Activity Report 2011

Section highlights of the Team
### Algorithmics, Programming, Software and Architecture

1. ABSTRACTION Project-Team ................................................................. 5  
2. ALGORITHMS Project-Team ................................................................. 6  
3. AOSTE Project-Team ................................................................. 7  
4. CASCADE Project-Team (section vide) ............................................. 8  
5. CONTRAINTES Project-Team (section vide) ....................................... 9  
6. FORMES Team (section vide) ............................................................ 10  
7. GALLIUM Project-Team ................................................................. 11  
8. MOSCOVA Project-Team ................................................................. 12  
9. PARKAS Team ................................................................. 13  
10. PLR2 Project-Team (section vide) .................................................... 14  
11. SALSA Project-Team ................................................................. 15  
12. SECRET Project-Team ................................................................. 16

### Applied Mathematics, Computation and Simulation

13. CAD Team ................................................................. 17  
14. CLASSIC Project-Team (section vide) ............................................. 18  
15. GAMMA3 Project-Team (section vide) ........................................... 19  
16. MATHFI Project-Team ................................................................. 20  
17. MICMAC Project-Team (section vide) ............................................. 21  
18. POEMS Project-Team ................................................................. 22  
19. SIERRA Project-Team ................................................................. 23

### Computational Sciences for Biology, Medicine and the Environment

20. BANG Project-Team (section vide) .................................................... 24  
21. CLIME Project-Team (section vide) ................................................ 25  
22. ESTIME Project-Team (section vide) ................................................ 26  
23. MACS Project-Team ................................................................. 27  
24. NEUROMATHCOMP Project-Team (section vide) ................................ 28  
25. REO Project-Team ................................................................. 29  
26. SISYPHE Project-Team ................................................................. 30

### Networks, Systems and Services, Distributed Computing

27. ARLES Project-Team ................................................................. 31  
28. GANG Project-Team ................................................................. 32  
29. HIPERCOM Project-Team ............................................................... 33  
30. RAP Project-Team (section vide) .................................................... 34  
31. REGAL Project-Team (section vide) ................................................ 35  
32. TREC Project-Team ................................................................. 36

### Perception, Cognition, Interaction

33. ALPAGE Project-Team (section vide) ................................................ 37  
34. AXIS Project-Team ................................................................. 38  
35. IMARA Project-Team ................................................................. 39  
36. IMEDIA Project-Team ................................................................. 40
37. SMIS Project-Team ................................................................. 41
38. WILLOW Project-Team .......................................................... 42
ABSTRACTION Project-Team

2.2. Highlights

The paper “Static Analysis and Verification of Aerospace Software by Abstract Interpretation”, written by the team [1], has been selected in 2011 by the AIAA Intelligent Systems Technical Committee as the Best Paper from the AIAA 2010 Infotech@Aerospace Conference.

The MemCAD ERC Starting Grant (“Memory Compositional Abstract Domains”) was started on October, 1st. 2011 (funded by the European Research Council “IDEAS” programme).
ALGORITHMS Project-Team

2.2. Highlights

Philippe Flajolet, head of the project and of former related projects at Inria, died suddenly on March 22. He is celebrated for opening new lines of research in analysis of algorithms, developing powerful new methods, and solving difficult open problems. A conference with more than 250 participants has been organized by the project in December. It will pay homage to the man as well as the multi-faceted mathematician and computer-scientist.
2.2. Highlights

Robert de Simone was made Honorary Professor of the Software Engineering Institute (SEI) at East China Normal University (ECNU) in Shanghai.
CASCADE Project-Team (section vide)
CONTRAINTES Project-Team (section vide)
FORMES Team (section vide)
GALLIUM Project-Team

2.2. Highlights

Xavier Leroy (EPI Gallium), Sandrine Blazy (EPI Celtique), Zaynah Dargaye (CEA) and Jean-Baptiste Tristan (Oracle Labs) were awarded the 2011 *La Recherche* prize in Information Sciences for their work on the CompCert verified compiler.
MOSCova is proud of producing the following important results in 2011:

- 1 PhD was defended, another one will be defended on February 8, 2012.
- 1 paper accepted at POPL 2012 (1 paper was accepted at POPL 2011).
2.1. Highlights

- Tobias Grosser has been awarded a Google European Doctoral Fellowship, a highly competitive 3 years scholarship of 120k € (14 recipients in 2011).
PI.R2 Project-Team (section vide)
2.2. Highlights

- **Computer Algebra.** Best Poster Award STOC 2011 (San Jose, USA) – PWE : Polynomial with Errors.
- **ANR Grants** Two new projects (HPAC and GEOLMI) were accepted (4 years projects).
- **Maple.** Maple 15 release : the contract with Maple was renewed until Dec. 2011.
SECRET Project-Team

2.2. Highlights

- **Cryptanalysis of several hash functions proposed to the SHA-3 competition:** this international competition, launched by the American National Institute of Standards and Technology, aims at selecting a new standard for hash functions\(^1\). The revision of the current standard FIPS 180-2 has actually been decided by NIST in response to the recent attacks against almost all existing hash functions (e.g. MD5, SHA-0, SHA-1). Among the 64 hash function proposals submitted to the SHA-3 competition, several candidates have been cryptanalyzed by some researchers of the project-team. More recently, we have provided a deep study of the algebraic properties of some of the finalists of the competition.

- **Discovery of a distinguishing property for the family of Goppa codes** which are used in the original McEliece cipher and the CFS signature scheme. Even if it does not lead to an attack, this property invalidates the previously known security proofs of these systems. Among the many families of linear codes which have been considered for code-based cryptography, Goppa codes seemed to be the only safe one. Now even Goppa codes seem to be questioned.

- **Organization of the WCC international conference**, which was held in Paris in April 2011. This was the seventh in the series of biannual workshops on *Coding and Cryptography*.

---

\(^1\) [http://csrc.nist.gov/groups/ST/hash/sha-3/]
2.2. Highlights

The new young Computer Graphics members who joined us this year, obtained high level papers (see New Results) and obtain two major success:

- Organize the international conference of ACM SIGGRAPH VRCAI 2011 in Hongkong;
- A cooperation project with CAS-BEGCL Imaging Technology Corporation on 3D computer animation movies.
CLASSIC Project-Team (section vide)
GAMMA3 Project-Team (section vide)
2.2. Highlights

The Mathfi project is acknowledged as an active part of the Université Paris-Est “Labex” BÉZOUT which has been recently selected by the French ministry of research.

A new team called “MathRisk” based on the current Mathfi project team is being launched on the theme of *mathematical treatment of risk*. 
MICMAC Project-Team (section vide)
2.2. Highlights

Among the significative scientific advances and successes of this year, that are illustrated by the finalization of several PhD theses, we would like to emphasize:

- The diversification and intensification of our research in the domain of ultra-sonic non destructive testing in the framework of a long term collaboration with CEA LIST. One spectacular concretization of this collaboration is the PhD thesis of S. Impériale about the modeling of piezoelectric sensors. A success in term of recognition of our activity in this fields is the acceptation of the European project.

- Several spectacular advances in the mathematical understanding of electromagnetic wave propagation in metamaterials (in the more general sense of the term and the development of corresponding numerical methods. These progresses have been successfully recognized via the ANR Project METAMATH, whose Poems is coordinator, on the thematic of metamaterials, a major topic for Poems in the forthcoming years.

- A pioneering work on the full modelization by physical models of a concert piano via the PhD thesis of J. Chabassier. This is an exemplary success of a multi disciplinary collaboration with the Unity of Mechanics at ENSTA (A. Chaigne)

Let us also mention the arrival of two new CNRS researchers, Marc Bonnet (DR) and Stéphanie Chaillat (CR), which bring new competences in the domains of integral equations and inverse problems.
SIERRA Project-Team

2.2. Highlights

The SIERRA project-team was created on January 1, 2011.
BANG Project-Team (section vide)
CLIME Project-Team (section vide)
ESTIME Project-Team (section vide)
2.2. Highlights

- First clinical validations on predictivity of cardiac biomechanical modeling for resynchronization therapy (CRT) planning, see [5];
- First results on data assimilation with actual medical images in collaboration with Hôpital Henri Mondor, see [1];

These highlights have been demonstrated in the News Focus entitled “La météo du cœur” shown in the Soir3 TV news on November 16th.
NEUROMATHCOMP Project-Team (section vide)
REO Project-Team

2.2. Highlights

- Marc Thiriet received the Franco-Taiwanese Science Foundation prize 2011 awarded by the French Academy of Sciences and the National Science Council of Taiwan (shared with Tony Wen-Hann Sheu).
- Laurent Boudin defended his habilitation thesis (HDR) on December 8, 2011.
2.2. Highlights

Mazyar Mirrahimi, Adis Hamini and Pierre Rouchon are the co-authors of an article in *Nature*, September 2011 on an application of real-time quantum feedback to the preparation and stabilization of a small number of photons in a cavity [12]. They have proposed the feedback scheme for quantum systems undergoing discrete-in-time non-destructive measurements that is used in this experiment.
2.2. Highlights

During this year, while we have been pursuing our research on advanced service-oriented architectures and related middleware solutions for next generation networking environments, we have made initial progress in research on several new subjects, called for by the ongoing drastic evolution of the networking environment:

- Dynamic interoperability among networked systems towards making them eternal, by way of on-the-fly generation of connectors based on adequate system models. This research is part of a major European collaborative project within the Future and Emerging Technology program of the EC FP7-ICT (§ 6.2, § 7.1.1).

- The use of Models@run.time to extend the applicability of models and abstractions to the runtime environment, arising from our anticipation that Models@run.time will play an integral role in the management of extremely distributed systems. We are exploring the use of Models@run.time to tackle the crucial problem of uncertainty in extremely distributed systems that are aware of their own requirements, as well as to support the runtime synthesis of software that will be part of the executing system (§ 6.2).

- Interaction paradigm abstractions and service oriented middleware for choreographies in the ultra-large scale future Internet. This research is also part of a major European collaborative project within the Software and Service Architectures and Infrastructures programme of the EC FP7-ICT (§ 6.4, § 7.1.2).

- System-level support for mobile social applications, by way of a middleware architecture that involves research in the areas of semantic models for social data, mobile distributed storage, a novel policy framework for access control, and efficient, predictive data-replication on resource-constrained devices, among others (§ 6.6).

Along with the above research, we completed the transfer of technology of our middleware technology for mobile handheld devices:

- The AMBIENTIC spin-off (http://www.ambientic.com/) was launched in early 2011. AMBIENTIC leverages the ARLES middleware technology that has been developed over the last 10 years for supporting the development of mobile collaborative services. AMBIENTIC specifically develops innovative mobile distributed services on top of the iBICOOP middleware that allows for seamless interaction and content sharing in today’s multi-* networks. The AMBIENTIC project is winner of the Concours national d’aide à la création d’entreprises de technologies innovantes award (http://www.enseignementsup-recherche.gouv.fr/pid20162/concours-national-d-aide-a-la-creation-d-entreprises-innovantes.html) in the Emergence category in 2009 and in the Création category in 2010.

In addition to the above, we co-organized a successful summer school on Formal Methods for Eternal Networked Software Systems, in the “SFM: International School on Formal Methods for the Design of Computer, Communication and Software Systems” series at Bertinoro, Italy. It covered topics such as connecting eternal software systems, formal foundations for connectors, dynamic connector synthesis, interaction behavior monitoring and learning, and dependability assurance of connected systems. We also co-organized FOME: Future of Middleware event at the 12th ACM/IFIP/USENIX International Middleware Conference in Lisbon, Portugal, which brought together a number of invited leading researchers in the field selected to offer comprehensive coverage of the key issues to be tacked in the near future in the area of Middleware research, such as: right abstractions for the development of future distributed systems; how to achieve interoperability and openness; and how to ensure dependability and security in the face of extremely large scale and heterogeneity in future distributed systems.
GANG Project-Team

2.2. Highlights

The paper [22] was awarded as a best article in the 25th Int. Symp. on Distributed Computing (DISC 2011).
2.2. Highlights

1. **Organization of MobiHoc 2011**, the Twelfth ACM International Symposium on Mobile Ad Hoc Networking. The HIPERCOM project contributed to the great success of this international conference held in Paris in May 2011. Philippe Jacquet served as General Chair, Christine Anocq as Local Arrangement Co-chair, Thomas Clausen as Finance Co-chair, Paul Muhlethaler, Anis Laouiti and Pascale Minet as Workshop Co-chairs, Emmanuel Baccelli as Registration Chair, Cédric Adjih as Web Chair.

2. **Contribution to the OCARI shows.** Pascale Minet, Cédric Adjih, Ichrak Amdouni and Ridha Soua were active contributors as well as LIMOS, TELIT and EDF to the two OCARI shows organized by EDF. The fist one in September was given for EDF executives. The second one in December was larger. Invited people came from government agencies and industries. The goal was to prove the feasibility of an OCARI wireless sensor network in industrial environments, focusing on time constrained traffic and energy efficiency.

3. **Habilitation à Diriger des recherches.** Aline carneiro Viana got her HDR entitled *Putting data delivery into context: Design and evaluation of adaptive networking support for successful communication in wireless self-organizing networks* from UPMC-Sorbonne University on the 14th December 2011.
RAP Project-Team (section vide)
REGAL Project-Team (section vide)
TREC Project-Team

2.2. Highlights

- The collaboration of TREC and the Wireless Foundations Center of UC Berkeley became part of the inria@siliconvalley program.
- The paper “Impact of Clustering on Diffusions and Contagions in Random Networks” [33] got the best paper award of NetGCOOP 2011: International conference on NETwork Games, COntrol and OPtimization.
ALPAGE Project-Team (section vide)
2.2. Highlights

1. A best paper at ECIR the major european conference on Information Retrieval and an article accepted [23] in Pattern Recognition journal (Elsevier).

2. AxIS has contributed to the Future Internet Assembly book on Smart Cities and Future Internet: towards cooperation frameworks for Open innovation [39].

3. An important effort has been done this year to get datasets from real applications in order
   - to validate our methods in data mining: it was the case for our ATWUEDA method applied on electric power plant curves from EDF [51].
   - to support our researches in expert finding with the important work of E. Smirnova in building experiment dataset based on the LinkedIn repository (cf. her visit at Intelius, USA) and with the Yahoo! agreement which allows us to get a large sample of the web graph, important for our work on name disambiguation,
   - and to consolidate and support our multi-disciplinary approach in understanding usage data, user experience and co-creation (methodology and data mining) by the data generated from several projects involving experiments with citizen (cf. 6.1).

4. SCDS method from Marascu’s thesis (2009) has been implemented as a Web service inside the FocusLab platform and was used for ELLIOT purposes (cf. 4.2.3). ATWUEDA has been applied successfully for system monitoring purposes at EDF.

5. AxIS Rocquencourt and AxIS Sophia Antipolis have worked on two common Pacalabs contracts (Ecoffices, an energetical challenge and HOTEL-REF-PACA related to the log analysis of Web sites referencing).

6. Fruitful relations established with the urban community of Nice Cote d’Azur (NCA) and the urban community of Antibes Sophia Antipolis in the context of various projects.

7. AxIS staff has prepared the evaluation of our past four years and our future research as our colleagues from the same topic “Perception, Cognition, Interaction: Knowledge and Data Representation and Management” in October 12-13 (our last evaluation was in November 2007).

Best Papers Awards:

[43] the 33rd European conference on Advances in information retrieval. E. Smirnova, K. Balog.
2.2. Highlights

- Year 2011 was a particular year, where the emblematic leader of IMARA – Michel Parent – has retired but remained a close collaborator with the team. His successor Fawzi Nashashibi is the new team leader.

- 2011 also saw the retirement of André Ducrot, who has been working for many years on image processing and lately visual odometry. Among the colleagues who left Imara this year, we would like to mention in particular Philippe Deschamps, who passed away last October. Philippe has been a researcher in several teams of Inria for more than thirty years.

- 2011 was also the end of several European projects: HAVEit, Intersafe-2, CityMobil and CityNet-Mobil. CityMobil showcases and the involvement of INRIA in the final event constituted a true breakthrough from the scientific and team visibility points of view. Thanks to the Cybercars service at La Rochelle, IMARA proved its leadership by performing a unique on-demand urban transportation system based on automated electric vehicles called Cybus.
2.2. Highlights

We organized the Plant Identification task at ImageCLEF 2011 (cf. http://imageclef.org/2011/plants and [19]). We submitted two runs [20], which won respectively the Scans images and the Scan-like images tasks.
SMIS Project-Team

2.2. Highlights

Best Paper Award:

2.2. Highlights

+ Julien Mairal, a former PhD student of J. Ponce and F. Bach won several prizes for his PhD thesis about “Sparse coding for machine learning, image processing and computer vision”. See details in section 9.1.
+ Jean Ponce was awarded an Advanced ERC Grant, starting Jan 2011.
+ Andrew Zisserman was awarded the Rank Prize for his “Outstanding contributions to modern computer vision” http://www.rankprize.org/.
+ The updated 2nd edition of the textbook “Computer Vision: A Modern Approach” by David Forsyth and Jean Ponce has been published by Pearson Education in November 2011.
+ The group has split into two on January 1st 2011 to create a new INRIA project-team called SIERRA. The new group and its interactions with WILLOW is described in section 6.5.