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**Université Nice - Sophia
Antipolis**

Activity Report 2011

Project-Team OASIS

Active objects, semantics, Internet and
security

IN COLLABORATION WITH: Laboratoire informatique, signaux systèmes de Sophia Antipolis (I3S)

RESEARCH CENTER
Sophia Antipolis - Méditerranée

THEME
Distributed Systems and Services

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Project-Team OASIS

Keywords: Safety, Component Programming, Distributed Objects, Cloud Computing, Service Oriented Architecture, Distributed System

1. Members

Research Scientists

Eric Madelaine [Team leader, Junior Researcher Inria, HdR]
Ludovic Henrio [Junior Researcher CNRS]

Faculty Members

Fabrice Huet [Associate Professor UNS]
Françoise Baude [Vice Team leader, Prof. UNS, HdR]
Fabien Hermenier [Associate Professor UNS from december 1st]
Denis Caromel [External Advisor, Prof. UNS]

Technical Staff

Brian Amedro [FUI CompatibleOne]
Bastien Sauvan [FP7 PLAY]
Elvio Borrelli [FP7 TEFIS]
Cristian Ruz [Oseo Spinnaker, from july 1st]
Fabien Viale [FP6 S4All, FP6 NESSI-Grid, Thales]
Franca Perrina [FP7 TEFIS, to july 15th]
Mathieu Schnoor [FP7 Tefis]
Oleg Smirnov [Microsoft - MCorePHP]
Yu Feng [FUI CompatibleOne]
Cedric Morandin [OJD]
Sanka Samaranayake [KIC-EIC Lab, since july 01]
Mauricio Jost [KIC-EIC Lab, since july 1st]
Sergei Dolgov [FUI CompatibleOne]
Iyad Alshabani [ANR Soceda, since july 1st]
Alexandra Savu [FP7 TEFIS, since oct 1]
Alexandre Bourdin [FP7 PLAY, since oct 1]

PhD Students

Cristian Ruz [INRIA, Conicyt, to june 30th]
Francesco Bongiovanni [INRIA-PACA + FP7 PLAY]
Guilherme Peretti-Pezzi [CIFRE SCP]
Laurent Pellegrino [FP7 PLAY]
Marcela Rivera [ATER UNS]
Sheheryar Malik [INRIA]
Virginie Legrand Contes [FP7 PLAY]
Michael Benguigui [INRIA-PACA + Oseo Spinnaker, from december 1st]

Administrative Assistants

Sandra Devauchelle [I3S]
Sylvie Lelaidier [INRIA]

2. Overall Objectives

2.1. Presentation

The team focuses its activities on distributed (Grid, Cloud, and more generally large-scale infrastructures) computing and more specifically on the development of secure and reliable systems using distributed asynchronous objects (active objects - OA of OASIS). From this central point of focus, other research fields are considered in the project:

- Semantics (first S of OASIS): formal specification of active objects with the definition of ASP (Asynchronous Sequential Processes) and the study of conditions under which this calculus becomes deterministic.
- Internet (I of OASIS): Large-scale, Internet-based computing with distributed and hierarchical components.
- Security (last S of OASIS): analysis and verification of programs written in such asynchronous models.

With these objectives, our approach is:

- theoretical: we study and define models and object-oriented languages (semantic definitions, equivalences, analysis);
- applicative: we start from concrete and current problems, for which we propose technical solutions;
- pragmatic: we validate the models and solutions with full-scale experiments.

Internet clearly changed the meaning of notions like locality, mobility and security. We believe that we have the skills to be significantly fruitful in this major application domain, i.e. Internet-based computing; more specifically, we aim at producing interesting results for Grid and more recently Cloud computing, peer-to-peer systems, service-based and collaborative applications.

2.2. Highlights

Eric Madelaine defended his HDR: "Specification, Model Generation, and Verification of Distributed Applications" in September.

BEST PAPER AWARD :

[30] **7th International Conference on Autonomic and Autonomous Systems (ICAS 2011)**. C. RUZ, F. BAUDE, B. SAUVAN.

3. Scientific Foundations

3.1. Programming with distributed objects and components

The paradigm of object-oriented programming, although not very recent, is clearly still not properly defined and implemented; for example notions like inheritance, sub-typing or overloading have as many definitions as there are different object languages. The introduction of concurrency and distribution into objects also increases the complexity. It appeared that standard Java constituents such as RMI (Remote Method Invocation) do not help building, in a transparent way, sequential, multi-threaded, or distributed applications. Indeed allowing, as RMI does, the execution of the same application to proceed on a shared-memory multiprocessors architecture as well as on a network of workstations (intranet, Internet), or on any hierarchical combination of both, is not sufficient for providing a convenient and reliable programming environment.

The question is thus: how to ease the construction (i.e. programming), deployment and evolution of distributed applications ?

One of the answers we suggest relies on the concept of active object, that act as a single entity, abstraction of a thread, a set of objects and a location. Active objects communicate by asynchronous method calls thanks to the use of futures. ProActive is a Java library that implements this notion of active objects. ProActive can also be seen as a middleware supporting deployment, runtime support, and efficient communication for large scale distributed applications.

Another answer we provide relies on component-oriented programming. In particular, we have defined parallel and hierarchical distributed components starting from the Fractal component model developed by INRIA and France-Telecom [43]. We have been involved in the design of the Grid Component Model (GCM) [4][20], which is one of the major results produced by the CoreGrid European Network of Excellence. The GCM is now officially intended to become a standard for Grid components, and most of our research on component models are related to it. GCM is now fully a standard for Grid components ([48] for the last published standard), and most of our research on component models are related to it. On the practical side, ProActive/GCM is a prototype implementation of the GCM above the ProActive library. ProActive/GCM is intended to become the reference implementation of the GCM, that was the goal of the European project GridCOMP.

We have developed overtime competencies in both theoretical and applicative side fields, such as distribution, fault-tolerance, verification, etc., to provide a better programming and runtime environment for object and component applications,

3.2. Formal models for distributed objects

A few years ago, we designed the ASP calculus [7] for modelling distributed objects. It remains to this date one of our major scientific foundations. ASP is a calculus for distributed objects interacting using asynchronous method calls with generalized futures. Those futures naturally come with a transparent and automatic synchronisation called wait-by-necessity. In large-scale systems, our approach provides both a good structure and a strong decoupling between threads, and thus scalability. Our work on ASP provides very generic results on expressiveness and determinism, and the potential of this approach has been further demonstrated by its capacity to cope with advanced issues, such as mobility, group communications, and components [6].

ASP provides confluence and determinism properties for distributed objects. Such results should allow one to program parallel and distributed applications that behave in a deterministic manner, even if they are distributed over local or wide area networks.

The ASP calculus is a model for the ProActive library. An extension of ASP has been built to model distributed asynchronous components. A functional fragment of ASP has been modelled in the Isabelle theorem prover [8].

3.3. Verification, static analysis, and model-checking

Even with the help of high-level libraries, distributed systems are more difficult to program than classical applications. The complexity of interactions and synchronisations between remote parts of a system increases the difficulty of analysing their behaviours. Consequently, safety, security, or liveness properties are particularly difficult to ensure for these applications. Formal verification of software systems has been active for a long time, but its impact on the development methodology and tools has been slower than in the domain of hardware and circuits. This is true both at a theoretical and at a practical level, from the definition of adequate models representing programs, the mastering of state complexity through abstraction techniques or through new algorithmic approaches, to the design of software tools that hide to the final user the complexity of the underlying theory.

We concentrate on the area of distributed component systems, where we get better descriptions of the structure of the system, making the analysis more tractable, but we also find out new interesting problems. For instance, we contributed to a better analysis of the interplay between the functional definition of a component and its possible runtime transformations, expressed by the various management controllers of the component system.

Our approach is bi-directional: from models to program, or back. We use techniques of static analysis and abstract interpretation to extract models from the code of distributed applications, or from dedicated specification formalisms [3]. On the other hand, we generate “safe by construction” code skeletons, from high level specifications; this guarantees the behavioural properties of the components. We then use generic tools from the verification community to check properties of these models. We concentrate on behavioural properties, expressed in terms of temporal logics (safety, liveness), of adequacy of an implementation to its specification and of correct composition of software components.

4. Application Domains

4.1. Grid and Cloud Computing

As distributed systems are becoming ubiquitous, Grid computing, and the more recent concept of Cloud computing are facing a major challenge for computer science: seamless access and use of large-scale computing resources, world-wide. It is believed that by providing pervasive, dependable, consistent and inexpensive access to advanced computational capabilities, computational grids will allow new classes of applications to emerge.

There is a need for models and infrastructures for grid and peer-to-peer computing, and we promote a programming model based on communicating mobile objects and components. Another challenge is to use, for a given computation, unused CPU cycles of desktop computers in a Local Area Network. This is local or wide area Computational Peer-To-Peer, a concept that can contribute to a global energy footprint reduction. This is a challenge that also appears in more stable and homogeneous environments compared to P2P systems, such as datacenters.

4.2. Service Oriented Architectures (SOA)

Service Oriented Architectures aim at the integration of distributed services at the level of the Enterprise or of the whole Internet, be they outsourced or not to Cloud infrastructures.

The OASIS team seeks solutions to the problems encountered here, with the underlying motivation to demonstrate the usefulness of a large-scale distributed programming approach as featured by ProActive and GCM:

- Interaction between services: the uniform usage of web services based client-server invocations, through the possible support of an Enterprise Service Bus, can provide a simple interoperability between them. GCM components can be exposed as web services [44], and we have conducted research and development to permit a GCM component to invoke an external web service through a client interface, and thus to have GCM/SCA components be integrated in SCA-based applications relying on SCA bindings configured as web services. For more loosely coupled interactions between services (e.g. compliant to the Web Services Notification standard), we pursue efforts to support publish-subscribe interaction models. Scalability in terms of event numbers, and full interoperability through the use of semantic web notations applied to these events are some of the key challenges the community is addressing and we too.
- Services compositions on a possibly large set of machines: if service compositions can even be turned as autonomic activities, these capabilities will really make SOA ready for the Internet scale. For service compositions represented as GCM-based component assemblies, we are indeed exploring the use of control components put in the components membranes, acting as sensors or actuators, that can drive the self-deployment and self-management of composite services, according to negotiated Service Level Agreements. For service orchestrations usually expressed as BPEL like processes, and expressing the *composition in time* aspect of the composition of services, supports for deployment, management, and execution capable to support dynamic adaptations are also needed. Here again we believe a middleware based upon distributed and autonomous components as GCM can really help.

5. Software

5.1. ProActive

Participants: B. Amedro, F. Baude, D. Caromel, F. Huet [correspondant], V. Legrand, E. Mathias, F. Perrina, F. Viale, O. Smirnov.

url: [Proactive Parallel Suite](#)

ProActive is a Java library (Source code under AGPL license) for parallel, distributed, and concurrent computing, also featuring mobility and security in a uniform framework. With a reduced set of simple primitives, ProActive provides a comprehensive API to simplify the programming of applications that are distributed on a Local Area Network (LAN), on cluster of workstations, Clouds, or on Internet Grids.

The library is based on an Active Object pattern that is a uniform way to encapsulate:

- a remotely accessible object,
- a thread,
- an actor with its own script,
- a server of incoming requests,
- a mobile and potentially secure agent.

and has an architecture to inter-operate with (de facto) standards such as:

- Web Service exportation (Apache Axis2 and CXF),
- HTTP transport,
- ssh, rsh, RMI/ssh tunnelling,
- Globus: GT2, GT3, GT4, gsi, Unicore, ARC (NordGrid)
- LSF, PBS, Sun Grid Engine, OAR, Load Leveler

ProActive is only made of standard Java classes, and requires **no changes to the Java Virtual Machine**, no preprocessing or compiler modification; programmers write standard Java code. Based on a simple Meta-Object Protocol, the library is itself extensible, making the system open for adaptations and optimisations. ProActive currently uses the RMI Java standard library as default portable transport layer, but others such as Ibis or HTTP can be used instead, in an adaptive way.

ProActive is particularly well-adapted for the development of applications distributed over the Internet, thanks to reuse of sequential code, through polymorphism, automatic future-based synchronisations, migration of activities from one virtual machine to another. The underlying programming model is thus innovative compared to, for instance, the well established MPI programming model.

In order to cope with the requirements of large-scale distributed and heterogeneous systems like the Grid, many features have been incorporated into ProActive, including support for many transport and job submission protocols, GCM component support, graphical visualization interface, object migration, distributed and non-functional exception handling, fault-tolerance and checkpointing mechanisms; file transfer capabilities, a job scheduler, a resource manager able to manage various hosting machines, support for JMX and OSGi capabilities, web service object exposition, an SCA personality, etc.

ProActive is a project of the former ObjectWeb, now OW2 Consortium. OW2 is an international consortium fostering the development of open-source middleware for cutting-edge applications: EAI, e-business, clustering, grid computing, managed services and more. For more information, refer to [5] [42] and to the web pages <http://www.objectweb.org> and <http://proactive.inria.fr/> which list several white papers.

ProActive management, distribution, support, and commercialisation is now ensured by the start-up company ActiveEon (<http://www.activeeon.com>), in the context of a collaboration with INRIA and UNS.

5.2. Vercors platform

Participants: E. Madelaine, R. Halalai, L. Henrio, A. Savu, M. Alexe.

The Vercors tools (<http://www-sop.inria.fr/oasis/Vercors>) include front-ends for specifying the architecture and behaviour of components in the form of UML diagrams. We translate these high-level specifications, into behavioural models in various formats, and we also transform these models using abstractions. In a final step, abstract models are translated into the input format for various verification toolsets. Currently we mainly use the various analysis modules of the CADP toolset.

- Our main effort this year was based on the development of a quite large case-study, two orders of magnitude larger than our previous experiments. This study was the opportunity to develop new methods for encoding our models using a new combination of CADP formalisms, combining compositional approaches, abstraction techniques, and distributed model-checking [22]. The implementation of these methods in the Vercors tools has started.

We have also been conducting experiments towards the next generation of specification formalism editors for VerCors, using the Papyrus UML-based environment.

6. New Results

6.1. Distributed Programming Models

6.1.1. Multi-active Objects

Participants: L. Henrio, I. Zsolt, F. Huet.

The active object programming model is particularly adapted to easily program distributed objects: it separates objects into several *activities*, each manipulated by a single thread, preventing data races. However, this programming model has its limitations in terms of expressiveness – risk of deadlocks – and of efficiency on multicore machines. We proposed extends active objects with *local multi-threading*. We rely on declarative *annotations* for expressing potential concurrency between requests, allowing easy and high-level expression of concurrency. This year contribution includes

- publication of the basic principles of the new model [25]
- refinement of the proposal and adding dynamic compatibility
- operational semantic for multi-active objects
- extensive experiments

6.2. Component-oriented Distributed and Large-Scale Programming

6.2.1. Behavioural models for Distributed Components

Participants: E. Madelaine, R. Halalai, A. Savu, M. Alexe, L. Henrio.

In the past, we defined the behavioural semantics of active objects and components, in [3]; we extended last year this work to take group communications. On the practical side, this work contributes to the Vercors platform; the overall picture being to provide tools to the programmer for defining his application, including its behavioural specification. Then some generic properties like absence of deadlocks, but also application specific properties can be validated on the composed model using an existing model-checker. We mainly use CADP model-checker, that also supports distributed generation of state-space. This year our main achievements are the following:

- We provided model for one-to-many component communication
- We provided a model for Byzantine failures, specified a component application supporting some Byzantine faults, and proved its correctness;
- We conducted heavy experiments on distributed model-checking in this context;
- We worked on the formal specification of the behavioural model generation for component systems.

Most of those results were published in [22] and [35].

6.2.2. *Enacting large-scale service orchestration using a component-based approach*

Participants: F. Baude, V. Legrand.

The distribution of business processes encompasses the inclusion of external service providers in the overall process as well as the usage of external infrastructures like clouds. Both of these approaches lead to decentralization and outsourcing of a part of the global workflow, resulting in a complexified management of the global orchestration. As a matter of fact, the overall data are decentralized among different domains and must, most of the time, be gathered manually. To this extent, we continue our work on agile and distributed orchestration, showing that the framework we develop eases multidomain orchestration management. Our approach extracts, gathers and digests data from the decentralized processes in order to provide a unified and global view of a distributed orchestration. This year we focussed in particular on :

- *The specification of the execution framework* extending the SCA specification by adding temporal dependencies
- *The definition of a use-case* allowing the provisioning of a large set of OSGi gateways.

This work resulted in the PhD thesis of Virginie Legrand [12].

6.2.3. *Autonomic Monitoring and Management of Components*

Participants: F. Baude, C. Ruz, B. Sauvan, R. Dib.

We have completed the design of a framework for autonomic monitoring and management of component-based applications. We have provided an implementation using GCM/ProActive taking advantage of the possibility of adding components in the membrane, and we have tested it in simple applications. Our implementation allows the designer to describe in a separate way each phase of the MAPE autonomic control loop (Monitoring, Analysis, Planning, and Execution), and to plug them or unplug them dynamically [16].

- We presented the general description of the framework and its capability to support autonomic behaviour in [30]. This work takes advantage of the componentized membrane of GCM/ProActive, and of the PAGCMScript reconfiguration extensions made in our team.
- We used our proposition to design an integrated framework to cover the life-cycle of a service application from business and design level, to deployment and execution concerns in a Cloud environment, in a work done in conjunction with Adrian Mos and Alain Boulze formerly leading the INRIA ADT *Galaxy* from INRIA Rhône-Alpes. This work was presented in the SoEA4EE workshop [29].
- We experimented with the use of our autonomic framework to integrate autonomic behaviour into skeletons. This work was taken during the engineering internship of Rima Dib, and included the collaboration with Marco Danelutto from Università di Pisa.

6.3. Middleware for Grid and Cloud computing

6.3.1. *RDF Data Storage and Retrieval In P2P Systems*

Participants: I. Filali, F. Huet, F. Baude, F. Bongiovanni, L. Pellegrino, B. Sauvan, I. Alshabani, A. Bourdin.

We have proposed in the context of the SOA4ALL FP7-IP project (8.3.1.1) the design and the implementation of a hierarchical Semantic Space infrastructure based on Structured Overlay Networks (SONS) [46],[10]. It aims at the storage and the retrieval of the semantic description of services at the Web scale [47]. This infrastructure combines the strengths of both P2P paradigm at the architectural level and the Resource Description Framework (RDF) data model at the knowledge representation level. As it is designed, the proposed infrastructure enables the processing of simple and complex queries. This year, the following achievements have been realised.

- A thorough survey of the existing works that have adapted the combination of RDF data model and the P2P communication model to build distributed infrastructures for RDF data storage and retrieval has been performed. This effort was published in a journal [34]. A previous but more complete version of this work can be found in a research report [45] and was used extensively in [39], [38], [36].
- We provided and presented in [23] an implementation of a three dimensional CAN overlay network for storing and retrieving RDF triples. At the implementation level, a modular and flexible architecture for the Semantic Space infrastructure has been proposed. The implementation relies on the ProActive Grid middleware and provides a clear separation between its sub-components (overlay, storage, query engine, etc.). The modularity of the architecture is combined with the decentralized aspect of the infrastructure enabling the RDF data storage and retrieval at large scale. The evaluation of the infrastructure through micro-benchmarks experiments on clusters and grids shows the impact of the architecture and data distribution on the performance of the storage and processing mechanisms.

In the context of the FP7 Strep PLAY (8.3.1.2) and French ANR SocEDA (8.2.2) research projects, we have extended the aforementioned work with a content-based Publish/Subscribe abstraction in order to support asynchronous queries for RDF-based events in large scale settings. In order to support these queries *efficiently*, we worked on an efficient broadcast primitive on top of CAN which we formalized and implemented (see section 6.3.2). We are also working towards a generalization of this broadcast algorithm to a multicast one, and contribute intensively to the general integration effort for offering such innovative semantic described event marketplace platform at cloud scale [41].

6.3.2. An algorithm for efficient broadcast over CAN-like P2P networks

Participants: L. Henrio, F. Bongiovani, A. Craciun.

The nature of some large-scale applications such as content delivery systems or publish/subscribe systems, built on top of structured overlay networks, demands application-level dissemination primitives which do not overwhelm the overlay and which are also reliable. Building such communication primitives in a reliable manner on top of such networks would increase the confidence regarding their behavior prior to deploying them in real settings. In order to come up with real efficient primitives, we take advantage of the underlying geometric topology of the overlay network and we also model the way peers communicate with one another. For this our objective is to design and prove an efficient and reliable broadcast algorithm for CAN-like P2P networks. To this aim, this year we:

- Formalised in Isabelle/HOL a CAN-like P2P system, devised formalised tools to reason on CAN topologies, and on communication protocols on top of CANs. We proved first completeness and correctness properties on some classes of broadcast algorithms.
- Designed an efficient broadcast algorithm on top of CAN and implemented it.

Preliminary results were presented at CFSE and published as a research report [37]; another publication is being written.under way.

6.3.3. Matlab/Scilab parallel programming

Participant: F. Viale.

Matlab & Scilab, with millions of users around the world, are industry standards for numerical computing. They both lack a powerful and modern parallel computing framework to meet the industry's growing demand in terms of parallel processing. This activity is intended to integrate into both softwares a toolbox for parallel processing, based on ProActive.

- This year, we implemented a ProActive Scilab toolbox with the same functionalities as the ProActive Matlab toolbox we built last year.

- We added in the Matlab toolbox a disconnected mode to allow closing the Matlab session while uncomplete Matlab jobs are still running on the scheduler side, and retrieving the job results at the next connection.
- We reorganized both Matlab and Scilab toolboxes with a cleaner and more intuitive API, a stronger and stabler implementation and an extensive documentation. We designed as well unit-tests to make the toolboxes fully usable for production standards.
- The Scilab toolbox is now deployed on PACAGrid cluster and used extensively by other partners of the OMD2 ANR.

6.3.4. Network Aware Cloud Computing

Participants: S. Malik, F. Huet.

We have proposed a cloud scheduler module named Network Awareness Module (NAM), which helps the scheduler to take the more efficient scheduling decisions on the basis of resource features, such as network latency, reliability, environment compatibility and monetary cost issues.

- Currently we are working on Reliability Assessment based Scheduling on Cloud Infrastructure. We are building a model, which enables a scheduler to schedule the tasks on cloud infrastructure, on the basis of adaptive reliability of nodes (virtual machine). The core of this model is a reliability assessment algorithm, which computes the reliability for individual resources and for the group of resources.
- We have proposed, designed and implemented an algorithm for the grouping of nodes on the basis of inter-node latencies. This algorithm can do the dynamic grouping and work with the incomplete latency information available. It groups the nodes on the basis of node latency instead of neighbor count. It produces mutually exclusive groups and can perform group reconfiguration.
- We have designed a model of the Virtual Cloud [27]. The concept of Virtual cloud revolves around the concept, “Rent Out the Rented Resources”. In this model, cloud vendors offer low cost cloud services by acquiring underutilized resources from some big third-party enterprise. The cloud vendor then further rents out those resources/services to the cloud users. The upfront and administrative costs for the Virtual cloud vendor are lower, and the cloud users access services at a cheaper rate.
- We have proposed a fault tolerance model for real time cloud computing [27]. In this model, the system tolerates the faults and makes the decision on the basis of reliability of the virtual machines. The reliability of the virtual machines is adaptive, which changes after every computing cycle. A metric model is given for the reliability assessment. The system provides both the forward and backward recovery mechanisms.

7. Contracts and Grants with Industry

7.1. Contracts with Industry

7.1.1. Spinnaker

Program: Oseo Isis

Project acronym: Spinnaker

Project title: Spinnaker

Duration: jun 2011 - may 2014

Coordinator: Tagsys

Other partners: Inside Secure; ActiveEon; Legrand; STIC; Sonim; INRIA; LCIS Valence; ENSMSE; Université de Tours; IETR; LIP6; Université de Marne la Vallée; ESEO

Abstract: SPINNAKER brings together six companies and nine research laboratories highly specialized in Radio Frequency (RF) and related technology areas. The objectives of SPINNAKER are to break down the barriers of RFID technology and face the great challenge of democratizing industrial RFID and NFC systems for the benefit of our daily lives in the areas of Retail, Health, Electronic Toll, and GSM. These challenges are:

- The miniaturization of technology: integration and miniaturization of RFID systems require new technologies and methodologies that are gathered in this project.
- The inter-connectivity, or large-scale deployment: RFID, as the Internet, interacts with many communicating contexts (workplace, home, mobile phone, shopping centers, etc.). The new economy resulting new services based on RFID will require a comprehensive and complete infrastructure.

7.2. Grants with Industry

The PhD thesis of Guilherme Peretti-Pezzi is financed as a CIFRE funding with the Société du Canal de Provence. This PhD will be defended on dec 15, 2011.

Michael Benguigui has started a PhD financed by Région Provence Alpes Cote d'Azur, in collaboration with ActiveEon.

Nuno Gaspar has started a PhD in collaboration with ActiveEon, for which we have applied for a CIFRE funding.

8. Partnerships and Cooperations

8.1. Regional Initiatives

8.1.1. PACAGRID Plateform

Program: CPER

Project acronym: PacaGrid

Project title: Contrat Plan État Région Grille et Calcul Pair-à-Pair

Duration: jan 2009 - dec 2011

Coordinator: INRIA Oasis

Other partners: Conseil Regional PACA

See also: <http://proactive.inria.fr/pacagrid/>

Abstract: This contract aims at building a regional computing platform. This is achieved by mixing desktop machines with dedicated ones like clusters. Users willing to submit a job will do so by accessing a web-page and uploading their program. It will then be scheduled and executed on a machine when available. A scheduler, a resource manager, and a web portal have been developed and are now operational.

In the first part of the project, the access to the platform was restricted to Inria members. Now that most of the tools have been developed, the access is open to industrial partners.

8.2. National Initiatives

8.2.1. ANR OMD2

Program: Cosinus

Project acronym: OMD2

Project title: Optimisation Multidisciplinaire

Duration: jan 2009 - jun 2012

Coordinator: Renault

Other partners: INRIA, ENSM-SE, UTC, ECP, IRCCyN, ENS CACHAN, CD-adapco, SIREHNA, ACTIVEEON, Digiteo (all french)

Abstract: The aim of this project is to define, develop and experiment a collaborative platform of multidisciplinary optimization - As "platform" we consider here a software environment hosting heterogeneous code and data, geographically distributed in equally heterogeneous machines. These codes can be sequential or parallel. These machines can be data servers, supercomputers, PC farms, etc. - As "collaborative" we consider this environment to be able to host, control and allow communication of these codes transparently for the user, according to their own work habits. - As "multidisciplinary optimization", we consider the collection of methods and numerical tools, objects of the other tasks in OMD2 and previously realized during project OMD. It has been decided that ProActive will be used as middleware for communication between machines, and that the ProActive Scheduler will be used as a basis for the collaborative platform. Similarly, Scilab will be used as a common language to describe optimization strategies.

8.2.2. ANR SocEDA

Program: Arpège

Project acronym: SocEDA

Project title: Plate-forme EDA sociale, largement distribuée pour l'informatique dans les nuages

Duration: nov. 2010 - oct. 2013

Coordinator: EBM WebSourcing

Other partners: ActiveEon, Ecole des Mines Albi, I3S CNRS (OASIS), CNRS/LIG (SARDES), INSA Lyon/LIRIS, France Telecom, INRIA Lille (ADAM), THALES communications.

See also: <http://www.soceda.org>

Abstract: The goal of SocEDA is to build a flexible, elastic and efficient platform for handling events generated by services deployed on top of federated and distributed enterprise service buses. To scale up and be highly configurable, the platform will be designed as a GCM based application built along Peer-to-peer principles for scalability and robustness, and deployed on Grid/Cloud hybrid environments. Publications/subscriptions will be organized along social links that may exist between the deployed services.

8.2.3. FUI CompatibleOne

Program: FUI

Project acronym: CompatibleOne

Project title: CompatibleOne

Duration: aug. 2010 - oct. 2013

Coordinator: Bull

Other partners: ActiveEon, Bull, CityPassenger, eNovance, INRIA, Institut Télécom, Mandriva, Nexedi, Nuxeo, OW2, Prologue, XWiki

See also: <http://www.compatibleone.org/>

Abstract: The competitiveness cluster Systematic, in Ile de France, has launched the Compatible One project, also labelled by the SCS cluster. The goal is to define an open solution for IaaS and PaaS. The CompatibleOne project identifies, aggregates and integrates leading open source technologies into a rich and comprehensive 'cloudware' stack. CompatibleOne is developing a meta-model-based framework for the abstraction of the configuration, management and integration of these technologies. This 'cloudware' framework, based on open, common standards and leading open source technologies, will offer cloud builders the greatest possible interoperability

8.3. European Initiatives

8.3.1. FP7 Projects

8.3.1.1. SOA4ALL

Title: Service Oriented Architectures for All

Type: COOPERATION (ICT)

Defi: Service & SA architectures, infrastructures and engineering

Instrument: Integrated Project (IP)

Duration: March 2008 - February 2011

Coordinator: Atos Origin (Spain)

Others partners: British Telecommunications (UK); The Open University (UK); SAP; CEFRIEL (It); STI - University of Innsbruck (At); EBM WebSourcing (Fr); Hanival Internet Services (At); Universität Karlsruhe (De); INRIA (Fr); iSOCO (Sp); Ontotext Lab (Bu); seekda (Au); TIE Nederland; TXT e-Solutions (It); The University of Manchester (Uk); Universidad de Sevilla (Es)

See also: <http://www.soa4all.eu/>

Abstract: Service Oriented Architectures for All (SOA4All) is a Large-Scale Integrating Project funded by the European Seventh Framework Programme, under the Service and Software Architectures, Infrastructures and Engineering research area.

SOA4All will help realize a world where billions of parties are exposing and consuming services via advanced Web technology: the main objective of the project is to provide a comprehensive framework and infrastructure that integrates complementary and evolutionary technical advances (i.e., SOA, context management, Web principles, Web 2.0 and Semantic Web) into a coherent and domain-independent service delivery platform.

8.3.1.2. 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: EBM WebSourcing (Fr), INRIA (OASIS and SARDES) (Fr), France Telecom (Fr), ICCS (Gr), Ecole des Mines Albi (Fr), CIM (Serbia).

See also: <http://www.play-project.eu/>

Abstract: The PLAY project will develop and validate an elastic and reliable architecture for dynamic and complex, event-driven interaction in large highly distributed and heterogeneous service systems. Such an architecture will enable ubiquitous exchange of information between heterogeneous services, providing the possibilities to adapt and personalize their execution, resulting in the so-called situational-driven process adaptivity. The OASIS Team is in charge of designing the key element of the PLAY Platform: the event cloud that is a publish/subscribe P2P based system, developed using the GCM technology.

8.3.1.3. TEFIS

Title: TEstbed for Future Internet Services

Type: COOPERATION (ICT)

Defi: Future Internet Experimental Facility and Experimentally-driven Research

Instrument: Integrated Project (IP)

Duration: June 2010 - November 2012

Coordinator: THALES Services SAS (France)

Others partners: Engineering Ingegneria Informatica S.p.A. (It); IT Innovation (UK); Fundação de Apoio à Universidade de São Paulo (Br); Thales Communications (Fr); ActiveEon (Fr); Lulea University of Technology (Se); Software Quality System S.A. (Es); Fraunhofer Institute FOKUS (De)

See also: <http://www.tefisproject.eu/>

Abstract: TEstbed for Future Internet Services (TEFIS) is a Large-Scale Integrating Project funded by the European Seventh Framework Programme, under the ICT research area and, more precisely, around the theme of Future Internet Experimental Facility and Experimentally-driven Research.

Internet is more and more used by services and applications as the common communication infrastructure. However, the Internet and Software industry is facing two main challenges. The first one is that Internet is progressively reaching a saturation point in meeting an ever increasing variety of user expectations. The second one is that the increasing complexity of ICT environments (user communities, network heterogeneity, multiplicity of terminals and platforms) is paralysing testing processes for the assessment of Internet-based services at large-scale. Product and business developers must be able to rapidly satisfy and anticipate user requirements while testing and sizing their applications and services, being sure to constantly have the right amount of reactivity with regards to market demands.

To address these challenges, TEFIS will provide an open platform to enable the design, dimensioning and user-centric validation of innovative applications and services on top of upcoming Future Internet technologies. The TEFIS platform will be a central access point to heterogeneous and complementary experimental facilities addressing the full development lifecycle of innovative services with the appropriate tools and testing methodologies.

8.3.1.4. FI-WARE

Title: Future Internet Core Platform

Type: COOPERATION (ICT)

Defi: PPP FI: Technology Foundation: Future Internet Core Platform

Instrument: Integrated Project (IP)

Duration: May 2011 - April 2014

Coordinator: Telefonica (Spain)

Others partners: Alcatel-Lucent (De,It); Atos Origin (Sp); Deutsche Telecom (De); Engineering - Ingegneria Informatica (It); Ericsson (Se); France Telecom (Fr); Fraunhofer GFD (De); Angewandten Forschung (De); IBM Israel Science And Technology (Il,Ch) IBM Research (Is); INRIA (Fr); INTEL Performance Learning Solutions (Ir); NEC Europe (UK); Nokia Siemens Networks (Ge,Hu,Fi); SAP (Ge); SIEMENS (Ge); Telecom Italia (It); Thales Communications (Fr); Technicolor SNC (Fr); Universita Di Roma La Sapienza (It); Universitaet Duisburg-Essen (De); University of Surrey (UK); Universidad Politecnica De Madrid (Es)

See also: <http://www.fi-ware.eu/>

Abstract: The high-level goal of the FI-WARE project is to build the Core Platform of the Future Internet, introducing an innovative infrastructure for cost-effective creation and delivery of versatile digital services, providing high QoS and security guarantees.

8.4. International Initiatives

8.4.1. Visits of International Scientists

8.4.1.1. Internship

We are hosting Ms Yanwen Chen, PhD student from East China Normal University (ECNU, Shanghai), for a 9 month visit funded by the INRIA Internship program, from 2011 nov. 15 to 2012 aug. 15. The thesis subject is "Formal Model and Scheduling Algorithms for Real-time CPS".

9. Dissemination

9.1. Animation of the scientific community

- **Francoise Baude**
 Editorial board of the French national journal, *Technique et Science Informatiques*, Ed Lavoisier, since February 2011
 Committee member of "Concurrency and Computation: Practice & Experience journal", special issue on "High Performance Computing and Simulation: Architectures, Systems, Algorithms, Technologies, Services, and Applications", February 2011.
 PC Member of ISPA'12
 Reviewer with Olivier Dalle of the PhD thesis of Pedro Velho, MESCAL EPI, July 2011.
 Reviewer of the PhD thesis of Louis Bouzonnet, SARDES EPI, September 2011.
 Jury head of the PhD defense of Ketan Maheshwari, MODALIS team, I3S CNRS, January 2011.
 Member of the PhD committee of Frédéric Alvaes, ASCOLA EPI, from 2010, whose role is to monitor if the PhD work goes smoothly
 Nominated member of the I3S CNRS laboratory council from November 2011. Replacement Head of the I3S CNRS laboratory ComRed. Member of the council of the "Sciences Informatiques" department at Polytech'Nice, from October 2011. Nominated as official representative for Univ of Nice Sophia-Antipolis in its participation as associate member in the EU EIT ICTLabs Knowledge and Innovation Community, from May 2011.
 Responsible for the setup and management of "Cordées pour la science à Sophia", Polytech'Nice-Sophia, in partnership with INRIA Sophia-Antipolis Méditerranée, from autumn 2011
- **Francesco Bongiovanni**
 Reviewer for 6 conferences (4 international and 2 national), and one international journal.

- **Ludovic Henrio**
Program Committee member of FESCA'11, FOCLASA'11, FESCA'12 and reviewer for the journal SCP (Science of Computer Programming).
- **Virginie Legrand**
PC member of 2nd international workshop ManFed, at IM'12
- **Fabrice Huet**
Local chair of the "Support Tools and Environment" topic of Euro-Par 2011 [19]. Program Committee member of I-SPAN 2011 and NBIS-2011.
- **Eric Madelaine**
Steering committee member of FACS'11 and FMCO'11
Program committee member of conferences FACS'11, and ICPP'11 and reviewer for the journal SCP (Science of Computer Programming)
Guest Professor of East China Normal University (ECNU), Shanghai.
- **Cristian Ruz**
Program Committee member of conferences ICAS 2012, SCCC 2011, and workshop WSDP 2011.

9.2. Teaching

Licence (ou équivalent): "Programming and Algorithmics in Java", PeiP and "Génie de l'Eau" 46+40 heures, L2+M1, department Polytech'Nice-Sophia.

Licence (ou équivalent): "Computer environment: introduction to operating system", 30 heures, L1, PeiP Polytech'Nice-Sophia.

Licence (ou équivalent): "Software Engineering", 24h, IUT Nice

Licence (ou équivalent): "Network Game Programming", 24h, IUT Nice

Master (ou équivalent): "Sémantique des Systèmes Distribués et Embarqués", 12 heures, M1, Université de Nice Sophia-Antipolis, France.

Master (ou équivalent): "Distributed Algorithmics", 24 heures, M2, Université de Nice Sophia-Antipolis, France.

Master (ou équivalent): "Programming of distributed applications", 42 heures, M1, Computer Science department Polytech'Nice-Sophia.

Master (ou équivalent): "Parallel and Distributed Programming", 42 heures, M1, Computer Science department, Université de Nice Sophia-Antipolis, France.

Master (ou équivalent): "Distributed Systems", 35 heures, M1, Computer Science department, Université de Nice Sophia-Antipolis, France.

PhD & HdR

HdR : Eric Madelaine, "Specification, Model Generation, and Verification of Distributed Applications", Université de Nice Sophia-Antipolis, 29/9/2011

PhD : Marcela Rivera, "Reconfiguration and lifecycle of distributed components: Asynchrony, coherence, and verification", Université de Nice Sophia-Antipolis, 16/12/2011, advisor Ludovic Henrio.

PhD: Muhammad Uzair Khan, "Supporting First Class Futures in a Fault-Tolerant Java Middleware", Université de Nice Sophia-Antipolis, 25/2/2011, advisor Ludovic Henrio.

PhD: Imen Filali, "Improving Resource Discovery in P2P Systems", Université de Nice Sophia-Antipolis, 7/2/2011, advisor Françoise Baude and Fabrice Huet

PhD: Guilherme Peretti-Pezzi, "High Performance Hydraulic Simulations on the Grid using Java and ProActive", Université de Nice Sophia-Antipolis, 15/12/2011, advisor Denis Caromel

PhD: Cristian Ruz, “Autonomic Monitoring and Management of Component-Based Services”, Université de Nice Sophia-Antipolis, 23/6/2011, advisor Françoise Baude.

PhD: Virginie Legrand-Contes, “Une approche à composants pour l’orchestration de services à grande échelle”, Université de Nice Sophia-Antipolis, 15/12/2011, advisor Françoise Baude and Philippe Merle (ADAM EPI).

PhD in progress : Francesco Bongiovanni, “Self organizing overlay networks and generic overlay computing systems”, Since Oct 2008, joined OASIS in Sept 2009, directors Françoise Baude and Fabrice Huet.

PhD in progress : Laurent Pellegrino “Pushing dynamic and ubiquitous event-based interaction in the Internet of services: a middleware for event clouds”, since Sept 2010, director Françoise Baude.

PhD in progress : Sheheryar Malik “Network Aware Cloud Computing”, since Oct 2009, Supervisors: Fabrice Huet and Denis Caromel

PhD in progress : Nuno Gaspar “Integrated, Autonomic, and Reliable Deployment and Management for SaaS composite applications”, since Nov 2011, Supervisor: Eric Madeleine

PhD in progress : Michaël Benguigui, “Modèles de programmation pour l’analyse de données sur machines multi-cœurs, grilles et clouds”, since Dec 2011, director Françoise Baude.

PhD in progress : Yanwen Chen, “Formal model and Scheduling for cyberphysical systems”, since Dec 2011, directors Eric Madelaine and Yixiang Chen (ECNU Shanghai)

10. Bibliography

Major publications by the team in recent years

- [1] L. BADUEL, F. BAUDE, D. CAROMEL. *Asynchronous Typed Object Groups for Grid Programming*, in "International Journal of Parallel Programming", 2007, vol. 35, n^o 6, p. 573-614.
- [2] L. BADUEL, F. BAUDE, D. CAROMEL, A. CONTES, F. HUET, M. MOREL, R. QUILICI. 9, in "Grid Computing: Software Environments and Tools", Springer, 2006, ISBN: 1-85233-998-5.
- [3] T. BARROS, R. BOULIFA, A. CANSADO, L. HENRIO, E. MADELAINE. *Behavioural Models for Distributed Fractal Components*, in "Annals of Telecommunications", jan 2009, vol. 64, n^o 1–2, also Research Report INRIA RR-6491 [DOI : 10.1007/s12243-008-0069-7], <http://hal.inria.fr/inria-00268965>.
- [4] F. BAUDE, D. CAROMEL, C. DALMASSO, M. DANELUTTO, V. GETOV, L. HENRIO, C. PÉREZ. *GCM: A Grid Extension to Fractal for Autonomous Distributed Components*, in "Annals of Telecommunications", 2009, vol. 64, n^o 1, p. 5–24 [DOI : 10.1007/s12243-008-0068-8], <http://hal.archives-ouvertes.fr/inria-00323919/en/>.
- [5] F. BAUDE, D. CAROMEL, F. HUET, L. MESTRE, J. VAYSSIÈRE. *Interactive and Descriptor-based Deployment of Object-Oriented Grid Applications*, in "11th IEEE International Symposium on High Performance Distributed Computing", 2002, p. 93–102.
- [6] D. CAROMEL, L. HENRIO. *A Theory of Distributed Object*, Springer-Verlag, 2005.
- [7] D. CAROMEL, L. HENRIO, B. SERPETTE. *Asynchronous and Deterministic Objects*, in "Proceedings of the 31st ACM Symposium on Principles of Programming Languages", ACM Press, 2004, p. 123–134, <http://doi.acm.org/10.1145/964001.964012>.

- [8] L. HENRIO, F. KAMMÜLLER, B. LUTZ. *ASPfun : A typed functional active object calculus*, in "Science of Computer Programming", 2011, vol. In Press, Corrected Proof [DOI : DOI: 10.1016/J.SCICO.2010.12.008], <http://www.sciencedirect.com/science/article/B6V17-51XR3D4-1/2/52153869e8c4df60a65b2d52bbf9828c>.
- [9] F. HUET, D. CAROMEL, H. E. BAL. *A High Performance Java Middleware with a Real Application.*, in "Proceedings of the ACM/IEEE SC2004 Conference on High Performance Networking and Computing, 6-12 November 2004, Pittsburgh, PA, USA", 2004.

Publications of the year

Doctoral Dissertations and Habilitation Theses

- [10] I. FILALI. *Improving Resource Discovery in P2P Systems*, University of Nice-Sophia Antipolis, February 2011.
- [11] M. KHAN. *A Study of First Class Futures: Specification, Formalization, and Mechanized Proofs*, University of Nice-Sophia Antipolis, February 2011.
- [12] V. LEGRAND CONTES. *Une approche à composants pour l'orchestration de services à grande échelle*, University of Nice-Sophia Antipolis, Dec 2011.
- [13] E. MADELAINE. *Specification, Model Generation, and Verification of Distributed Applications*, Université de Nice Sophia-Antipolis, September 2011, Habilitation à Diriger des Recherches, <http://hal.inria.fr/tel-00625248/en>.
- [14] G. PERETTI-PEZZI. *High Performance Hydraulic Simulations on the Grid using Java and ProActive*, University of Nice-Sophia Antipolis, December 2011.
- [15] M. RIVERA. *Reconfiguration and Life-cycle of Distributed Components: Asynchrony, Coherence and Verification*, University of Nice-Sophia Antipolis, December 2011.
- [16] C. RUZ. *Autonomic Monitoring and Management of Component-Based Services*, University of Nice-Sophia Antipolis, Jun 2011.

Articles in International Peer-Reviewed Journal

- [17] L. HENRIO, F. KAMMÜLLER, B. LUTZ. *ASPfun : A typed functional active object calculus*, in "Science of Computer Programming", 2011, vol. In Press, Corrected Proof, - [DOI : DOI: 10.1016/J.SCICO.2010.12.008], <http://www.sciencedirect.com/science/article/B6V17-51XR3D4-1/2/52153869e8c4df60a65b2d52bbf9828c>.
- [18] E. MATHIAS, F. BAUDE. *A Component-Based Middleware for Hybrid Grid/Cloud Computing Platforms*, in "Concurrency and Computation: Practice and Experience", 2012, To appear.

International Conferences with Proceedings

- [19] R. M. BADIA, F. HUET, R. VAN NIEUWPOORT, R. KELLER. *Introduction*, in "Euro-Par (1)", 2011, p. 1-2.

- [20] F. BAUDE. *A perspective on the CoreGRID Grid Component Model (invited talk)*, in "CoreGRID/ERCIM Workshop on Grids, Clouds and P2P Computing, Euro-Par 2011 Parallel Processing Workshops", Springer, 2011, 2, To appear.
- [21] F. BAUDE, V. LEGRAND CONTE. *A component-based orchestration management framework for multidomain SOA*, in "1st IFIP/IEEE Workshop on Managing Federations and Cooperative Management, in conjunction with 12th IFIP/IEEE International Symposium on Integrated Network Management", 2011, p. 1156-1163.
- [22] R. A. BOULIFA, R. HALALAI, L. HENRIO, E. MADELAINE. *Verifying Safety of Fault-Tolerant Distributed Components*, in "International Symposium on Formal Aspects of Component Software (FACS 2011)", Oslo, Lecture Notes in Computer Science, Springer, Sept 2011.
- [23] I. FILALI, L. PELLEGRINO, F. BONGIOVANNI, F. HUET, F. BAUDE. *Modular P2P-Based Approach for RDF Data Storage and Retrieval*, in "AP2PS 2011, The Third International Conference on Advances in P2P Systems", November 2011, p. 39-46.
- [24] A. GAIKWAD, V. D. DOAN, M. BOSSY, F. ABERGEL, F. BAUDE. *SuperQuant Financial Benchmark Suite for Performance Analysis of Grid Middlewares*, in "Post-proceedings of the 4th Int. Conference on High Performance Scientific Computing, Modeling, Simulation and Optimization of Complex Processes, March 2-6 2009", Hanoi, Vietnam, 2011.
- [25] L. HENRIO, F. HUET, Z. ISTVÁN, G. SEBESTYÉN. *Adapting Active Objects to Multicore Architectures*, in "ISPDC", Cluj, Romania, IEEE Computer Society, 2011, <http://hal.inria.fr/hal-00644169/en/>.
- [26] S. MALIK, F. HUET. *Adaptive Fault Tolerance in Real Time Cloud Computing*, in "2011 IEEE World Congress on Services", Washington DC, United States, IEEE, Jul. 2011, <http://hal.inria.fr/hal-00639904/en/>.
- [27] S. MALIK, F. HUET. *Virtual Cloud: Rent Out the Rented Resources*, in "6th IEEE International Conference for Internet Technology and Secured Transactions (ICITST-2011)", Abu Dhabi, United Arab Emirates, IEEE, Dec. 2011, <http://hal.inria.fr/hal-00641398/en/>.
- [28] G. PERETTI-PEZZI, E. VAISSIÉ, Y. VIALA, B. GRAWITZ, F. BONNADIER, P. GOURBESVILLE. *High Performance and Grid Computing Based Hydraulic Simulations using the Clement Formula*, in "Computing and Control for the Water Industry 2011", Centre for Water Systems, Exeter, United Kingdom, August 2011.
- [29] C. RUZ, F. BAUDE, B. SAUVAN, A. MOS, A. BOULZE. *Flexible SOA Lifecycle on the Cloud using SCA*, in "3rd International Workshop on Service-oriented Enterprise Architecture for Enterprise Engineering (SoEA4EE 2011), in conjunction with 15th IEEE International Enterprise Distributed Object Computing Conference (EDOC)", IEEE Computer Society, 2011, p. 275-282, ISBN 978-0-7695-4426-7.
- [30] *Best Paper*
C. RUZ, F. BAUDE, B. SAUVAN. *Flexible Adaptation Loop for Component-based SOA applications*, in "7th International Conference on Autonomic and Autonomous Systems (ICAS 2011)", IEEE Explorer, 2011, Best paper awarded.

Conferences without Proceedings

- [31] F. BONGIOVANNI, L. HENRIO. *Mechanical Support for Efficient Dissemination on the CAN Overlay Network*, in "Conférence Francaise en Systèmes d'Exploitation (CFSE)", April 2011.
- [32] F. BONGIOVANNI, L. HENRIO. *Mechanical Support for Efficient Dissemination on the CAN Overlay Network*, in "Sophia-Antipolis Formal Analysis Workshop", France Sophia-Antipolis, Oct 2011.
- [33] L. HENRIO, F. HUET, Z. ISTVÁN. *Multi-active Objects*, in "Sophia-Antipolis Formal Analysis Workshop", France Sophia-Antipolis, Oct 2011.

Scientific Books (or Scientific Book chapters)

- [34] I. FILALI, F. BONGIOVANNI, F. HUET, F. BAUDE. *A Survey of Structured P2P Systems for RDF Data Storage and Retrieval*, in "Transactions on Large-Scale Data-and Knowledge-Centered Systems III", Springer, 2011, p. 20–55.

Research Reports

- [35] R. AMEUR-BOULIFA, R. HALALAI, L. HENRIO, E. MADELAINE. *Verifying Safety of Fault-Tolerant Distributed Components – Extended Version*, INRIA, September 2011, n^o RR-7717, <http://hal.inria.fr/inria-00621264/en>.
- [36] F. BAUDE, F. BONGIOVANNI, L. PELLEGRINO, V. QUÉMA. *Requirement Specification for the Event Cloud Component, Deliverable D.2.1*, FP7 Play EU project, Sept. 2011, final version.
- [37] F. BONGIOVANNI, L. HENRIO. *Mechanical Support for Efficient Dissemination on the CAN Overlay Network*, INRIA, April 2011, n^o RR-7599, Also accepted at CFSE 2011 and SAFA 2011 (extended abstract), <http://hal.inria.fr/inria-00585057/en>.
- [38] LIG AND I3S CNRS PARTNERS. *SocEDA-D2.3.1-State of the Art and Requirements*, ANR SocEDA project, Oct. 2011, final version.
- [39] G. MENRZAS, D. APOSTOLOU, Y. VERGINADIS, V. TSALIKIS, N. STOJANOVIC, R. STÜHMER, J. LORRÉ, C. HAMERLING, F. BAUDE, L. PELLEGRINO. *State of the Art, Deliverable D.1.1*, FP7 Play EU project, Feb. 2011, final version.
- [40] G. PERETTI-PEZZI, D. CAROMEL, E. VAISSIÉ, Y. VIALA, B. GRAWITZ, F. BONNADIER. *High Performance Hydraulic Simulations on the Grid using Java and ProActive*, INRIA, January 2011, n^o RR-7508, <http://hal.inria.fr/inria-00555866/en>.
- [41] R. STÜHMER, L. STOKANOVIC, N. STOJANOVIC, Y. VERGINADIS, L. PELLEGRINO. *PLAY conceptual architecture, Deliverable D.1.4*, FP7 Play EU project, Sept. 2011, final version.

References in notes

- [42] L. BADUEL, F. BAUDE, D. CAROMEL, A. CONTES, F. HUET, M. MOREL, R. QUILICI. 9, in "Grid Computing: Software Environments and Tools", Springer, 2006, ISBN: 1-85233-998-5.

-
- [43] E. BRUNETON, T. COUPAYE, M. LECLERCP, V. QUEMA, JEAN-BERNARD. STEFANI. *An Open Component Model and Its Support in Java.*, in "7th Int. Symp. on Component-Based Software Engineering (CBSE-7)", LNCS 3054, may 2004.
- [44] J. DÜNNWEBBER, F. BAUDE, V. LEGRAND CONTE, N. PARLAVANTZAS, S. GORLATCH. ?, in "Integrated Research in GRID computing - Invited papers from the 1st CoreGRID Integration Workshop 2005", V. GETOV, D. LAFORENZA, A. REINEFELD (editors), Springer, 2006, ISBN: 978-0-387-47656-8. Also as the CoreGrid TR003 report, <http://www.coregrid.net/mambo/images/stories/TechnicalReports/tr-0003.pdf>.
- [45] I. FILALI, F. BONGIOVANNI, F. HUET, F. BAUDE. *RDF Data Indexing and Retrieval: A survey of Peer-to-Peer based solutions*, INRIA, Nov. 2010, n^o RR-7457, <http://hal.archives-ouvertes.fr/inria-00540314/en/>.
- [46] I. FILALI, F. HUET, L. PELLEGRINO. *RDF Data Based Storage and Retrieval In Structured P2P Networks*, in "11èmes Journées Doctorales en Informatique et Réseaux", 2010.
- [47] R. KRUMMENACHER, F. HUET, M. FRIED, L. PELLEGRINO, I. PEIKOV, A. SIMOV. *A Distributed Semantic Marketplace*, SOA4All IP Project Deliverable from the SOA4All Runtime WP (WP1), Feb 2010, n^o D1.3.3A.
- [48] TC-GRID, ETSI. *ETSI TS 102 830: GRID; Grid Component Model; Part 4: GCM Fractal JAVA API*, European Telecommunications Standards Institute (ETSI), Sophia-Antipolis, France, 2010, http://webapp.etsi.org/workprogram/Report_WorkItem.asp?wki_id=28857.