RESEARCH CENTER
Rennes - Bretagne-Atlantique

FIELD

Activity Report 2015

Section Highlights of the Team

Edition: 2016-03-21

ALF Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Awards

Pierre Michaud won the 2nd Data Prefetching Championship held in conjunction with ISCA 2015 (Portland, June 2015).
BEST PAPERS AWARDS :
[27] **2nd Data Prefetching Championship**. P. MICHAUD.

ASAP Project-Team

4. Highlights of the Year

4.1. Highlights of the Year

Anne-Marie Kermarrec created the Mediego Startup in April 2015

Michel Raynal was accepted as a new member of the Academia Europaea.

4.1.1. Awards

Fabien André and Anne-Marie Kermarrec received the Award "Prix du magazine la recherche" in Computer science for the Eurosys 2014 paper "Archiving cold data in warehouses with clustered network coding"[1].

ASCOLA Project-Team (section vide)

ASPI Project-Team (section vide)

ATLANMODELS Team

5. Highlights of the Year

5.1. Highlights of the Year

"Software Modernization Revisited: Challenges and Prospects" appears in IEEE Computer Magazine. Based on our past and present experience in software migration projects, this article puts the focus on some important factors/challenges to take into consideration when dealing with such projects and propose corresponding recommendations to maximize the chance of success. In this respect, it notably presents some concrete findings we have made while collaborating with our partners during the 3 years of the ARTIST EU project.

CAIRN Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

Our work on accuracy evaluation and optimisation for fixed point arithmetic was presented during a tutorial "Fixed-point refinement, a guaranteed approach towards energy efficient computing" at IEEE/ACM Design Automation and Test in Europe (DATE'15) [70].

Some Granit out of Cairn... The GRANIT team at IRISA is a spin-off of the CAIRN team created in January 2015, and all of the GRANIT members were formerly belonging to CAIRN. This decision was motivated by two main reasons: CAIRN had reached a critical size (nearly twenty permanent researchers) and the scope of its research was becoming really broad. During the last period, the global scope of CAIRN was the research of new architectures, algorithms and design methods for flexible and energy efficiency domain-specific system-on-chip (SoC), promoting the use of reconfigurable hardware. The research activities of CAIRN were organized around three main topics: (i) The invention and the design of new reconfigurable platforms with an emphasis on flexible arithmetic operator design, dynamic reconfiguration management and low-power consumption. (ii) The development of their corresponding design flows (compilation and synthesis tools) to enable their automatic design from high-level specifications. (iii) The interaction between algorithms and architectures especially for wireless communications and wireless sensor networks. In brief, the two first topics will still be investigated by CAIRN, while GRANIT will explore the third one, with a new focus on algorithm and architecture adaptivity and cooperation between wireless nodes.

Awards The paper "Energy-Aware Computing via Adaptive Precision under Performance Constraints in OFDM Wireless Receivers" [39] received the best paper at the IEEE Computer Society Annual Symposium on VLSI (ISVLSI).

BEST PAPER AWARD :

[39] **IEEE Computer Society Annual Symposium on VLSI (ISVLSI 15)**. F. CLADERA, M. GAUTIER, O. SENTIEYS.

CELTIQUE Project-Team

4. Highlights of the Year

4.1. Highlights of the Year

4.1.1. Awards

Alan Schmitt has received the 2015 Most Influential POPL Paper Award for the 2005 paper “Combinators for Bi-Directional Tree Transformations: A Linguistic Approach to the View Update Problem” [8].

CIDRE Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

This year, beside the continuation of the work we realized on intrusion detection, privacy, or trust management (see below), we started to investigate new areas, namely malware analysis and hardware security.

A classical problem in dynamic analysis of malware is to be able automatically execute functions / methods of applications under monitoring. Dynamic analysis is helpful only if a malicious action has been observed, unfortunately some malicious functionality might be hidden or was trimmed for not executing when being called under certain circumstances / in certain environments. We have developed a new approach in the automatic triggering of suspicious code [25]. In few words, our approach consists in identify suspicious code and modifying the bytecode of the infected application in order to force the execution of the suspicious code. We have implemented GroddDroid a tool dedicated to the automatic triggering of Android malware. This work has received the Best Paper award at the 10th International Conference on Malicious and Unwanted Software.

We have initiated this year different research activities in the domain of hardware security. Our goal is not to protect devices against hardware attacks such as side-channels but to use hardware mechanisms to strengthen the software stack against traditional software attacks. In this context, we are particularly interested in software/hardware co-design approaches. More precisely, we want to focus on two challenges :

- We want to use formal methods to evaluate the security guarantees provided by hardware platforms, which combine different CPUs, chipsets and memories;
- We want to investigate how dedicated hardware could be used to monitor the whole software stack (from the firmware to the user-mode applications).

The first challenge is the main objective of a bilateral research project with the French national agency for computer security (ANSSI) started in January 2015. We supervise the PhD of Thomas Lethan in the context of this project. The second challenge is studied in a bilateral research project with HP Inc Research Labs. This project started in 2012 but has been extended this year. The main objective of this extension is to propose an approach combining software instrumentation and external monitoring by a dedicated hardware to detect intrusions in UEFI firmware. The second challenge is also studied in the HardBlare collaborative project started in October 2015. The goal of this project is to use a dedicated co-processor to enforce Dynamic Information Flow Control on the main CPU.

This year, we also contributed in the organization and program committee of two major events of our communities:

- the 19-th edition of OPODIS, the International Conference on Principles of Distributed Systems (https://opodis2015.irisa.fr) was organized in Rennes, December 14-17th, with Emmanuelle Anceaume as the general chair of the conference ;
- Nicolas Prigent was the program chair of the 12th IEEE International Symposium on Visualization for Cyber Security (VizSec) that took place in Chicago, Illinois, USA on the 26th of October, 2015.

5.1.1. Awards

Our work on GroddDroid has received the best paper award at 10th International Conference on Malicious and Unwanted Software .
BEST PAPERS AWARDS :
[25] **10th International Conference on Malicious and Unwanted Software**. A. ABRAHAM, R. ANDRIATSIMANDEFITRA RATSISAHANANA, A. BRUNELAT, J.-F. LALANDE, V. VIET TRIEM TONG.

DECENTRALISE Team (section vide)

DIONYSOS Project-Team

4. Highlights of the Year

4.1. Highlights of the Year

Awards

Pierre L'Ecuyer was named titan of simulation at the 2015 Winter Simulation Conference.

We had one best short paper award in 2015 on a novel access mechanism for M2M communications in LTE-Advanced Networks (see 6.4).
BEST PAPER AWARD :
[60] **18th ACM International Conference on Modeling, Analysis and Simulation of Wireless and Mobile Systems (MSWIM)**. M. BOUZOUITA, Y. HADJADJ-AOUL, N. ZANGAR, G. RUBINO, S. TABBANE.

DIVERSE Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

"Multi-tier diversification in Web-based software applications" appears in IEEE Software Magazine. This paper emphasizes a new type of software monoculture in Internet applications and introduces the idea of diversification in space and time at multiple levels of the software stacks. We experiment with a realistic Internet application to demonstrate the feasibility of multi-tier diversification. This experiment highlights the challenges that are ahead of software engineers if they want to systematically break the applicative monoculture of Internet applications.

The book "Globalizing Domain-Specific Languages" appears in the LNCS series. This book, edited by Benoit Combemale, Betty H.C. Cheng, Robert B. France, Jean-Marc Jézéquel, Bernhard Rumpe is the result of the Dagstuhl seminar organized by the GEMOC initiative in October 2014.

5.1.1. Awards

Ten years most influential paper award at MODELS'15 for the pioneering paper about the Kermeta meta-language [0] [117]

P.-A. Muller, F. Fleurey, J.-M. Jézéquel
Weaving executability into object-oriented meta-languages
Proc of MODELS/UML, p. 264-278, 2005.

[0] http://www.cnrs.fr/ins2i/spip.php?article1733

DREAM Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

The Dream project ended on the 31st of december 2015. A new EPI project, named Lacodam, is under way.

DYLISS Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

The main novelty in 2015 was the use of Semantic Web technologies to support the integration and query and investigation of large-scale heterogeneous databases. These technologies were applied in the framework of the MiRNAdapt project (funded by ANR) to design a tool for representing and querying bio-molecular information. The tool Askomics was designed in this perspective. In addition, Semantic Web technologies are currently combined with Formal Concept Analysis, to decipher the main regulators of complex systems, with application in cancer system biology (novel project funded by Plan Cancer).

ESTASYS Team

4. Highlights of the Year

4.1. Highlights of the Year

The ESTASYS team has developped a full tool chain for the rigorous design of Systems of Systems and has achieved its two years objectives. The team has also prepared its reconfiguration into a new team where security issues will become fundamental.

4.1.1. Awards

Axel Legay has received a Villumn award from Aalborg University.

FLUMINANCE Project-Team (section vide)

GENSCALE Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

Special Issue

Publication of a special issue on Discrete Applied Mathematics. Guest Editors: A. Mucherino, R. de Freitas, C. Lavor [35]

Awards

For the third time in the last three editions of JOBIM (National workshop on Biology, Informatics and Mathematics), PhD students of the GenScale team won the best poster award:

- JOBIM 2015: Simka: fast kmer-based method for estimating the similarity between numerous metagenomic datasets [39] (https://hal.inria.fr/hal-01180603)
- JOBIM 2013 : MINIA on a Raspberry Pi, Assembling a 100 Mbp Genome on a Credit Card Sized Computer (https://hal.inria.fr/hal-00842027)
- JOBIM 2012 : Compareads: comparing huge metagenomic experiments (https://hal.inria.fr/hal-00760332)

In 2014, due to the ECCB conference in Strasbourg, France, there was no specific JOBIM event.

HYBRID Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

Hybrid had 4 papers published at IEEE Virtual Reality Conference in 2015 : [19] [16] [18] [23].

Hybrid team was also strongly involved in IEEE Virtual Reality Conference, which took place for the first time in France in 2015 (Arles, March 23-27), with A. Lécuyer: Program Chair, F. Argelaguet and M. Marchal: Research Demos Chairs, F. Nouviale: Exhibit Chair, B. Arnaldi: Supporters Chair.

5.1.1. Awards

- Best PhD Thesis award from “Fondation Rennes 1” for former PhD student Fabien Danieau for his work "Contribution to the study of haptic feedback for improving the audiovisual experience" co-supervised with Technicolor company.
- Project PREVIZ received the “business” award in Trophies “Loading the future” (24/11, Nantes, Competitivity Cluster "Images et Réseaux").
- The algorithm developed by Lucas Royer (co-supervised by A. Krupa, M. Marchal and G. Dardenne) won the first place of the MICCAI Challenge on Liver Ultrasound Tracking.

HYCOMES Team

4. Highlights of the Year

4.1. Highlights of the Year

The main progress on hybrid systems modeling can be summarized as follows:

- As part of his PhD work, Ayman Aljarbouh has designed and implemented regularization techniques for hybrid systems with chattering behaviour [9]. His techniques enable the efficient simulation of chattering behavior that can not be simulated with pure *event-driven* simulation techniques.
- A constructive semantics for guarded DAE systems has been proposed. Guarded DAE systems are equivalent to the kernel language used as an intermediate format by several Modelica compilers. This semantics, based on a nonstandard (infinitesimal) time model [3], allows to determine the structural differentiation index and infer the causal dependencies of a system of guarded DAEs. The semantics has been implemented in SUNDAE, a prototype software, developed in the context of the Sys2soft (7.2) and Modrio projects (7.3.1).

I4S Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

Paper [30]. was nominated for best paper at IFAC SAFEPROCESS in 2015.

A. Nassiopoulos is launching the startup Ecotropy from December 2015.

IPSO Project-Team

4. Highlights of the Year

4.1. Highlights of the Year

4.1.1. Awards

E. Faou received the SIAM Germund Dahlquist prize in september 2015.

KERDATA Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Awards

Gilles Kahn honorary award of the SIF and the Academy of Science: 2nd prize for Matthieu Dorier in 2015.
The Gilles Kahn Honorary Award is given every year to at most the 3 best PhD theses in Computer Science in France and is jointly delivered by the *Société Informatique de France* (SIF) and the French Academy of Science. The candidates are judged on all aspects of their PhD work, including fundamental contributions to industrial transfers, publication impact, teaching, mentoring, and scientific dissemination activities. A Grand Prize and two *ex aequo* Accessit Prizes are given. Matthieu Dorier was given one of the latter.

PhD award of the Fondation Rennes 1: 2nd prize for Matthieu Dorier in the Matisse Doctoral School in 2015.
The Rennes 1 Foundation PhD award from the Fondation Rennes 1 is given every year to 8 outstanding new doctors from the 4 doctoral schools associated with the University of Rennes 1 (2 awards per doctoral school). The candidates are judged on the innovative aspects of their PhD thesis, "innovative" being understood in the sense of impact on socioeconomic development and technology transfers.

5.1.2. 5 International Journals

This year the team published 5 papers in high-quality journals including IEEE Transactions on Parallel and Distributed Systems, IEEE Transactions on Cloud Computing, Future Generation Computer Systems (2), World Wide Web.

LAGADIC Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Awards

- The work of Lucas Royer and Alexandre Krupa concerning non-rigid target tracking in ultrasound images [47] (see Section 7.6.1) was awarded by the organizers of the MICCAI CLUST'15 challenge (MICCAI Challenge on Liver Ultrasound Tracking) as being the best method for real-time and accurate target tracking in 3D ultrasound sequences.
- Paolo Robuffo Giordano has been awarded as Best Associate Editor of ICRA'2015.

LINKMEDIA Project-Team (section vide)

MIMETIC Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

In March 2015, Ludovic Hoyet arrived in MimeTIC has full-time Inria CR2 researcher. It's an important event for the team as it will reinforce and push the Virtual Human simulation topic in the team. Ludovic has a unique expertise in both computer animation and perceptual studies which will enable us to tackle original problems, such as developping innovative animation methods while taking the perception of the user into account, contrary to classical approaches based on dynamic simulation.

Our work "Intuitive and Efficient Camera Control with the Toric Space", co-authored by Christophe Lino and Marc Christie has been selected at SIGGRAPH 2015, the premier and most selective computer graphics scientific event. The paper presents a novel representation to interactively and intuitively manipulate cameras, and to perform interpolations between camera keyframes while maintaining on-screen visual properties. Results of this paper, together with earlier work on automated viewpoint computation (Directors Lens patent), are now available as a plugin in Autodesk's Motion Builder. This technology is exploited by the french SME Solidanim http://www.solidanim.com through a technological transfer partnership.

Platforms in Immerstar project: Immerstar is the new name of our jointed platforms, namely Immersia on Inria campus and Immermove on ENS Campus. This year, we succeeded to end up the building of the first phase of Immermove platform. Associated with a sport area equipped with a high end motion capture system, an immersive setup has been installed. It is a L-shaped setup with 12m*4m front screen and floor. It allows to perform immersive interaction experiments between real and virtual human. To follow this first phase, and sustained by Inria and our academic institutions, we succeeded to the CPER call that will be implemented from 2016 to 2020. We will have the opportunity to invest and to improve the two immersive platforms (Immersia and Immermove) and their possibilities of distantly collaborate.

5.1.1. Awards

Caroline Martin won the "Jean Vives" Award for her work on the analysis of tennis serves. This price is discerned by the Académie nationale olympique française and given during the 40th congress of the Society of Biomechanics, 2015.

MYRIADS Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

- Christine Morin has been made Knight of the French legion of Honour by decret of the President of French Republic (December 31, 2014) for her contribution to Higher Education and Research. Antoine Petit, President of Inria, presented her with the insignia on February 24th, 2015.
- The HARNESS European project was successfully completed in September 2015. Although the final evaluation report is still pending, the verbal comments by project reviewers were very positive. The HARNESS project has developed a new generation cloud computing platform that integrates heterogeneous hardware (FPGAs, GPGPUs, programmable routers, etc.) and networking resources in order to provide vastly increased performance for a broader array of applications. With HARNESS, cloud providers can profitably manage specialized hardware and network technologies much as they do today's commodity resources, and software engineers can seamlessly integrate them into the design of their cloud-hosted applications.

PANAMA Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Awards

Srdan Kitic won the CONEXANT award for best student paper on audio signal processing at LVA/ICA'2015 conference .

BEST PAPERS AWARDS :

[31] **LVA/ICA 2015 - The 12th International Conference on Latent Variable Analysis and Signal Separation**. S. KITIĆ, N. BERTIN, R. GRIBONVAL.

SAGE Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

The team SAGE ended in December 2015.

N. Nassif, J. Erhel and B. Philippe published a book entitled "introduction to computational linear algebra" [23]. E. Gallopoulos, B. Philippe and A. Sameh published a book entitled "Parallelism in Matrix Computations".

SERPICO Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

Publication of overview papers

Publication of two tutorial-style overview papers:

- D. Fortun, P. Bouthemy, C. Kervrann. Optic flow modeling and computation: a survey, Computer Vision and Image Understanding, 134:1-21, 2015.
- C. Kervrann, C.O.S. Sorzano, S.T. Acton, J.-C. Olivo-Marin, M. Unser. A guided tour of selected image processing and analysis methods for fluorescence and electron microscopy, IEEE Journal of Signal Topics in Signal Processing (Special issue on Advanced Signal Processing in Microscopy and Cell Imaging, Lead Guest Editor: C. Kervrann), 10(1):1-25, 2016.

SIROCCO Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

- C. Guillemot has received a Google faculty research award
- T. Maugey has received an AIS grant ("Aide à installation scientitifique") from the region of Brittany.
- The papers [31], [28] have been recognized as “Top 10%” at the IEEE international conference ICIP 2015.

SUMO Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

The book on "Petri Net Synthesis" [44] co-authored by Eric Badouel, Luca Bernardinello, and Philippe Darondeau was published in October 2015 by Springer-Verlag in the EATCS Series "Texts in Theoretical Computer Science". This book is a comprehensive, systematic survey of the synthesis problem, and of region theory which underlies its solution, covering the related theory, algorithms, and applications. It is also a tribute to Philippe who passed away two years ago and could not see the final result of this project.

The SUMO team also welcomes the arrival of Ocan Sankur as a CNRS researcher. After a PhD at LSV (ENS Cachan) in 2013 supervised by Patricia Bouyer and Nicolas Markey, Ocan Sankur did a post-doc at Université Libre de Bruxelles in the group of Jean-François Raskin. His research work focuses on the robustness of quantitative systems, for their verification and synthesis.

TACOMA Team (section vide)

TASC Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Awards

1. The PhD thesis of Jean-Guillaume Fages about *the use of graph structure in constraint programming* got the following awards:
   - PhD thesis award by the French association for AI.
   - Doctoral research award by the Association for Constraint Programming.
2. The paper of the PhD student Anicet Bart (*Verifying a Real-Time Language with Constraints*, Anicet Bart, Charlotte Truchet and Eric Monfroy [29]) got the best paper award of the SAT/CSP track of the ICTAI 2015 conference.
3. The solver Choco3 got a bronze medal in the 2015 minizinc challenge.

BEST PAPERS AWARDS :
[29] **27th IEEE International Conference on Tools with Artificial Intelligence**. A. BART, C. TRUCHET, E. MONFROY.

TEA Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

TEA became an Inria project-team in 2015 and developed new and promising collaborations with Mitsubishi, on factory automations, with UCSD on refinement type theory and with UCSD-UCLA again, on time synchronisation protocols verificaton.

We published a paper in the automotive session of the 52nd. Digital Automation Conference (core A*) on our project with Toyota ITC [19] as well as two patents filed with the USPTO.

5.1.1. Awards

Our paper on "Polychronous automata" [13] received the Best Paper Award at the TASE'15 conference.
BEST PAPERS AWARDS :
[13] **TASE 2015, 9th International Symposium on Theoretical Aspects of Software Engineering**. P. LE GUERNIC, T. GAUTIER, J.-P. TALPIN, L. BESNARD.

VISAGES Project-Team

5. Highlights of the Year

5.1. Highlights of the Year

5.1.1. Awards

- In 2015, the Neurinfo platform obtained the IBISA label. The IBISA label is a national label for technological platforms awarded by the GIS IBISA on an annual basis.
- In 2015, Edan G was elected Fellow of the European Academy of Neurologie.