



IN PARTNERSHIP WITH:
CNRS

Université de Lorraine

Activity Report 2015

Project-Team COAST

Web Scale Trustworthy Collaborative Service Systems

IN COLLABORATION WITH: Laboratoire lorrain de recherche en informatique et ses applications (LORIA)

RESEARCH CENTER
Nancy - Grand Est

THEME
Distributed Systems and middleware

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Project-Team COAST

Creation of the Team: 2014 July 01, updated into Project-Team: 2015 July 01

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Computer Science and Digital Science:

- 1.1.6. - Cloud
- 1.1.7. - Peer to peer
- 1.3. - Distributed Systems
- 2.6.2. - Middleware
- 3.1.3. - Distributed data
- 5.1.1. - Engineering of interactive systems

Other Research Topics and Application Domains:

- 6.1.1. - Software engineering
- 6.3.1. - Web
- 6.5. - Information systems

1. Members

Research Scientist

Claudia-Lavinia Ignat [Inria, Researcher]

Faculty Members

François Charoy [Team leader, Univ. Lorraine, Professor, HdR]
Mehdi Ahmed Nacer [Univ. Lorraine, until Aug 2015]
Khalid Benali [Univ. Lorraine, Associate Professor, HdR]
Gérôme Canals [Univ. Lorraine, Associate Professor]
Claude Godart [Univ. Lorraine, Professor]
Gérald Oster [Univ. Lorraine, Associate Professor]
Olivier Perrin [Univ. Lorraine, Professor, HdR]
Pascal Urso [Univ. Lorraine, Associate Professor]
Samir Youcef [Univ. Lorraine, Associate Professor]

Engineer

Phillippe Kalitine [Univ. Lorraine]

PhD Students

Amina Ahmed Nacer [Univ. Bejaia, Cotutelle]
Luc André [Univ. Lorraine, ATER]
Ahmed Bouchami [Univ. Lorraine]
Quang Vinh Dang [Univ. Lorraine]
Victorien Elvinger [Univ. Lorraine, from Oct 2015]
Elio Goettelmann [Univ. Lorraine]
Jordi Martori Adrian [Inria]
Hoai Le Nguyen [Univ. Lorraine, from Sep 2015]
Hoang Long Nguyen [Univ. Lorraine, from Nov 2015]
Guillaume Rosinosky [Univ. Lorraine, Bonitasoft, granted by CIFRE]

Post-Doctoral Fellow

Kahina Bessai [Univ. Lorraine]

Visiting Scientist

Valerie Shalin [Wright State University, Invited Professor, October 2015]

Administrative Assistants

Sophie Drouot [Inria]

Delphine Hubert [Univ. Lorraine]

Martine Kuhlmann [CNRS]

2. Overall Objectives

2.1. Overall Objectives

Coast research domain is data centred service oriented computing and collaboration. With the raise of the Web as a platform, people consume applications as services from the web or from mobile apps. These applications are cooperative, human centred and connected to social applications. They must cope with unprecedented load and their deployment in Cloud environment requires sophisticated architectures. Their users are distributed in space (people live in different locations), in time (people participate at different time) and they cross organizational barriers. Coordination is hard and privacy and trust are key issues. New challenges appear every day. We have chosen to consider them regarding three dimensions that are primary for web and service based system stakeholders :

1. The first dimension refers to collaborative management of data, a key aspect in the development of distributed collaborative systems.
2. The second dimension is concerned with assembling and coordinating high level services, involving people, applications, and information sources on the basis of process models.
3. The third dimension concerns non functional aspects of data and service management, and more particularly the security and trust dimensions that are basics to ensure a wide acceptance of the approaches that we advocate.

We consider these dimensions at a Web scale and in contexts where there is no central authority. This raises many issues related to governance, compliance and security, trust and privacy but also to awareness and coordination. At this scale, we are also always facing the recurring problem of interoperability since we want to offer collaborators a flexibility concerning the chosen work models and technologies. We are tackling these dimensions in specific domains where they have strong interrelations:

- in software engineering where it is always difficult to find the best compromise between explicit and implicit coordination and where stands the difficulties related to collaborative software development.
- in crisis management where many organisations have to cooperate in a very ad-hoc way, share data and coordinate with a constantly changing goal, with very big issues at stake and with strong political emphasis.
- and in all domains where there is a strong need for cooperation.

3. Research Program

3.1. Introduction

Our scientific foundations are grounded on distributed collaborative systems supported by sophisticated data sharing mechanisms and on service oriented computing with an emphasis on orchestration and on non functional properties.

Distributed collaborative systems enable distributed group work supported by computer technologies. Designing such systems require an expertise in Distributed Systems and in Computer-supported collaborative activities research area. Besides theoretical and technical aspects of distributed systems, the design of distributed collaborative systems must take into account the human factor to offer solutions suitable for users and groups. The COAST team vision is to move away from a centralized authority based collaboration towards a decentralized collaboration where users have full control over their data that they can store locally and decide with whom to share them. The Coast team investigates the issues related to the management of distributed shared data and coordination between users and groups.

Service oriented Computing [22] is an established domain on which the ECOO, SCORE and now the Coast team have been contributing for a long time. It refers to the general discipline that studies the development of computer applications on the web. A service is an independent software program with a specific functional context and capabilities published as a service contract (or more traditionally an API). A service composition aggregates a set of services and coordinates their interactions. The scale, the autonomy of services, the heterogeneity and some design principles underlying Service Oriented Computing open new research questions that are at the basis of our research. They span the disciplines of distributed computing, software engineering and computer supported collaborative work (CSCW). Our approach to contribute to the general vision of Service Oriented Computing and more generally to the emerging discipline of Service Science has been and is still to focus on the issue of the efficient and flexible construction of reliable and secure high level services through the coordination/orchestration/composition of other services provided by distributed organizations or people.

3.2. Consistency Models for Distributed Collaborative Systems

Collaborative systems are distributed systems that allow users to share data. One important issue is to manage consistency of shared data according to concurrent access. Traditional consistency criteria such as locking, serializability, linearizability are not adequate for collaborative systems.

Causality, Convergence and Intention preservation (CCI) [25] are more suitable for developing middleware for collaborative applications.

We develop algorithms for ensuring CCI properties on collaborative distributed systems. Constraints on the algorithms are different according to the kind of distributed system and to the data structure. The distributed system can be centralized, decentralized or peer-to-peer. The type of data can include strings, growable arrays, ordered trees, semantic graphs and multimedia data.

3.3. Optimistic Replication

Replication of data among different nodes of a network allows improving reliability, fault-tolerance, and availability. When data are mutable, consistency among the different replicas must be ensured. Pessimistic replication is based on the principle of single-copy consistency while optimistic replication allows the replicas to diverge during a short time period. The consistency model for optimistic replication [24] is called eventual consistency, meaning that replicas are guaranteed to converge to the same value when the system is idle.

Our research focuses on the two most promising families of optimistic replication algorithms for ensuring CCI:

- the operational transformation (OT) algorithms [20]
- the algorithms based on commutative replicated data types (CRDT) [23].

Operational transformation algorithms are based on the application of a transformation function when a remote modification is integrated into the local document. Integration algorithms are generic, being parametrized by operational transformation functions which depend on replicated document types. The advantage of these algorithms is their genericity. These algorithms can be applied to any data type and they can merge heterogeneous data in a uniform manner.

Commutative replicated data types is a new class of algorithms initiated by WOOT [21] a first algorithm designed WithOut Operational Transformations. They ensure consistency of highly dynamic content on peer-to-peer networks. Unlike traditional optimistic replication algorithms, they can ensure consistency without concurrency control. CRDT algorithms rely on natively commutative operations defined on abstract data types such as lists or ordered trees. Thus, they do not require a merge algorithm or an integration procedure.

3.4. Process Orchestration and Management

Process Orchestration and Management is considered as a core discipline behind Service Management and Computing. It includes the analysis, the modelling, the execution, the monitoring and the continuous improvement of enterprise processes and is for us a central domain of studies.

Much efforts have been devoted in the past years to establish standard business process models founded on well grounded theories (e.g. Petri Nets) that meet the needs of both business analysts but also of software engineers and software integrators. This has led to heated debate in the BPM community as both points of view are very difficult to reconcile. On one side, the business people in general require models that are easy to use and understand and that can be quickly adapted to exceptional situations. On the other side, IT people need models with an operational semantic in order to be able to transform them into executable artefacts. Part of our work has been an attempt to reconcile these point of views. It resulted in the development of Bonita product and more recently on our work in crisis management where the same people are designing, executing and monitoring the process as it executes. But more generally, and at a larger scale, we have been considering the problem of process spanning the barriers of organisations and thus more general problem of service composition as a way to coordinate inter organisational construction of applications providing value based on the composition of lower level services [19].

3.5. Service Composition

We are considering processes as pieces of software whose execution traverse the boundaries of organisations. This is especially true with service oriented computing where processes compose services produced by many organisations. We tackle this problem from very different perspectives, trying to find the best compromise between the need for privacy of internal processes from organisations and the necessity to publicize large part of them, proposing to distribute the execution and the orchestration of processes among the organisations themselves, and attempting to ensure non functional properties in this distributed setting [18].

Non functional aspects of service composition relate to all the properties and service agreements that one want to ensure and that are orthogonal to the actual business but that are important when a service is selected and integrated in a composition. This includes transactional context, security, privacy, and quality of service in general. Defining and orchestrating services on a large scale while providing the stakeholders with some strong guarantees on their execution is a first class problem for us. For a long time, we have proposed models and solutions to ensure that some properties (e.g. transactional properties) were guaranteed on process execution, either through design or through the definition of some protocols. Our work has also been extended to the problems of security, privacy and service level agreement among partners. These questions are still central in our work. Then, one major problem of current approaches is to monitor the execution of the compositions, integrating the distributed dimension. This problem can be tackled using event-based algorithms and techniques. Using our event oriented composition framework DISC, we have obtained new results dedicated to the runtime verification of violations in service choreographies.

4. New Software and Platforms

4.1. Replication Benchmark

Participants: Pascal Urso [contact], Mehdi Ahmed Nacer, Gérald Oster.

The Replication Benchmark is a performance evaluation framework for optimistic replication mechanisms used in collaborative applications. It contains a library of implementation of several CRDT (Commutative Replicated Data Type) and OT (Operational Transformation) algorithms for different data types: text, set, trees. The framework is able to evaluate the performance of comparable algorithms on different corpus of events traces. These events traces can be produced randomly according to different parameters, can be extracted from real real-time editing session that have been recorded, or can be automatically extracted from distributed version control repositories such as the one produced with Git. Performances of the algorithms are measured in term of execution time, memory footprint and merge result quality (compared to manual merge history stored in git repositories). The source code of this evaluation framework is available at <https://github.com/coast-team/replication-benchmark/>.

4.2. MUTE

Participants: Claudia-Lavinia Ignat, Luc André, François Charoy, Gérald Oster [contact].

MUTE (Multi-User Text Editor) is a web-based text editing tool that allows to edit documents collaboratively in real-time. It implements our recent work on collaborative editing algorithms and more specifically the LOGOOTSPPLIT+ approach [17]. Compared to existing web-based collaborative text editing tool this editor does not require a powerful central server since the server is not performing any computation and acts as a simple broadcast server. Our editor offers support for working offline while still being able to reconnect at a later time. This prototype is distributed under the term of GNU GPLv3 licence and is freely available at <https://github.com/coast-team/mute-demo/>. A demo server is hosted at <http://www.coedit.re/>.

4.3. OpenPaaS POC

Participants: Olivier Perrin [contact], Ahmed Bouchami.

The OpenPaaS Proof of Concept was presented during the final review of the FSN OpenPaaS project. Our contribution was dedicated to the authentication mechanism, and to the authorization framework. These two functionalities was delivered thanks to two RESTful services. The authentication service wrapped the LemonLDAP::NG product within a fully RESTful service, while the authorization service uses the reputation of people within the Enterprise Social Network, and computes the decision/rejection of access based on the trust level of the subject requesting the access. The source code can be obtained via request addressed to Olivier Perrin.

5. New Results

5.1. Probabilistic Partial Orderings

Participants: Jordi Martori Adrian, Pascal Urso.

Ordering events in a distributed system fundamentally consists in delaying event delivery. Partial ordering, such as FIFO and causal order, has many usage in practical distributed and collaborative systems and can be obtained in arbitrarily large and dynamic networks. However, partial orderings imply that messages cannot be sent and delivered as soon as produced.

In [14], we study the latency induced by such partial orderings. We obtain a probabilistic measure of the moment a message can be delivered according the different characteristics of the distributed system. Having such a measure helps to understand the systems behaviour and to design new protocols. For instance, our measure allows us to parametrize a naive, albeit efficient, fault-tolerant causal delivery mechanism. We experimentally validate our approach using Internet-scale production distribution latency including faults.

5.2. Effect of Delay on Group Performance

Participants: François Charoy, Claudia-Lavinia Ignat [contact], Gérald Oster.

We continued our work on studying the effect of delay in real-time collaborative editing. Delays exist between the execution of one user's modification and the visibility of this modification to the other users. Such delays are in part fundamental to the network, as well as arising from the consistency maintenance algorithms and underlying architecture of collaborative editors. Existing quantitative research on collaborative document editing does not examine either concern for delay or the efficacy of compensatory strategies.

In [12] we studied a collaborative note taking task where we introduced simulated delay. The study was done with 20 groups of 4 users which were asked to listen to a short interview and take notes. We found out a general effect of delay on performance related to the ability to manage redundancy and errors across the document. We interpret this finding as a compromised ability to maintain awareness of team member activity, and a reversion to independent work. Measures of common ground in accompanying chat indicate that groups with less experienced team members attempt to compensate for the effect of delay. In contrast, more experienced groups do not adjust their communication in response to delay, and their performance remains sensitive to the delay manipulation. Results of this study support our team assertion that delay associated with conventional consistency maintenance algorithms will impede group performance. Therefore, these results promote the use of novel algorithms such as CRDTs and motivate the pursuance of research and development on these approaches.

5.3. A CRDT Supporting Selective Undo for Collaborative Text Editing

Participants: Luc André, Claudia-Lavinia Ignat [contact].

Selective undo is an important feature in collaborative editors. With selective undo, a user can undo an earlier operation, regardless of when and where the operation was generated. Current systems that support selective undo are subject to two main limitations. Firstly, they only support undo of operations on atomic objects (e.g. characters or un-breakable lines). In the case of string-wise operations such as copy-paste, find-replace or select-delete, users can typically only undo earlier operations character by character. Secondly, selective undo may lead to undesirable effects. For example, a user first inserts a misspelled word and then makes a correction. The correction depends on the first insertion of the word. It is undesirable to undo the insertion alone and leave the correction behind as a groundless modification. In [15] we proposed a novel consistency maintenance approach relying on a layered commutative replicated data type (CRDT) that supports selective undo of string-wise operations in collaborative editing. This is the first work that manages undesirable effects of undo. Our performance study shows that it provides sufficient responsiveness to the end users.

5.4. A Trust-Based Formal Delegation Framework for Enterprise Social Networks

Participants: Ahmed Bouchami, Olivier Perrin [contact].

Collaborative environments raise major challenges to secure them. These challenges increase when it comes to the domain of Enterprise Social Networks (ESNs) as ESNs aim to incorporate the social technologies in an organization setup while asserting greater control of information security. In this context, the security challenges have taken a new shape as an ESN may not be limited to the boundaries of a single organization and users from different organizations can collaborate in a common federated environment.

We address the problem of the authorization's delegation in federated collaborative environments like ESNs with an approach based on event-calculus, a temporal logic programming formalism. While the traditional approaches are either user-centric or organization-centric, the approach bridges the gap between these two views and the proposed framework enhances the delegation scheme. We have proposed a behavior monitoring mechanism, that permits to assess principals' trust level within the federated collaborative environment [10].

5.5. Risk Management in the Cloud. Application to Business Process Deployment

Participants: Claude Godart [contact], Elio Goettelmann.

The lack of trust in cloud organizations is often seen as braking forces to SaaS developments. This work proposes an approach which supports a trust model and a business process model in order to allow the orchestration of trusted business process components in the cloud.

The contribution is threefold and consists in a method, a model and a framework. The method categorizes techniques to transform an existing business process into a risk-aware process model that takes into account security risks related to cloud environments. These techniques are partially described in the form of constraints to automatically support process transformation. The model formalizes the relations and the responsibilities between the different actors of the cloud. This allows to identify the different information required to assess and quantify security risks in cloud environments.

The framework is a comprehensive approach that decomposes a business process into fragments that can automatically be deployed on multiple clouds. The framework also integrates a selection algorithm that combines the security information of cloud offers and of the process with other quality of service criteria to generate an optimized configuration. It is implemented in a tool to assess cloud providers.

Elio Goettelmann has defended his PhD thesis entitled “Risk-aware Business Process Modeling and Trusted Deployment in the Cloud” on October 2015 [1] based on this result. This framework has been combined to an access control model for strengthening access controls in the context of a collaborative federation of components [9].

5.6. Secure Business Process Deployment in SaaS Contexts

Participants: Amina Ahmed Nacer, Claude Godart [contact], Elio Goettelmann, Samir Youcef.

Business process (BP) stakeholders want the benefits of the cloud, but they are also reluctant to expose their BP models which express the know-how of their companies. To prevent such a know-how exposure, we are developing a design-time approach for obfuscating a BP model by splitting its model into a collaboration of BP fragments semantically equivalent to the initial BP. This breaking down renders the discovery of the deep content of a critical fragment or of the whole process semantics, by cloud providers much harder when these fragments are deployed in a multi-cloud context. While existing contributions on this topic remain at the level of principles, we propose an algorithm supporting such a BP model transformation [11]. To validate this approach, we are developing a new metric of obfuscation. Complementary to obfuscation, we are developing techniques to reuse, at design time, business process fragments from the cloud, but with limited security risks [8].

5.7. Web Services Selection with QoS

Participants: Amina Ahmed Nacer, Kahina Bessai, Claude Godart [contact], Samir Youcef.

The development of the web technologies and the increase of available services raise the issue of the selection of the most appropriate service among a set of candidate web services. First of all, the services offering a given functionality are discovered. Then, the service selection process assists users in choosing the services that better meets their preferences. These preferences are generally expressed as potentially objective functions often conflicting.

Most of existing works trying to select the best web services are based either on a single evaluation criterion or, at best, on the use of an aggregation function like weighted sum of several quantitative evaluation criteria, or the use of the Pareto optimality notion.

In this work, we address some shortcomings of existing approaches by introducing a new optimality notion based on two tests: (i) concordance and (ii) discordance tests. It presents an efficient algorithm to select only the best services using the introduced optimality notion. Moreover, the proposed algorithm exhibits encouraging results as supported by a series of experiments [7].

6. Bilateral Contracts and Grants with Industry

6.1. Bilateral Grants with Industry

6.1.1. CIFRE Grant with Bonitasoft

Participants: François Charoy, Samir Youcef, Guillaume Rosinosky.

Bonitasoft is a leading software company in the domain of open source Business Process Management Systems. The objective of this grant is to help Bonitasoft to support effective elastic BPM operation in the Cloud by leveraging both the business knowledge, the process models and the execution history of process instances and correlate them with cloud resource consumption. Guillaume Rosinosky has been recruited as a PhD Student to work on this project. We will define models that will be validated based on a detailed analysis of existing use cases that we have started to collect from Bonitasoft and its clients.

7. Partnerships and Cooperations

7.1. National Initiatives

7.1.1. FSN OpenPaaS (2012–2015)

Participants: Olivier Perrin [contact], Ahmed Bouchami.

Partners: SAMOVAR team (Telecom SudParis), COAST project-team (Université de Lorraine, LORIA), ARMINES (Ecole des Mines d'Albi), Brake France, Linagora.

Website: <http://www.open-paas.org/>

The OpenPaaS project aims at developing a PaaS (Platform as a Service) technology dedicated to enterprise collaborative applications deployed on hybrid clouds (private/public). OpenPaaS is a platform that allows to design and deploy applications based on proven technologies provided by partners such as collaborative messaging systems, integration and workflow technologies that will be extended in order to address Cloud Computing requirements. Available as an open-source Enterprise Social Network, the OpenPaaS project innovates both at the collaborative level and by its capacity to leverage heterogeneous cloud technologies at the IaaS level (Infrastructure as a Service). This project is funded under the French FSN umbrella (Fond National pour la société Numérique).

7.1.2. OpenPaas NG (2015–2018)

Participants: Claudia-Lavinia Ignat, François Charoy [contact], Gérald Oster, Olivier Perrin.

Partners: Linagora, XWiki SAS, Nexedi, COAST project-team (Université de Lorraine, LORIA), DaScim team (LIX).

Website: <http://www.open-paas.org/>

This project is financed by BpiFrance and involves French industrial leaders in open-source software development (Linagora, Nexedi, XWiki) and academic partners in collaborative work (COAST team) and recommender systems (DaScim team, LIX). The goal of the project is to develop next generation cloud enabled virtual desktop based on Enterprise Social Network concept to provide advanced collaborative and recommendation services. COAST team is responsible of the work package dedicated to the design of the peer-to-peer collaborative middleware. In this context, we bring our expertise on data replication for collaborative data in peer-to-peer environments and on trust and access control and identity management in distributed collaborative information systems.

7.1.3. Inria ADT PLM (2014-2016)

Participants: G erald Oster [contact], Matthieu Nicolas.

Partners: COAST project-team, VERIDIS project-team.

Website: <https://github.com/BuggleInc/plm/>

This work is performed jointly with Martin Quison (previously member of project-team VERIDIS, now Professor at ENS Rennes).

The Programmer's Learning Machine (PLM) is a software platform dedicated to computer programming education. This generic platform offers support to teachers for creating programming microworlds suitable to teaching courses. It features an integrated and graphical environment, providing a short feedback loop to students in order to improve the effectiveness of the autonomous learning process.

This project aims at establishing an experimental platform for studying the teaching of basic programming and a research instrument to design new collaborative learning environments.

7.2. European Initiatives

7.2.1. FP7 & H2020 Projects

7.2.1.1. SyncFree (2013-2016)

Participants: Pascal Urso [contact], Jordi Martori Adrian.

Program: FP7-ICT-2013-10

Project acronym: SyncFree

Project title: Large-scale computation without synchronisation

Duration : October 2013 - September 2016

Coordinator: Marc Shapiro, Inria

Other Partners: REGAL project-team (Inria Paris - Rocquencourt / LIP6, coordinator), Basho Technologies Limited (United Kingdom), Trifork AS (Denmark), Rovio Entertainment OY (Finland), Faculdade de Ci ncias e Tecnologia (Universidade Nova de Lisboa, Portugal), Universit  Catholique de Louvain (Belgium), Ko c University (Turkey), Technische Universit t Kaiserslautern (Germany) and COAST project-team.

Large-scale on-line services including social networks and multiplayer games handle huge quantities of frequently changing shared data. Maintaining its consistency is relatively simple in a centralised cloud, but no longer possible due to increased scalability requirements. Instead, data must be replicated across several distributed data centres, requiring new principled approaches to consistency that will be explored by the SyncFree project. <http://syncfree.lip6.fr/>

7.3. International Initiatives

7.3.1. Inria Associate Teams not involved in an Inria International Labs

7.3.1.1. USCOAST

Title: User Studies on Trustworthy Collaborative Systems

International Partner (Institution - Laboratory - Researcher):

Wright State University (USA) - Department of Psychology - Valerie Shalin

Start year: 2013

See also: <http://uscoast.loria.fr>

USCoast has as main objective the validation of trustworthy collaborative systems using experimental user studies. This type of validation requires the expertise of both computer scientists that designed the systems and social scientists for conceptualizing and measuring human behaviour in collaborative work. The project focuses on the real-time requirements and trust policies in collaborative editing, resulting in a theory for the effect of real-time constraints in collaborative editing and awareness management for the coordination of work in the presence of conflict and disruption. The project also proposes light security mechanisms for decentralised collaboration, based on measures of voluntary compliance with data sharing restrictions. New methods will be developed for the cost-effective evaluation of collaborative work to compensate for otherwise unrealistic sample sizes and costly engineering, using game theory to inspire task analogues and simulated users along with human users.

7.4. International Research Visitors

7.4.1. Visits of International Scientists

Valerie Shalin

Date: October 10, 2015 - November 5, 2015

Institution: Wright State University (USA)

Valerie Shalin worked on the validation of trust-based collaboration, specifically on the design and analysis of the experiments with users on the trust game.

7.4.2. Visits to International Teams

7.4.2.1. Research stays abroad

François Charoy spend 7 weeks at Wright State University, OH, in the Knoesis Team lead by Prof. Amit Sheth as part of the USCOAST associated team.

8. Dissemination

8.1. Promoting Scientific Activities

8.1.1. Scientific events selection

8.1.1.1. Member of the conference program committees

- Claude Godart was PC member of the conference program committee of BPM (Business Process Management), BPMDS (Business Process Modeling, Development and Support), CBI (IEEE Conference on Business Informatics), EDOC (The enterprise computing conference), ICSOC (International Conference on Services Computing), IEEE CLOUD Computing, ICWS (IEEE International Conference on Web Services), SCC (IEEE International Conference on Services Computing), IEEE/WIC/ACM WI (Web Intelligence conference), WISE (Web Information Systems Engineering) conferences.
- Claudia-Lavinia Ignat was PC member of CSCW (International Conference on Computer Supported Cooperative Work and Social Computing) 2015 and 2016, CDVE (International Conference on Cooperative Design, Visualization and Engineering) 2015, ICEBE (International Conference on e-Business Engineering) 2015, Best paper awards committee at CSCW 2016
- Olivier Perrin was PC Member of ICSOC 2015, I3E 2015 (14th IFIP Conference on e-Business, e-Services and e-Society), VECOS 2015 (9th International Workshop on Verification and Evaluation of Computer and Communication Systems), SITIS 2015.

- François Charoy was PC Member of ICEBE (International Conference on Business Engineering) 2015, CTS 2015 (International Symposium on Collaborative Technologies and Systems), DG.O (International Conference on Digital Government Research) 2015, IEEE International Conference on Business Information Systems and of several workshops.
- Khalid Benali was PC Member of IWEI 2015 (International IFIP Working Conference on Enterprise Interoperability), COLLA 2015 (International Conference on Advanced Collaborative Networks, Systems and Applications), WorldCIST'15 (World Conference on Information Systems and Technologies), ICDS 2015 (The International Conference on Digital Society), MEDES 2015 (ACM/IFIP International Conference on Management of Emergent Digital EcoSystems), INFORSID'2015, INNOV 2015 (International Conference on Communications, Computation, Networks and Technologies), I3E 2015 (The 14th IFIP Conference on e-Business, e-Services and e-Society), and AFIN 2015 (The Seventh International Conference on Advances in Future Internet).
- Gérald Oster was a PC member of CoopIS 2015 (International Conference on Cooperative Information Systems).

8.1.1.2. Member of the editorial boards

- Claude Godart is member of the editorial board of “IEEE transaction on Service Computing”, “International Journal of Services Computing” and member of the review board of the “International Journal of Next Generation Computing”.
- Claudia-Lavinia Ignat is member of the editorial board of Journal of CSCW (Computer Supported Cooperative Work).
- François Charoy is member of the editorial board of Service Oriented Computing and Applications Journal (Springer).

8.1.1.3. Reviewer - Reviewing activities

- In 2015, Olivier Perrin reviewed papers for IEEE Transactions on Services Computing journal and Elsevier Computers & Security journal.
- In 2015, Claudia-Lavinia Ignat reviewed papers for IEEE Transactions on Software Engineering.

8.1.2. Invited talks

- François Charoy has been invited as a keynote Speaker at the Pro-VE Conference in Albi [5] on Collaborative Networks and Crisis Management.
- François Charoy has been invited as a keynote Speaker at the ISCRAM Med conference in Tunis [6] on Web Scale collaboration and Crisis Management.

8.2. Teaching - Supervision - Juries

8.2.1. Teaching

Permanent members of the COAST project-team are leading teachers in their respective institutions. They are responsible of lecture in disciplines like software engineering, database systems, object oriented programming and design, distributed systems, service computing and even more advanced topics at all levels and in all kind of departments in the University. Most of the PhD Students have also teaching duties in the same institutions. As a whole, the COAST team accounts for more than 2500 hours of teaching. Members of the COAST team are also deeply involved in the pedagogical and administrative life of their departments.

- Gérôme Canals is the head of the Computer science department of the Nancy-Charlemagne University Institute of Technology (IUT Nancy Charlemagne) since sept. 2010, and is responsible for the professional licence degree “Web application programming” since sept. 2001.
- Claude Godart is responsible for the Computer Science department of the engineering school ESSTIN.
- Khalid Benali is responsible for the professional Master degree speciality “Distributed Information Systems” of MIAGE and of its international branch in Morocco.

- François Charoy is responsible of the Software Engineering specialisation at the TELECOM Nancy Engineering School of University of Lorraine.
- Gérald Oster is responsible of the 3rd year internship program at the TELECOM Nancy Engineering School of University of Lorraine.
- Pascal Urso is responsible for the “Security, Services, Systems and Network” track of the master degree in computer science at University of Lorraine since September 2013.

8.2.2. Supervision

PhD (in progress): Quang Vinh Dang, Trust-based large scale collaboration, started in 10/2014, Claudia-lavinia Ignat and François Charoy

PhD (in progress): Hoai Le Nguyen, Study of group performance and behavior in collaborative editing, started in 9/2015, Claudia-Lavinia Ignat and François Charoy

PhD (in progress): Hoang Long Nguyen, A Trust Based Authorization Model and Framework for the Cloud, started in 11/2015, Claudia-Lavinia Ignat and Olivier Perrin

PhD (in progress): Luc André, Replication and Consistency Maintenance in Peer-to-Peer Collaborative Environment, started in 9/2011, François Charoy and Gérald Oster

PhD (in progress): Victorien Elvinger, Secured Replication for Peer-to-Peer Collaborative Infrastructures, started in 10/2015, François Charoy and Gérald Oster

PhD (in progress): Ahmed Bouchami , Sécurité des données collaboratives d’une plateforme PaaS, started in 11/2012, Olivier Perrin

PhD (in progress): Adrien Devresse , Study of effective sharing and analysis of very large metadata repositories: application to the High Energy Physics computing community, started on 11/2011, Olivier Perrin

PhD (in progress): Jordi Martori i Adrian, Data constraints for large-scale collaboration, started in 10/2013, François Charoy and Pascal Urso

PhD (in progress): Guillaume Rosinoski, Elastic BPM and the Cloud, started in 10/2014, François Charoy and Samir Youssef

PhD (defended): Mehdi Ahmed Nacer ended 5/2015, François Charoy and Pascal Urso.

8.2.3. Juries

- Claudia-Lavinia Ignat was a member of the jury for the recruitment in 2015 of permanent Inria junior researchers at Inria Nancy-Grand Est.
- François Charoy was head of the Selection committee at TELECOM Nancy, Université de Lorraine

COAST members were members of the following PhD and HdR defense committees:

- Amina Saoutal, PhD, Université de Technologie de Troyes, December 2015 (François Charoy et Claudia-Lavinia Ignat)
- Laurent Cailleux, PhD, Telecom Bretagne, January 2015 (François Charoy)
- Mehdi Ahmed Nacer, PhD, Université de Lorraine, May 2015 (François Charoy and Pascal Urso)
- Victor Codecedo, PhD, Université de Lorraine, September 2015 (François Charoy)
- Aurélie Montarnal, PhD, Ecoles des Mines D’Albi, October 2015 (François Charoy)
- Houssemed Medhioub, PhD, Université Pierre et Marie Curie, Paris, April 2015 (Olivier Perrin)
- Akram Bedoui, PhD, Université de Lorraine, Nancy, November 2015 (Olivier Perrin)
- Kevin Royer, PhD, ENSMA Poitiers, March 2015 (Claude Godart)
- Saoussen Cheikhrouhou, PhD, Université de Sfax, June 2015 (Claude Godart)
- Samuel Marchal, PhD, Université de Lorraine and Université du Luxembourg, June 2015 (Claude Godart)
- Mustapha Aznag, PhD, Université Aix-Marseille, Juillet 2015 (Claude Godart)
- Mohamed Bentounsi, PhD, Université Paris-Descartes, Juillet 2015 (Claude Godart)
- Elio Goettelmann, PhD, Université de Lorraine, October 2015 (Claude Godart)
- Kahina Gani, PhD, Université Blaise Pascal, Clermont-Ferrand, December 2015 (Claude Godart)

8.3. Popularization

- In 2015, Claudia-Lavinia Ignat participated at “Le Village des Sciences” at Loria.
- François Charoy has been invited to participate to a panel at Grand Est Numérique 3

8.4. Institutional commitment

- Claudia-Lavinia Ignat is in charge of European affairs for Inria Nancy Grand-Est. She is the Delegate of International Relations for Inria Nancy-Grand Est and member of COST-GTRI commission. She is member of the Inria Nancy-Grand Est COMIPERS committee. She led a working group called GT Europe that had to come up with certain propositions that could reinforce the participation of Inria Nancy-Grand Est researchers at european project calls. She participated to the working group “Livret d’accueil” that was in charge with the design of a booklet for newcomers at Inria Nancy-Grand Est. She is responsible with the activity kindergarten at AGOS Inria Nancy-Grand Est.

8.5. Collective Responsibilities outside Inria

- François Charoy is head of the “Commission de choix” of TELECOM Nancy and member of the Administration Council of TELECOM Nancy.
- François Charoy is elected member of CNU.
- Gérald Oster is member of the Administration Council of TELECOM Nancy and of the “Commission de choix” of TELECOM Nancy.
- Claude Godart is member of the Administration Council of the engineering school ESSTIN and member of the recruitment committee of the engineering school ESSTIN.

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Publications of the year

Doctoral Dissertations and Habilitation Theses

- [1] E. GOETTELMANN. *Risk-aware Business Process Modelling and Trusted Deployment in the Cloud*, Université de Lorraine, October 2015, <https://hal.inria.fr/tel-01237669>

Articles in International Peer-Reviewed Journals

- [2] M. AHMED-NACER, P. URSO, F. CHAROY. *ICST Transactions Preprint Merging By Decentralized Eventual Consistency Algorithms*, in "EAI Endorsed Transactions on Collaborative Computing", January 2015, vol. 1, n° 6 [DOI : 10.4108/EAI.21-12-2015.150817], <https://hal.inria.fr/hal-01261869>
- [3] N. BOUDJLIDA, B. GASMI BOUMEZOUED. *Conceptual Graphs for Formally Managing and Discovering Complementary Competences*, in "Springer LNAI", 2016, <https://hal.inria.fr/hal-01253436>
- [4] Y. LIAO, M. LEZOUCHE, H. PANETTO, N. BOUDJLIDA, E. ROCHA LOURES. *Semantic annotation for knowledge explicitation in a product lifecycle management context: a survey*, in "Computers in Industry", August 2015, vol. 71, pp. 24-34 [DOI : 10.1016/J.COMPIND.2015.03.005], <https://hal.archives-ouvertes.fr/hal-01123854>

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- [5] F. CHAROY. *Keynote - Pro-VE Conference 2015 : Collaborative Networks and Crisis Management*, in "XVI IFIP Working Conference on Virtual Enterprises", Albi, France, Frédéric Bénaben, October 2015, <https://hal.inria.fr/hal-01219053>

- [6] F. CHAROY. *Keynote - Web Scale collaboration and Crisis Management*, in "ISCRAM-Med", Tunis, Tunisia, October 2015, <https://hal.archives-ouvertes.fr/hal-01227841>

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- [7] A.-N. AMINA, K. BESSAI, S. YUCEF, C. GODART. *A Multi-criteria Based Approach for Web Service Selection Using Quality of Service (QoS)*, in "2015 IEEE International Conference on Services Computing (SCC)", New-York, United States, June 2015 [DOI : 10.1109/SCC.2015.83], <https://hal.inria.fr/hal-01237664>
- [8] A.-N. AMINA, E. GOETTELMMANN, S. YUCEF, A. TARI, C. GODART. *Business Process Design by reusing Business Process fragments from the cloud*, in "8th IEEE International Conference on Service Oriented Computing & Applications", Rome, Italy, October 2015, <https://hal.inria.fr/hal-01239872>
- [9] A. BOUCHAMI, E. GOETTELMMANN, O. PERRIN, C. GODART. *Enhancing Access-Control with Risk-Metrics for Collaboration on Social Cloud-Platforms*, in "TrustCom-BigDataSE-ISPA 2015", Helsinki, Finland, The 14th IEEE International Conference on Trust, Security and Privacy in Computing and Communications, IEEE, August 2015 [DOI : 10.1109/TRUSTCOM.2015.458], <https://hal.inria.fr/hal-01240381>
- [10] A. BOUCHAMI, O. PERRIN, E. ZAHOR. *Trust-Based Formal Delegation Framework for Enterprise Social Networks*, in "The 14th IEEE International Conference on Trust, Security and Privacy in Computing and Communications (IEEE TrustCom-15)", Helsinki, Finland, August 2015 [DOI : 10.1109/TRUSTCOM.2015.366], <https://hal.inria.fr/hal-01240387>
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