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INSTITUT NATIONAL DE RECHERCHE EN INFORMATIQUE ET EN AUTOMATIQUE

Project-Team ECOO

Middleware for supporting cooperative work through Internet

Lorraine

THEME COG

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2. Overall Objectives

2.1. Overall Objectives

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

The ECOO project is interested in the development of Web information systems, with a focus on services for deploying distributed teams and virtual enterprises on the Internet. Related services include data sharing, task management, and group awareness services.

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.

Difficult research problems related to this problematic and addressed by ECOO this last three years are:

- consistency maintenance of semantically linked data,
- consistency maintenance of replicas of the same data,
- context based awareness,
- integration of these dimensions.

In the next few years we will concentrate our work on the two first topics revisited as:

- process modelling, collaborative processing,
- collaborative editing.

The awareness dimension will be considered from the point of view of these two topics.

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

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 [39], 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 characteristics of our approach is the consideration that, in a lot of application, 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, mobile ... Especially, the Isolation property seems problematic for interacting activities exchanging intermediate results in complex feedback loops. To surpass the limits of traditional transaction models, several well founded or exotic models have been proposed.

Regarding the transactional problematic, 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 like CVS are used since several years by thousands of software developers. We can even say that the *copy/modify/merge* paradigm is one of the more concrete 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 develop 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 implicate 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 nature: 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 (e-commerce, business process, cooperative software development, co-design and co-engineering ...).

5. Software

5.1. Introduction

All the softwares listed in this section have not reached the same level of diffusion. Bonita is distributed with a GPL License as an ObjectWeb project and continue to evolve without ECOO direct implication. LibreSource has just been released with a QPL License. Its evolutions are under the control of an architects board leaded by the Artenum company. jXyDiff is a library distributed by INRIA. PROM is a joint work within a community of people implied in process mining. WSCompositionEditor and Sams are prototypes in which we feel a lot of possibilities.

5.2. Bonita flexible workflow management system

Participants: François Charoy [responsible], Claude Godart, Pascal Molli.

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 is 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 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 BeanShel scripting language. Bonita is available as an ObjectWeb project on the ObjectWeb forge (http://bonita.forge.objectweb.org/).

5.3. LibreSource: services for hosting virtual teams

Participants: Pascal Molli [responsible], Guillaume Bort, François Charoy, Claude Godart, Florent Jouille, Sébastien Jourdain, 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 inovative point is the fact that the synchonizer can be distributed on several sides, 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. It has been developed in the frame of the RNTL PureSource project (cf. 7.1).

5.4. jXyDiff: XML diff. algorithm

Participants: Pascal Molli [responsable], Sébastien Jourdain.

jXyDiff is a Java implementation of the XyDiff algorithm [29] which provides for finding differencies between XML files. It has been implemented in cooperation with the Gemo project of INRIA Futurs.

5.5. PROM mining plug-ins

Participants: Walid Gaaloul [responsible], Claude Godart.

We have provided the PROM 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.

The ProM framework (http://www.processmining.org) is a pluggable framework developped by a community concerned with process mining. It supports a variety of process management techniques and can be extended by simply adding plug-ins, i.e., there is no need to know or recompile the source code. Currently, more than 30 plug-ins have been added. The architecture of ProM allows for five different types of plug-ins.

5.6. WSCompositionEditor

Participants: Olivier Perrin [responsible], Sami Bhiri, Claude Godart.

WSCompositionEditor allows a designer to graphically composes (Web) Services with patterns for defining Composite (Web) Services. Service descriptions can be refined with transactional properties. The editor is associated an environment allowing simulating the transactional behavior of Composite Services, i.e. how they globally behave in case of failure. Simulation is based on an extension of Bonita (http://bonita.objectweb.org/) with plug-ins to manage transactional properties. This extended Bonita can also be used as a process engine to execute composite services. All is written in Java.

5.7. SAMS: Synchronous, Asynchronous, MultiSynchronous editor

Participants: Pascal Molli [responsible], Sébastien Jourdain, Gérald Oster.

In the context of cooperative work, a team alternates divergence phases where each member works in insulation on copies of objects and convergence phases during which the group reconciles and validates data. To support this style of working, we propose the concept of SAMS environments. A SAMS environment allows team members to work in Synchronous, Asynchronous or Multi-Synchronous mode while ensuring the coherence of shared data. Users of SAMS environment can choose interaction mode according to their needs, and the environment will ensure the coherence of data. Sams is available freely at http://woinville.loria.fr/sams.

5.8. Coopera: cooperation for everybody

Participants: François Charoy [responsible], Claude Godart.

Coopera allows a virtual team to organize, and its participants to cooperate. Its objective are in the vein of BSCW and SourceForge but with a focus on coordination and a simplified interface and architecture that put the power of version management at the range of almost everybody.

This result has been obtained thanks to several usage analyses: cooperation between several classrooms of several primary schools [6] and continuing education of nurses distributed through France.

It integrates services for object sharing, communicating, task management and group awareness. Object sharing supports file versioning and access right control. Classical synchronous and asynchronous communication tools are integrated. Task management provides to-do-lists and flexible workflows. One characteristic of Coopera is the provision of awareness, and especially state awareness in different visualization forms.

Coopera http://coopera.loria.fr is implemented with basic Web technologies (HTTP, PHP, Mysql ...) and can be easily deployed. It has been developed in the frame of the Coopera project from the RIAM network.

6. New Results

6.1. Transactional consistency, process concurrency, Web processes

6.1.1. Introduction

We are now exploring process in two main directions ”Extending workflow management systems to support the subtlety of creative interactions” and ”Concurrency and atomicity of long term interactive processes”. This is motivated by the observation that in a real complex cooperative development there is not one well defined process, but several, only partly specified processes that co-habit and interact. How to support concurrency between processes having their proper internal control structure, potentially instantiated from different process models? How to discover processes, and especially cooperation rules from logs of process executions when these processes are not explicitly defined? These two questions are related each to the other by the fundamental need to characterize and formalize cooperative interactions. Concerning concurrency between processes, the idea is, in opposition with the state of the art which mainly founds atomicity on isolation, to take advantage of the structure and the semantics of processes to increase the synergy and the parallelism between processes. Concerning, process discovery, the objective is to find out cooperation patterns and how processes are related each to others in a given application. We see the application of this research naturally in the coordination of multi-user creative applications.

This year main contributions are:

- the definition of a framework for combining (Web) services with transactional properties and for validating such combination,
- an algorithm for mining workflow patterns with transactional properties, and for mining and improving recovery strategies.

6.1.2. Transactional Web services composition

Participants: Sami Bhiri, Walid Gaaloul, Claude Godart, Olivier Perrin.

The Web services approach is extending the role of the Web from a support of information interaction to a middleware for B2B interactions. One of the interesting concepts that this technology offers is the possibility to define a new service by combining existing Web services. We are interested in ensuring reliable Web services composition; such a composite service (CS) can be also seen as a process that executes on the Web.

For that purpose, we propose a model that extends Web services description to better express their transactional properties and that extends and merge workflow and advanced transactional models (ATM) concepts to better support composite Web services reliability. To support designers in the definition of reliable composite Web services, we have developed three approaches [2].

Contrary to ATM, the first approach starts from designers requirements to determine the transactional mechanisms ensuring correct executions [9]. The second approach is based on the concept of *Transactional Workflow Patterns* [8]. A *Transactional Workflow Pattern* is a pattern that extends workflow patterns with transactional properties. Workflow patterns allow a designer to define a composite Web service by connecting together a set of transactional patterns. Accordingly, we propose a set of coherence rules to ensure such defined CS reliability. The third approach proceeds by reengineering the composite service (CS) [19]. This approach allows improving CS recovery mechanisms by analysing its executions traces.

One important characteristic of our model is that the correctness criteria is explicitly defined by the process designers.

6.1.3. Mining process patterns using transactional properties and mining transactional properties

Participants: Sami Bhiri, Walid Gaaloul, Claude Godart, Mohsen Rouached.

Our aim is to develop a model (theory and tools) that allows the mining of concurrent and transactional process behaviour from event-based logs. Our work rests on data mining and workflow mining in general, but also on transactional interactions discovery. Our objective is to surpass the limits of current work to discover more transactional characteristics like activity properties (retriable, pivot, compensatable) and recovery rules.

For this purpose, we have proposed a new approach [18] to discover workflow patterns by statistically analyzing workflow logs. This approach proposes new mechanisms that allow the analysis of incomplete logs and a better specification of the transactional properties. Concretely, based on a dynamic mechanism of log concurrent window sliding, we can better specify [18] "join" and "fork" points and improve the discovery of activities concurrent behaviour.

Thereafter, we have proposed an algorithm [20] to improve the recovery management of processes. For this purpose, first we discover transactional dependencies between activities and activity states, especially after failures and recovery, and then we propose rules to correct or/and improve these recovery mechanisms if they do not meet the discovered design requirements.

This is being implemented in the process mining platform PROM (http://www.processmining.org) in the frame of a cooperation with the TU/e Eindhoven.

This work will continue in two directions: first a better characterization of process transactional behaviour, especially we think by better exploiting data flow analysis while we have concentrated until now on control flow analysis. Also we start a study on Web services mining.

6.1.4. Spheres of atomicity

Participants: François Charoy, Adnene Guabtni.

Current business process management systems allow composing and coordinating services on heterogeneous distributed systems. They are based on a service oriented architecture (SoA). This approach implies new hypothesis regarding data management that are not anymore controlled by a single organisation. Moreover, although existing systems allow describing complex processes, they do not provide a flexible framework to describe the required quality of the execution: safety, security, reliability. The goal of this work is to allow

separating the concerns regarding the definition of the coordination requirement (the process) and the definition of the execution requirement (the execution of the process). We propose to express the required execution quality of processes or fragment processes.

Our approach follows the work of Davies on Sphere of control [30] and tries to generalise the work of Alonso on Atomicity and Isolation of process execution [33]. We propose to attach execution properties to subset of processes that we call transactional spheres. A sphere is a set of activities inside a process. Our model allows ensuring some properties based on different criteria on the execution of these activities. For instance, it allows ensuring that the view on data is the same for all activities of the sphere (cohesion). It also allows ensuring that the execution of the activities of the sphere is serializable with other concurrent spheres or processes (coherence). These different levels are described in [22], [21].

6.1.5. e-Contracting

Participants: Claude Godart, Olivier Perrin, Mohsen Rouached, Ustun Yildiz.

A contract is a statement of intent that regulates behaviour among organizations and individuals. An electronic contract is its reification in software that can be instantiated as a set of obligations that are fulfilled between parties, refused or waived as future events occur. (Towards the Electronic Contract, M. Morciniec, C. Bartolini, B. Monahan, M. Sallé, HP Labs.)

In some way a contract is a shalllow process definition that occurs when there is a lot of competion between the business partners, or simply when the cooperation process is weakly defined. We are interested in this approach as a mean to define and deploy light weight processes. A study in the context of *software process* with the Centre de Recherche Gabriel Lipmann (Luxembourg) has started. First ideas are described in [28], [27].

6.1.6. Perspectives

This year contributions regarding concurrency control of processes are of very high level or are very promisong. Nevertheless this problematics needs yet a lot of work. Especially, the work at the junction between the combination of transactional activities on one hand, and process mining et the other hand, i.e. a good characterization and formalization of process interaction patterns, is very sensitive.

Ongoing work concerns the management of more complex activity dependencies than these currently considered for activity combination, and the discovery of complex properties like compensation properties, what has not yet been completely achieved. The idea of recovery spheres needs also to be consedered in the context of service composition and more deeply in process mining.

A last point concerning our perspectives on this topic is the explosion of the research about business processes in general (driven by Web processes) and collaborative processes in particular. This clearly underlines the interest of our current orientation.

6.2. Operational transformations

6.2.1. Automatic proving of transformation functions

Participants: Pascal Molli, Gerald Oster, Hala Skaf-Molli, Pascal Urso.

Real-time groupware systems allow a group of users to manipulate the same object (i.e. a text, an image, a graphic, etc.) at the same time from physically dispersed sites that are interconnected by a supposed reliable network. In order to achieve good responsiveness and friendly collaboration, the shared objects are replicated at the local memory of each participating user. One of the most significant issues in building real-time groupware systems with replicated architecture is consistency maintenance of shared objects [38].

Operational transformation is an approach [31], [34] which allows to build real-time groupware like shared editors. Algorithms like aDOPTed [32], GOTO [37], SOCT 2,3,4 [36] are used to maintain the consistency of shared data. However these algorithms rely on the definition of transformation functions. If these functions are not correct then these algorithms cannot ensure the consistency of shared data.Proving the correctness of transformation functions even on a simple typed object like a String is a complex task.

If we have more operations on more complex typed objects, the proof is almost impossible without a computer. This is a serious bottleneck for building more complex real-time groupware software. We propose to assist development of transformation functions with SPIKE , an automated theorem prover which is suitable for reasoning about functions defined by conditional rewrite rules [35]. This approach requires specifying the transformation functions in first order logic. Then, SPIKE automatically determines thecorrectness of transformation functions. If correctness is violated, SPIKE returns counter-examples. Since the proofs are automatic, we can handle more (even complex) operations and develop quickly correct transformation functions. We have found this year many counter-examples to existing transformation function [25]. We have proposed new set of correct transformation functions [7], [23].

6.2.2. Perspectives

Collaborative editing allows users to edit the same text from multiple sites across Internet. For example, recently collaborative editing allowed Wikipedia to collect more than 1,600,000 articles in more than 100 languages. Moreover, more than 13 millions of page requests per day and more than 4,000 changes are made every day by more than 12,000 active writers. Thus, Wikipedia is an example of massive collaborative editing. Scalability is one of the key issues for massive collaborative editing. For example, Wikipedia uses a database pessimistic replication approach. Thus all changes are routed on a single master database that propagates changes to slaves within distributed atomic transactions. Consequently, the master database is a congestion point that limits scalability of this approach. Wikipedia relies on ”brutal force” to handle this load. On the one hand, the optimistic replication approach greatly improves performances. It can be deployed on peer-to-peer network and scales with cheap resources. On the other hand, it is more difficult to ensure consistency. Traditionally, the optimistic replication systems ensure eventual consistency i.e. replicas can diverge but must converge when system is idle. Optimistic replication is suited for collaborative editing. CVS, real-time group editors are good examples of optimistic replication algorithms applied to collaborative editing. However, these systems have not been designed for massive collaborative editing. Consequently, they often require a central site, a total ordering, a consensus or vector clocks. These well known mechanisms or algorithms are not designed for a large number of sites. The main issue for massive collaborative editing systems, based on optimistic replication, is to ensure eventual consistency and scalability. So far, only Usenet and DNS ensure both eventual consistency and scalability. However, they are not suited for collaborative editing. WOOT [23], [4] is an optimistic replication algorithm designed for massive collaborative editing. It does not require the central site, total ordering, consensus or vector clocks. It does not use the number of sites as its parameter. It is designed to be deployed on a very large peer-to-peer network. WOOT can be used to developp collaborative environement for e-learning, software-engineering (P2P configuration management), content management (P2P wiki)...

6.3. Group awareness

Group awareness models and mechanisms have a central situation in the cooperative applications that we are concerned with, because they interact directly with users and are largely responsible for tool acceptation. They allow each participant to be aware of other participants activities, enhancing in this way the synergy, the coordination, the communication and the social links in the group.

We develop two main activities related to awareness in groupware systems. The first one focus on awareness and context, and the second one is dedicated to awareness in knowledge management systems.

6.3.1. Group Awareness and Context

Participants: Gérôme Canals, Christophe Bouthier, Sauwsan Alshattnawi.

The aim of this work is to build awareness mechanisms capable of scaling up to large groups and supporting important heterogeneity in usage situations. Our approach to address theses two requirements is based on adapting the awareness service to the local work and usage context of each user. Delivered awareness information and the delivery modalities are then specific to each user depending on their role, activity, interaction modality, personal preferences, and device, and thus more pertinent to the individual situation.

A first step toward this goal was to build a peer-to-peer architecture for a context based awareness service. This architecture was implemented in an experimental prototype [11]. This architecture is based on an explicit context representation at each peer. This representation is based on a set of Bayesian networks that compute local and remote low-level events to deduce more high level facts. The local context of each user is described by the status of the local networks. The adaptation engine we use is a rule based engine that takes decisions each time the local context representation is updated. This decision may concern the dissemination of the information in the change is due to a local event, or the presentation of the information if the change is due to a remote event. In this first work, adaptation decisions concern the potential recipient and the level of details (disseminated information), the modality (query based, peripheral, and intrusive) and the time (immediate, delayed, and cancelled) of the delivery. The context representation is restricted to only the work and activity context of the participants.

Our actual work on this approach concern its extension in order to integrate it with a cooperative platform, and to integrate new events in the context computation. The goal is to get a more complete context representation by adding information and events from the cooperative platform (groups, users, activities) and from the physical usage context (connectivity, device, localisation, ...). A first study has been done about how to extend the architecture to capture and aggregate events from the cooperative platform and how to combine them with events from the local peers.

6.3.2. Awareness and Knowledge-intensive Communities

Participants: Gérôme Canals, Alicia Diaz.

The goal of this work is to provide support to workgroups engaged in a knowledge-intensive activity (e.g. a design project, a software project) to capitalize and share common knowledge. We particularly focus on mechanisms to make explicit the shared emergent knowledge and to support individual and divergent point of views about this emergent knowledge.

Awareness plays a central role in our approach. On one hand, awareness is the main source for knowledge discovery and learning about other's activity and skills. On the other hand, awareness is helpful to understand the evolution of the shared knowledge and the occurrence of divergent points of view about this knowledge [3], [13].

We already have proposed a framework based on a private/public knowledge workspace to store the emergent knowledge. Divergences between individual points of views are supported through encapsulation in discussion artefacts organized in discussion threads. This allows keeping track of knowledge evolution in parallel with the arguments and contribution from the participants. We have also introduced the notion of knowledge awareness as the central mechanism for being aware and understanding knowledge contribution and evolution in a group.

This framework has been instantiated with a particular knowledge representation model in a prototype called Co-Protégé [14]. Co-Protégé is an extension of Protégé and we use the Protégé language to build ontologies that represent the shared knowledge as well as discussion artefacts and threads, activities and member profiles.

In collaboration with the University of New South Wales (Australia), this framework has also been applied to support mass customization processes [12].

6.3.3. Perspectives

Concerning awareness and context, a short term perspective is to finish the technical integration of our approach in the ECOO cooperative platform. The goal is enhance this platform with an awareness service that take into account the work context of each user when delivering awareness information.

Concerning awareness and knowledge, short termed perspectives rely on the prototype and its evaluation. The actual prototype will be extended to support OWL as the ontology definition language. A first step toward its evaluation is to prepare it for dissemination in the Protégé community.

7. Contracts and Grants with Industry

7.1. RNTL LibreSource: cooperative software development and community animation (2003-2005)

Participants: Pascal Molli [responsible], Guillaume Bort, François Charoy, Claude Godart, Sébastien Jourdain, Gérald Oster.

Project partners of LibreSource (formerly PureSource) are Université Henri Poincaré Nancy 1, Université Henri Poincaré Nancy 2, INRIA, Artenum society and University Paris 7-Denis Diderot.

LibreSource allows a virtual team to organize and its participants to cooperate. Its objective are in the vein of BSCW's, SourceForge's and Toxic Farm's, but with a particular focus on coordination and an original object sharing technology.

Object sharing rests on an original vision where copy convergence is based on the operational transformation approach that provides for a safe and generic synchronizer.

LibreSource is implemented on a J2EE application server and is available on Jonas.

LibreSource has been released in June 2005: http://www.libresource.org

7.2. Framework for Content Management (2004-2006)

Participants: François Charoy [responsible], Guillaume Bort, Florent Jouille.

We contribute to the development of a Content Management System developped by 2ST Enterprise. The organization of the CMS is based on the resource management architecture of LibreSource. It has been developped with Enterprise Java Beans. It is operational on several sides with hundreds of users.

8. Other Grants and Activities

8.1. Regional actions

Mobi5 action (2002/2005) of the CPER Intelligence Logicielle (Software Intelligence, axis Qualité et sûreté Logicielle (Quality and Safety of software)). It has funded the development of XML transformation functions satisfying condition C_1 and the development the XyDiff Java engine. The generic So6 synchronizer can now synchronize efficiently and safely XML files.

8.2. National actions

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

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 (7.1).

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

Khalid Benali has been program committee member of Inforsid 2005.

Gérôme Canals has been program committee member of UbiMob 2005.

8.3. European actions

8.3.1. Network of Excellence INTEROP (2004-2007)

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

Goals of Interop (http://www.interop-noe.org/) are:

- the emergence of a lasting European Research community on interoperability of enterprise software applications,
- to create the conditions of an innovative and competitive technology transfer by bringing upstream conceptualisation of business based interoperability,
- to achieve by the end of the project the integration process which will assemble knowledge components (ontology, enterprise modelling, architecture and enabling technologies) and prepare a lasting centre of competence on Enterprise Interoperability with maximum research and audience.

8.3.2. Postdoctoral cooperation

Sami Bhiri, ECOO PHD has joined in November 2005 Chriss Bussler ” Web semantics ” group at University of DERI, Ireland for one year.

Gérald Oster, ECOO PHD has joined in November 2005 Moira Norrie ” Global Information System ” group at ETH Zurich.

8.3.3. Co-directed theses

Thesis of Ustun Yildiz with University of Luxembourg (2004-2007): Electronic contracting in software process context.

8.3.4. Cooperation with TU Eindhoven

Walid Gaaloul, ECOO PHD student has spent 6 months in Eindhoven with Wil van der Aalst team to work on process and Web services mining. He should spend six additional months in 2006 at the same place.

8.4. International Actions

8.4.1. Rorax project, French-Libanese program CEDRE (2006-2008)

RORAX: optimistic replication and automatic repearing of XML documents. Responsibles : Hala SKAF-MOLLI (Université Henri Poincaré Nancy 1) et Hala NAJA-JAZZAR (Université Libanaise). The project is just started for two years.

8.4.2. ARC Irex Grant with UNSW in Sydney

We cooperate since several years with members of the ”Information Management” and ”Computer Sciences and Engineering” schools of the University of New South Wales in Sydney on two main themes: transactional web services, and awareness. This cooperation is partially founded by an Irex Grant of ARC (Australian Research Council) and Université Henri Poincaré Nancy 1.

8.4.3. Co-directed theses

Thesis of Alicia Diaz with LIFIA, La Plata, Argentine (2002-2005): Knowledge sharing process in communities of practice.

8.4.4. Conference program committees and organizations

We organized in Nancy in September 2005 the third Business Process Management conference http://bpm2005.loria.fr/ (180 received papers, 20 selected long papers, 5 industrial papers, 16 short papers, proceedings published in Springer LNCS 3649, 130 participants).

Khalid Benali has been or is program committee member of Interop-Esa 2005 and 2006.

Nacer Boudjlida has been program co-chair of Interop-Esa 2005 [1] and of the International Workshop on Enterprise and Networked Enterprises Interoperability with the BPM 2005 conference. He has been or is program committee member of Interop-Esa 2006, of the 10th International Workshop on Exploring Modelling Methods and Systems Analysis and Design 2005 (with CAiSE)

François Charoy has been program committee member of BPM (Nancy, 2005) and of Interop-Esa (Geneva, 2005).

Claude Godart has been general chair of BPM 2005 (Business Process Management Conference, Nancy), program co-chair of the first IEEE workshop on Teamware (with the Saint conference, Trento 2005). He has been or is program committee member of BPM 2005 and 2006 (Business Process Management), Saint 2005 and 2006 (IEEE Symposium on Applications and the Internet), EDOC 2005 and 2006 (The enterprise computing conference), WISE 2005 (Web Information Systems), ICSOC 2005 (IC on Service Oriented Computing), Electronic Commerce 2006 (IEEE CEC), Enterprise Computing, E-Commerce and E-Services 2006 (IEEE EEE) and of several workshops.

Jacques Lonchamp is programm PC member of COOP 2006.

Olivier Perrin has been local organizer of the BPM 2005 conference in Nancy and he is programm PC member of BPM 2006.

8.5. Visits, Invitations

Fharad Danesgard, senior lecturer at University of New South Wales, Sydney, Australia, has visited ECOO during two months in January and February.

Olivera Marjanovic, senior lecturer at University of New South Wales, Sydney, Australia, has visited ECOO during one month in September.

9. Dissemination

9.1. Scientific Community Animation

Khalid Benali is member of the CNU (National University Council) which is responsible of recruitement and management of university teacher-researcher carreer.

Nacer Boudjlida is chair of the technical committee of the INTEROP Network of Excellence. He is responsible for a master degree speciality in Software Engineering at the University Henri Poincaré Nancy 1 (France) and at IGA, Casablanca (Morrocco).

Gérôme Canals is member of the orientation board of GDR I3.

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) in 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 Loboratory), Professor at CEA/EDF/INRIA summer school 2005 (theme: Cooperative Work).

Jacques Lonchamp is head of the recruitment committee of the University Nancy 2.

9.2. Teaching

ECOO members have responsibilities in several formations from University Henri Poincaré Nancy 1, University Nancy 2 and INPL, at different levels, including third cycle (Research Master, Professional Master, ESIAL, ESSTIN, ISIAL).

10. Bibliography

Books and Monographs

[1] D. KONSTANTAS, J.-P. BOURRIÈRES, M. LÉONARD, N. BOUDJLIDA (editors). *Interoperability of Enterprise Software and Applications, INTEROP-ESA'05*, n° ISBN-10: 1-84628-151-2, Springer Verlag, 2005.

Doctoral dissertations and Habilitation theses

[2] S. BHIRI. *Approche transactionnelle pour assurer des compositions fiables de services Web*, Thèse d'université, Université Henri Poincaré Nancy1, October 2005.

[3] A. DIAZ. *Supporting Divergences in Knowledge Sharing Communities*, Thèse d'université, Université Henri Poincaré Nancy1, October 2005, http://tel.ccsd.cnrs.fr/tel-00010910.

[4] G. OSTER. *Réplication optimiste et cohérence de données dans les environnements collaboratifs*, Thèse d'université, Université Henri Poincaré Nancy1, November 2005, http://tel.ccsd.cnrs.fr/tel-00010865.

Articles in refereed journals and book chapters

[5] C. DONG, N. BOUDJLIDA. *Federated Mediators for Query Composite Answers*, in "Enterprise Information Systems, VI", I. SERUCA, J. FILIPE, S. HAMMOUDI, I. CORDEIVO (editors). , Selected papers from the 6th International Conference on Enterprise Information Systems - ICEIS' 2004, Kluwer Academics Publishers, 2005.

[6] N. GRÉGORI, J.-C. HAUTECOUVERTURE, F. CHAROY, C. GODART. *Combining Ergonomics, Culture and Scenario for the Design of a Cooperation Platform*, in "AI & Society, Vol. 20, No. 3", to appear, 2005.

[7] A. IMINE, M. RUSINOWITCH, G. OSTER, P. MOLLI. *Formal Design and Verification of Operational Transformation Algorithms for Copies Convergence*, in "Theoretical Computer Science", to appear, 2005.

Publications in Conferences and Workshops

[8] S. BHIRI, K. GAALOUL, O. PERRIN, C. GODART. *Overview of Transactional Patterns : Combining Workflow Flexibility and Transactional Reliability for Composite Web Services*, in "3rd International Conference on Business Process Management - Short paper - BPM'05, Nancy, France", W. M. P. VAN DER AALST, B. BENATALLAH, F. CASATI, F. CURBERA (editors). , Lecture Notes in Computer Science, vol. 3649, Springer-Verlag GmbH, Sep 2005, p. 440-445.

[9] S. BHIRI, O. PERRIN, C. GODART. *Ensuring required failure atomicity of composite Web services*, in "14th international conference on World Wide Web, WWW 2005, Chiba, Japan, May 10-14. ACM, ISBN 1-59593-046-9", ACM, Mar 2005, p. 138-147.

[10] S. BHIRI, O. PERRIN, C. GODART. *Reliable Web Services Composition using a Transactional Approach*, in "IEEE International Conference on e-Technology, e-Commerce and e-Service - EEE 2005, Hong Kong, China", IEEE Computer Society, May 10-14 2005, p. 15-21.

[11] C. BOUTHIER, J. BITCHEVA, G. CANALS. *A Context-Adaptive Group Awareness Tool*, in "International Symposium on Applications and the Internet - SAINT 2005. Workshop 6 : Teamware : Supporting Scalable Virtual Teams in Multi-organizational Settings, Trento, Italy", IEEE Computer Society, Jan 2005, p. 238-241.

[12] G. CANALS, F. DANESHGAR, A. DIAZ. *Workspace Design Schemas for Divergence-supportive Knowledge Sharing Communities*, in "International Mass Customization Meeting - IMCM'05, Klagenfurt, Austria", Jun 2005.

[13] F. DANESHGAR, G. CANALS, A. DIAZ. *Process Awareness in Divergence-supportive Knowledge Communities*, in "5th International Conference on Knowledge Management - I-KNOW'05, Graz, Austria", K. TOCHTERMANN, H. MAURER (editors). , 2005, p. 212-219.

[14] A. DIAZ, G. BALDO. *CO-Protégé : A Groupware Tool for Supporting Collaborative Ontology Design with Divergence*, in "8th International Protégé Conference, Madrid, Spain", Jul 2005.

[15] C. DONG, N. BOUDJLIDA. *Matchmaking in Heterogeneous Environments*, in "First International Conference on Interoperability of Enterprise Software and Applications - INTEROP-ESA'05, Geneva, Switzerland", in Doctoral Symposium, INTEROP, Feb 2005.

[16] C. DONG. *An Architecture for Heterogeneous Federated Mediators*, in "2nd INTEROP-EMOI Open Workshop on Enterprise Models and Ontologies for Interoperability - INTEROP-EMOI'05, Porto, Portugal", Co-located with the 17th Conference on Advanced Information Systems Engineering - CAiSE'05, Jun 2005.

[17] W. GAALOUL, S. ALAOUI, K. BAÏNA, C. GODART. *Mining Workflow Patterns through Event-data Analysis*, in "International Symposium on Applications and the Internet - SAINT 2005. Workshop 6 : Teamware : Supporting Scalebable Virtual Teams in Multi-organizational Settings, Trento, Italy", Feb 2005.

[18] W. GAALOUL, K. BAÏNA, C. GODART. *Towards Mining Structural Workflow Patterns*, in "16th International Conference on Database and Expert Systems Applications - DEXA'05, Copenhagen, Danemark", R. W. KIM VIBORG ANDERSEN (editor). , Lecture Notes in Computer Science, vol. 3588, Springer-Verlag, Aug 2005, p. 24-33.

[19] W. GAALOUL. *Business Process Intelligence : Discovering and Improving Transactional behavior of Composite Services From Logs*, in "Doctoral symposium in INTEROP-ESA'05 - First International Conference on Interoperability of Enterprise Software and Applications, Geneva, Switzerland", Feb 2005.

[20] W. GAALOUL, C. GODART. *Mining Workflow Recovery From Event Based Logs*, in "3rd International Conference on Business Process Management - BPM'05, Nancy, France", W. M. P. VAN DER AALST, B. BENATALLAH, F. CASATI, F. CURBERA (editors). , Lecture Notes in Computer Science, vol. 3649, Springer-Verlag GmbH, LORIA, Sep 2005, p. 169-185.

[21] A. GUABTNI, F. CHAROY, C. GODART. *Customizable Isolation in Transactional Workflow*, in "First International Conference on Interoperability of Enterprise Software and Applications, Geneva, Switzerland", Feb 2005.

[22] A. GUABTNI, F. CHAROY, C. GODART. *Spheres of isolation : adaptation of isolation levels to transactional workflow*, in "3rd International Conference on Business Process Management - Short paper - BPM'05, Nancy, France", W. M. P. VAN DER AALST, B. BENATALLAH, F. CASATI, F. CURBERA (editors). , Lecture Notes in Computer Science, vol. 3649, Springer-Verlag GmbH, LORIA, Sep 2005, p. 458 - 463.

[23] A. IMINE, P. MOLLI, G. OSTER, M. RUSINOWITCH. *Towards Synchronizing Linear Collaborative Objects with Operation Transformation*, in "International Conference on Formal Techniques for Networked and Distributed Systems - FORTE 2005, Taipei, Taiwan", F. WANG (editor). , Lecture Notes in Computer Science, vol. 3731, IFIP International Federation for Information Processing, Oct 2005, p. 411-427.

[24] J. LONCHAMP. *A Structured Chat Framework for Distributed Educational Settings*, in "6th International Conference on Computer Supported Collaborative Learning - Interactive paper - CSCL'05, Taipei, Taiwan", Lawrence Erlbaum Associates, USA, May 2005, p. 403-407.

[25] G. OSTER, P. URSO, P. MOLLI, A. IMINE. *Edition collaborative sur réseau pair-à-pair à large échelle*, in "Journées Francophones sur la Cohérence des Données en Univers Réparti - CDUR 2005, Paris, France", Nov 2005.

[26] M. ROUACHED, O. PERRIN, C. GODART. *A Contract Layered Architecture for Regulating Cross-Organisational Business Processes*, in "3rd International Conference on Business Process Management - Short paper - BPM'05, Nancy, France", W. M. P. VAN DER AALST, B. BENATALLAH, F. CASATI, F. CURBERA (editors). , Lecture Notes in Computer Science, vol. 3649, Springer-Verlag GmbH, Sep 2005, p. 410-415.

[27] M. ROUACHED, O. PERRIN, C. GODART. *A Contract-Based Approach for Monitoring Collaborative Web Services Using Commitments in the Event Calculus.*, in "6th International Conference on Web Information Systems Engineering, Wise, New York, NY, USA, November 20-22", LNCS 3806, Dec 2005, p. 426-434.

[28] U. YILDIZ, O. PERRIN, C. GODART. *On automating networked enterprise management*, in "International Workshop on Enterprise and Networked Enterprises Interoperability - ENEI'2005, Nancy, France", Lecture Notes in Computer Science, Sep 2005.

Bibliography in notes

[29] G. COBENA, S. ABITEBOUL, A. MARIAN. *Detecting Changes in XML Documents*, in "The Eighteenth International Conference on Data Engineering - ICDE 2002, San Jose, California, USA", February 2002, p. 41-52, http://citeseer.ist.psu.edu/cobena01detecting.html.

[30] C. T. DAVIES JR.. *Data Processing Spheres of Control*, in "IBM Systems Journal 17(2): 179-198", 1978.

[31] M. A. ELLIS, B. STROUSTRUP. *The annoted C++, reference manual*, ISBN 0-201-51459-1, Addison-Wesley, 1990.

[32] M. RESSEL, D. NITSCHE-RUHLAND, R. GUNZENHAUSER. *An Integrating, Transformation-Oriented Approach to Concurrency Control and Undo in Group Editors*, in "Proceedings of the ACM Conference on Computer Supported Cooperative Work (CSCW'96), Boston, Massachusetts, USA", November 1996, p. 288-297.

[33] H. SCHULDT, G. ALONSO, C. BEERI, H.-J. SCHEK. *Atomicity and Isolation for Transactional Processes*, in "ACM TODS", vol. 27, n° 1, 2002, p. 1-53.

[34] H. SHEN, C. SUN. *Flexible notification for collaborative systems*, in "Proceedings of the 2002 ACM conference on Computer supported cooperative work", ACM Press, 2002, p. 77–86.

[35] S. STRATULAT. *A general framework to build contextual cover set induction provers*, in "Journal of Symbolic Computation", vol. 32, n° 4, 2001, p. 403-445.

[36] M. SULEIMAN, M. CART, J. FERRIÉ. *Concurrent Operations in a Distributed and Mobile Collaborative Environment*, in "Proceedings of the Fourteenth International Conference on Data Engineering, February 23-27, 1998, Orlando, Florida, USA", IEEE Computer Society, 1998, p. 36-45.

[37] C. SUN, X. JIA, Y. ZHANG, Y. YANG, D. CHEN. *Achieving convergence, causality preservation, and intention preservation in real-time cooperative editing systems*, in "ACM Transactions on Computer-Human Interaction (TOCHI)", vol. 5, n^o 1, 1998, p. 63–108.

[38] N. VIDOT, M. CART, J. FERRIÉ, M. SULEIMAN. *Copies convergence in a distributed real-time collaborative environment*, in "Proceedings of the ACM Conference on Computer Supported Cooperative Work (CSCW'00), Philadelphia, Pennsylvania, USA", December 2000.

[39] WFMC. *Workflow Management Coalition*, Technical report, AIIM, 1995.