RESEARCH CENTER

FIELD
Networks, Systems and Services, Distributed Computing

Activity Report 2014

Section Highlights of the Team

Edition: 2015-06-01

ASAP Project-Team

6.1. Highlights of the Year

- Anne-Marie Kermarrec is the recipient of the **ACM/IFIP/USENIX/Middleware 10-Years Best Paper Award**, for her paper *The peer sampling service: Experimental evaluation of unstructured gossip-based implementations* (Middleware 2004), co-authored with Márk Jelasity, Rachid Guerraoui, and Maarten van Steen.
- Anne-Marie Kermarrec is the recipient of the **WISE 2014 Best Paper Award**, for her paper [18], co-authored with Alexandra Olteanu and Karl Aberer.
- Michel Raynal is the recipient of the **PODC 2014 Best Paper Award**, for his paper [34], co-authored with Achour Mostefaoui and Moumen Hamouna.
- The MEDIEGO recommendation engine was demonstrated at **Le Web 14** in partnership with FranceTV.

BEST PAPERS AWARDS :
[18] **15th International Conference on Web Information System Engineering (WISE 2014)**. O. ALEXANDRA, A.-M. KERMARREC, K. ABERER.
[34] **ACM PODC**. A. MOSTEFAOUI, M. HAMOUNA, M. RAYNAL.

ATLANMOD Project-Team (section vide)

CIDRE Project-Team

6.1. Highlights of the Year

The supervision of distributed system relies heavily on correlation mechanisms that are responsible for collecting alerts coming from sensors and detecting complex scenarios in the flow of alerts. The problem is that it requires to write complex correlation rules. The work we have performed proposes a technique to generate semi-automatically such correlation rules. It describes a process that uses an attack tree and a representation of the system as inputs, and generate a correlation tree that can be translated in an alert correlation description language. This work received the best paper award of SAR-SSI 2014 [50].

One approach to protect the privacy of users in personalized recommendation systems is to publish a sanitized version of the profile of the user by relying a non-interactive mechanism compliant with the concept of differential privacy. In a joint work with Raghavendran Balu and Teddy Furon (LinkMedia Inria team), we have consider two existing schemes offering a differentially private representation of profiles: BLIP (BLoom-and-flIP) and JLT (Johnson-Lindenstrauss Transform). For assessing their security levels, we play the role of an adversary aiming at reconstructing a user profile. To realize this, we design two inference attacks named single and joint decoding. The first inference attack tests the presence of a single item in the profile, and is iterated independently for each possible item of the item set. In contrast, the second inference attack aims at deciding whether a particular subset of items is likely to be in the user profile. This attack is tested on all the possible subsets of items. Our contributions are a theoretical analysis and practical implementations of both attacks tested on datasets composed of real user profiles revealing that joint decoding is the most powerful attack. This also gives useful insights on the setting the differential privacy parameter ϵ. This work has received the best student paper award at the conference ESORICS 2014.

BEST PAPERS AWARDS :

[27] **European Symposium on Research in Computer Security**. R. BALU, T. FURON, S. GAMBS.

COAST Team (section vide)

CTRL-A Exploratory Action

6.1. Highlights of the Year

We have been invited to participate to the organization of events, which highlight our active presence in the scientific life in the two domains which we are bridging :

- autonomic computing: Eric Rutten is PC member, as well as workshops chair, of the 12th IEEE International Conference on Autonomic Computing, ICAC 2015 (http://icac2015.imag.fr/), and PC co-chair of the 3rd IEEE International Conference on Cloud and Autonomic Computing, CAC 2015 (http://autonomic-conference.org/), the two major conferences on the topic.
- control: Eric Rutten is organizer of a special session on discrete control for computing at the 12th IFAC - IEEE International Workshop on Discrete Event Systems, WODES 2014 (http://wodes2014.lurpa.ens-cachan.fr/), the main conference specialized in Discrete Event Systems, ; he is on the IFAC Technical Committee 1.3 on Discrete Event and Hybrid Systems, (http://tc.ifac-control.org/1/3/) and on the IEEE Control Systems Society Discrete Event Systems Technical Committee (http://discrete-event-systems.ieeecss.org).

MIMOVE Team

6.2. Highlights of the Year

This year has seen the following acknowledgments of the team's contributions:

- Valérie Issarny was distinguished as Chevalier de la Legion d'Honneur for her contributions to science and European scientific cooperation in research and education.
- One of the team's major publication by S. Ben Mokhtar, D. Preuveneers, N. Georgantas, V. Issarny, and Y. Berbers, titled "EASY: Efficient semAntic Service discoverY in pervasive computing environments with QoS and context support" [1], published in the Journal of Systems and Software (Volume 81, Issue 5), is one of the top ten (10) most cited papers among all the papers published by JSS in 2008.

MYRIADS Project-Team

5.1. Highlights of the Year

- The Contrail project coordinated by Christine Morin received the "Excellent" grade at its final review held on March 14th, 2014 in Brussels.
- Anne-Cécile Orgerie has been awarded the Young Researcher prize of the Lyon city in November 2014.
- Christine Morin has been awarded one of the 12 "Etoile de l'Europe 2014" prizes in December 2014 for the coordination of the Contrail European project.

BEST PAPERS AWARDS :
[18] **4th International Conference on Cloud Computing and Services Science**. H. FERNANDEZ, C. STRATAN, G. PIERRE.

REGAL Project-Team

5.1. Highlights of the Year

- *Garbage collection for big data on large-memory NUMA machines*. We developed NumaGiC, a high-throughput garbage collector for big-data algorithms running on large-memory NUMA machines (see Section 4.1). This result, a collaboration with the Whisper team, will be presented at ASPLOS 2015 [29].
- *Explicit consistency*. We propose an alternative approach to the strong-vs.-weak consistency conundrum, *explicit consistency*. Static analysis identifies precisely what is the minimal amount of synchronisation that is necessary to maintain the invariants required by an application (see Section 5.3.11). This result will be presented at EuroSys 2015 [53].
- *Lower bounds and optimality for CRDTs*. This is the first paper to study the inherent lower bounds of replicated data types. The contribution includes derivation of lower bounds for several data types, improvement of some implementations, and proved optimality of others (see Section 5.3.10). This result was presented at POPL 2014 [25].

SCALE Team (section vide)

SPIRALS Team

6.1. Highlights of the Year

In 2014, we are proud to have organized the 17th ACM SIGSOFT International Conference on Component-Based Software Engineering and Software Architecture (CompArch) that has been held in Lille from 30 June to 3 July 2014.

CompArch is the main conference of the ACM SIGSOFT group on software architectures and software components. The conference is held alternatively in North America and in Europe. The 17th edition has been held this year in France for the first time. The conference brings together about 100 researchers from the academia and the industry.

WHISPER Team

6.1. Highlights of the Year

The paper “Faults in Linux 2.6” was published in the ACM journal Transactions on Computer Systems in June 2014 . It has been downloaded from the ACM digital library almost 300 times since then. The paper was reviewed in the Linux Weekly News, in the German professional IT website golem.de, and was the subject of an invited presentation at a joint session of the Linux Kernel Summit and LinuxCon North America.

Julia Lawall was invited to the 2014 Linux Kernel Summit, an invitation-only meeting of core Linux developers. She was subsequently invited to participate in the plenary Linux Kernel Developer Panel at LinuxCon Europe, with 2000 attendees.

Julia Lawall was invited to give a keynote at the conference Modularity (formerly AOSD) on her work on Coccinelle [16].

BEST PAPERS AWARDS :

[] **ACM Transactions on Computer Systems**. N. PALIX, G. THOMAS, S. SAHA, C. CALVÈS, G. MULLER, J. L. LAWALL.

ALGORILLE Project-Team (section vide)

ALPINES Project-Team

6.1. Highlights of the Year

We have released a version of FreeFem++ (v 3.33) which introduces new and important features related to high performance computing:

- Interface with PETSc library
- Interface with HPDDM (see above)
- improved interface with the parallel direct solver MUMPS

This release enables, for the first time, end-users to run the very same code on computers ranging from laptops to clusters and even large scale computers with thousands of computing nodes

AVALON Project-Team (section vide)

HIEPACS Project-Team

6.1. Highlights of the Year

In the context of HPC-PME initiative, we started a collaboration with ALGO'TECH INFORMATIQUE and we have organised one of the first PhD-consultant action implemented by Xavier Lacoste led by Pierre Ramet. ALGO'TECH is one of the most innovative SMEs (small and medium sized enterprises) in the field of cabling embedded systems, and more broadly, automatic devices. The main target of the project is to validate the possibility to use the sparse linear solvers of our team in the area of electromagnetic simulation tools developped by ALGO'TECH. This collaboration will be developed next year in the context of the European project FORSTISSIMO. The principal objective of FORTISSIMO is to enable European manufacturing, particularly SMEs, to benefit from the efficiency and competitive advantage inherent in the use of simulation.

As a conclusion of the OPTIDIS project we organized the first International Workshop on Dislocation Dynamics Simulations that was devoted to the latest developments realized worldwide in the field of Discrete Dislocation Dynamics simulations. This international event held in December 10th to the 12th at "Maison de la Simulation" in Saclay, France and attracted 55 participants from many different countries including England, Germany, France, USA, ... The workshop gathered most of the active researchers working on dislocation dynamics from numerical simulations to experimentatios. Thanks to the success of this workshop, a second one will be scheduled in England during 2016.

KerData Project-Team

6.1. Highlights of the Year

IEEE Cluster 2014. The KerData Team had a leading role the organization of the IEEE Cluster 2014 conference, held in Madrid (22–26 September 2014): Gabriel Antoniu as PC Chair, Luc Bougé as Student Mentoring Program Chair, Alexandru Costan as Submissions Chair.

MESCAL Project-Team (section vide)

MOAIS Project-Team (section vide)

ROMA Team

6.1. Highlights of the Year

Yves Robert was awarded the 2014 IEEE Technical Committee on Scalable Computing (TCSC) Award for Excellence.

In October 2014, CERFACS, ENS Lyon, INPT, Inria and University of Bordeaux launched a consortium around the software package MUMPS (see http://mumps-consortium.org).

RUNTIME Team

6.1. Highlights of the Year

- This year we started very large collaborations with the BULL/Atos company. WE started one European project, one PIA french project and one PhD thesis. The amount of Person Year funded with this project exceed 10. The research we will do with Bull covers resource management, process placement, platform modeling, application modeling, affinity abstraction.
- The StarPU software is used by CEA for automatically distributing linear algebra on their cluster of 144 hybrid nodes.

TYREX Project-Team (section vide)

ASCOLA Project-Team

6.1. Highlights of the Year

Nicolas Tabareau was awarded a starting grant from the European Research Council (ERC), the most prestigious type of research projects of the European Union for young researchers. From 2015–2020 he will pursue research on “CoqHoTT: Coq for Homotopy Type Theory.”

Jonathan Pastor has won the joint 1st prize at the Grid5000 Scale challenge, an international challenge for large-scale experiments on geographically-distributed cluster environments. Jonathan has shown with a colleague how to deploy and manage thousands of VMs in such an environment using his approach to fully distributed virtual machine management.

This year we have provided major research results in two domains. First, we have developed several new approaches for the formal reasoning over software in the domains of theorem proving [31], as well as reasoning over distributed interaction protocols [32] and software compositions [24]. Second, we have developed new methods supporting dynamic computations over the cloud, both by means of more elastic cloud applications [27] and better locality management for the dynamic placement of virtual machines in Cloud infrastructures [29].

DIVERSE Project-Team

6.1. Highlights of the Year

"Globalizing Modeling Languages" appears in IEEE Computer Magazine. This paper synthesizes our vision of how domain-specific languages form the foundations of global software development. Its appearance in a highly visible venue is major milestone for the dissemination and impact of our work about the diversity of languages.

DiverSE extremely present at the SPLC conference. SPLC is the main international conference for software product line engineering. In 2014, the DiverSE team had a very strong presence at this conference, presenting novel scientific contributions, results of industrial collaborations, and demonstrations of latest software tools.

FOCUS Project-Team

6.1. Highlights of the Year

Valeria Vignudelli has received the AILA (Associazione Italiana di Logica e sue Applicazioni) award for her 2014 master thesis.

INDES Project-Team (section vide)

PHOENIX Project-Team

6.1. Highlights of the Year

- A best paper award was obtained at ASSETS 2014 (The 16th International ACM SIGACCESS Conference on Computers and Accessibility), by the 5 authors of the paper "Tablet-Based Activity Schedule for Children with Autism in Mainstream Environment" .

BEST PAPERS AWARDS :
[26] **ASSETS 2014 - The 16th International ACM SIGACCESS Conference on Computers and Accessibility**. C. FAGE, L. POMMEREAU, C. CONSEL, E. BALLAND, H. SAUZÉON.

RMOD Project-Team

6.1. Highlights of the Year

- Pharo 3.0 has been released in April 2014.
- Moose 5.0 has been released in December 2014.
- The book Deep into Pharo has been released publicly http://www.deepintopharo.com.
- RMOD entered in a sponsoring agreement with LAM Research, Inc.

TACOMA Team (section vide)

COATI Project-Team (section vide)

DANTE Team

6.1. Highlights of the Year

6.1.1. The Internet of Things: A new equipments of excellence

Inaugurated last autumn, the very large scale IoT-LAB platform (https://www.iot-lab.info) is strengthening the capabilities of the FIT equipment of excellence dedicated to the Internet of Things. Offering a unique wide-ranging collection of equipment, these laboratories are available to both researchers and commercial companies alike.

IoT-LAB is a large-scale experimental platform for communicating objects and networks of sensors. It enables the rapid deployment of experiments and the collection of large amounts of data. It includes over 2700 sensor nodes, distributed over six sites in France, offering a wide range of different processor architectures and radio components. IoT-LAB is available for use on line. It is already used by over 300 users in forty countries, including around ten commercial companies. As of the end of October 2014, some 10 000 experiments had already been carried out.

6.1.2. Graph-based signal processing

Our first results towards the definition of a digital framework for signal processing on graphs constitutes an important outcome of DANTE's activity in 2014. Our participation to this emerging discipline was marked with several scientific recognitions: publication in the main DSP conference [14], involvement in the first ANR project focusing on this theme and retained for funding (2015-2019), we are in charge of the organisation of a Special Session dedicated to "Methodologies for signal processing on graphs" at Eusipco conference (2015).

6.1.3. Complex contagion process

Diffusion of innovation can be interpreted as a social spreading phenomena governed by the impact of media and social interactions. Although these mechanisms have been identified by quantitative theories, their role and relative importance are not entirely understood, since empirical verification has so far been hindered by the lack of appropriate data. Here we analyse a dataset recording the spreading dynamics of the world's largest Voice over Internet Protocol service to empirically support the assumptions behind models of social contagion. We show that the rate of spontaneous service adoption is constant, the probability of adoption via social influence is linearly proportional to the fraction of adopting neighbors, and the rate of service termination is time-invariant and independent of the behavior of peers. By implementing the detected diffusion mechanisms into a dynamical agent-based model, we are able to emulate the adoption dynamics of the service in several countries worldwide. This approach enables us to make medium-term predictions of service adoption and disclose dependencies between the dynamics of innovation spreading and the socioeconomic development of a country. This work was recently published in the Journal of the Royal Society Interface.

DIANA Team

5.1. Highlights of the Year

Arnaud Legout and Thierry Parmentelat designed and realized the very first Inria Mooc hosted on the FUN platform. This Mooc is devoted to the study of the Python language, and targets undergrandudate students. The objective of the course is to give students a thorough understanding of the internal mechanisms of language, and lead them to small and realistic applications. This Mooc was a big success: 9166 persons registered to the course, out of them five hundred followed the whole course and more than a hundred finished the project. For more details on this Mooc see https://www.france-universite-numerique-mooc.fr/courses/inria/41001/Trimestre_4_2014/about.

DIONYSOS Project-Team

5.1. Highlights of the Year

Pierre L'Ecuyer received the Award of Merit from the Canadian Operational Research Society, 2014.

We had one best paper award in 2014 on a novel architecture for resilient networks (see 5.8).
BEST PAPER AWARD :
[50] **IEEE International Conference on Innovations for Community Services**. D. LEQUÉRÉ, C. BETOULE, G. THOUENON, Y. HADJADJ-AOUL, A. KSENTINI, R. CLAVIER.

DYOGENE Project-Team

6.1. Highlights of the Year

- F. Baccelli received 2014 IEEE Communications Society Stephen O. Rice Prize in the Field of Communications Theory:

  http://www.comsoc.org/about/memberprograms/comsoc-awards/rice.
- F. Baccelli received 2014 IEEE Communications Society Leonard G. Abraham Prize in the Field of Communications Systems:

  http://www.comsoc.org/about/memberprograms/comsoc-awards/abraham.
- F. Baccelli received ACM Sigmetrics Achievement Award 2014:

  http://www.sigmetrics.org/achievementaward-2014.shtml.
- F. Simatos received 2014 ACM SIGMETRICS Rising Star Researcher Award:

  http://www.sigmetrics.org/risingstar-2014.shtml.
- P. Brémaud published a book "Fourier Analysis and Stochastic Processes". Series: Universitext. Springer, Sept. 2014 - 385 pages.
- PhD student C. Rovetta received best tool paper award at Valuetools 2014 for the paper [18].

FUN Project-Team

5.1. Highlights of the Year

- Opening of the 256 M3 sensor nodes of the Lille's FIT IoT Lab platform.
- We have designed a novel single-based localization method, UNS, for accurate localization of mobile devices that only needs a small aperture array unlike all previous works. UNS is currently under patenting.
- We have provided a set of recognized contributions in the area of Smart Cities, re-thinking their architecture and break vertical silos between every network and application.

GANG Project-Team

5.1. Highlights of the Year

Pierre Fraigniaud has received the Prize for Innovation in Distributed Computing 2014.

HIPERCOM2 Team

6.1. Highlights of the Year

- Hipercom 2 took part to the Inria-Industry meeting focusing on Telecommunications organized by Inria at Rocquencourt in November 2014. We presented a demonstration of the OCARI wireless sensor network.
- Hipercom 2 organized an Inria-DGA day "Software Defined Network (SDN) & MANET" at Paris in October 2014.

INFINE Team

6.1. Highlights of the Year

- We proved a conjecture made in 2011 about the feasibility of non-trivial community detection just above a threshold below which it was known that only trivial detection could be done, see [13]. This was published in ACM STOC'14 and well-received, as the proof required the invention of new techniques to control the spectral properties of random matrices.
- The official opening of IoT-LAB of all sites through the "Workshop Internet Of Things/Equipex FIT IoT-LAB" held in Grenoble (on 6 and 6 november 2014), has been a major event for our team: it concludes several years of preparation of the IoT-LAB site located in Rocquencourt, currently managed by C. Adjih, E. Baccelli and I. Amdouni, which was itself opened the same month https://www.iot-lab.info/opening-of-the-paris-rocquencourt-site/.

MADYNES Project-Team

6.1. Highlights of the Year

The following points of 2014 deserves to be highlighted:

- One new permanent member joined the MADYNES team: Jérôme François as Inria researcher.
- An IBM Faculty Award has been received by a team member (Rémi Badonnel, TELECOM Nancy) for his work on security and cloud computing.

BEST PAPER AWARD :

[21] **8th IFIP WG 6.6 International Conference on Autonomous Infrastructure, Management, and Security, AIMS 2014**. A. MAYZAUD, A. SEHGAL, R. BADONNEL, I. CHRISMENT, J. SCHÖNWÄLDER.

MAESTRO Project-Team

6.1. Highlights of the Year

E. Altman has received the "Isaacs' Award" granted by the International Society on Dynamic Games in recognition for his research on dynamic game theory.

M. El Chamie got the Best Session Presentation Award at the IEEE American Control Conference ACC 2014 for the paper "Newton's method for constrained norm minimization and its application to weighted graph problems," co-authored with G. Neglia.

THANES is a new French-Brazilian joint-team between MAESTRO and researchers from Univ. Federal do Rio de Janeiro (Brazil) and Carneggie Mellon Univ. (USA). The team investigates network science problems with a particular focus on Online Social Networks.

BEST PAPERS AWARDS :

[43] **6th IEEE INFOCOM International Workshop on Network Science for Communication Networks (NetSciCom)**. K. AVRACHENKOV, P. BASU, G. NEGLIA, B. RIBEIRO, D. TOWSLEY.

[70] **4th IEEE Online Conference on Green Communications (GreenComm)**. C. ROTTONDI, G. NEGLIA, G. VERTICALE.

MUSE Team (section vide)

RAP Project-Team (section vide)

SOCRATE Project-Team

6.1. Highlights of the Year

6.1.1. FIT/CortexLab Inauguration

FIT(Future Internet of Things) is a french Equipex (Équipement d'excellence) which aims to develop an experimental facility, a federated and competitive infrastructure with international visibility and a broad panel of customers. FIT is be composed of four main parts: a Network Operations Center (NOC), a set of Embedded Communicating Object (ECO) test-beds, a set of wireless OneLab test-beds, and a cognitive radio test-bed (CorteXlab) deployed by the Socrate team in the Citi lab. In 2014 the construction of the room was finished see Figure 5 . SDR nodes have installed in the room, 42 industrial PCs (Aplus Nuvo-3000E/P), 22 NI radio boards (USRP) and 18 Nutaq boards (PicoSDR, 2x2 and 4X4) can be programmed from internet now.

A very successfully inauguration took place on the 28th October 2014 [0], with the noticable venue of Vincent Poor, Dean of School of Engineering and Applied Science of Princeton University.

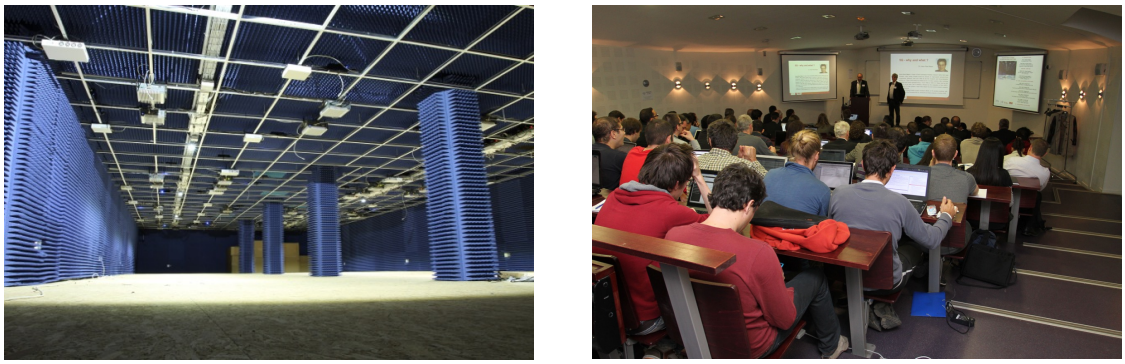

Figure 5. Photo of the FIT/CortexLab experimentation room installed and a snaptshot of the inauguration meeting

[0] http://www.inria.fr/centre/grenoble/actualites/inauguration-reussie-de-la-plateforme-cortexlab-equipex-fit

URBANET Team

6.1. Highlights of the Year

Two scientific results can be distinguished in UrbaNet activity this year. First of all, the work did in collaboration with Orange Labs during the PhD thesis of O. Erdene-Ochir (defended in 2013) led to a patent [38] related to routing in wireless sensor networks under resiliency constraints.

A second important result is represented by the book chapter "Wireless Access Networks for Smart Cities" [31], a common contribution of all the permanent members of the team. We hope that this chapter will become the reference on wireless networking within the new and dynamic smart cities community.