



INSTITUT NATIONAL DE RECHERCHE EN INFORMATIQUE ET EN AUTOMATIQUE

*Project-Team ECOO*

*Middleware for supporting cooperative  
work through Internet*

*Nancy - Grand Est*

THEME COG

*Activity*  
*R* *eport*  
2007



## Table of contents

<b>1. Team</b> .....	<b>1</b>
<b>2. Overall Objectives</b> .....	<b>1</b>
2.1. Introduction	1
2.2. Highlights	2
<b>3. Scientific Foundations</b> .....	<b>2</b>
3.1. Process modeling, Workflow.	2
3.2. Cooperative transactions	3
3.3. Software configuration and version management	3
3.4. Real time synchronous editors	3
3.5. Usage analysis	3
<b>4. Application Domains</b> .....	<b>4</b>
<b>5. Software</b> .....	<b>4</b>
5.1. Introduction	4
5.2. Bonita flexible workflow management system	4
5.3. LibreSource: services for hosting virtual teams	4
5.4. PROM mining plug-ins	5
5.5. BPEL2EC: a translator from BPEL4WS specification to Event Calculus notations.	5
5.6. Wooki : a P2P Wiki system	5
5.7. WSCompositionEditor	5
<b>6. New Results</b> .....	<b>5</b>
6.1. Overview	5
6.2. Process engineering	6
6.2.1. Introduction	6
6.2.2. Static and dynamic process compliance verification	6
6.2.3. Decentralized definition and enactment of service-oriented processes	6
6.2.4. Cross domain process management. Application to e-Government.	7
6.2.5. Spheres of flexibility	7
6.2.6. Perspectives in process-engineering	7
6.2.6.1. Decentralized definition and enactment of service-oriented processes	7
6.2.6.2. Cross domain process management:	8
6.2.6.3. Web services composition and validation	8
6.3. Massive Collaborative editing	8
6.3.1. Consistency Maintenance of Hierarchical Structures	8
6.3.1.1. First solution	8
6.3.1.2. Second solution	9
6.3.2. Consistency Maintenance in Peer-to-peer Environments	9
6.3.2.1. Scalability	9
6.3.2.2. Generic Undo	9
6.3.3. Workspace awareness for collaborative edition	9
6.3.3.1. Real-time Awareness for Asynchronous Collaboration	9
6.3.3.2. Change Awareness for Graphical Editing	10
6.3.3.3. Divergence Awareness in Collaborative Knowledge Management	10
6.3.4. Perspectives in Massive Collaborative Editing	10
6.3.4.1. Awareness for asynchronous P2P collaborative edition	10
6.3.4.2. Awareness Support in Collaborative Software Development	10
6.3.4.3. Peer-to-peer Semantic Wiki	10
6.3.4.4. Undo in WOOT	10
6.4. Enterprise Interoperability	11
<b>7. Contracts and Grants with Industry</b> .....	<b>11</b>

---

7.1. European IP Qualipso (2006-2010)	11
7.2. RNTL Xwiki Concerto (2006-2009)	11
<b>8. Other Grants and Activities</b> .....	<b>11</b>
8.1. Regional actions	11
8.2. National actions	12
8.3. European actions	12
8.3.1. Network of Excellence INTEROP (2004-2007)	12
8.3.2. IP Qualipso (2006-2010)	13
8.4. International Actions	13
8.4.1. Conference program committees and organizations	13
8.4.2. Postdoctoral cooperation	14
8.4.3. Co-advisory of thesis	14
8.4.4. Liban, Rorax, CEDRE project	14
8.4.5. Tunisie, eGov, INRIA-DGRST project	14
8.4.6. Chili, CoreWeb, INRIA-CONICYT project	15
8.4.7. South America, Semantic-based support for Collaborative Design Activity, Stic-Amsud project	15
8.5. Visits, Invitations	15
<b>9. Dissemination</b> .....	<b>15</b>
9.1. Scientific Community Animation	15
9.2. Teaching	15
<b>10. Bibliography</b> .....	<b>16</b>

# 1. Team

*ECOO is a project of LORIA (UMR 7503), a joint venture between CNRS, INRIA, Université Henri Poincaré Nancy 1, Université Nancy 2 and Institut National Polytechnique de Lorraine.*

## Head of project team

Claude Godart [ Professor, Université Henri Poincaré Nancy 1, ESSTIN, HdR ]

## Vice-Head of project team

Pascal Molli [ Assistant Professor, Université Henri Poincaré Nancy 1, HdR ]

## Administrative Assistant

Laurence Félicité

## Scientific staff

Khalid Benali [ Assistant Professor, Université Nancy 2, HdR ]

Nacer Boudjlida [ Professor, Université Henri Poincaré Nancy 1, HdR ]

Gérôme Canals [ Assistant Professor, Université Nancy 2 ]

François Charoy [ Assistant Professor, Université Henri Poincaré Nancy 1, ESIAL ]

Claudia Ignat [ Research Scientist, INRIA ]

Jacques Lonchamp [ Professor, Université Nancy 2, HdR ]

Gérald Oster [ Assistant Professor, Université Henri Poincaré Nancy 1, ESIAL ]

Olivier Perrin [ Assistant Professor, Université Nancy 2 ]

Hala Skaf-Molli [ Assistant Professor, Université Henri Poincaré Nancy 1 ]

Pascal Urso [ Assistant Professor, Université Henri Poincaré Nancy 1 ]

## PHD Students

Sawsan Alshattnawi [ French government grant since October 2005 ]

Dong Chen [ UHP grant since October 2003 ]

Sergiu Dumitriu [ Cifre grant since December 2007 ]

Walid Fdhila [ MESR grant since October 2007 ]

Khaled Gaaloul [ SAP grant since October 2005 ]

Adnene Guabtni [ ATER, Nancy University, ESSTIN, until June 2007 ]

Nawal Guermouche [ INRIA-Region Lorraine grant since October 2006 ]

Charbel Rahhal [ UHP grant since October 2006 ]

Mohsen Rouached [ MESR grant since October 2005 ]

Ustun Yildiz [ Luxembourg FNSR grant since October 2004, ATER UHP since October 2007 ]

Stéphane Weiss [ CNRS-Region Lorraine grant since October 2006 ]

## Post-doctoral Fellow

Sami Bhiri [ to DERI University, Gallway, Ireland, since October 2005 to September 2007 ]

Walid Gaaloul [ to DERI University, Gallway, Ireland, since October 2006 ]

Adnene Guabtni [ to University of New South Wales, Sydney, Australia, since June 2007 ]

Claudia Ignat [ from ETH Zurich, Switzerland, since October 2006 to September 2007 ]

Manuelle Kirsh-Pinheiro [ from LSR-Imag, Grenoble, since October 2006 to September 2007 ]

## Technical Staff

Oscar Barros [ Technical staff, since September 2007 ]

Jérôme Blanchard [ Technical staff, FP6 IP Qualipso, since February 2007 ]

Julien Maire [ Technical staff, RNTL Xwiki, since February 2007 ]

# 2. Overall Objectives

## 2.1. Introduction

**Keywords:** *business process, collaboration, cooperation, cooperative editing, coordination, data consistency, data replication, distributed enterprise, distributed team, information systems, web service, workflow.*

ECOO is interested in the development of cooperative, distributed, and process-aware Web Information Systems.

An Information System (IS) is a particular type of work system that uses information technology to capture, transmit, store, retrieve, manipulate, or display information, thereby supporting one or more other work systems.

The advent of the web has pushed new IS applications as electronic commerce, collaborative editing, e-learning, e-engineering or scientific workflow. A common characteristic of such applications is to be cooperative, i.e. human-centred, and creative by nature and implicating more subtle machine mediated interactions than traditionally.

Such applications are distributed in space (people work in different locations), in time (people work at different time) and they cross organizational barriers, making difficult their coordination and crucial the problems of privacy and trust.

The ECOO approach is characterized by its focus on coordination, a crucial problem due to the lost of natural awareness resulting from distribution in space and time: we are particularly interested in process-aware information systems that manage and execute operational processes involving people, applications, and information sources on the basis of process models.

The work is organized as follows. The axis entitled PROCESS ENGINEERING is concerned with the development of new process models in two main directions: increasing the flexibility of existing process models to support creative cooperative applications such as collaborative editing and e-engineering, and integrating business processes with Web technologies. The axis entitled COLLABORATIVE EDITING is concerned with the development of collaborative editing systems but with a scientific focus on data consistency in peer to peer architectures. Interactions between axes are mainly Web Programming in the large, Web Information Systems Architecture, Editing Processes, and Data Consistency.

(The axis AWARENESS existing in last year organization has been integrated in the two remaining axes. This is because while we feel that awareness is important, it is not in our objective to study it in general, out of a particular context.)

Privileged applications in our target are creative cooperative applications such as cooperative editing, co-conception, co-engineering, service orchestration in various domains such as Software Engineering, e-Commerce, e-Learning, Architecture-Engineering-Construction.

It is a strategic objective for us to develop software and to experiment it "outside the laboratory". We support the "Open Source Software initiative" (see IP Qualipso in section 7.1), software Bonia in section 5.2 and LibreSource in section 5.3.

## 2.2. Highlights

In 2007:

- we organized the eight Web Information Systems Engineering conference (150 participants, <http://wise2007.loria.fr/>),
- the Interop V-Lab <http://www.interop-vlab.eu/> was launched in the continuation of the Interop NoE,
- we released the first P2P wiki system Wooki (<http://wooki.sf.net>),
- Ustun Yildiz has got the best student paper award of the Webist 2007 conference.

## 3. Scientific Foundations

### 3.1. Process modeling, Workflow.

An important research direction of ECOO concerns the coordination of a distributed team based on an explicit definition of working processes (workflow).

Traditional workflow models [34], if they seem a good starting point for this modelling activity, suffer from a lack of flexibility in both control flow and data flow definition and interpretation; there are too rigid to model the subtlety of interactions characterizing creative cooperative activities.

As a consequence, different approaches have been proposed to extend the traditional workflow approach towards cooperative applications. In this context, our main stream approach is to keep a traditional process description model but with a different semantic for integrating control and data flow flexibility.

Another emerging characteristic of our approach is the consideration that, in many applications, there is not one explicit process, but several interacting processes, potentially based on different models (functional, state-based, dataflow), and in some cases not explicitly defined.

### 3.2. Cooperative transactions

To be able to define properties of workflow executions, activities are generally considered as black boxes executing as ACID transactions. Unfortunately, ACIDity seems antagonistic with cooperation, cooperative processes being of long time duration, of uncertain development, dynamically defined and mobile. Especially, the Isolation property seems problematic for interacting activities exchanging intermediate results in complex feedback loops. To overcome the limits of traditional transaction models, several well founded or exotic models have been proposed.

Regarding the transactional issue, in the vein of [33], and in the aforementioned objective of multi-model process integration, we are concerned with the concurrency control and atomicity of transactional processes. This can be sketched in a top-down or in a bottom-up perspective. For both perspectives, we are developing a transactional framework to provide active support for transactional activities composition and composition evaluation.

### 3.3. Software configuration and version management

One domain in which cooperative work is organized since a long time is the software development domain. Tools such as CVS are used since several years by thousands of software developers. The *copy/modify/merge* paradigm is one of the most wide-spreaded implementation of cooperative work at a large scale. However, we have to note that this model, which synchronizes one entity at a time, if it is highly operational, suffers from some weakness regarding consistency of shared data.

The copy/modify/merge paradigm has deeply influenced our view of cooperation. But our objective is to integrate it in a more global vision for better taking into account semantic links between two or more objects, and better integrating asynchronous work phases with synchronous phases.

### 3.4. Real time synchronous editors

Synchronous editors allow to maintain as soon as possible the consistency of two or more copies of the same object that are concurrently modified at the same time by several users distributed through a network. Algorithms are founded on the fusion of execution traces.

We use trace fusion algorithms for everything that requests a synchronous view of several user modifications including the synchronous visualization of divergence between users modifying asynchronously copies of the same object. We extended these algorithms for assuring a smooth and consistent transition from asynchronous to synchronous phases, especially for the reconciliation of divergent copies. We have developed a technology for specifying and implementing a generic and secure synchronizer.

### 3.5. Usage analysis

Cooperative work includes an important human dimension. A bad apprehension of this dimension leads inevitably to the rejection of any software solution on the field. A good study of actual usages before, during and after development is predominant.

Usage analysis is more a research topic in social sciences than in computer sciences. Our approach is to involve potential users early in the development process (participative design). Also, we ask specialists (psychologists, educationists), when possible, to conduct these analyses. We have had the opportunity to develop this strategy thanks to scientific and industrial relationships.

## 4. Application Domains

### 4.1. Application Domains

Our work aims at supporting creative cooperative applications of various natures: co-design, co-engineering, e-learning, cooperative authoring for participants distributed in time, space and eventually in organizations. It corresponds to enterprises cooperating through Internet to the design and/or development of a common product such as e-commerce, business process, cooperative software development, co-design and co-engineering.

## 5. Software

### 5.1. Introduction

The software products listed in this section have not reached the same level of diffusion. Bonita is distributed with a LGPL License and has developed its proper community. LibreSource has been released with a QPL License and a commercial license is "sold" by the Artnum Company. PROM is a joint initiative of a community of people involved in process mining. BPEL2EC, Wooki and WSCompositionEditor are research prototypes that we believe constitute the basis for the development of future popular products.

### 5.2. Bonita flexible workflow management system

**Participants:** François Charoy [responsible], Oscar Barros, Claude Godart.

The Bonita workflow model is defined as a classical graph based one, but with an advanced execution model that allows different kinds of execution strategies: from classical and automatic, to less constrained user driven. Another difference with classical models is that process definition can be dynamic: Bonita supports direct process instantiation and execution. A new process can be created by cloning another running or finished process and then adapted to specific needs. Process fragment importation is also possible. Bonita is implemented on a J2EE application server. It is available on the application server Jonas. It provides a definition and an execution API available as a session bean and as Web services. Integration of external components can be done inside activities using the BeanShell scripting language. Bonita is available as an ObjectWeb project on the ObjectWeb forge (<http://bonita.objectweb.org/>).

Bonita is a foundation of the *Process Virtual Machine* project <http://www.onjava.com/pub/a/onjava/2007/05/07/the-process-virtual-machine.html>.

### 5.3. LibreSource: services for hosting virtual teams

**Participants:** Pascal Molli [responsible], Jérôme Blanchard, François Charoy, Claude Godart, Gérald Oster.

LibreSource allows a virtual team to organize and its participants to cooperate. Its objective is in the vein of BSCW and SourceForge, but with an original object sharing model where copy convergence is based on the operational transformation approach which provides for a safe and generic synchronizer. In other words, LibreSource is not restricted to the synchronization of source code, but can apply to any type of data (XML for example) if the corresponding transformation operations are provided.

Another innovative point is the fact that the synchronizer can be distributed on several sites, thus providing for the modelling of (hierarchically organized) processes.



LibreSource also integrates traditional services for object sharing, communication, task management and group awareness.

LibreSource (<http://www.libresource.org/>) is implemented on a J2EE application server. It is available on Jonas.

## 5.4. PROM mining plug-ins

**Participants:** Walid Gaaloul [responsible], Claude Godart, Mohsen Rouached.

The ProM framework (<http://www.processmining.org>) is a pluggable framework developed by a community concerned with process mining. It supports a variety of process management techniques and can be extended by simply adding plug-ins. Currently, more than 30 plug-ins have been added. The architecture of ProM allows for five different types of plug-ins.

We have provided this framework with mining plug-ins, the goal of which is to extract a process model from a given event log without using any additional knowledge of the process.

## 5.5. BPEL2EC: a translator from BPEL4WS specification to Event Calculus notations.

**Participants:** Mohsen Rouached [responsible], Walid Fdhila, Claude Godart, Pascal Urso.

BPEL2EC is a translator from BPEL process description to Event Calculus in the objective of static and dynamic verification. This software is developed in the frame of the CPER PSW project (see 8.1).

## 5.6. Wooki : a P2P Wiki system

**Participants:** Pascal Molli [responsible], G r me Canals, Julien Maire, G rald Oster, Pascal Urso.

Wooki (<http://wooki.sourceforge.net>) is a P2P wiki system: a wooki network is a P2P network of wiki servers where each server stores a copy of the replicated wiki pages. Wooki uses an epidemic propagation approach to broadcast changes on the overlay network, combined with the WOOT algorithm to merge concurrent changes. Wooki is scalable, and supports dynamic networks and disconnected operations.

## 5.7. WSCompositionEditor

**Participants:** Olivier Perrin [responsible], Claude Godart.

*WSCompositionEditor* allows a designer to graphically compose (Web) Services with patterns for defining Composite (Web) Services. Service descriptions can be refined with transactional properties. The editor is associated with an environment that allows the simulation of the transactional behaviour of Composite Services, i.e. how they globally behave in case of failure. Simulation is based on an extension of Bonita with plug-ins to manage transactional properties. The *WSCompositionEditor* can also be used as a process engine to execute composite services. The implementation is done in Java.

# 6. New Results

## 6.1. Overview

The section starts presents our results concerning our research work on Process Engineering and Collaborative Editing. For each of these two dimensions, first results are described and then perspectives are given.

## 6.2. Process engineering

### 6.2.1. Introduction

Processes have received a lot of attention in the last decade and succeeded in proposing workflow solutions for office automation. The topic is subject again to a lot of interests carried by the expansion of business on the Web, but with the need to satisfy new application requirements and execution contexts. We are interested in different aspects of process engineering: the introduction of the flexibility requested to model the subtlety of user interactions in creative applications; modelling and implementing consistency properties as requested by complex transactional processes; composing existing process fragments of different nature and models; abstracting a global view from a process set; tuning processes with regards to real mined executions; discovering of process models from execution logs; evaluating privacy violation risk with regards to the degree of details exposed in process descriptions; integrating process with data flow. In addition, most of these aspects must be considered in a decentralized context in the frame of Web services and peer to peer architectures.

This year results are mainly concerned with validation of composed Web services, decentralized definition and enactment of service-oriented processes, task delegation techniques in cross domain processes, and spheres of flexibility.

### 6.2.2. Static and dynamic process compliance verification

**Participants:** Walid Fdhila, Claude Godart, Pascal Urso, Mohsen Rouached.

Verifying the compliance of a process to its definition is very challenging. Verification can be done either a-priori, i.e., at design time, or a-posteriori, i.e., after runtime to test and repair design errors, and formally verify whether the process design does have certain desired properties. For the a-priori part of the verification, we must be able to express the requirements using a formalism we can reason on to check if the behavioural properties are consistent. This task becomes not trivial if composition processes manage complex service dependencies. For the a-posteriori part of the verification, the execution should be auditable by providing functionalities to collect execution logs.

Our work [21], [20], [10] attempts to apply Web service log-based analysis and process model checking techniques to provide knowledge about discrepancies between process models and related instances using a-posteriori verification. More precisely, given an event log, we verify a process composition's requirements after runtime, to provide knowledge about the context of and the reasons of discrepancies between process models and related instances. This kind of verification is necessary since some interactions between Web services that constitute a process may be dynamically specified at runtime, causing unpredictable interactions with other services, and making the a-priori verification method insufficient as it only takes into account static aspects.

Then, we show the ability to combine the components for monitoring the compliance of Web services compositions with specified requirements, and the components for discovering services at run-time. We propose to use the specifications of the violated requirements to generate queries for discovering services that could substitute for malfunctioning services.

We have developed a prototype using the translator from BPEL4WS specification to Event Calculus introduced in section 5.5.

### 6.2.3. Decentralized definition and enactment of service-oriented processes

**Participants:** Walid Fdhila, Claude Godart, Ustun Yildiz.

Current work on business process management, even when based on service oriented architectures, lacks of support when decentralized processes span over several organizations and have sophisticated decentralized (at the extreme peer-to-peer) interactions. In order to deal with the current limitations of existing approaches, we are developing an approach to support decentralized management of a distributed business process, including distributed control in the context of management rules.

Based on the initial work started previous year, we have defined a theoretical framework for the decentralization of a process model, i.e. a set of operations for the distribution of a centralized process. More precisely, we have provided operations for decentralizing control and data flow definitions into a conversation integrating distribution aspects [31], [27], [29].

To complement this first contribution, we have had a reflection on how to integrate new decentralization criteria such as privacy consideration and more generally designers' requirements related to decentralization [28], [26].

We have defined an architecture to execute such decentralized processes in the context of the existing Web services standardization effort.

Finally we have started a study on how to generalize this approach in a dynamic context, where activities are defined on the flight, coupling dynamic service binding of choreography to the decentralized execution of an orchestration specification.

#### **6.2.4. Cross domain process management. Application to e-Government.**

**Participants:** François Charoy, Khaled Gaaloul, Claude Godart.

The execution of cross-domain processes (for example eGovernment processes) is a challenging topic. In earlier work, we presented an approach based on collaborative workflows to support eGovernment interoperability. However, such collaborative workflows often appear to be lacking transparency and control supporting concepts and mechanisms. These are needed as eGovernment workflows appear to be heavily human-centric. What is in many cases described as collaboration appears to be a mere coordination and synchronization of processes, often ignoring human-centric interactions.

To analyse the gap between coordination and collaboration in the context of workflow management for eGovernment, we worked on an R4eGov case study for identifying the key distinguishing factors regarding collaboration as opposed to coordination. Based on this, we focused on the concept of task delegation in the context of heavily human-centric collaborative workflows in general. Then, we investigated additional delegation requirements regarding the specification of advanced security and privacy mechanisms. It addresses the modelling and mapping of access rights to tasks and respective delegation and revocation tasks [12].

This work takes place in the frame of a collaboration between SAP Research Karlsruhe and ECOO.

#### **6.2.5. Spheres of flexibility**

**Participants:** François Charoy, Claude Godart, Adnene Guabtani.

An approach that we have explored to better support process flexibility is based on the idea of a sphere. A sphere is a subset of activities of a given process to which we want to attach some constraints, execution properties or qualities. They can be of different nature. For instance, we may want to control concurrency of data access for a given set of activities. This is what we are trying to achieve with what we call spheres of isolation. Spheres of isolation are a mean to express, independently of the process, the way activities can exchange data inside the sphere and with other activities or spheres. They can also be adapted to a distributed setting based on Web services. This work aims at proposing a generic coordinator to enforce these properties depending on the defined protocol. This work is described in the Phd thesis of Adnene Guabtani [4].

#### **6.2.6. Perspectives in process-engineering**

As introduced above, Process Engineering is a very hot topic and perspectives are numerous. ECOO is well positioned on several of these topics. In the next year(s), we plan to address in priority the following questions : the first two question are related to software design while the third is to software verification.

##### **6.2.6.1. Decentralized definition and enactment of service-oriented processes**

**Participants:** François Charoy, Walid Fdhila, Claude Godart, Ustun Yildiz.

The objective at middle term is to generalize the work developed in Yildiz's Phd thesis by :

- capitalizing on this work and previous work on transactional patterns to develop an equipped methodology for the design of decentralized processes,
- introducing additional quality of service properties such as performance, trust, privacy and so on.

#### 6.2.6.2. *Cross domain process management:*

**Participants:** François Charoy, Khaled Gaaloul, Claude Godart.

eGovernment is a very interesting study field to consider regarding services, composition of services, human services mixed with security, privacy and governance problems. A system that would both allow a citizen or a business to make a request to an administration, to follow the advance of his case in the daedalus of different organisations, to be ensured that regulations and laws are enforced for his safety and the government safety would greatly enhance the fluidity of Customer or Business to Government relationships, allowing even further refinements. This implies to be able to model government processes, from the point of view of what has to be done and from the point of view of what has to be enforced. These points of view are somehow orthogonal (one is procedural and one is declarative, one relates to functions and the other relates to both data, functions and time). Our goal to reconcile these points of view.

#### 6.2.6.3. *Web services composition and validation*

**Participants:** Walid Fdhila, Claude Godart, Nawal Guermouche, Olivier Perrin, Mohsen Rouached.

Our first objective is to strengthen the work introduced above on this topic; especially, we would like to release the translator from BPEL to EC "outside the laboratory".

A second objective is to enlarge the nature of properties that we want to verify; we think especially to more sophisticated temporal requirements and/or security properties.

Another objective is to use formalization and verification techniques for automatic error correction, for example by deploying a mediation of Web services and/or by changing on the fly a service by another.

### 6.3. Massive Collaborative editing

The Web is becoming a global read-write information space where billions of people share their knowledge and resources. The need for supporting mass collaboration is manifested by the increasing popularity of wiki and weblog systems. One of the reasons of the success of these collaborative tools is that they do not require any specific skills for publishing and editing. These systems enable a community of users to collaboratively build work of arts such as Wikipedia, the online encyclopedia. However, these tools provide limited functionalities for collaborative authoring of shared documents. Collaborative editing field of research investigates different aspects for supporting groups of people in the authoring process of a set of shared documents over a computer network. Based on our previous experience in this field we are researching various issues specific to the mass collaboration such as consistency maintenance of structured data, consistency maintenance in peer-to-peer environments and awareness aspects in large groups.

#### 6.3.1. *Consistency Maintenance of Hierarchical Structures*

**Participants:** Claudia Ignat, Gérald Oster.

Operational transformation is a suitable mechanism for maintaining consistency in real-time and asynchronous collaboration. However, most of these approaches were developed only for linear structured documents. The tree representation encompasses a large class of documents, such as text and XML documents. We developed two main solutions for consistency maintenance over hierarchical documents.

##### 6.3.1.1. *First solution*

Our first approach [17] consisted in the development of a generic synchronization framework for the reconciliation of file systems containing text and XML documents. Transformation functions specific for a hierarchical structure were proposed. The framework was integrated in the SO6 revision management tool included in the LibreSource platform (<http://www.libresource.org/>). However, our framework is limited to an architecture based on a central server.

### 6.3.1.2. Second solution

Our second solution was the development of a multi-level editing approach [32], [14] for maintaining consistency over hierarchical-based documents such as text and XML documents in peer-to-peer environments. The multi-level editing approach involves logging edit operations that refer to each node and a recursive application of any linear merging algorithm over the document structure. Keeping operations associated with the tree nodes to which they refer facilitates the computation of awareness information and the handling of conflicting changes referring to units of the document. Moreover, increased efficiency is obtained compared to existing approaches that use a linear structure for representing documents.

### 6.3.2. Consistency Maintenance in Peer-to-peer Environments

**Participants:** Claudia Ignat, Pascal Molli, Gérald Oster, Pascal Urso, Stéphane Weiss.

Continuing the research directions investigated in previous years in the domain of consistency maintenance in peer-to-peer environments we made progress on our WOOT approach aiming at scalability and on our TTF approach aiming at genericity. Scalability and genericity are two very important aspects in the collaboration in peer-to-peer environments. In what follows we detail our contribution on the two aspects.

#### 6.3.2.1. Scalability

We developed an optimistic replication algorithm called WOOTO suitable for massive collaborative editing in dynamic peer-to-peer systems. WOOTO is an optimized version of the WOOT algorithm. Based on this approach we developed a peer-to-peer wiki-based collaborative writing tool called Wooki (<http://wooki.sourceforge.net/>). Compared to traditional wikis, Wooki [25] offers a better scalability and enhanced performances. Furthermore it allows offline-work and long-term disconnections. In the context of the RECALL project (INRIA ARC 2006-2007, <http://recall.loria.fr/>), we compared and evaluated our WOOTO approach with respect to other optimistic approaches for collaborative editing in peer-to-peer environments [15].

#### 6.3.2.2. Generic Undo

After proposing last year a solution for achieving convergence, we proposed this year a novel undo approach based on compensation mechanism for collaborative editing systems. In [24], we show that every existing undo mechanism for operational transformation approach are either incorrect or limited. The correctness of our proposition has been formally established by using the automated theorem prover SPIKE. As a validation of our approach, we built the Graveyard (<http://potiron.loria.fr/projects/graveyard>) real-time collaborative editor providing undo capability.

### 6.3.3. Workspace awareness for collaborative edition

**Participants:** Jérôme Canals, Claudia Ignat, Pascal Molli, Gérald Oster.

Group awareness is an important factor of successful collaboration, being defined as an understanding of the activities of others which provides a context for your own activity. We focused on workspace awareness, particularly on providing awareness about the states of the shared documents in various contexts. We are interested in what information should be provided to users to prevent conflicting changes in large user groups and to understand divergence when conflicts cannot be avoided. We investigated how such awareness information can be provided in the asynchronous collaboration over text documents, in the collaboration over graphical documents, and in collaborative knowledge management.

#### 6.3.3.1. Real-time Awareness for Asynchronous Collaboration

Asynchronous collaborative editing systems such as CVS and Subversion allow users to work in parallel in isolation and publish their changes at a later time. However, working in isolation might generate concurrent modifications that lead to conflicts. In order to avoid these undesired situations, we proposed a new interaction mode [16] where users can work in isolation but awareness information about group members activity is provided in real-time. Concurrent modifications performed by users are precisely localised in the form of annotations on other user document copies.

### 6.3.3.2. Change Awareness for Graphical Editing

Approaches that concentrate on change awareness in the domain of graphical authoring are limited and none of them attempts to compute overall information about user changes on a graphical scene of objects and visualise this information in a lightweight fashion. We aimed to fill this gap and therefore we proposed an awareness model [18] that computes and presents changes in collaborative authoring tools. We proposed metrics for measuring the changes performed on the graphical objects and a visualization mechanism based on the concept of heat maps.

### 6.3.3.3. Divergence Awareness in Collaborative Knowledge Management

Many knowledge management systems avoid divergence to occur in the knowledge repository and try to keep conflicts outside of the system. We developed an approach that recognizes divergence as being a natural part of any collaborative process supported by the KM system [9], [6]. In this approach, divergence awareness makes the divergence occurrence evident, and thus manageable by the participants and discussion awareness gives means to understand the evolution of the shared artifacts by linking version lines and discussion/arguments threads.

## 6.3.4. Perspectives in Massive Collaborative Editing

### 6.3.4.1. Awareness for asynchronous P2P collaborative edition

**Participants:** Sawsan Alshattnawi, G r me Canals, Pascal Molli.

In an asynchronous P2P editor, concurrent updates are merged on each site without the control of users. Although the underlying merge algorithm may produce free of conflicts results, the merged document need to be reviewed by a user. Our objective is to help end-users in this review process by providing awareness about what changes were concurrently made to the document. This awareness mechanism will be based on three components : a log analyzer that detects concurrent operations for a merged document, a visualization tool to underline the effects of the concurrent operations in the document, and a visualization tool to underline concurrent operations in the history log of the document.

### 6.3.4.2. Awareness Support in Collaborative Software Development

**Participants:** Claudia Ignat, G r ald Oster.

One of our future work directions is to improve the traditional collaboration mode used in software engineering with a new interaction mode where awareness is provided in real-time but user privacy is kept. Details of changes transmitted by a user to other users are filtered according to user preferences. In order to automate the filtering process we plan to introduce a trust metric, i.e. changes generated by a user will be filtered and sent to the other users according to the trust that user has in other users.

### 6.3.4.3. Peer-to-peer Semantic Wiki

**Participants:** Pascal Molli, Hala Skaf-Molli, Charbel Rahhal.

Many algorithms exist to guarantee convergence in the long term, but none was designed to take into account semantic data [19]. The first challenge of this work is to study the behavior of the existing optimistic replication algorithms in case of not structured data like those of wikis but including structured data like those of the semantic annotations. This original combination of data was never studied in optimistic replication or data synchronization files. The second challenge is to build a semantic wiki based on a peer to peer architecture.

### 6.3.4.4. Undo in WOOT

**Participants:** Pascal Molli, Pascal Urso, St phane Weiss.

The currently used collaborative tools such as version control systems or wikis offer users the possibility to revert only the last modification performed. In the context of distributed collaborative systems where concurrent modifications often happen, an undo mechanism should offer the possibility to revert any change performed by any user. We aim to build such an undo feature for the WOOT approach. Such a feature should be based on the fact that WOOT does not remove deleted data but keeps deleted data as tombstones.



## 6.4. Enterprise Interoperability

**Participants:** Khalid Benali, Nacer Boudjlida.

On this topic, we have worked on semantic-based and model-based solutions for interoperability thanks to semantic annotation of models [8], [13]. We identified a variety of annotation types (structural, terminological and behavioural annotations) to express the deep semantics of a model, or part of a model, to enable its unambiguous interpretation by cooperating actors (humans or machines). For interoperability purposes, that variety of annotation types serves, at the same time, for model exchange, model transformation and model traceability. In addition, we explored, we defined and we partly experimented a software architecture to support model annotations. That architecture integrates modelling tools, ontology management tools and annotation management ones. This contribution helped us in the identification of further research, the main one being “how to identify concepts in an ontology that may serve for the actual provision of model annotations”. Additional research directions are the use of annotations in a collaborative process. These research directions are currently under consideration.

## 7. Contracts and Grants with Industry

### 7.1. European IP Qualipso (2006-2010)

**Participants:** Pascal Molli [Responsible], Jérôme Blanchard, François Charoy, Claude Godart, Gérald Oster.

The goal of the QualiPSO integrated project (No 034763) is to define and implement technologies, procedures and policies to leverage the Open Source Software development current practices to sound and well recognised and established industrial operations (<http://www.qualipso.org/>).

ECOO is especially concerned with the specification and the development of the Qualipso factory.

### 7.2. RNTL Xwiki Concerto (2006-2009)

**Participants:** Jérôme Canals [Responsible], Julien Maire, Pascal Molli, Gérald Oster.

XWiki Concerto (<http://concerto.xwiki.com/>) is a 2006 RNTL project which aims at developing a Wiki web application running on top of a P2P network and supporting mobile users with a variety of devices (from smartphones to desktops). The main scientific challenge is the design and implementation of an optimistic replication mechanism for the dissemination and merge of concurrent updates occurred of different copies of a shared document. This mechanism should not use a reference copy and should support sites that frequently join/leave the overlay network. The partners of the project are: XperNet (XWiki editor), Mandriva (Linux editor), ENST, EISTI, Objectweb and the INRIA Projects ATLAS and ECOO.

## 8. Other Grants and Activities

### 8.1. Regional actions

The COWS action of the CPER Intelligence Logicielle (Software Intelligence, axis “Quality and Safety of software”, 2006-2007) is developed by the CASSIS and ECOO projects. Its goal is to study how constraint reasoning can apply to the design of secure Web services. A first objective is to formally specify the composition of web services. A second objective concerns the coordination of a set of services guaranteeing that executions conform to what is expected by parties. A last objective is the development of composed services, including exception management. COWS terminated by the end of 2007.

This PSW (Proof of Services Web, 2007-2008) project of the CPER MISN, axis "safety and security of systems", aims at developing a formal technique framework for Web services composition in order to address security and safety issues. A first goal is the specification of a formal framework for a flexible composition of Web services. These Web services are viewed as base component of the service-oriented architectures. A second goal concerns the use of automated formal proof techniques at different stages of the composition process. Finally, a third goal is to create (and/or adapt) automated formal proof environments to master efficiently the behavior of software components in order to validate critical properties such as correctness, completeness and conformity. PSW has started by the end of 2007.

The ICRISIS project (funded by MEDD) is an interdisciplinary project that aims to produce a conceptual and technological framework to support and execute crisis simulations. It should allow to prepare, execute and analyze crisis simulation involving students or professionals. Crisis management is a major concern in our society. It is very important to provide future and actual managers with a pedagogical framework to allow them to learn how to act and react in a highly unanticipated situation. The project will help to develop and assess methods and tools to support crisis simulation preparation, execution and analysis. Regarding ECOO, this project is a challenge because crisis management is a case where the limit of classical process management solutions is reached. Reactivity, adaptivity and flexibility, human interactions are in this context required to the extreme. We expect interesting results from the experimentation that will be conducted in the context of the various simulations that will take place during the project. Partners of the project are Laego Team of Ecole des Mines (Leader of the project), Beta-Nancy 2, LabPsyLor from Nancy 2 and UPV, Erpi from ESGI, LSG from ENSIC. Participants to the simulation come from the SDIS 54, the Nancy prefecture and France Bleu.

## 8.2. National actions

COPS (Composition Of Policies and Services, 2006-2008) is an ARA action interested in modelling security properties, composition of web services integrating security properties and guaranties, and monitoring of services conversations for preserving security policies. COPS involves LORIA Nancy, IRIT Toulouse, LIF Marseille and MS R&D Cambridge.

The RECALL ARC (<http://recall.loria.fr>) has started in 2006 and ended by the end of 2007. We observed that the data sharing in P2P networks relies on a massive replication of data. The main problem is to maintain the consistency of replicas in case of concurrent updates. Unfortunately, existing algorithms do not scale or do not preserve semantic of the application. Our objective was to develop a new algorithm to deploy collaborative application such as wikis, blogs, CMS or forges on P2P networks.

Ecoo participates to the working groups *Services Web* and *UbiMob* (Ubiquity, Mobility) of GDR I3 and to the GDR MACS ECI.

We participate to several contracts with national enterprises (cf. 7.2).

We collaborate with several French laboratories and universities in the context of the INTEROP Network of Excellence (see 8.3).

## 8.3. European actions

### 8.3.1. Network of Excellence INTEROP (2004-2007)

**Participants:** Nacer Boudjlida [responsible], Khalid Benali, François Charoy, Dong Chen, Walid Gaaloul, Claude Godart, Adnene Guabtini, Olivier Perrin, Pascal Urso.

ECOO team's members were involved in INTEROP, a European Network of Excellence (NoE, <http://interop-vlab.eu/>) who aimed at improving interoperability solutions thanks to the summing up of concepts and techniques coming from three domains: (enterprise) systems modelling, semantics (ontology), software system architectures and platforms. Besides chairing the NoE technical committee (N. Boudjlida) during the whole duration of the NoE activities (November 2003-April 2007), ECOO members played a central role in this network thanks to their involvement in the three types of activities that usually compose a NoE work plan.



(i) Considering the set of the so-called “*Integrating activities*”, ECOO members contributed to the (early) specifications and to the (final) evaluation of the implementation of an ontology-based system, called the Knowledge Map system, that aims at defining, storing, retrieving and reasoning on individuals’ as well as on institutions’ capabilities. This system is founded on an initial ontology for the interoperability domain.

(ii) Considering the so-called “*Joint research activities*”, ECOO members contributed to semantic-based and model-based solutions for interoperability thanks to semantic annotation of models (see 6.4).

Last but not least, a final contribution to the INTEROP NoE concerned its sustainability beyond the European Commission fundings. Indeed, N. Boudjlida was a member of the Virtual Laboratory Task Force which was in charge of defining a European-wide distributed research laboratory on the interoperability topic (INTEROP V-Lab).

#### 8.3.1.1. Interop V-Lab.

The INTEROP V-Lab (<http://www.interop-vlab.eu/>) has been officially created in Brussels on March 2007 as an international non-profit making association (serving the international interest). In this context, Nancy played also a leading role in the definition of the so-called INTEROP V-Lab “pole” (a partner of the INTEROP V-Lab): the Grande Region pole. The Grande Region pole encompasses Luxembourg (Centre de Recherche Public Henri Tudor), Belgium (University of Namur) and North-Eastern France (Nancy Université, UHP Nancy 1) and it is defined as a Scientific (International) Interest Group (Groupement d’Intérêt Scientifique or GIS). Its attachment to the INTEROP V-Lab is still running.

#### 8.3.2. IP Qualipso (2006-2010)

**Participants:** Pascal Molli [Responsible], Jérôme Blanchard, François Charoy, Claude Godart, Gérald Oster.

The goal of the QualiPSO integrated project (No 034763) is to define and implement technologies, procedures and policies to leverage the Open Source Software development current practices to sound and well recognised and established industrial operations.

ECOO is especially concerned with the specification and the development of the Qualipso factory.

## 8.4. International Actions

### 8.4.1. Conference program committees and organizations

We have organized in Nancy the 7th international conference on Web Information Systems Engineering (WISE 2007). We will organize the 9th IFIP conference on e-Business, e-Services and e-Society (I3E 2009).

Nacer Boudjlida has been or is Program Committee member of the 3rd (2007) and 4th (2008) International Conference on Interoperability of Enterprise Systems and Applications, CAISE (Computer Assisted Information Systems) 2007 and 2008, and of several workshops.

François Charoy has been local organizer of the Wise (Web Information Systems Engineering) conference, program committee member of this conference, and of several workshops.

Claude Godart has been general chair of Wise 2007 (Web Information Systems Engineering) organized in Nancy by INRIA and Nancy University. He has been programme co-chair of the International Workshop on Governance, Risks, and Compliance in Web Information Systems. He has been or is program committee member of BPM (Business Process Management) 2007 and 2008, CAISE(Computer Assisted Information Systems Engineering) 2007 and 2008, Collaborative Computing (CollaborateComm) 2007, EDOC (The enterprise computing conference) 2007, Electronic Commerce (IEEE CEC) 2007 and 2008, EEE(Enterprise Computing, E-Commerce and E-Services) 2007 and 2008, ICSOC 2007 and 2008 (IC on Service Oriented Computing), Saint (Symposium on Applications and the Internet) 2007 and 2008, SCC (Service Computing Conference) 2007 and 2008, and of several workshops.

Claudia Ignat and Pascal Molli has been program co-chair of the International Workshop on Collaborative Editing Systems in conjunction with Group 2007.

Olivier Perrin is or has been Program Committee member of BPM (Business Process Management) 2007 and 2008, of Wise (Web Information Systems Engineering) 2007, and of several workshops.

Hala Skaf-Molli has been or is regular Program Committee member of ICEIS (Conference on Enterprise Information Systems) 2007 and 2008, IFIP CONFENIS (Conference on Research and Practical Issues of Enterprise Information Systems) 2007, ICCTA (International Conference on Information and communication Technologies: from theory to application) 2008.

#### **8.4.2. Postdoctoral cooperation**

Walid Gaaloul, ECOO PHD has joined in November 2005 Manfred Hauswirth "Web Semantics" group at University of DERI, Ireland, for two years.

Adnene Guabtni, ECOO PHD has joined in June 2007 Fethi Rabhi and Boualem Benatallah at University of New South Wales in Sydney, Australia, for two years.

#### **8.4.3. Co-advisory of thesis**

Thesis of Charbel Rahhal with University Lebanese of Beyrouth (2006-2009): collaborative editing processes for peer-to-peer networks (Pascal Molli).

Thesis of Ustun Yildiz with University of Luxembourg and CRPGL (Centre de recherche Public de Luxembourg)(2004-2008): process decentralization and decentralized processes (Claude Godart).

Thesis of Hassina Talankikite with Bejaïa University, Algeria (Nacer Boudjlida).

Thesis of Salah Hamr with Constantine University, Algeria (Nacer Boudjlida).

#### **8.4.4. Liban, Rorax, CEDRE project**

During collaborative writing, shared documents are replicated on geographically distant sites. Each user works on an individual copy. This results in divergent copies. Merging techniques such as those proposed by the Operational Transformation approach reconcile the differences among the replicas and ensure their convergence. Although the merging techniques resolve conflicting syntax, they do not help preserve semantic coherence which is an important aspect of an effective document. The objective of RORAX is to ensure the semantic coherence of merged documents.

RORAX is a financed by CEDRE, the French-Libanese program of the scientific cooperation. It is a joint project between the university Henri Poincaré and the Libanese University. The responsible of the project in France is Hala Skaf-Molli and the responsible in Lebanon is Hala Naja-Jazzar.

#### **8.4.5. Tunisie, eGov, INRIA-DGRST project**

This project involves the ECOO LORIA team-project from Nancy, the SOC team from the IRIT lab in Toulouse and the SOIE team from ENSI in Tunis.

The Egov project is a franco-tunisian project funded by the DGRST and INRIA. Its goal is to combine multi-agent technology and workflow technology to enhance the flexibility of process execution involving multiple government agencies. The project aims at tackling the problems related to organisational mismatches between agencies and to semantic interoperability. In this context, the interaction models used in multi agent systems could be adapted to model the subtlety of interactions (negotiation, contract management, mediation, argumentation) between citizens, government agencies and other organisation. During this two years project, we expect to provide a model and a framework that will support the flexibility of interactions that may occur. Two approaches will be considered, one with a centralised control on the administrative process and the other with a control distributed among organisations.

#### **8.4.6. Chili, CoreWeb, INRIA-CONICYT project**

We are working with the CASSIS project and the UTFSM (Valparaiso, Chile) on applying constraint programming techniques for the Web services composition problem. Our first contribution allows us to use a constraint model to instantiate a given abstract composition by selecting the most appropriate concrete Web services with respect to a given query. Then, the concrete composition is built using an incremental scenario by propagating the constraints attached to the Web services. An important aspect is that the instantiation can be dynamically updated during the execution via a monitoring phase.

#### **8.4.7. South America, Semantic-based support for Collaborative Design Activity, Stic-Amsud project**

The project includes Loria/Ecoo and Loria/Orpailleur, Lifa-UNLP (argentina), SCC-Universidade de Sao Paulo (Brasil), and UTFSM-Valparaiso (Chile)

This project is to apply Semantic Web technologies to better support computer-based collaborative design systems. It will deal with the problem of building software support for collaborative design activities guided by domain knowledge. This infrastructure uses domain ontologies to help designers in assembling design components by helping them in searching adequate components, detecting conflicts, searching related documents, finding people with the adequate skills, etc. This design work can be done by several people distributed in time, space and organizations. The main research lines are knowledge representation for design activities and processes, support for collaborative design activities, with a particular focus on coherence/divergence support, coordination and awareness, knowledge management for design processes.

### **8.5. Visits, Invitations**

Olivera Marjanovic, Faculty of Economics and Business, University of Sydney, has visited us during one month in June 2007.

## **9. Dissemination**

### **9.1. Scientific Community Animation**

Nacer Boudjlida has been chair of the technical committee of the INTEROP Network of Excellence. He is study director of the master degree Software Intelligence at the University Henri Poincaré Nancy 1.

Claude Godart is head of the recruitment committee of the University Henri Poincaré Nancy 1 (Computer Sciences, 27th section). He is study director of the research master degree "Distributed Services and Networks". He has been member of the recruitment committee of the University of Luxembourg (Computer Sciences, Faculty of Information Systems) from 2003 to 2005. He is member of the Scientific Committee of the Laboratory of Computer Sciences of Littoral (LIL). He has been evaluator for France Telecom R&D (World Class Jury), evaluator for LAFMI (French/Mexican Laboratory), Professor at CEA/EDF/INRIA summer school 2005 (theme: Cooperative Work), evaluator of a laboratory for the CENAR (Comité National d'Evaluation des Activités de Recherche, Tunisia). He has been general chair of WISE 2007 and will be general chair of IFIP I3E 2009.

### **9.2. Teaching**

ECOO members have important responsibilities and are leading teachers in several cursus in Nancy University (University Henri Poincaré Nancy 1, University Nancy 2 and INPL), at different levels, including third cycle (Research Master, ESIAL, ESSTIN, Professional Master).

## 10. Bibliography

### Year Publications

#### Books and Monographs

- [1] B. BENATALLAH, F. CASATI, D. GEORGAKOPOULOS, C. BARTOLINI, W. SADIQ, C. GODART (editors). *Web Information Systems Engineering conference proceedings*, Springer, LNCS 4831, December 2007.
- [2] N. BOUDJLIDA, D. CHENG, N. GUELFY (editors). *The 18th Conference on Advanced Information Systems Engineering (CAiSE '06), Forum Proceedings, Theme: Trusted Information Systems, Luxembourg, June 5-9, 2006*, CEUR Workshop Proceedings, vol. 231, CEUR-WS.org, 2007.
- [3] M. WESKE, M.-S. HACID, C. GODART (editors). *Web Information Systems Engineering workshops proceedings*, Springer, LNCS 4832, December 2007.

#### Doctoral dissertations and Habilitation theses

- [4] A. GUABTNI. *Sphères de comportement pour la modélisation et l'exécution de procédés flexibles*, Thèse de doctorat, Ph. D. Thesis, Université Henri Poincaré - Nancy1, Ecole doctorale IAEM Lorraine, Avril 2007.
- [5] P. MOLLI. *Cohérence de données dans les environnements collaboratifs*, Habilitation à diriger des recherches, Ph. D. Thesis, Université Henri Poincaré - Nancy1, Ecole doctorale IAEM Lorraine, mai 2007.

#### Articles in refereed journals and book chapters

- [6] F. DANESHGAR, G. CANALS, A. DIAZ. *An Awareness Framework for Divergence Knowledge Communities.*, in "Encyclopedia of E-Collaboration", N. F. KOCK (editor), Information Science Reference, 2007, <http://hal.inria.fr/inria-00169743/en/>.
- [7] O. MARJANOVIC, H. SKAF-MOLLI, P. MOLLI, C. GODART. *Innovative Learning Designs Enabled by Process-Driven Collaborative Editing*, in "Journal of Educational Technology and Society", vol. 10(1), 2007, p. 124–135.

#### Publications in Conferences and Workshops

- [8] N. BOUDJLIDA, H. PANETTO. *Enterprise Semantic Modelling for Interoperability*, in "Proceedings of the 12th IEEE International Conference on Emerging Technologies and Factory Automation, ETFA 2007, 25-28 September, Patras, Greece", 2007.
- [9] A. DIAZ, G. CANALS. *The collaborative knowledge sharing framework*, in "International IADIS International Conference e-Society - IADIS 2007, Lisbon Portugal", 2007, <http://hal.inria.fr/inria-00169738/en/>.
- [10] W. GAALLOUL, M. ROUACHED, S. BHIRI, C. GODART, M. HAUSWIRTH. *Formal Verification of Composite Service Recovery Mechanisms Consistency*, in "Proceeding of the International Conference on Collaborative Computing: Networking, Applications and Worksharing (CollaborateCom 2007), New York", IEEE Press, 2007.

- [11] W. GAALLOUL, M. ROUACHED, C. GODART, M. HAUSWIRTH. *Verifying Composite Service Recovery Mechanisms: A Transactional Approach based on Event Calculus*, in "Proceedings of the 15 th International Conference on Cooperative Information Systems (COOPIS)", LNCS, Springer, 2007.
- [12] K. GAALLOUL, F. CHAROY, A. SCHAAD, H. LEE. *Collaboration for Human-Centric eGovernment Workflows*, in "Governance, Risk and Compliance in Web Information Systems - Workshop in Conjunction with WISE2007, Nancy France", Lecture Notes in Computer Science, vol. 4832, Springer Berlin / Heidelberg, 2007, p. 195-206, <http://hal.inria.fr/inria-00182290/en/>.
- [13] S. HAMRI, N. BOUDJLIDA, M. BOUFAIDA. *An approach for building an OWL Ontology for Workflow Interoperability*, in "Proceedings of the 3rd International Conference on Interoperability of Enterprise Software and Applications, Madere, Portugal", R. GONÇALVES, J. MÜLLER, K. MERTINS, M. ZELM (editors), ISBN: 978-1-84628-857-9, Springer-Verlag, March 2007, p. 357–364.
- [14] C.-L. IGNAT, G. OSTER. *Flexible Reconciliation of XML Documents in Asynchronous Editing*, in "Proceedings of the International Conference on Enterprise Information Systems: Software Agents and Internet Computing - ICEIS 2007, Funchal, Madeira, Portugal", June 2007, p. 359–366.
- [15] C. IGNAT, G. OSTER, P. MOLLI, M. CART, J. FERRIÉ, A.-M. KERMARREC, P. SUTRA, M. SHAPIRO, L. BENMOUFFOK, J.-M. BUSCA, R. GUERRAOLI. *A Comparison of Optimistic Approaches to Collaborative Editing of Wiki Pages*, in "Proceedings of the International Conference on Collaborative Computing: Networking, Applications and Worksharing - CollaborateCom 2007, White Plains, New York, USA", November 2007.
- [16] C.-L. IGNAT, G. OSTER, P. MOLLI, H. SKAF-MOLLI. *A Collaborative Writing Mode for Avoiding Blind Modifications*, in "Proceedings of the Ninth International Workshop on Collaborative Editing Systems, GROUP 2007, IEEE Distributed Systems Online, Sanibel Island, Florida, USA", November 2007.
- [17] G. OSTER, H. SKAF-MOLLI, P. MOLLI, H. NAJA-JAZZAR. *Supporting Collaborative Writing of XML Documents*, in "Proceedings of the International Conference on Enterprise Information Systems: Software Agents and Internet Computing - ICEIS 2007, Funchal, Madeira, Portugal", June 2007, p. 335–342.
- [18] S. PAPADOPOULOU, C.-L. IGNAT, M. C. NORRIE. *Awareness Model to Overview Modifications in Collaborative Graphical Authoring Tools*, in "Proceedings of the Ninth International Workshop on Collaborative Editing Systems, GROUP 2007, IEEE Distributed Systems Online, Sanibel Island, Florida, USA", November 2007.
- [19] C. RAHHAL, H. SKAF-MOLLI, P. MOLLI, N. D. SILVA. *SemCW: Semantic Collaborative Writing using RST*, in "The 3rd International Conference on Collaborative Computing: Networking, Applications and Worksharing - CollaborateCom 2007, New York, USA", nov 2007.
- [20] M. ROUACHED, C. GODART. *Reasoning about Events to Specify Authorization Policies for Web Services Composition*, in "Proceedings of the 5 th IEEE International Conference on Web Services, ICWS", L.-J. (. ZHANG, K. P. BIRMAN, J. ZHANG (editors), IEEE Computer Society Press, 2007, p. 481-488.
- [21] M. ROUACHED, C. GODART. *Requirements-driven Verification of WSBPEL Processes*, in "Proceedings of the 5 th IEEE International Conference on Web Services, ICWS", L.-J. (. ZHANG, K. P. BIRMAN, J. ZHANG (editors), IEEE Computer Society Press, 2007, p. 354-363.

- [22] M. ROUACHED, C. GODART. *Specification and Verification of Authorization Policies for Web Services Composition*, in "CAISE Forum", CEUR Workshop Proceedings, vol. 247, CEUR-WS.org, 2007.
- [23] S. SADIQ, C. GODART, M. ZUR MUEHLEN. *Introduction to the WISE Governance, Risk and Compliance in Web Information Systems Workshop*, in "Governance, Risk and Compliance in Web Information Systems - Workshop in Conjunction with WISE 2007, Nancy France", LNCS, vol. 4832, Springer, 2007, p. 111-112.
- [24] S. WEISS, P. URSO, P. MOLLI. *Compensation in Collaborative Editing*, in "Proceedings of the Ninth International Workshop on Collaborative Editing Systems, GROUP 2007, IEEE Distributed Systems Online, Sanibel Island, Florida, USA", November 2007.
- [25] S. WEISS, P. URSO, P. MOLLI. *Wooki: a P2P Wiki-based Collaborative Writing Tool*, in "Proceedings of the International Conference on Web Information Systems Engineering - WISE 2007, Nancy, France", LNCS 4831, Springer, December 2007.
- [26] U. YILDIZ, C. GODART. *Centralized versus Decentralized Conversation-based Orchestrations*, in "Proceedings of the IEEE Joint Conference on E-Commerce Technology and Enterprise Computing, E-Commerce and E-Services, CEC/EEE, Japan", IEEE Computer Society Press, 2007, p. 289-296.
- [27] U. YILDIZ, C. GODART. *Dynamic Decentralized Service Orchestrations*, in "Proceedings of the 3 th International Conference on Web Information Systems and Technologies, WEBIST, Spain", J. FILIPE, J. CORDEIRO, B. ENCARNACAO, V. PEDROSA (editors), INSTICC Press, 2007, p. 36-45.
- [28] U. YILDIZ, C. GODART. *Enhancing Secured Service Interoperability with Decentralized Orchestration*, in "Proceedings of the 23 th International Conference on Data Engineering Workshops, ICDE Workshops, Turkey", V. ORIA, A. ELMAGARMID, F. LOCHOVSKY, Y. SAYGIN (editors), IEEE Computer Society Press, 2007, p. 725-733.
- [29] U. YILDIZ, C. GODART. *Information Flow Control with Decentralized Service Compositions*, in "Proceedings of the 5 th IEEE International Conference on Web Services, ICWS, USA", L.-J. (. ZHANG, K. P. BIRMAN, J. ZHANG (editors), IEEE Computer Society Press, 2007, p. 9-17.
- [30] U. YILDIZ, C. GODART. *Synchronization Solutions for Decentralized Service Orchestrations*, in "Proceedings of the Second IEEE International Conference on Internet and Web Applications and Services, ICIW, Mauritius", S. GALIZIA, ET AL (editors), IEEE Computer Society Press, 2007.
- [31] U. YILDIZ, C. GODART. *Towards Decentralized Service Orchestrations*, in "Proceedings of the 27 th ACM Symposium on Applied Computing, SAC, Korea", S. OSSOWSKI, R. MENEZES (editors), ACM Press, 2007, p. 1662-1666.

## References in notes

- [32] C.-L. IGNAT, M. C. NORRIE. *Multi-level Editing of Hierarchical Documents*, in "Journal of Computer Supported Cooperative Work", to appear.
- [33] H. SCHULDT, G. ALONSO, C. BEERI, H.-J. SCHEK. *Atomicity and Isolation for Transactional Processes*, in "ACM TODS", vol. 27, n<sup>o</sup> 1, 2002, p. 1-53.
- [34] WFMC. *Workflow Management Coalition*, Technical report, AIIIM, 1995.