Approche Economique Territoriale Intégrée pour le Climat
Duration: 2010 - 2013
Coordinator: Patrick Criqui (EDDEN)
Partners: UMR EDDEN, company ENERDATA Conseil, VEOLIA Environnement, CSTB (Centre Scientifique et Technique du Bâtiment), IDDRI (Sciences Politiques Paris), UMR PACTE.

Abstract: AETIC project aims to achieve three objectives: 1) to provide economic tools which allow to calculate and integrate costs and quantities useful for the territorial climate policy (PCL—"Plan Climat Local"). 2) to provide an analysis of the PCL of Grenoble metropolitan area. 3) to define a consistent and innovative methodology for the definition of the PCL.

A project related to previous activities in computer vision of project members:

**Program: ANR CONTINT**

**Project acronym: ROM**

Project title: Realtime Onset Matchmoving
Duration: 2008 – 2011
Coordinator: Duran Duboi SA
Other partners: VORTEX (IRI Toulouse, France)

Abstract: This industrial R&D project concerns the generation of special effects for movie or other film productions. In particular, the goal is to provide tools for successful onset matchmoving, that is the estimation of camera trajectories during acquisition, with immediate pre-visualization of special effects superimposed on acquired sequences. Besides this real-time aspect of matchmoving, the project also addresses the problem of preparing a shooting, by analyzing if matchmoving with natural features is possible and if not, by instrumenting the scene with artificial markers in appropriate positions.
7.3. European Initiatives

A project related to previous activities in computer vision of project members:

Program: ESA ITI (European Space Agency Triangular Initiatives)
Project acronym: ITI 3D
Project title: Multi-View 3D Reconstruction of Asteroids
Duration: 2010 – 2011
Coordinator: EADS Astrium
Abstract: The goal of the project is to implement and validate algorithms for image-based 3D modeling of asteroids. The algorithms combine multi-view stereo and shape-from-shading.

7.4. International Initiatives

7.4.1. INRIA International Partners

We collaborate closely with Tomàs De La Barra (Modelistica company, Professor at Facultad de Arquitectura y Urbanismo (Venezuela)). Tomàs De La Barra is the founder of the Land-Use and Transport Integrated Model Tranus. In the framework of this collaboration, Tomàs visited us for one week to advance the calibration of Tranus on Grenoble, and an ECOS NORD project has been submitted.

7.4.2. Visits of International Scientists

7.4.2.1. Post-docs

Juho Kannala (2 months, Nov/Dec 2011)
Institution: University of Oulu and National Academy of Finland

7.4.2.2. Internships

Mariano Luis Fernandez (from Apr 2011 until Sep 2011)
Subject: Re-implementation of a land use / transport model
Institution: Universidad Nacional del Centro de la Provincia de Buenos Aires (Argentina)

Luis Manterola (from Jun 2011 until Nov 2011)
Subject: Adaptation of the land use part of TRANUS model to the OPUS framework
Institution: Universidad Nacional del Centro de la Provincia de Buenos Aires (Argentina)

Alejandro Deymonnaz (from Jul 2011 until Dec 2011)
Subject: Shape From Ambient Shading
Institution: Universidad de Buenos Aires (Argentina)

7.4.3. Participation In International Programs

Program: ECOS NORD Venezuela
Project acronym: TRACER (submitted)
Project title: TRanus, Analyse de la Calibration et des Erreurs, Retours sur Grenoble et Caracas
Duration: 2012 - 2015
Coordinator: Laurence Tubiana (IDDRI), Tomàs de le Barra (Facultad de Arquitectura y Urbanismo, Venezuela)
Other partners: IDDRI, STEEP, Facultad de Arquitectura y Urbanismo (Venezuela)

Abstract: Having quantified elements on urban dynamics is necessary if one wants to implement policies that are coherent with sustainable urban objectives. Land use and transport integrated (LUTI) models enable such a quantification. Their use has successfully increased in the framework of urban prospect where environmental issues are preponderant. A large dissemination of such tools in the local authority agencies is nowadays crucial to evaluate urban policies, yet limited by various difficulties, such as lack of robustness and calibration issues. The objective of this project is to bring answers to these limitations. We choose to focus on the Tranus model, one of the most used LUTI model. Our work will be organized in three research directions. First, we aim at analyzing how Tranus is used by local agencies. Then, a comparison between the Tranus implementation and use for the cities of Grenoble (France) and Caracas (Venezuela) is planned. And finally semi-automatic calibration tools will be developed, and an uncertainty and sensitivity analysis will be performed.
7. Partnerships and Cooperations

7.1. National Actions

7.1.1. ANR VERSO ARESA2 - “Avancées en Réseaux de capteurs Efficaces, Sécurisés et Auto-Adaptatifs” (2009-2012, 160 keuros)
Participants: Fabrice Valois, Marine Minier.

Aresa2 is a national initiative (ANR) started in December 2009 and focusing on IP and Security issues in wireless sensor networks. It follows the first ANR/RNRT - Aresa. Fabrice Valois is the leader of the workpackage about self-organisation and Marine Minier is involved in the workpackage on security. The leader of Aresa2 is Orange Labs and the others partners are: Coronis Systems, VERIMAG, LIG, Télécom Bretagne and INRIA.

7.1.2. ANR - Banet - Body Area Networks and Technologies (2007-2010, 129 keuros)
Participants: Paul Ferrand, Jean-Marie Gorce, Claire Goursaud, Nikolaï Lebedev, Guillaume Villemaud.

Banet is a national initiative (ANR) started in January 2008 and focusing on Body Area Network (BAN) systems. Jean-Marie Gorce is the leader of the workpackage 'Standard air interface, network and protocol system design'. The budget for Swing is 120 keuros. Providing a framework for Body Area Networks (BAN), defining a reliable communication protocol, optimizing BAN technologies and enhancing energy efficiency of network components are the major stakes of then National Project BANET, led by CEA-Leti. It aims at defining precise frameworks to design optimized and miniaturized wireless communication systems. These body area networks target a wide applications range, such as consumer electronics, medical care and sports.

7.1.3. ANR - ECOSCELLS - Efficient Cooperating Small Cells (2009-2012, 260 keuros)

ECOSCELLS is a national initiative (ANR) which aims at developing algorithms and solutions to ease Small Cells Network (SCN) deployment. Theoretical studies will provide models for understanding the impact of radio channels, and to permit the definition of new algorithms exploiting a full diversity (user, spatial, interferences, etc.) of such networks. The novelty of the project is not to consider the interference as a drawback anymore, but to exploit it in order to offer an optimal resource utilization. The algorithms will be based on most recent developments in distributed algorithms, game theory, reinforcement learning. Architecture and algorithms for the backhauling network will also be proposed.

7.1.4. ANR - Rapide - Design and analysis of stream ciphers for constrained environments (2006-2011, 47 keuros)
Participants: Cédric Lauradoux, Marine Minier.

Rapide is a national initiative (ANR). Marine Minier is responsible of the work package “MACs construction”. Stream ciphers are less popular than their block ciphers counterparts, due to the lack of real standards. However, they become essential as soon as we want to reach important flows for limited costs in software or hardware. The aim of this national project is to study, construct and evaluate new stream ciphers built upon a non-linear transition function and to better evaluate the properties of the filtering function to discard known attacks, especially the algebraic ones.

7.1.5. ANR INS BLOC - “block ciphers dedicated to constrained environments” (2011-2015, 80 keuros)
Participants: Marine Minier, Cédric Lauradoux.
BLOC is a research project partially funded by the French National Research Agency. It has been proposed to INS 2011 call. It aims at studying the design and analysis of block ciphers dedicated to constrained environments.

### 7.1.6. ANR - Cormoran - “Cooperative and Mobile Wireless Body Area Networks for Group Navigation” (2011-2014, 140 keuros)

**Participants:** Paul Ferrand, Jean-Marie Gorce, Claire Goursaud, Isabelle Augé-Blum.

Cormoran project targets to figure out innovative communication functionalities and radiolocation algorithms that could benefit from inter/intra-WBAN 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-WBAN 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).

### 7.1.7. FUI ECONHOME - “Energy efficient home networking” (2010-2014, 330 keuros)

**Participants:** Nikolaï Lebedev, Florin Hutu, Jean-Marie Gorce, Guillaume Villemaud.

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 (STB), 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.

### 7.1.8. ADR Selfnet - “Self Optimization Networking” (2008-2011, 350 keuros)

**Participants:** Virgile garcia, Sandesh Uppoor, Nikolaï Lebedev, Jean-Marie Gorce, Hervé Rivano, Fabrice Valois, Marco Fiore.

This action is a part of the common lab of Inria and Alcatel Lucent Bell Labs. This action groups several team of Inria with Alcatel teams and addresses different aspects of Self Networking: distributed algorithms, energy efficiency, mobility. Virgile Garcia is finishing his PhD on distributed power management in cellular networks and Sandesh Uppoor is in his 2nd year on mobility models.

### 7.2. Actions Funded by the EC

#### 7.2.1. Projet iPLAN - FP7-PEOPLE-IAPP-2008 (2009-2012, 440 keuros)

**Participants:** Jean-Marie Gorce, Guillaume Villemaud, Nikolaï Lebedev, Dmitry Umansky, Meiling Luo.

iPLAN (is a FP7 project of the FP7-PEOPLE-IAPP-2008 call. iPLAN (Indoor Planning) The iPlan consortium is made of the Ranplan Company, the CITI Lab- oratory and the University of Bedfordshire and proposes the study of Indoor planning and optimization models and tools. The aim is to develop fast and accurate radio propagation models, investigate various issues arising from the use of femtocells, develop an automatic indoor radio network planning and optimization and facilitate knowledge integration and transfer between project partners, to enable cross-fertilization between radio propagation modeling, wireless communications, operations research, computing, and software engineering.

Meiling is currently seconded full-time for 2 years in Ranplan Company, and Nikolai Lebedev is seconded full-time for 1 year.

#### 7.2.2. DistMo4wNet - FP6 fellowship (2006-2011, 240 keuros)

**Participants:** Jean-Marie Gorce, Katia Jaffrès-Runser.
DistMo4wNet is a FP6 project labelled in the FP6 framework in the outgoing fellowship program. Jean-Marie Gorce is the scientific responsible of the program, and Katia Jaffres-Runser is the applicant. She was supported from January 2007 through June 2009, for two years at the Stevens Institute of Technology where she works with Pr. Cristina Comaniciu on distributed optimization of wireless networks protocols.
8. Partnerships and Cooperations

8.1. National Collaborations

Additionally, we collaborated in 2011 with the following INRIA project teams:

- OASIS (Sophia-Antipolis): distributed verification tools (Eric Madelaine);
- POP-ART (Rhône-Alpes): behavioral adaptation of software services and conformance checking of choreography specifications (Gregor Gössler);
- SARDES (Rhône-Alpes): verification of protocols for component-based architectures and virtualization (Fabienne Boyer, Olivier Gruber, and Noël de Palma).

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

- Gaëlle Calvary and Sophie Dupuy (LIG, Grenoble);
- Pascal Poizat (LRI, Orsay);
- Meriem Ouederni (LINA, Nantes);
- Xavier Blanc and Cédric Teyton (LABRI, Bordeaux).

8.2. European Collaborations

The VASY project team is member of the FMICS (Formal Methods for Industrial Critical Systems) working group of ERCIM (see http://fmics.inria.fr). From July 1999 to July 2001, H. Garavel chaired this working group; since July 2002, he has been a member of the FMICS Board, and is in charge of dissemination actions. In November 2011, R. Mateescu was elected chairman of the FMICS working group.

In addition to our partners in aforementioned contractual collaborations, we had scientific relations in 2011 with several European universities and research centers, including:

- Polytechnic University of Bucharest (Valentin Cristea);
- Saarland University (Jonathan Bogdoll, Pepijn Crouzen, Arnd Hartmanns, and Holger Hermanns);
- University of Coimbra (Javier Camara);
- University of Málaga (Carlos Canal, Meriem Ouederni, and Ernesto Pimentel).

D. Thivolle defended his PhD thesis at the Polytechnic University of Bucharest on April 29, 2011.

Our long-term partnership with Saarland University has been strengthened by the Humboldt Forschungspreis received by H. Garavel, who started regular visits to Saarland University.

H. Garavel has participated in the review of the DFG (Deutsche Forschungsgemeinschaft) transregional project AVACS (Automatic Verification And Analysis of Complex Systems, see http://www.avacs.org) on September 14–15, 2011.

8.3. International Collaborations

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.
8.4. Visits and Exchanges

In 2011, we had the following scientific exchanges:

- Nicolas Halbwachs (VERIMAG) visited us on January 28, 2011 and gave a talk entitled “Analyse de programmes: propriétés numériques et tableaux”.
- Thomas Lambolais and Thanh-Liem Phan (Ecole des Mines d’Alès) visited us on February 9, 2011.
- Meriem Ouederni (University of Málaga, Spain) visited us from June 27 to July 1, 2011 and from November 21 to November 25, 2011.
- Freark van der Berg (University of Twente, The Netherlands) visited us on October 17–21, 2011.
- Farhad Arbab (CWI, Amsterdam, The Netherlands) visited us on November 22, 2011 and gave a talk entitled “Interaction-Based Concurrency”.
- Gianluigi Zavattaro (University of Bologna, Italy) visited us on November 22, 2011 and gave a talk entitled “Parameterized Verification of Ad Hoc Network Protocols”.
- The annual VASY seminar was held in Autrans (France) on November 28–30, 2011.
- Xavier Blanc (LaBRI, Bordeaux) attended the VASY annual seminar and gave on November 28, 2011 a talk entitled “Vpraxis et évolution d’applications Internet”.
- Christian Attiogbe (LINA, Nantes) attended the VASY annual seminar and gave on November 29, 2011 a talk entitled “Composition dynamique de processus dans les systèmes complexes”.
- Grégory Batt (INRIA Rocquencourt) attended the VASY annual seminar and gave on November 30, 2011 a talk entitled “A general computational method for robustness analysis with applications to synthetic gene networks”.
- Holger Hermanns (Saarland University) visited us on December 1st, 2011 and gave a LIQ keynote entitled “From Concurrency Models to Numbers: Performance, Dependability, Energy”.


7. Partnerships and Cooperations

7.1. Regional Initiatives

7.1.1. Autonomy

Participants: Audrey Colbrant, Yohan Lasorsa, Jacques Lemordant, David Liodenot, Mathieu Razafimahazo.

Autonomy is a 22-month project funded by the global competitiveness cluster Minalogic (6th call for R&D projects) that started in March 2010, and is coordinated by ST Ericsson. Other partners are ST Microelectronics, Raisonance, Université de Grenoble, and Ivès.

The goal of the project is to develop high-tech tools to improve autonomy for people with disabilities. These tools are integrated in mobile devices such as cell phones or special-purpose devices, to improve the quality of life of people with disabilities. These devices access remote dedicated services to help geolocation and guiding. They take advantage of the latest advances in embedded systems: cameras, audio, video, GPS, RFID, compass, accelerometer, gyroscope. Two major application areas are addressed: software tools on cell phones for sight disabled people, and guiding and information tools for moving around in a city.

7.1.2. Grenoble Augmented City

Participants: Audrey Colbrant, Yohan Lasorsa, Jacques Lemordant, David Liodenot, Mathieu Razafimahazo.

Grenoble Augmented City is a large scale experimentation of augmented reality technologies, funded by the Rhône-Alpes Region for 12 months. Coordinated by CCSTI Grenoble, the project includes GRESEC (Stendhal University, Grenoble), the public libraries of Grenoble, the tourist office of Grenoble, and musée Dauphinois.

This project uses XML formats for multimedia content (HTML5), interactive audio (A2ML), and points of interest (W3C POI) in complex mixed reality applications. As a consequence, the authoring of a specific application is greatly simplified.

The MRB browser developed by WAM is a Mixed Reality Browser whose main features are:

- use of an XML format for Points of Interest (POI) issued from an on-going discussion within the W3C Points of Interest working group,
- use of HTML5 for the multimedia content of POIs, allowing easy authoring inside a standard HTML5 browser,
- navigation between POIs at the level of the format using MAUDL audio POIs,
- switching between Augmented Reality and Augmented Virtuality through the use of panoramic images and the concept of groups of POIs.

The MRB browser is running on the iPhone 4 and the iPad.

A cultural heritage visit of Grenoble can be downloaded from the web and played on site in Augmented Reality or remotely in Augmented Virtuality. This visit will be tested by visually impaired people.

7.2. National Initiatives

7.2.1. Codex

Codex is a project funded by ANR as part of its Emerging Domains program (DEFIS). It started in March 2009 for a duration of 36 months. WAM is working with five partners: INRIA Saclay Île-de-France (project-team Leo), INRIA Lille Nord-Europe (project-team Mostrare), University Paris Sud, Centre universitaire de Blois, and Innovimax SARL.

Codex seeks to push the frontier of XML technology innovation in three interconnected directions:

- Languages and algorithms: prototypes are developed for efficient and expressive XML processing, in particular advancing towards massively distributed XML repositories.
- Codex considers models for describing, controlling, and reacting to the dynamic behavior of XML corpora and XML schemas with time.
- The project proposes theories, models and prototypes for composing XML programs for richer interactions, and XML schemas into rich, expressive, yet formally grounded type descriptions.

7.2.2. C2M

Participants: Fabien Cazenave, Cécile Roisin.

Multimedia Cooperative Publishing Chain (C2M) is a project funded by ANR as part of its Digital Contents and Interaction program (CONTINT). It started in September 2009 for a duration of 24 months. WAM is working with five partners: Université de Technologie de Compiègne, Kelis Conseil et Développement, Amexio, Heudiasyc laboratory (CNRS), Institut National de l’Audiovisuel (INA).

The project aims at integrating XML publishing chains, Enterprise Content Management (ECM), and multimedia creation tools, in order to design a complete digital system for multimedia creation, management and publishing.

The main challenge lies in the convergence of several approaches:

- storage and management of document fragments,
- structured editing,
- maintaining and repurposing content,
- planning, cooperation and production.

Convergence is made possible by the maturity of XML technologies and by the collaborative practices popularized by the web.

7.3. European Initiatives

7.3.1. Venturi

Participants: Yohan Lasorsa, Jacques Lemordant, David Liodenot, Mathieu Razafimahazo.

immersiVe ENhancement of User-woRld Interactions, FP7-ICT-2011-7, STREP, duration: 36 months starting in October 2011, Partners: Fondazione Bruno Kessler (Italy), Fraunhofer Heinrich Hertz Institute (Germany), ST Microelectronics (Italy), ST-Ericsson (France), Metaio (Germany), e-Diam Interactive (Spain), Sony-Ericsson (Sweden).

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.

7.4. International Initiatives

7.4.1. INRIA International Partners

We are working with the MEDIA group at EPFL (Lausanne, Switzerland) on XML editing, more specifically on the template-driven approach.
Members of the WAM project-team participate in several activities of the World Wide Web Consortium (W3C):

- Vincent Quint is a member of the W3C Advisory Committee.
- Nabil Layaida is a member of the W3C Synchronized Multimedia working group.
- Jacques Lemordant is a member of the W3C Points of Interest Working Group.
- The Amaya web editor is developed jointly with W3C. The software is distributed by W3C.