Activity Report 2011

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BYMOORE Exploratory Action

5. Contracts and Grants with Industry

5.1. Grants with Industry

- **ANR MHANN** (Memristive Hardware Artificial Neural Networks Accelerators): The purpose of this project is to build a medium scale prototype of such a bio inspired architecture, by using long life and nanometric-ferroelectric memristors. The area, performance and power benefits of this approach will be evaluated to define its interest for embedded systems. The MHANN project is multi disciplinary in the sense that it proposes new physical concepts for devices (physics) and aims at integrating them into on chip bio inspired architectures (micro electronics, computer science and architectures).

- **ANR NEMESIS** (NEuroMorphic hardwarE for Smart vIsion Sensor): This project aims at exploring the potential of biologically-inspired spike-based image processing supported by the realization of massively parallel yet scalable hardware thanks to 3D stacking of integrated circuits.

- **ANR Arch2Neu** (Neuromorphic hardware and software environment for versatile computing): Arch2Neu aims at investigating the potential of neuromorphic architectures for computing purposes, and particularly for signal-processing applications. We develop analog neural hardware, interconnections architectures, libraries, and compilers to provide to the user a versatile and efficient computing machine. You can learn more about our research through the dedicated webpages.
COMETE Project-Team (section vide)
7. Contracts and Grants with Industry

7.1. Contracts with Industry


DAHU Project-Team (section vide)
DEFI Project-Team

7. Contracts and Grants with Industry

7.1. RODIN project

Participant: Grégoire Allaire.

Launching of the RODIN project (Robust Optimal Design in INdustry) in 2011 with EADS IW, Renault, ESI Group, Eurodecision, Ecole Polytechnique, Paris 6 University, INRIA. One of the aims of the RODIN project is to develop a new shape optimization software for solid structures in the framework of the SYSTUS code developed by ESI-group.

7.2. ANR, Program COSINUS, 2010-2013

Participants: Jing-Rebecca Li, Houssem Haddar, Armin Lechleiter.

We obtained 200K euros grant from ANR, program Cosinus, 2010-2013. J.R. Li is the coordinator of this project: “Simulation du signal d’IRM diffusion dans des tissus biologiques (SIMUDMRI)”, which is a joint proposal between INRIA-Saclay (Coordinator) and CEA Neurospin.

http://www.cmap.polytechnique.fr/~jingrebeccali/grants/simudmri.html

7.3. ANR, Program MN, 2011-2014

Participants: Houssem Haddar, Armin Lechleiter.

We obtained a 220K euros from ANR, program MN, 2011-2014, in the framework of the project: Modelization and numerical simulation of wave propagation in metamaterials. This is a joint ANR with POEMS (INRIA Rocquencourt), DMIA, Département de Mathématiques de l’ISAE and IMATH, Laboratoire de Mathématiques de l’Université de Toulon. https://www.rocq.inria.fr/poems/metamath

7.4. EDF R&D, 2010-2013

Participants: Houssem Haddar, Armin Lechleiter, Zixian Jiang.

We have partnership grant with STEP department of EDF R&D on non destructive testing using eddy current probes. This grant covers the expenses of the PhD thesis of Zixian Jiang.

7.5. PEPS (CNRS short grant), 2011

Participant: Grégoire Allaire.

PEPS (CNRS short grant) with EDF on optimal design of nuclear reactor cores. This grant covered the expenses of a sixth month internship (Master M2).

7.6. PhD advising

Participant: Grégoire Allaire.

Contracts covering PhD advising (Thèses CIFRE) with EADS, IFP and Renault (2011-2013).
DIGIPLANTE Team (section vide)
7. Contracts and Grants with Industry

7.1. Contracts with Industry

Alban Quadrat and Arnaud Quadrat (SAGEM Défense Sécurité, Etablissement de MASSY) have initiated discussions between SAGEM, the DISCO project and the L2S about a future collaboration in the direction of the analysis of the effect of the time-delay in inertially stabilized platforms for optical imaging systems. We hope that these discussions will conclude in a contract in 2012 on this subject.
7. Contracts and Grants with Industry

7.1. Contracts with Industry

- **Intrasene**: spatio-temporal modeling of low gliomas brain tumors [PhD thesis S. Parisot: 2010-2013]
- **General Electric HealthCare**
GECO Team (section vide)
7. Contracts and Grants with Industry

7.1. Geometry Factory

The initial development phase of the CGAL library has been made by a European consortium. In order to achieve the transfer and diffusion of CGAL in the industry, a company called GEOMETRY FACTORY has been founded in January 2003 by Andreas Fabri (http://www.geometryfactory.com).

The goal of this company is to pursue the development of the library and to offer services in connection with CGAL (maintenance, support, teaching, advice). GEOMETRY FACTORY is a link between the researchers from the computational geometry community and the industrial users.

It offers licenses to interested companies, and provides support. There are contracts in various domains such as CAD/CAM, medical applications, GIS, computer vision...

GEOMETRY FACTORY is keeping close contacts with the original consortium members, and in particular with GEOMETRICA.

In 2011, GEOMETRY FACTORY had the following new customers for CGAL packages developed by GEOMETRICA: Acute3D (3D Delaunay, France), Ansys (2D Circular Kernel, CAD, USA), Autodesk (Poisson Surface reconstruction, CAD, USA), Esri (AABB Tree, GIS, USA), ExxonMobil (3D Delaunay, oil, USA), Halliburton (Poisson Surface reconstruction, oil, USA), Metria (2D Delaunay, GIS, Spain), Petrobras (2D Mesh, Surface mesher, Segment Voronoi diagram, oil, Brasil), Petroglyphgames (2D Constrained Delaunay, games, USA), Zimmer (Poisson Surface reconstruction, medical, Canada).

Moreover, research licenses (in-house research usage for all of CGAL) have been purchased by: Geovariances (petrol, France), Siemens Corporate Research (medical, USA), Spot Image (GIS, France), IGN (GIS, France), Kappa Engineering (oil, Germany), MPI Metal Research (Germany).
GRAND-LARGE Project-Team (section vide)
7. Contracts and Grants with Industry

7.1. DGA/MI

Participants: Cédric Adjih, Pascale Minet, Paul Mühlethaler.

Period: 2007 - 2011

Partners: DGA/MI.

The DGA/MI, French MoD/DGA, contract has been notified in December 2007. It has a duration of 36 months. It focuses on mobile ad hoc networks. DGA/MI is interested in the standardization done at the IETF and more particularly within the MANET and AUTOCONF groups, where the HIPERCOM team-project is active. Furthermore, this contract addresses topics that belong to DARPA’s recent initiatives about new military wireless networks able to adapt to changing conditions. These networks will be self-forming, self-healing, self-configuring and self-optimizing. They will provide an intelligent relaying and an intelligent power management. All these topics are present in the DGA/MI contract:

- OLSRv2: identification of the differences with the previous version and expected benefits;
- Multicast protocols: analysis and performance evaluation of three multicast protocols: SMOLSR, MOLSR and MOST;
- Autoconfiguration in IPv6: choice of a solution adapted to military applications;
- Dynamic routing over a hierarchical topology: when does a hierarchical routing outperforms a flat one?
- Adaptive routing on high frequency (HF) links;
- Merge of networks.

Three of them are leading an implementation on a real platform comprising 18 nodes. Nodes are equipped with 802.11b cards and measurements tools on Linux. They implement the OLSR routing protocol. This testbed allows CELAR to make demonstrations with a real mobile ad-hoc network, and evaluate the potential benefits of such a network in military tactical applications, with a special focus on performances and reliability.

This year, we were solicited by DGA/MI for the expertise of European industrial proposals about the design of wireless mobile ad hoc networks supporting tactical military applications. Our comments contributed to improve the solutions presented.

7.2. OCARI2

Participants: Ichrak Amdouni, Pascale Minet, Cédric Adjih, Ridha Soua.

Period: 2010 - 2011

Partners: EDF, LIMOS, TELIT.

At the end of the OCARI (Optimization of Ad hoc Communications in Industrial networks) project, funded by ANR, started in February 2007 and ended in 2010, EDF the coordinator decided to continue the project with a restricted number of partners: TELIT, LIMOS (Clermont Ferrand university) and INRIA. The goal was to prove the feasibility on commercially available cards of the OCARI stack designed during the ANR project and to make a public demonstration of this product. During the year 2011, the OCARI stack has been improved and implemented on the ZE51 module of TELIT based on the Texas Instrument CC2530 Chipset.
The OCARI project deals with wireless sensor networks in an industrial environment. It aims at responding to the following requirements which are particularly important in power generation industry and in warship construction and maintenance:

- Support of deterministic MAC layer for time-constrained communication,
- Support of optimized energy consumption routing strategy in order to maximize the network lifetime,
- Support of human walking speed mobility for some particular network nodes, (e.g. sinks),
- Support of IEC61804/EDDL and HART application layer.

The development of OCARI targets the following industrial applications:

- Real time centralized supervision of personal dose in electrical power plants,
- Condition Based Maintenance of mechanical and electrical components in power plants as well as in warships,
- Environmental monitoring in and around power plants,
- Structure monitoring of hydroelectric dams.

To meet the requirements of supported applications (remote command of actuators, tele-diagnostic...), new solutions will be brought to manage several communication modes, ranging from deterministic data transfers to delay tolerant transfers. A key issue is how to adapt routing algorithms to the industrial environment, taking into account more particularly limited network resources (e.g.; bandwidth), node mobility and hostile environment reducing radio range.

The OCARI project aims at developing a wireless sensor communication module, based on IEEE 802.15.4 PHY layer and supporting EDDL and HART application layer. The INRIA contribution concerns more particularly energy efficient routing and node activity scheduling.

- The energy efficient extension of OLSR, called EOLSR, is implemented on top of the MAC protocol defined by LATTIS and LIMOS. The MAC protocol is a variant of ZigBee ensuring some determinism and quality of service and allowing leave nodes (e.g. sensor, actuator) as well as router nodes to sleep. The EOLSR protocol avoids nodes with low residual energy and selects the routes minimizing the energy consumed by an end-to-end transmission.

- SERENA, the protocol used to schedule router node activity, is based on three-hop coloring. It allows any node to sleep during the slots that are attributed neither to its color nor to its one-hop neighbors. SERENA contributes to a more efficient use of energy: less energy is spent in the idle and interference states. Hence, network lifetime is considerably increased. SERENA has been optimized for the specific context of OCARI (i.e.; very limited bandwidth 250kbps, small size messages 127 bytes, limited memory and limited processing power) have been delivered.

These protocols have been implemented in the OCARI stack, operating on a ZE51 module of TELIT.

### 7.3 SensLab and FIT

**Participants:** Cédric Adjih, Emmanuel Baccelli, Ala Eddin Weslati.

**Period:** 2011 - 2021

**Partners:** INRIA (Lille, Sophia-Antipolis, Grenoble), INSA, UPMC, Institut Télécom Paris, Institut Télécom Evry, LSIIT Strasbourg.

The HIPERCOM team started the development of a testbed for SensLab in 2010. This testbed located in building 21 at Rocquencourt INRIA center consists now of 40 wireless SensLab nodes. This number will reach 128 nodes by the end of the year 2012.

A location has been found for the new testbed of the EQUIPEX FIT: the basement of building 1 at Rocquencourt. An engineer has been recruited for this project.
7.4. ACRON

**Participant:** Cédric Adjih.

**Period:** 2011 - 2014

**Partners:** Supélec (Télécommunications), INRIA, ENS TREC, INRIA HIPERCOM, Université Paris-Sud, IEF.

ACRON is a DIMLSC DIGITEO project. It deals with analysis and design of self-organized wireless networks. The HIPERCOM team project will study the theoretical limits of wireless networking.

7.5. SWAN

**Participants:** Cédric Adjih, Salman Malik.

**Period:** 2011 - 2014

**Partners:** CNRS, Supélec, Université Paris-Sud (L2S), LTCI, LRI, INRIA Hipercam and IEF.

SWAN, Source-aWAre Network coding, is a DIMLSC DIGITEO project. It deals with network coding for multimedia.

7.6. MOBSIM

**Participants:** Cédric Adjih, Paul Mühlethaler, Hana Baccouch.

**Period:** 2011 - 2013

**Partners:** INRIA Sophia, INRIA Genoble.

MOBSIM is an ADT, Action of Technology Development. It aims at developing the NS3 simulation tool. The HIPERCOM team focuses on routing protocols and MAC protocol (namely the EY-NPMA protocol Elimination Yield Non-Preemptive Multiple Access). An engineer has been recruited for this project.

7.7. SAHARA

**Participants:** Philippe Jacquet, Pascale Minet, Cédric Adjih, Ridha Soua, Erwan Livolant.

**Period:** 2011 - 2014

**Partners:** EADS, Astrium, BeanAir, Eurocopter, Oktal SE, Reflex CES, Safran Engineering Systems, CNES, ECE, EPMI, LIMOS.

SAHARA is a FUI project, labelled by ASTECH and PEGASE, which aims at designing a wireless sensor network embedded in an aircraft. The proposed solution should improve the embedded mass, the end-to-end delays, cost and performance in the transfers of non critical data.

7.8. e-comp@gonon

**Participants:** Emmanuel Baccelli, Philippe Jacquet, Cédric Adjih, Anis Laouiiti, Salman Malik.

**Period:** 2008 - 2011

**Partners:** Archos, SCNF, Telecom SudParis, DGE, Deveryware.

E-comp@gonon is a System@tic project. The goal is the realization of a new type of multimedia terminal, enhanced with wireless ad hoc IP connectivity based on the OLSR protocol.

7.9. SMARTMESH

**Participants:** Philippe Jacquet, Emmanuel Baccelli, Cédric Adjih, Pascale Minet.

**Period:** 2009 - 2012

**Partners:** SAGEM, CEA, Telecom SudParis, Tunecharger, Ineo, Orelia, Prodomo.

SMARTMESH is a System@tic project, focused on the design of intelligent wireless sensor mesh networking for video surveillance and intrusion alarm systems.
IN-SITU Project-Team (section vide)
7. Contracts and Grants with Industry

7.1. Contracts with Industry

7.1.1. DataPublica

Participants: Ioana Manolescu, Nathalie Pernelle, Chantal Reynaud, Fatiha Saïs, Brigitte Safar.

A collaboration has been initiated with the DataPublica start-up (F. Bancilhon, C. Frisch) and the Zenith INRIA team (ex-ATLAS) from Montpellier. DataPublica aims at drawing up a catalog of the public data sources of the French domain, and in particular those produced by public administration, mostly in Excel files. The contract with DataPublica aims at designing a semantic annotation tool for typing entities in columns of tables in the geographic domain.
7. Contracts and Grants with Industry

7.1. Contracts/Contracts


- Thèse CIFRE de J-B. Dumont, financée par Orange Labs (encadrant Orange Labs: Mustapha Bouhtou, directeur de thèse: S. Gaubert), démarrée en septembre 2010. Sujet: tarification de services data et gestion des ressources dans les réseaux mobiles 3G et LTE.
7. Contracts and Grants with Industry

7.1. Contracts and Grants with Industry

So far, several contacts with industry have been established, but no bilateral contracts have materialized yet. Cooperations with France Télécom, Alcatel-Lucent and NEC are currently being developed within the EU IP UNIVERSELF, which has started in October 2010.
7. Contracts and Grants with Industry

7.1. Grants with Industry: Abrain project

Participants: Bertrand Thirion [Correspondant], Jean-Baptiste Poline.

Joint acquisition of neuroimaging and genetic data on large cohorts of subjects is a new approach used to assess and understand the variability that exists between individuals, and that has remained poorly understood so far. As both neuroimaging- and genetic-domain observations represent a huge amount of variables (of the order of $10^6$), performing statistically rigorous analyses on such amounts of data represents a computational challenge that cannot be addressed with conventional computational techniques. In this project, we plan to introduce grid and cloud computing techniques to address the computational challenge using cloud computing tools developed at INRIA (Kerdata team) and the Microsoft Azure cloud computing environment.

The ABrain project (2010-2013), funded by INRIA-Microsoft common lab.
PARTIAL Project-Team (section vide)
7. Contracts and Grants with Industry

7.1. Systematic: Hi-Lite

Participants: Claude Marché [contact], Jean-Christophe Filliâtre, Sylvain Conchon, Evelyne Contejean, Andrei Paskevich, Alain Mefsout, Mohamed Iguernelala, Denis Cousineau.


Hi-Lite is a project aiming at popularizing formal methods for the development of high-integrity software. It targets ease of adoption through a loose integration of formal proofs with testing and static analysis, that allows combining techniques around a common expression of specifications. Its technical focus is on modularity, that allows a divide-and-conquer approach to large software systems, as well as an early adoption by all programmers in the software life cycle.

Our involvements in that project include the use of the Alt-Ergo prover as back-end to already existing tools for SPARK/ADA, and the design of a verification chain for an extended SPARK/ADA language to verification conditions, via the Why VC generator.

This project is funded by the french ministry of industry (FUI), the Île-de-France region and the Essonne general council for 36 months from September 2010.

7.2. CEA-Airbus contract

Participants: Sylvain Conchon [contact], Évelyne Contejean, Claude Marché.

In conjunction with the INRIA funding of ADT Alt-Ergo, a specific support contract has started in Sep 09, between INRIA, CEA Saclay and Airbus France at Toulouse. This is to support our efforts for the maintainance and to feature updates of Alt-Ergo, for its use at Airbus software development and certification of avionics critical code.

7.3. Airbus contract

Participant: Sylvain Conchon [contact].

This 2 years support contract has started in Sep 10, between INRIA and Airbus France at Toulouse. This is to support our efforts for the DO-178B qualification of Alt-Ergo.

PROVAL Project-Team
7. Contracts and Grants with Industry

7.1. Grants with Industry

Academic and industrial collaborations are supported by CSDL (Complex Systems Design Lab) project of the Pôle de Compétitivité SYSTEM@TIC PARIS-REGION (11/2009-10/2012). Among the involved industrial partners, we can mention Dassault Aviation, EADS, EDF, MBDA and Renault. The goal of the project is the development of a scientific platform of decisional visualization for preliminary design of complex systems.
SECSI Project-Team (section vide)
7. Contracts and Grants with Industry

7.1. Contracts with EDF

Participants: Gilles Celeux, Jean-Michel Poggi.

- SELECT has a contract with EDF regarding modelling uncertainty in deterministic models.
- SELECT has a contract with EDF regarding wavelet analysis of the electrical load consumption for the aggregation and desaggregation of curves to improve total signal prediction.

7.2. Other contracts

Participants: Gilles Celeux, Rémy Fouchereau.

- SELECT has a contract with SAFRAN - SNECMA, an high-technology group (Aerospace propulsion, Aircraft equipment, Defense Security, Communications), regarding modelling reliability of Aircraft Equipment (collaboration with Patrick Pamphile (Université Paris-Sud)).
7. Contracts and Grants with Industry

7.1. Contracts with Industry

- A GEMPLUS contract corresponds to É. Brier’s thesis on the use of (hyper-)elliptic curves in cryptology.
- D. Augot, with Christine Eisenbess, is in discussion with MassiveRand, an SME providing random bits at high rate, in order to provide Rabin’s HyperEncryption, which is provably secure.
7. Contracts and Grants with Industry

7.1. Contracts with Industry


- **THALES** – 2011-2014 (40 kEur). side-contract to Gaetan Marceau-Caron’s CIFRE Ph.D.; Participants: Marc Schoenauer, Gaetan Marceau-Caron.


7.2. Grants with Industry

TYPICAL Project-Team (section vide)