

**ASSESSORIA DE COOPERAÇÃO INTERNACIONAL - ASCIN/CNPq**  
**CONVÊNIOS BILATERAIS**  
**DETALHAMENTO DE PROJETO**  
**Edital 44/2005**

**Convênio:** CNPq/CNR - **País:** Itália  
**Nome do Coordenador:** Leila Ribeiro (Brasil) e Andrea Corradini (Itália)  
**Proposta submetida em:** 30/setembro/2005 no Brasil, e 29/abril/2005 na Itália

**1. Problema(s) e justificativa(s) (Máximo de 2 páginas)**

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The fast and continuous evolution of computing and communication capabilities have resulted in massively distributed computational environments (e.g., Internet). These environments, often called *open environments*, are characterized by distinctive features like massive geographical distribution; highly dynamic environments; absence of a global control; partial failures; lack of security and high heterogeneity due to the diversity of communication links (delay, throughput), cooperating organizations, services offered. On the other side, the demand for computing and communication anywhere and anytime leads to the need of support to both physical (node) as well as code mobility. Due to all these factors, developing applications for such environments is rather complex and therefore research efforts have been directed to improve support for development of distributed applications.

A basic question in software development is if the proposed program is really a solution for the considered problem. The lack of for system development nowadays, mainly due to market and economic pressure, makes the development of reliable, failure-free distributed, mobile systems very difficult. Often failures occur only in special situations and cannot be retraced. One of the reasons is that these systems are usually very large and it is impossible to simulate or test every possible configuration. Another source for failures are ambiguous requirements.

The main advantage of including formal methods in software development is to be able to assure correctness. The first step is to build a model of the solution (specification) using a formal language. Having this formal model as base, we can: carry on mathematical proofs to guarantee that this model possesses the required properties (verification); analyse whether the proposed solution is acceptable from the point of view of performance, indicating which are the best implementation strategies; validate the model through simulations; follow a rigorous software development, being able to prove that the implementation is correct with respect to the specification (generation of correct code).

The main aim of this cooperation project is to improve the quality of software for open environments, in special mobile and distributed applications, through the use of formal methods.

The long term goal of the cooperation among the sites involved is the integration of the main approaches to specification, verification and analysis into a consistent framework for the development of high-quality mobile/distributed applications.

Since the targeted environment matches a widely used communication and computing platform, the Internet, significative enhancements in the reliability of software systems for

such environments shall have great impact. With the large scale deployment of software through the Internet, the costs for correcting bugs grow very fast. Assuring system properties during the construction helps to minimize the number of bugs with the distributed versions of the product. Software developers may therefore be specially interested in the methods and techniques to be developed in the project.

## 2. Estado-da-arte (Máximo de 2 páginas)

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Existing approaches to tackle the lack of reliability and quality of distributed systems focus especially on the following points. Formal specification techniques like UML [27], SDL [10] and MSC [23] should be used for capturing requirements and for first design steps. Probably one of the most prominent of such specification techniques is UML, which consists of a number of different diagram types for specifying the behavior and structure of a system under design. Case tools like Rational Rose [29], ObjectGEODE [33] or Rhapsody [22] assist in the specification process, allow the refinement of specifications and can sometimes generate (incomplete) program code for prototype systems. By automatically generating as much as possible of the program code the amount of programming errors is to be reduced. However, practical needs by the software developers resulted in most of the formal specification techniques to be semi-formal, i.e., the formalisms lack formal foundation in order to give more freedom to the system designers. As a result the created system specifications often contain ambiguities.

Other approaches focus on the modeling of the system under design. Thereby, a formal model of the system is created by abstracting away the less important system behaviour. Prominent formal models are Petri nets, process algebras and automata models. Subsequently, the formal model can be employed to analyse the behaviour, prove that at least the system model shows the wanted, i.e. correct, behaviour or possesses certain properties. Further efforts aim at automatically generating the formal model out of the formal specification in order to ensure, that the formal model represents exactly the specified system and that, therefore, the properties of the formal model imply the same properties for the specified system.

Concerning mobile systems, already with the  $\pi$ -calculus [25, 26], there had been some efforts towards computational models for mobile systems, e.g. based on abstract state machines [24], on mobile ambients [9], and on actors [1, 2]. However, to be used in practical applications, high-level specification languages as well as programming languages whose semantics can be described using such models must be provided. There are some proposals of corresponding programming languages (e.g. KLAIM [12], Mobile UNITY [31], Pict [28], Nomadic Pict [34]), but on the level of specification and verification/analysis of mobile applications, there is still no formal method that is largely used.

The group of researchers gathered by this project contributed already in various complementary aspects of the development of correct distributed software. In the following, we list main contribution related to the topics of this project:

1. *Unfolding semantics of graph transformations*: The work on this topic concerns the investigation of the relationships among different unfolding models for graph transformation systems developed in the University of Pisa and in the Federal University of Rio Grande do Sul. A new model of unfolding, tailored for Single-Pushout graph grammars, has been designed, and it has been proved that it enjoys several properties that did not hold for other models. These results have been published in a conference proceedings [6], and a full version of the paper has been submitted for publication in the journal *Information and Computation*.

2. *Foundations of verification techniques*: In [5] a framework for the verification of behavioural properties of systems modelled as graph transformation systems is outlined. The properties can be expressed in a temporal logic which is basically a  $\mu$ -calculus where

the state predicates are formulae of a monadic second order logic, describing graph properties. The verification technique relies on an algorithm for the construction of finite over-approximations of the unfolding of a graph transformation system. The above approach is specialized for *finite-state* systems in [4], with a technique based on the unfolding semantics and generalising McMillan's complete prefix approach, originally developed for Petri nets, to graph transformation systems. This technique allows to check properties of the graphs reachable in the system, expressed in a monadic second order logic.

3. *Specification and Verification of Distributed Systems*: Several contributions are concerned with the use of variants of graph transformation systems for the specification of distributed systems with mobility, and for verifying relevant properties on them. [13, 14, 15, 16, 18, 32] use Object Based Graph Transformation Systems (OB-GTS) for modeling distributed systems, and translate the specification to Promela, the specification language for the SPIN model checker, in order to prove properties on them. Object-Based GTS are graph transformation systems that include main aspects of the object paradigm (encapsulation, communication via message passing). [3] presents a methodology for system specification and verification based on UML diagrams and interpreted in terms of graphs and graph transformations. Once a system is modeled in this framework, a temporal graph logic can be used to express some of its relevant behavioral properties. Then, under certain constraints, such properties can be checked automatically.

4. *Applications: Fault Models*: In [19] the expressiveness of OB-GTS is tested for specifying and reasoning about the behaviour of distributed systems in presence of faults. The fault behaviour is modeled as an unwanted but possible transition of the system. As a case study, the specification of a pull-based failure detector is presented, and then the model is extended to include the behaviour of the crash fault model.

5. *Translation of Object-Oriented Features to GTS*: The reference OO programming language for this activity is Java. The idea is that by translating Java programs (written in a suitable fragment of language) to GTS, we can obtain a neat correspondence between concepts of OO languages and corresponding concepts of GTS: this would allow us to borrow, in the future, more advanced concepts from OO languages (for example concerning multi-threading, dynamic loading, modularity mechanisms, and so on). Preliminary results have been published in [11], where we presented the GTS encoding of a fragment of Java including definition of classes and object creation, instance and static variables, conditional statements, method invocation, and iterative statements using recursion. A related but different approach has the goal of defining a truly *object oriented* extension of OB-GTS, by modelling explicitly the inheritance mechanism. Preliminary results about this topic were published in [20, 21]. A mid-term goal of the project is to join these two threads by extending the encoding of Java in order to include inheritance.

6. *Semantics of Transactions and Refinement in Graph Transformation Systems*: Inspired to the work on *zero-safe* Petri nets, a *zero-safe graph transformation system* is defined as a typed GTS where the graph of types is equipped with a given subgraph, the idea being that items not belonging to such subgraph correspond to zero-safe places. Then a transaction is defined, informally, as a derivation of minimal length (up to shift equivalence), where both the start and the target graphs are typed on the given subgraph of the graph of types. Work is progressing towards the definition of a semantics of such transactions in the line of that of zero-safe nets, where an abstract transformation system is defined, whose direct derivations are transactions of the lower level system.



### 3. Objetivos, metas e resultados

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*The main aim of this cooperation project is to improve the quality of software for open environments, in special mobile and distributed applications, through the use of formal methods.*

The sites involved in this project proposal have experience in various techniques for the foundation, specification, verification, analysis and implementation of concurrent and distributed systems with mobility, ranging from model theoretic issues to tools and real size applications. The long term goal of the cooperation among the sites listed below is the integration of the main approaches to specification, verification and analysis into a consistent framework for the development of high-quality mobile/distributed applications. More concrete objectives the projects aims at are the development of:

1. *Mathematical foundation of the notion of coordination, regarded as a fundamental structuring concept for interactive, open, secure architectures;*
2. *Analysis and verification techniques for formalisms supporting Internet applications;*
3. *Logics tailored for the specification and design of networking applications;*
4. *Modular specification methods for this application domain;*
5. *Correct implementations based on these specification methods, taking into account existing platforms for distributed systems;*
6. *Adaption and integration of tools to support the proposed methods and techniques.*

Partial results have already been achieved during the project in the past years (from 2001 to 2004). Most of the activities by the partners focused on the study of the theory and applications of *graph transformation systems*, a very expressive specification formalism for the systems under consideration (as reported in the Final Report of the IQ-Mobile II project).

Indeed, graph transformation systems provide a rich framework for specification, equipped with a solid theoretical background, some powerful analysis and verification techniques, and a few prototypical tools for supporting the development of specification. However, several topics need to be investigated further in order to bring the framework to maturity.

In the two years duration of the project there will be four scientific missions, each one involving two researchers. Since this is a follow-up project, the partners involved have already identified concrete themes of common interest and potential fields of cooperation. These are grouped in the following four workpackages:

**Workpackage 1: Theoretical Foundations for Distributed, Open, Mobile Systems**

This workpackage concentrates on the semantical foundations of formalisms used for the specification and the development of open, distributed and mobile applications. In particular, the focus will be mainly on the (unfolding-based) concurrent semantics of (possibly finite-state) systems, which will provide the basis for analysis techniques developer under Workpackage 2; and on the semantics of modularity concepts for rule based specification languages, including, for example, inheritance mechanisms and interfaces

**Workpackage 2: Analysis of Distributed Mobile Systems**

This workpackage is concerned with the research on analysis and verification techniques for open/mobile systems. This includes the study of modal (spatial/temporal) logics for expressing relevant properties of such systems, and the development of analysis techniques for the (semi-)automated verification of such properties, possibly based on abstractions of the systems which do not reduce the concurrent behaviour to interleaving.

**Workpackage 3: Applications**

In this workpackage we shall validate the analysis techniques developed in Workpackage 2 with suitable case studies. These will range from “toy case studies” used as running examples to explain the theoretical and methodological results, to larger case studies, modelling for example systems with partial failures, allowing for the specification and verification of various fault models.

**Workpackage 4: Tools and Environments**

A long term goal of the project is to design an integrated environment where the user could use several tools to support: the specification of his/her application, possibly using graph transformation-based visual languages; the translation of the specification to executable code, typically in an object-oriented language; the analysis and verification of relevant properties of the application, expressed as formulae of high-level logics interpreted directly on the specification.

The implementation of such tools cannot be addressed within the present project because it requires the availability of people (doctoral students or professional programmers) for whom no support is foreseen. Nevertheless, the members of the project will experiment their approaches with the help of existing, publicly available tools.

As a continuation project, we have already various partial results in the areas of the project. The results expected for the continuation of the project naturally tend to be in the same direction, however, more robust and complete.

The main expected scientific result of this project is a methodology for the development of high quality mobile/distributed applications in open environments. This includes the integration of many different aspects that are needed for an adequate development of this

kind of software:

- Specification languages;
- Case studies (to validate the proposed techniques);
- Analysis and verification techniques, to assure the correctness and desired quality of service (including aspects of scalability, dependability/fault tolerance and security);
- Modularization and coordination techniques;
- Semantical models.

It is our intention to support the methodology with the integrated use of existing tools for editing, parsing, analysis and verification, among others.

Besides the scientific contributions, we expect that the project will continue to foster the integration of the teams of the different institutions of Brazil and Italy, the generation of many scientific and didactic publications, and will contribute to improve the technological skills of the project participants in the area of increasing economic importance of Internet applications.

## 4. Metodologia

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The methodological approach presented in section 3 of this document is further detailed here by specifying the activities which we plan to carry out within each one of the four Workpackages. Several of the activities that we plan are based on activities performed during years 2003/04 within the project and on the corresponding achieved results. For each workpackage the institutions directly involved are listed.

### Workpackage 1: Theoretical Foundations for Distributed, Open, Mobile Systems

. *Institution Involved:* DIPISA, PUCRS, UFRGS

- A1 Modularity concepts for Graph Transformation Systems (GTS):** Graph transformation systems are a powerful specification formalisms for highly dynamic distributed systems, e.g., where changes in the connectivity or in the structure of the network are part of the normal behaviour. However, GTS are still lacking sophisticated modularity concepts, which are essential when designing real-size applications. Continuing the research activity started within the project in the last years, we intend to design and experiment modularity mechanisms for GTS's. One direction that we intend to follow is to revisit in the framework of GTS's some concepts already well understood for OO languages, including *inheritance* mechanisms and *interfaces*.
- A2 Concurrent semantics:** We intend to continue the investigation of the concurrent semantics of graph grammars, based on the results already obtained in the project. This semantical framework will be used as a basis for the design of analysis and verification techniques for distributed and mobile systems modelled via GTS's, which are the main activity planned for Workpackage 2.
- A3 Refinement mechanisms and Transactions:** In order to tackle the complexity of the design of non-trivial systems, it is necessary to model a system at different levels of abstractions, linked by suitable notions of refinement. In this case, a single operation at a higher level of abstraction may correspond to a computation at a lower level, which has to be considered as atomic. Thus the notion of *transaction* emerges as a natural concept in this framework. Continuing the work that we started on the definition of transactions for GTS's, we intend to explore refinement mechanisms for GTS's.

### Workpackage 2: Analysis of Distributed Mobile Systems

. *Institution Involved:* DIPISA, ISTI, PUCRS, UFRGS, UFRN.

- A4 Verification techniques for GTS:** Continuing some work already started in the project, we will further investigate techniques to prove in a (semi-)automated way relevant properties of distributed systems modeled with GTS. Such verification techniques are typically based on the concurrent semantics of GTS, thus representing the concurrent aspects of the behaviour of a system directly, without resorting to the standard interleaving, and thus mitigating the state explosion problem.

- A5 Development of expressive logics for GTS:** In order to be able to express relevant properties of systems modeled as GTS's, suitable modal logics (with spatial and temporal modalities) are needed. Clearly, (fragments of) such logics must be decidable, in order to be usable in the verification techniques of the previous activity. We shall continue the study of such logics, looking for the best trade-off between expressivity and decidability.
- A6 Verification using existing model checkers:** Besides defining new analysis technique, we will experiment traditional ones by providing translations from the specification languages based on GTS's (including Object Based Graph Grammars (OBGG)) to the input languages of publicly available model checkers, like SPIN, JACK and HAL. This will allow us to experiment the effectiveness of verifying relevant properties of the modeled system using these model checkers.
- A7 Analysis of verification problems:** This activity is also a continuation of the investigations started in the previous project, and it is concerned with the analysis of which properties are of particular interest in open/mobile systems, and whether they are decidable or not. Decidability depends both on the graph transformation formalism used to model such systems, and on the logics used to express the property.

### Workpackage 3: Applications

*Institution Involved:* DIPISA, ISTI, PUCRS

- A8 Translating JAVA to GTS:** The translation of a significant fragment of Java to graph transformation systems is, first of all, an interesting application of a specification framework based on GTS's, as the states of a Java program can be seen as distributed states in a natural way (both on a single machine, thinking to pointers and heap manipulation, and, *a fortiori*, when the application is truly distribute). Furthermore, we are convinced that such translation can be a source of inspiration for recasting several concepts of OO languages (inheritance, dynamic binding, polymorphism,) in the framework of GTS's.
- A9 Fault models:** One important feature of open systems is the presence of partial failures. We will continue investigating how to represent various classical fault models in terms of different formalisms. The approach we follow is to introduce the behavior of selected faults in a modeled application and achieve a specification that combines the behavior of the desired application in their presence. The use of the SPIN environment is also under investigation for the specification and verification of systems in the presence of various fault models. With this, we are then able to reason about robustness and fault-tolerance mechanisms with our methods and tools.
- A10 Case studies:** Small-size case studies and running examples will be proposed for illustrating and validating the foundations, methods and tools developed in the project.

#### **Workpackage 4: Tools and Environments**

*Institution Involved:* DIPISA, ISTI, UFRGS, UFRN.

**A11 Animation techniques for simulation:** The animation for GTS-based specifications of systems could improve greatly the understanding and validation of the modelled systems. We intend to work on this topic, using the tool GenGED [7, 8] to provide animation modules for our applications.

**A12 Experimenting with tools for verification of GTS:** Recently, several prototypes of tools for the verification of systems specified with GTS have been made available to the community, like AUGUR<sup>1</sup> and GROOVE [30]. We intend to experiment with such tools in order to see if they provide the features needed by our specification framework based on GTS. As the members of the project have strong contacts with the developers of these tools, we are confident that we can also influence their future development, if this will be considered convenient.

## 5. Informações sobre as equipes brasileira(s) e estrangeira(s)

<b>Equipe(s) brasileira(s):</b>			
Liste os pesquisadores integrantes da(s) equipe(s) brasileira(s).			
<b>Nome</b>	<b>Instituição</b>	<b>Sigla</b>	<b>Titulação</b>
Leila Ribeiro	Universidade Federal do Rio Grande do Sul	UFRGS	Doutora
Álvaro Freitas Moreira	Universidade Federal do Rio Grande do Sul	UFRGS	Doutor
Luciana Foss	Universidade Federal do Rio Grande do Sul	UFRGS	Mestre
Fernando Luís Dotti	Pontifícia Universidade Católica do Rio Grande do Sul	PUCRS	Doutor
Cristina Nunes	Pontifícia Universidade Católica do Rio Grande do Sul	PUCRS	Mestre
Anamaria Martins Moreira	Universidade Federal do Rio Grande do Norte	UFRN	Doutora
David Boris Paul Déharbe	Universidade Federal do Rio Grande do Norte	UFRN	Doutor

<b>Equipe(s) estrangeira(s):</b>			
Liste os pesquisadores integrantes da(s) equipe(s) estrangeira(s).			
<b>Nome</b>	<b>Instituição</b>	<b>Sigla</b>	<b>Titulação</b>
Andréa Corradini	Università di Pisa	DIP	Doutor
Ugo Montanari	Università di Pisa	DIP	Doutor
Gianluigi Ferrari	Università di Pisa	DIP	Doutor
Fabio Gadducci	Università di Pisa	DIP	Doutor
Paolo Baldan	Università di Pisa/Università Cá Foscari-Venezia	DIP/VEN	Doutor
Alessandra Raffaetà	Università di Pisa/Università Cá Foscari-Venezia	DIP/VEN	Doutora
Stefania Gnesi	Consiglio Nazionale delle Ricerche, Istituto di Scienza e Tecnologia dell'Informazione	ISTI	Doutora

## **6. Modelo de gestão, cooperação internacional e compromisso das instituições participantes do projeto (Máximo de 3 páginas)**

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The research group involved in this project is constituted by researchers from 3 Brazilian Institutions and 2 Italian institutions. In Brazil, 2 of them are consolidated research centers in the area of Computer sciences (UFRGS and PUCRS) and 1 emerging research center (UFRN). The researchers are highly qualified (12 doctors and a group of graduate students) working in the areas of concentration of the project (formal methods and distributed systems). The two Italian partners are well established research centers in Computer Science, and the main involved researchers have long standing experience in the themes addressed in the project. The involved institutions of Brazil and Italy are listed below (more detailed description can be found in section 8).

- **[DIP]** Università degli Studi di Pisa, Dipartimento di Informatica, Pisa, Italia. Direttore: Prof. Ugo Montanari. [<http://www.di.unipi.it/>]
- **[ISTI]** Consiglio Nazionale delle Ricerche, Istituto di Scienza e Tecnologia dell'Informazione "Alessandro Faedo", Pisa, Italia. Direttore: Prof. Piero Maestrini. [<http://www.isti.cnr.it/>]
- **[UFRGS]** Universidade Federal do Rio Grande do Sul, Instituto de Informática. Av. Bento Gonçalves, 9500 -Bloco IV Agronomia -POA -RS. Director: Prof. Philippe Olivier Alexandre Navaux. [<http://www.inf.ufrgs.br/>]
- **[PUCRS]** Pontifícia Universidade Católica do Rio Grande do Sul (PUCRS), Faculdade de Informática (FACIN), Programa de Pós-Graduação em Ciências da Computação (PPGCC). Av. Ipiranga, 6681 -Prédio 16, Porto Alegre -RS, CEP: 90619-900, Brazil. Director: Profa. Dra. Vera Lúcia Strube de Lima. [<http://www.inf.pucrs.br/>]
- **[UFRN]** Universidade Federal do Rio Grande do Norte, Departamento de Informática e Matemática Aplicada (DIMAp). Campus Universitário de Lagoa Nova, 59072-970 -Natal -RN. Director: Profa. Anamaria Martins Moreira. [<http://www.dimap.ufrn.br/>]

This proposal is for a continuation of a scientific cooperation that started in 2001, between UFRGS, PUCRS, DIP and CNR. In the present proposal, UFRN will join the cooperation. They will contribute with the expertise in verification and algebraic reuse and modularization techniques. Now, we present the list of involved researchers, together with the list of their main research areas (for the coordinators, we add a paragraph about their qualificati for this project):

### 1. Prof. Dr. Andrea Corradini -Associated Professor (Italian coordinator)

**Main research interests:** Specification and verification of concurrent and distributed systems; Categorical and algebraic techniques for semantics of computational formalisms; Graph rewriting systems; Algebraic and coalgebraic specification; Term rewriting systems; Semantics of concurrency.

**Qualification for this project:** Specifically relevant for the project are the works of A.

Corradini on the specification of computational formalisms using structured transition systems and coalgebras, graph rewriting and algebraic techniques, as well on the concurrent semantics of Petri nets and Graph Grammars.

A. Corradini was Coordinator the TMR Network “General Theory of Graph Transformation Systems” (GETGRATS) (1996-2001), a european project contracted by the Dipartimento di Informatica di Pisa (Prof. Montanari), with other six european partners. He had manging experience in other european projects (APPLIGRAPH [Applications of Graph Transformation] (1997-2001), COMPUGRAPH II [Computing by Graph Transformations] (1993-1996), MASK [Mathematical Structures for the Semantics of Concurrency] (1993-1995).

2. Prof. Dr. Leila Ribeiro -Associated Professor [UFRGS] (Brazilian coordinator)

**Main research interests:** Formal semantics, formal specification and verification, concurrent systems, modularization and composition of systems.

**Qualification for this project:** Profa. Leila Ribeiro has been dedicating to the area of specification and formal semantics since some years. Her undergraduate final project, master thesis as well as the doctor thesis have been carried in this area. In the last years she has been investigating the specification, semantics and composition of concurrent systems, mainly using the formalism of graph grammars. In particular, she has been investigating the use of graph grammars for the description of mobile systems, for description of simulation models and animation. Moreover, she started investigations on the analysis of graph grammars. She also took part, as coordinator or member, in many projects involving research institutions from Brazil and abroad. For her scientific achievements, Leila Ribeiro received in 1999 the Santista Prize in the category young scientist in Computer Science.

3. Dr. Paolo Baldan -Ricercatore [DIP]

**Main research interests:** Semantics of Concurrency, Domain Theory, Graph Transformation Systems, Model checking, Algebraic and Categorical Semantics.

4. Prof. Dr. Gianluigi Ferrari -Professore Associato [DIP]

**Main research interests:** Formal specification and verification of mobile systems, programming languages for network computing, tool support for mobile systems and theoretical aspects of distributed computing.

5. Prof. Fabio Gadducci -Professore Associato [DIP]

**Main research interests:** Semantics of Concurrency, Rewriting Systems, Algebraic and Categorical Semantics, Temporal Logic, Graph Transformation.

6. Prof. Ugo Montanari -Professore Ordinario [DIP]

**Main research interests:** Semantics of Concurrency, Process Description and Object Oriented Languages, Constraint Programming, Graph Rewriting Systems, Coordination Models, Algebraic and Categorical Models of Concurrency, Models and Languages for Open Distributed Systems.

7. Dr. Alessandra Raffaetà -Ricercatore [DIP]

**Main research interests:** Representation and reasoning on spatio-temporal data, interoperability, high-level interface towards geographical information systems, deductive databases

8. Dott. Stefania Gnesi -Ricercatore [ISTI]

**Main research interests:** Methods and tools for the formal specification and verification of distributed and mobile systems; applications of model checking techniques for the formal verification of complex systems and to security problems.

9. Prof. Dr. Álvaro Freitas Moreira -Associated Professor [UFRGS]

**Main research interests:** formal operational semantics and type systems for agent oriented programming languages, database query languages and process calculi. He is also interested in model driven development and formal verification.

10. Prof. Dr. Fernando Luís Dotti -Associated Professor [PUCRS]

**Main research interests:** formal verification and quantitative analysis of distributed systems and communication protocols.

11. Prof. Dr. Anamaria Martins Moreira -Associated Professor [UFRN]

**Main research interests:** formal specification and verification, algebraic specifications and model based specifications, software reuse, tools for software development.

12. Prof. Dr. David Déharbe -Associated Professor [UFRN]

**Main research interests:** formal specification and verification, model checking, theorem proving, rigorous software engineering, engineering of smart card applications.

## **7. Justificativa para a cooperação internacional**

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From our joint activity we can identify some benefits already achieved and various potential benefits, not only in scientific, but also in social and economic fields for both countries:

- Qualification of people in a socially and economically important area. This includes qualification to work in this area in the academia as well as in industry. This is a result we can already witness since various M.Sc. and Ph.D. students are involved in the project, and the bi-lateral discussions serve very much to focus, motivate and qualify their work.
- Integration of research institutes of Italy and Brazil. The integration of research institutes takes place naturally, along with the various scientific missions.
- The results of the project can be applied in strategic areas as telecommunication services, network management, mobile computing, electronic commerce, distributed information retrieval, active networks, workflow management systems, as well as in developing new flexible communication applications.
- Brazil is a country in which many innovative distributed and Internet applications are developed (and even exported to other countries), for example, in the areas of electronic commerce, bank automation, electronic voting systems, electronic tax declarations, etc. Knowledge about the practical needs and problems when building and executing such large and complex systems, as well as the technology used, can be of great value to improve the theoretical research made in Italy and to qualify people to work in EU software development industries.
- The Italian research institutes have a long history of research in theoretical aspects of concurrent and distributed systems, needed for the development of high-quality software. Therefore, one of the benefits for Brazilians will be to get in closer contact with state of the art research in this area. This will contribute to qualify researchers in Brazil.

## **8. Infra-estrutura disponível para realização do projeto**

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A brief description of each involved institution is given below. The resources needed to implement this project are basically computers, which are available in all these institutions in adequate configurations. Moreover, all institutions agree in arranging suitable rooms and computers for the guests of the partner sides during their scientific missions.

### **Universidade federal do Rio Grande do Sul (UFRGS)**

Created in 1989, the Informatics Institute is today a reference institution for other research and educational centers in Brazil and South America. The Institute has over 70 lecturers, most of them holding Doctoral or Master degrees. The Institute is divided into two departments: Department of Theoretical Informatics and Department of Applied Informatics.

The Institute is located in an area of 5,000 sq. m. at the Campus do Vale of the Federal University of Rio Grande do Sul (UFRGS). Its laboratories are equipped with approximately 350 computers (workstations, servers and PCs). All equipments are connected to a LAN linking laboratories, offices and the library. The library offers about 12,000 books, handbooks, journals and magazines, tapes, CD ROMs and other publications.

Besides the Undergraduate courses on Computer Science and Computer Engineering, the Institute has a Graduate Programme on Computer Science (CPGCC/UFRGS) offering Doctoral and Master Degree programme. The research work in progress within the Institute covers a wide range of topics in computer science. Many projects are supported by agencies like CNPq, CAPES, FAPERGS and FINEP. The Institute maintains research projects with many European academic institutions.

### **Pontifícia Universidade Católica do Rio Grande do Sul (PUCRS)**

The Graduate Programme in Computer Science (PPGCC -Programa de Pós Graduação em Ciência da Computação) of the Pontifical Catholic University of RS (PUCRS - Pontifícia Universidade Católica do Rio Grande do Sul) was founded in 1993 to provide human resources for research, development and teaching activities in Computer Science. Nowadays, the PPGCC-PUCRS is composed of 20 full-time lecturers, most of them holding PhD degrees from European universities. In the next years a considerable amount of lecturers will be completing their PhD abroad and joining back the PPGCC. Currently, around 100 students are pursuing their MSc. or PhD. degrees at the PPGCC. Various former graduate students are pursuing their PhD. abroad.

The research in progress within the PPGCC covers a wide range of topics in computer science. Many projects are supported by agencies like MCT, CNPq, CAPES, FAPERGS. The Programme has cooperation with many European academic institutions. To accomplish its research goals, the PPGCC is organized in 5 research groups: Scientific Computing, Artificial Intelligence, Digital Systems and Computer Architectures, Information Systems, and Parallel and Distributed Processing.

## **Universidade Federal do Rio Grande do Norte (DIMAP-UFRN)**

The *Universidade Federal do Rio Grande do Norte* (UFRN -Federal University of Rio Grande do Norte) is a medium size public University located in the North-east of Brazil, in the city of Natal. The *Departamento de Informática e Matemática Aplicada* (DIMAp -Informatics and Applied Mathematics Department) is the department of UFRN responsible for Computer Science teaching and research. It is a relatively small and young department which supports two undergraduate courses (Computer Science and Computer Engineering) and one graduate program with a Masters course. The department is located in a proper building which groups staff offices, teaching labs, research labs and administration.

Research in DIMAp-UFRN covers a range of sub-areas of Computer Science: Formal Methods, Artificial Intelligence, Distributed Systems, Software Engineering, Optimization, Theoretical Foundations of Computer Science, Design of Integrated Circuits, Computer Science Applied to the Petroleum and Gas Industry. Since 1998, when the graduate program group started its consolidation, the group has participated and coordinated a number of research projects with financing from CNPq, CAPES, FINEP, ANP, and carried out international cooperations (NSF/USA, COFECUB/France and INRIA/France). The Department has also coordinated different Brazilian and international events that took place in Natal these last years such as SBRC (Brazilian symposium in computer networks), SBCCI (Brazilian symposium in integrated circuits design), SBAC-PAD (Brazilian symposium in computer architecture and high performance computing), Wollic (Workshop on Logic Information and Computation), as well as the IFIP general meeting.

## **Dipartimento di Informatica -Università di Pisa (DIPISA)**

The Dipartimento di Informatica of Pisa was founded in 1969 when a group of researchers of the CSCE (“Center for Studies on Electronic Computing Machines”, established in 1955) joined the University of Pisa. After a major rearrangement in the undergraduate study program in 1993, and a second one in 2001, the Department now offers two levels of undergraduate curricula: a three years program (“Laurea in Informatica”), followed by a two years one (“Laurea Specialistica in Informatica”). Since 1986 it also offers a post-graduate school in Computer Science (“Dottorato”).

The Department provides computing facilities for research and education. Both sets of facilities are connected to the Internet via the university service network, SeRRA, and the Italian research network, GARR. The facilities for research include thirty servers with UNIX-like operating systems. A large number of personal computers (more than 200) are deployed in the different offices and laboratories. Seven network printers, accessible from all operating systems, provide high-quality laser printing facilities. Other available equipment include a couple of scanners, CD masterizers and a digital camera.

The Library of the Department is a service for the students of the undergraduate and postgraduate study programs, as well for professors and researchers of the department. The Library has currently around 13,000 books, with an increment of about 400 books per year, and 96 subscriptions to journals. The library also offers to its users access to a growing number of periodicals, journals and conference proceedings available in

electronic format over the WWW.

The Department has at present about 80 members (42 professors, 21 assistant professors and 18 administrative and technical staff members). About 30 post-graduate students are enrolled in the PhD courses.

The main areas of current research in the Department are: Algorithms and Data Structures, Computer architecture, Artificial Intelligence and Robotics, Databases and Information Retrieval, Computational Mathematics, Programming Languages, Software Methodology and Engineering. The members of the Department have a remarkable scientific production at international level: the 1999 issue of the Annual Research Report listed 426 “external” publications in the three years from 1997 to 1999, including books and papers published in books, journals, national or international conference proceedings. The Department is involved either as partner or as coordinator in many national and international projects. The Department also carries out research programs in cooperation with several computer companies on medium and long term research themes.

### **Istituto di Scienza e Tecnologie dell’Informazione "Alessandro Faedo" (ISTI) of the Consiglio Nazionale delle Ricerche (CNR) Pisa -Italy**

The Istituto di Scienza e Tecnologie dell’Informazione "Alessandro Faedo" was established in 2002 by merging two institutes: The “Istituto di Elaborazione dell’Informazione (IEI)” and the “Centro Nazionale Universitario di Calcolo Elettronico (CNUCE)”.

The IEI was established in 1968, and has a permanent staff of about 90 (50 researchers and 40 supporting personnel), plus an average of 30 temporary staff, composed of postgraduate students, part-time collaborators and visiting professors. Most of the scientific activity is performed within the framework of national and international research projects. In particular the Institute conducts theoretical and applied interdisciplinary research activities in the following sectors: Programming languages and software engineering; System architectures; Database and multimedia theory and applications; Multimedia information storage and retrieval; Signal and image processing; Computational geometry and computer graphics. Technical and software services are also provided to support the research activities and the transfer of knowhow and results to industry and other external users. CNR has among its statutory purposes the transfer of research results, expertise and knowhow to the industrial community. IEI also promotes the scientific education of students, post-graduates and young researchers. Members of the staff lecture at the University of Pisa and other Italian universities, holding courses in computer sciences and engineering. The IEI library was established in 1955, and is thus one of the oldest Computer Science libraries in Europe. The library currently contains more than 8000 books, 600 (400 active) serial collections and 19 abstracting journals. In addition to its card catalog organized according to the cataloging rules of the US Library of Congress, a number of databases and on-line catalogs are available to the user.

## **9. Informações Complementares**

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## 10. Currículo dos integrantes da equipe estrangeira

1. Professional data/activity/Actuación Profesional/Local de Trabajo			
Full name/Nombre <b>Andrea Corradini</b>		e-mail <b>andrea@di.unipi.it</b>	
Institution/Entidad <b>Universita' di Pisa</b>		Present position Cargo/Función <b>Professore associato</b>	
Department/División/Unidad <b>Dipartimento di Informatica</b>		Start date (month/year) Inicio (mes/año) <b>1/09/2002</b>	
Office address/Dirección profesional <b>Largo B. Pontecorvo 3</b>		P.O. box Casilla de correo	
City/Ciudad <b>Pisa</b>	State/Province/ Pcia.	Country/País <b>Italia</b>	Zip code/C.P. <b>56127</b>
Phone number/Teléfono <b>( +39 ) 050 2212786</b>	Extension/Interno	Fax <b>(+39)0502212 726</b>	Fecha de nacimiento <b>21/10/1960</b>
2. Academic background/Titulación/Formación Académica			
<b>Degree/Grado</b> "Laurea" degree	Field of knowledge/Curso <b>Computer Science</b>		Start / End date / Periodo <b>1979 / 1984</b>
	Institution/Entidad/Institución <b>Universita' di Pisa</b>	City/ ciudad <b>Pisa</b>	Country/País /Pcia. <b>Italia</b>
<b>Degree/Grado</b> PhD	Field of knowledge/Curso <b>Computer Science</b>		Start / End date / Periodo <b>1986 / 1990</b>
	Institution/Entidad/Institución <b>Universita' di Pisa</b>	City/Ciudad <b>Pisa</b>	Country/País /Pcia <b>Italia</b>
<b>Degree/Grado</b>	Field of knowledge/Curso		Start / End date / Periodo
	Institution/Entidad/Institución	City/Ciudad	Country/País /Pcia
<b>Degree/Grado</b>	Field of knowledge/Curso		Start / End date / Periodo
	Institution/Entidad/Institución	City/Ciudad	Country/País /Pcia
<b>Degree/Grado</b>	Field of knowledge/Curso		Start / End date / Periodo
	Institution/Entidad/Institución	City/Ciudad	Country/País /Pcia



in Information and Computation 171(1) (2001), 1--49.

P.Baldan, A.Corradini, U.Montanari, and L.Ribeiro. Coreflective concurrent semantics for single-pushout graph grammars. In M.Wirsing, D.Pattinson, and R.Hennicker, editors, Workshop on Algebraic Development Techniques (WADT02), volume 2755 of Lecture Notes in Computer Science. Springer, 2003.

A.Corradini, F.L.Dotti, L.Foss, and L.Ribeiro. Translating java code to graph transformation systems. In H.Ehrig, G.Engels, F.Parisi-Presicce, and G.Rozenberg, editors, Proceedings of International Conference on Graph Transformation (ICGT) '04, volume 3256 of Lecture Notes in Computer Science, pages 383--398. Springer Verlag, 2004.

**8. Languages/Idiomas**

Indicate your language proficiency/Marcar la columna apropiada: P – poor/ P - poco G – good/R – razoablemente E – excellent/B - bien

Language/Idioma	Speaking Habla	/Reading Lee	/Writing Escribe	Language/ Idioma	Speaking Habla	/Reading/ Lee	Writing / Escribe
Italiano	E	E	E				
English	E	E	E				
Espanol	E	E	E				
German	G	G	G				
Francais	G	G	G				

<b>1. Professional data/activity/Actuación Profesional/Local de Trabajo</b>			
Full name/Nombre <b>Paolo Baldan</b>		e-mail <a href="mailto:baldan@dsi.unive.it">baldan@dsi.unive.it</a>	
Institution/Entidad Universita` Ca' Foscari di Venezia		Present position Cargo/Función Ricercatore (research assistant)	
Department/División/Unidad Dipartimento di Informatica		Start date (month/year) Inicio (mes/año) Nov 2001	
Office address/Dirección profesional Via Torino, 155		P.O. box Casilla de correo	
City/Ciudad Venezia	State/Province/ Pcia.	Country/País Italia	Zip code/C.P. I-30172
Phone number/Teléfono ( +39 ) 041 2348476	Extension/Interno	Fax (+39)0412348419	Fecha de nacimiento <b>14/04/1969</b>
<b>2. Academic background/Titulación/Formación Académica</b>			
<b>Degree/Grado</b> Laurea	Field of knowledge/Curso Computer Science		Start / End date / Periodo 1988 / 1994
	Institution/Entidad/Institución Universita` di Udine	City/ ciudad Udine	Country/País /Pcia. Italia
<b>Degree/Grado</b>	Field of knowledge/Curso Computer Science		Start / End date / Periodo 1995 / 2000
	Institution/Entidad/Institución Universita` di Pisa	City/Ciudad Pisa	Country/País /Pcia Italia
<b>Degree/Grado</b>	Field of knowledge/Curso		Start / End date / Periodo /
	Institution/Entidad/Institución	City/Ciudad	Country/País /Pcia
<b>Degree/Grado</b>	Field of knowledge/Curso		Start / End date / Periodo /
	Institution/Entidad/Institución	City/Ciudad	Country/País /Pcia
<b>Degree/Grado</b>	Field of knowledge/Curso		Start / End date / Periodo /
	Institution/Entidad/Institución	City/Ciudad	Country/País /Pcia

3. Research interests/Área de Actuación				
Field of Study/Segmento/Actividad				CNPq use/Para uso del
Domain Theory; Semantics of Concurrency; Specification and verification				
Of concurrent and distributed systems; Categorical and algebraic approaches to the semantics of computational formalisms; Graph rewriting systems;				
Analysis of open ended systems.				
4. Current position/Actividad actual				
Managerial and/or administrative activity/Dirección administración				
Research and Development/Investigación y Desarrollo	Research Assistant (ricercatore)			
Technical service/specialization/ Trabajo técnico/especialización Others/Otros				
5. Work experience/Experiencia profesional				
5.1. Institution/Intitucion	Position/Función	Activities/Actividades	Local/Local	Start - End date/Inicio y data final
Universita` di Pisa	PhD student	Research		1995-2000
Universita` di Pisa	PostDoc Researcher	Research and Teaching		2000-2001
Universita` Ca' Foscari di Venezia	Research Assistant (Ricercatore)	Research and Teaching		2001-now
6. Scientific, technological and artistic production/Producción científica, tecnológica y artística				
	Number/Cantidad		Number/Cantidad	
1. scientific articles in national scientific journals/artículos científicos publicados en periódicos especializados nacionales	0	6. papers presented in congresses, seminars, conferences, etc./comunicación en congresos, seminarios, conferencias, palestras, etc.	30	
2. scientific articles in international scientific journals/artículos científicos en periódicos especializados extranjeros	7	7. participation in expositions, presentations, etc./participación en exposiciones, presentaciones etc	0	
3. articles for scientific divulgement/artículos de divulgación científica	2	8. motion pictures, videos, audiovisual and media production / películas, videos, audiovisuales realizados	0	
4. defended thesis/tesis defendidas	1	9. patents/patentes	0	



<b>1. Professional data/activity/Actuación Profesional/Local de Trabajo</b>			
Full name/Nombre <b>Ugo Montanari</b>		e-mail <b>ugo@di.unipi.it</b>	
Institution/Entidad <b>Universita' di Pisa</b>		Present position Cargo/Función <b>Professore ordinario</b>	
Department/División/Unidad <b>Dipartimento di Informatica</b>		Start date (month/year) Inicio (mes/año) <b>9/1975</b>	
Office address/Dirección profesional <b>Largo B. Pontecorvo 3</b>		P.O. box Casilla de correo	
City/Ciudad <b>Pisa</b>	State/Province/ Pcia.	Country/País <b>Italia</b>	Zip code/C.P. <b>56127</b>
Phone number/Teléfono <b>( +39 ) 050 2212721</b>	Extension/Interno	Fax <b>(+39)0502212 726</b>	Fecha de nacimiento <b>17/7/1943</b>
<b>2. Academic background/Titulación/Formación Académica</b>			
<b>Degree/Grado</b>	Field of knowledge/Curso	Start / End date / Período	
"Laurea" degree	<b>Electronic Engineering</b>	1962 / 1966	
	Institution/Entidad/Institución	City/ ciudad	Country/País /Pcia.
	<b>Politecnico di Milano</b>	<b>Milano</b>	<b>Italia</b>
<b>Degree/Grado</b>	Field of knowledge/Curso	Start / End date / Período	
	Institution/Entidad/Institución	City/Ciudad	Country/País /Pcia
<b>Degree/Grado</b>	Field of knowledge/Curso	Start / End date / Período	
	Institution/Entidad/Institución	City/Ciudad	Country/País /Pcia
<b>Degree/Grado</b>	Field of knowledge/Curso	Start / End date / Período	
	Institution/Entidad/Institución	City/Ciudad	Country/País /Pcia
<b>Degree/Grado</b>	Field of knowledge/Curso	Start / End date / Período	
	Institution/Entidad/Institución	City/Ciudad	Country/País /Pcia

<b>3. Research interests/Área de Actuación</b>				
Field of Study/Segmento/Actividad				CNPq use/Para uso del
Semantics of Concurrency, Process Description and Object Oriented Languages, Constraint Programming, Graph Rewriting Systems, Coordination Models, Algebraic and Categorical Models of Concurrency, Models and Languages for Open Distributed Systems, Network Aware Programming, Service Oriented Computing.				
<b>4. Current position/Actividad actual</b>				
Managerial and/or administrative activity/Dirección y/o administración	Head of Department			
Research Development/Investigación y Desarrollo	Full professor			
Technical service/specialization/ Trabajo técnico/especialización Others/Otros				
<b>5. Work experience/Experiencia profesional</b>				
5.1. Institution/Intitucion	Position/Función	Activities/Actividades	Local/Local	Start - End date/Inicio y data final
CNR	Researcher	Research	Pisa	1972-1975
Dip. di Informatica	Full professor	Research and teaching	Pisa	1975 - now
<b>6. Scientific, technological and artistic production/Producción científica, tecnológica y artística</b>				
	Number/Cantidad			Number/Cantidad
1. scientific articles in national scientific journals/artículos científicos publicados en periódicos especializados nacionales	4	6. papers presented in congresses, seminars, conferences, etc./comunicación en congresos, seminarios, conferencias, palestras, etc.		174
2. scientific articles in international scientific journals/artículos científicos en periódicos especializados extranjeros	66	7. participation in expositions, presentations, etc./participación en exposiciones, presentaciones, etc.		0
3. articles for scientific divulgement/artículos de divulgación científica	15	8. motion pictures, videos, audiovisual and media production / películas, vídeos, audiovisuales realizados		0
4. defended thesis/tesis defendidas	0	9. patents/patentes		0
5. advised thesis/tesis dirijidas	15	10. books/libros		2
<b>7. Main publications/Principales publicaciones:</b>				
Relevant publications related to the project/Publicaciones relevantes para el proyecto.				
Ferrari, G., Montanari, U., Tile Formats for Located and Mobile Systems, Information and Computation, Vol 156 (1-2), pp 173-235, 2000.				



<b>1. Professional data/activity/Actuación Profesional/Local de Trabajo</b>			
Full name/Nombre <b>Gian Luigi Ferrari</b>		e-mail <b>giangi@di.unipi.it</b>	
Institution/Entidad <b>Universita' di Pisa</b>		Present position Cargo/Función <b>Professore associato</b>	
Department/División/Unidad <b>Dipartimento di Informatica</b>		Start date (month/year) Inicio (mes/año) <b>1/10/2000</b>	
Office address/Dirección profesional <b>Largo B. Pontecorvo 3</b>		P.O. box Casilla de correo	
City/Ciudad <b>Pisa</b>	State/Province/ Pcia.	Country/País <b>Italia</b>	Zip code/C.P. <b>56127</b>
Phone number/Teléfono <b>( +39 ) 050 2212766</b>	Extension/Interno	Fax <b>(+39)0502212726</b>	Fecha de nacimiento <b>15/06/1960</b>
<b>2. Academic background/Titulación/Formación Académica</b>			
<b>Degree/Grado</b> "Laurea" degree	Field of knowledge/Curso <b>Computer Science</b>		Start / End date / Período 1979 / 1984
	Institution/Entidad/Institución <b>Universita' di Pisa</b>	City/ ciudad <b>Pisa</b>	Country/País /Pcia. <b>Italia</b>
<b>Degree/Grado</b> PhD	Field of knowledge/Curso <b>Computer Science</b>		Start / End date / Período 1986 / 1990
	Institution/Entidad/Institución <b>Universita' di Pisa</b>	City/Ciudad <b>Pisa</b>	Country/País /Pcia <b>Italia</b>
<b>Degree/Grado</b>	Field of knowledge/Curso		Start / End date / Período
	Institution/Entidad/Institución	City/Ciudad	Country/País /Pcia
<b>Degree/Grado</b>	Field of knowledge/Curso		Start / End date / Período
	Institution/Entidad/Institución	City/Ciudad	Country/País /Pcia
<b>Degree/Grado</b>	Field of knowledge/Curso		Start / End date / Período
	Institution/Entidad/Institución	City/Ciudad	Country/País /Pcia

<b>3. Research interests/Área de Actuación</b>				
Field of Study/Segmento/Actividad				CNPq use/Para uso del
Specification and verification of distributed systems and mobile systems;				
Models and Languages for global computing;				
Language-based security;				
Tool support for mobile and distributed systems;				
<b>4. Current position/Actividad actual</b>				
Managerial administrative activity/Dirección administrativa	and/or y/o	Asóciate Coordinator of the undergraduate programs (Laurea and Laurea Specialistica)		
Research Development/Investigación y Desarrollo	and y	Associated professor		
Technical service/specialization/ Trabajo técnico/especialización Others/Otros				
<b>5. Work experience/Experiencia profesional</b>				
<b>5.1. Institution/Intitucion</b>	<b>Position/Función</b>	<b>Activities/Actividades</b>	<b>Local/Local</b>	<b>Start - End date/Inicio y data final</b>
Dip. di Informatica	Research assistant	Research and teaching	Pisa	1992-2000
Dip. di Informatica	Associated prof.	Research and teaching	Pisa	2000- now
<b>6. Scientific, technological and artistic production/Producción científica, tecnológica y artística</b>				
	Number/Cantidad		Number/Cantidad	
1. scientific articles in national scientific journals/artículos científicos publicados en periódicos especializados nacionales	0	6. papers presented in congresses, seminars, conferences, etc./comunicación en congresos, seminarios, conferencias, palestras, etc.	62	
2. scientific articles in international scientific journals/artículos científicos en periódicos especializados extranjeros	16	7. participation in expositions, presentations, etc./participación en exposiciones, presentaciones, etc.	0	
3. articles for scientific divulgement/artículos de divulgación científica	6	8. motion pictures, videos, audiovisual and media production / películas, vídeos, audiovisuales realizados	0	
4. defended thesis/tesis defendidas	1	9. patents/patentes	0	
5. advised thesis/tesis dirijidas	3	10. books/libros	0	
<b>7. Main publications/Principales publicaciones:</b>				
Relevant publications related to the project/Publicaciones relevantes para el proyecto.				
M.Bartoletti, P. Degano, G. Ferrari. Stack Inspection and Secure Program Transformations. International Journal of Information Security}, 2, 1-31, 2004.				

G. Ferrari, S. Gnesi, U. Montanari, M. Pistore. A Model Checking Verification Environment for Mobile Processes. In ACM Transactions on Software Engineering and Methodologies (ACM TOSEM), 12(4) 440-473, 2003.

G. Ferrari, U. Montanari, E. Tuosto. Co-algebraic minimization of HD-automata for the pi-calculus using polymorphic types. Theoretical Computer Science, 331, 325-365, 2005.

M. Bartoletti, P. Degano, G. Ferrari. Enforcing Secure Service Composition. In Proc. 18th IEEE Computer Security Foundations Workshop (CSFW'05), IEEE Press, 2005.

**3. Languages/Idiomas**

Indicate your language proficiency/Marcar la columna apropiada: P – poor/ P - poco G – good/R – razoablemente E – excellent/B - bien

Language/Idioma	Speaking Habla	/Reading Lee	/Writing Escribe	Language/ Idioma	Speaking Habla	/Reading/ Lee	Writing / Escribe
Italiano	E	E	E				
English	E	E	E				
Espanol							
German							
Francais							

<b>1. Professional data/activity/Actuación Profesional/Local de Trabajo</b>			
Full name/Nombre <b>Fabio Gadducci</b>		e-mail <b>gadducci@di.unipi.it</b>	
Institution/Entidad <b>Università di Pisa</b>		Present position Cargo/Función <b>Professore Associato</b>	
Department/División/Unidad <b>Dipartimento di Informatica</b>		Start date (month/year) Inicio (mes/año) <b>1/01/2005</b>	
Office address/Dirección profesional <b>Largo Pontecorvo 3c</b>		P.O. box Casilla de correo	
City/Ciudad <b>Pisa</b>	State/Province/ Pcia. <b>Pisa</b>	Country/Pais <b>Italia</b>	Zip code/C.P. <b>I-56127</b>
Phone number/Teléfono <b>( +39 ) 050 2212716</b>	Extension/Interno	Fax <b>050 2212726</b>	Fecha de nacimiento <b>25/3/1966</b>
<b>2. Academic background/Titulación/Formación Académica</b>			
<b>Degree/Grado</b> "Laurea"	Field of knowledge/Curso <b>Computer Science</b>		Start / End date / Periodo <b>1984 /1989</b>
	Institution/Entidad/Institución <b>Università di Pisa</b>	City/ ciudad <b>Pisa</b>	Country/Pais /Pcia. <b>Italia</b>
<b>Degree/Grado</b> PhD	Field of knowledge/Curso <b>Computer Science</b>		Start / End date / Periodo <b>1989/1992</b>
	Institution/Entidad/Institución <b>Università di Pisa</b>	City/Ciudad <b>Pisa</b>	Country/Pais /Pcia <b>Italia</b>
<b>Degree/Grado</b>	Field of knowledge/Curso		Start / End date / Periodo <b>/</b>
	Institution/Entidad/Institución	City/Ciudad	Country/Pais /Pcia
<b>Degree/Grado</b>	Field of knowledge/Curso		Start / End date / Periodo <b>/</b>
	Institution/Entidad/Institución	City/Ciudad	Country/Pais /Pcia
<b>Degree/Grado</b>	Field of knowledge/Curso		Start / End date / Periodo <b>/</b>
	Institution/Entidad/Institución	City/Ciudad	Country/Pais /Pcia

3. Research interests/Área de Actuación				
Field of Study/Segmento/Actividad			CNPq use/Para uso del	
Specification and verification of concurrent and distributed systems; categorical and algebraic techniques for semantics of computational devices, graph and term graph rewriting systems.				
<b>4. Current position/Actividad actual</b>				
Managerial and/or administrative activity/Dirección administración		Vice-chairman, master course in Applied Informatics, based in La Spezia		
Research and Development/Investigación y Desarrollo		Associated professor		
Technical service/specialization/ Trabajo técnico/especialización				
Others/Otros				
<b>5. Work experience/Experiencia profesional</b>				
5.1. Institution/Intitución	Position/Función	Activities/Actividades	Local/Local	Start - End date/Inicio y data final
Informatics Dept., Pisa	Research assistant	Research and teaching		2000/2004
Informatics Dept., Pisa	Associated Prof.	Research and teaching		2004 on
<b>6. Scientific, technological and artistic production/Producción científica, tecnológica y artística</b>				
	Number/Cantidad		Number/Cantidad	
1. scientific articles in national scientific journals/artículos científicos publicados en periódicos especializados nacionales		6. papers presented in congresses, seminars, conferences, etc./comunicación en congresos, seminarios, conferencias, palestras, etc.	30	
2. scientific articles in international scientific journals/artículos científicos en periódicos especializados extranjeros	7	7. participation in expositions, presentations, etc./participación en exposiciones, presentaciones etc.		
3. articles for scientific divulgement/artículos de divulgación científica		8. motion pictures, videos, audiovisual and media production / películas, vídeos, audiovisuales realizados		
4. defended thesis/tesis defendidas	1	9. patents/patentes		
5. advised thesis/tesis dirigidas		10. books/libros		

**7. Main publications/Principales publicaciones:**

Relevant publications related to the project/Publicaciones relevantes para el proyecto.

Fabio Gadducci and Ugo Montanari, Graph Processes with Fusions: Concurrency by Colimits, Again. In *Formal Methods in Software and Systems Modeling (Ehrig Festschrift)*, volume 3393 of Lecture Notes in Computer Science. Springer, 2005, pages 84-100.

Paolo Baldan and Andrea Corradini and Fabio Gadducci, Specifying and Verifying UML Activity Diagrams Via Graph Transformation. In *Global Computing, IST/FET International Workshop*, volume 3267 of Lecture Notes in Computer Science. Springer, 2004, pages 18-33.

Fabio Gadducci, Term Graph Rewriting for the pi-Calculus. In *Programming Languages and Systems, First Asian Symposium*, volume 2895 of Lecture Notes in Computer Science. Springer, 2003, pages 37-54.

**8. Languages/Idiomas**

Indicate your language proficiency/Marcar la columna apropiada: P – poor/ P - poco G – good/R – razoablemente E – excellent/B - bien

Language/Idioma	Speaking Habla	/Reading Lee	/Writing Escribe	Language/ Idioma	Speaking Habla	/Reading/ Lee	Writing Escribe
Italiano	E	E	E				
English	E	E	E				
Espanol	G	G	G				
German	P	P	P				
French	P	P	P				

1. Professional data/activity/Actuación Profesional/Local de Trabajo			
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Phone number/Teléfono <b>( +39 ) 041 2348441</b>	Extension/Interno	Fax <b>+39 041 2348419</b>	Fecha de nacimiento <b>12/05/1970</b>
2. Academic background/Titulación/Formación Académica			
Degree/Grado <b>“Laurea” degree</b>	Field of knowledge/Curso <b>Computer Science</b>		Start / End date / Período <b>1989 / 1994</b>
	Institution/Entidad/Institución <b>Universita' di Pisa</b>	City/ ciudad <b>Pisa</b>	Country/País /Pcia. <b>Italia</b>
Degree/Grado <b>PhD</b>	Field of knowledge/Curso <b>Computer Science</b>		Start / End date / Período <b>1995 / 1999</b>
	Institution/Entidad/Institución <b>Universita' di Pisa</b>	City/Ciudad <b>Pisa</b>	Country/País /Pcia <b>Italia</b>
Degree/Grado	Field of knowledge/Curso		Start / End date / Período <b>/</b>
	Institution/Entidad/Institución	City/Ciudad	Country/País /Pcia
Degree/Grado	Field of knowledge/Curso		Start / End date / Período <b>/</b>
	Institution/Entidad/Institución	City/Ciudad	Country/País /Pcia
Degree/Grado	Field of knowledge/Curso		Start / End date / Período <b>/</b>
	Institution/Entidad/Institución	City/Ciudad	Country/País /Pcia

3. Research interests/Área de Actuación				
Field of Study/Segmento/Actividad				CNPq use/Para uso del
<b>Representation and Reasoning on Spatio-Temporal data</b>				
<b>Interoperability</b>				
<b>High level Interfaces towards Geographical Information Systems</b>				
<b>Deductive databases</b>				
4. Current position/Actividad actual				
Managerial and/or administrative activity/Dirección administración				
Research and Development/Investigación y Desarrollo	<b>Research Assistant</b>			
Technical service/specialization/ Trabajo técnico/especialización Others/Otros				
5. Work experience/Experiencia profesional				
5.1. Institution/Intitucion	Position/Función	Activities/Actividades	Local/Local	Start - End date/Inicio y data final
Dip. di Informatica Università Ca' Foscari	Research Assistant	Research and teaching	Venezia	2001 - now
6. Scientific, technological and artistic production/Producción científica, tecnológica y artística				
	Number/Cantidad		Number/Cantidad	
1. scientific articles in national scientific journals/artículos científicos publicados en periódicos especializados nacionales	<b>0</b>	6. papers presented in congresses, seminars, conferences, etc./comunicación en congresos, seminarios, conferencias, palestras, etc.	<b>19</b>	
2. scientific articles in international scientific journals/artículos científicos en periódicos especializados extranjeros	<b>4</b>	7. participation in expositions, presentations, etc./participación en exposiciones, presentaciones etc	<b>0</b>	
3. articles for scientific divulgation/artículos de divulgación científica	<b>0</b>	8. motion pictures, videos, audiovisual and media production / películas, vídeos, audiovisuales realizados	<b>0</b>	
4. defended thesis/tesis defendidas	<b>1</b>	9. patents/patentes	<b>0</b>	
5. advised thesis/tesis dirigidas	<b>0</b>	10. books/libros	<b>0</b>	
7. Main publications/Principales publicaciones:				



1. Professional data/activity/Actuación Profesional/Local de Trabajo			
Full name/Nombre <b>Stefania Gnesi</b>		e-mail <b>gnesi@isti.cnr..it</b>	
Institution/Entidad <b>CNR</b>		Present position Cargo/Función <b>Professore ordinario</b>	
Department/División/Unidad <b>Istituto di Scienze e Tecnologia dell'Informazione (ISTI)</b>		Start date (month/year) Inicio (mes/año) <b>1/1984</b>	
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Phone number/Teléfono <b>( +39 ) 050 3152918</b>	Extension/Interno	Fax <b>(+39)0503152 810</b>	Fecha de nacimiento <b>21/7/54</b>
2. Academic background/Titulación/Formación Académica			
<b>Degree/Grado</b> "Laurea" degree	Field of knowledge/Curso <b>Computer Science</b>	Start / End date / Periodo <b>1972 / 1978</b>	
	Institution/Entidad/Institución <b>Universita' di Pisa</b>	City/ ciudad <b>Pisa</b>	Country/País /Pcia. <b>Italia</b>
<b>Degree/Grado</b>	Field of knowledge/Curso	Start / End date / Periodo	
	Institution/Entidad/Institución	City/Ciudad	Country/País /Pcia
<b>Degree/Grado</b>	Field of knowledge/Curso	Start / End date / Periodo	
	Institution/Entidad/Institución	City/Ciudad	Country/País /Pcia
<b>Degree/Grado</b>	Field of knowledge/Curso	Start / End date / Periodo	
	Institution/Entidad/Institución	City/Ciudad	Country/País /Pcia
<b>Degree/Grado</b>	Field of knowledge/Curso	Start / End date / Periodo	
	Institution/Entidad/Institución	City/Ciudad	Country/País /Pcia

<b>3. Research interests/Área de Actuación</b>				
Field of Study/Segmento/Actividad				CNPq use/Para uso del
the development of formal methods and tools tools for the formal specification and verification of concurrent distributed and mobile systems, and their applications to safety-critical systems and to security protocols.				
<b>4. Current position/Actividad actual</b>				
Managerial and/or administrative activity/Dirección y/o administración	Head of the Formal Methods and Tools Laboratory			
Research Development/Investigación y Desarrollo	Senior Researcher			
Technical service/specialization/ Trabajo técnico/especialización Others/Otros				
<b>5. Work experience/Experiencia profesional</b>				
5.1. Institution/Intitucion	Position/Función	Activities/Actividades	Local/Local	Start - End date/Inicio y data final
CNR	Researcher	Research	Pisa	1984-now
<b>6. Scientific, technological and artistic production/Producción científica, tecnológica y artística</b>				
	Number/Cantidad			Number/Cantidad
1. scientific articles in national scientific journals/artículos científicos publicados en periódicos especializados nacionales		6. papers presented in congresses, seminars, conferences, etc./comunicación en congresos, seminarios, conferencias, palestras, etc.		85
2. scientific articles in international scientific journals/artículos científicos en periódicos especializados extranjeros	20	7. participation in expositions, presentations, etc./participación en exposiciones, presentaciones, etc.		0
3. articles for scientific divulgement/artículos de divulgación científica		8. motion pictures, videos, audiovisual and media production / películas, videos, audiovisuales realizados		0
4. defended thesis/tesis defendidas	0	9. patents/patentes		0
5. advised thesis/tesis dirijidas	3	10. books/libros		1
<b>7. Main publications/Principales publicaciones:</b>				
Relevant publications related to the project/Publicaciones relevantes para el proyecto.				
De Francesco N., Fantechi A., Gnesi S., Inverardi P. - <i>Finite approximations for model checking non-finite-state processes</i> . In: The Computer Journal, Vol. 44 n. 2 (2001), 109-123. British Computer Society, 2001.				
Bernardeschi C., Fantechi A., Gnesi S. - <i>Formal validation of fault-tolerance mechanisms inside GUARDS</i> . In: Reliability Engineering and System Safety Vol. 71 (2001), 261-270. Elsevier, 2001.				
Bernardeschi C., Fantechi A., Gnesi S. - <i>Model checking fault tolerant systems</i> . In: Software Testing Verification and Reliability Vol. 12 n. 4 (2002), 1-25. Wiley, 2002.				



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