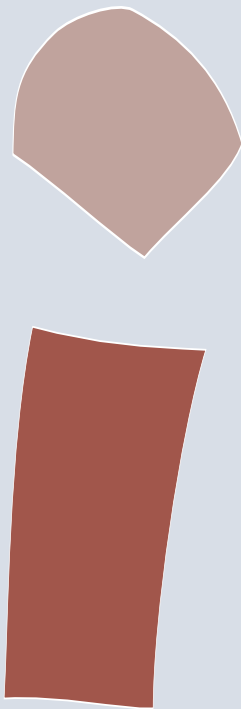


B.3 / Research groups

Programming and Software Engineering



Research groups
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équipe Programmation et génie logiciel

Responsable : Marie-Claude Gaudel

L'équipe Programmation et Génie Logiciel est composée de trois groupes :

- Le groupe Génie Logiciel est connu depuis longtemps pour ses travaux sur le rôle des méthodes formelles dans le développement de logiciel. Actuellement, l'essentiel de ses activités concerne le test basé sur différentes méthodes de spécification formelle, avec une nouvelle orientation vers les méthodes probabilistes et statistiques.
- Le groupe Interaction Homme-Machine travaille sur plusieurs sujets liés aux systèmes interactifs, parmi lesquels les nouvelles techniques d'interaction, les systèmes de travail collaboratif, la visualisation d'informations complexes, la conception participative et la réalité augmentée.
- Le groupe Réseaux Mobiles est récent. Il a été créé en septembre 2000 avec l'objectif de développer au LRI une compétence sur les systèmes mobiles et sans fil. Les travaux de ce groupe portent sur les systèmes cellulaires (UMTS), la mobilité sur internet, les réseaux adhoc et les réseaux mobiles.

La synergie entre ces trois groupes est assurée par de nombreuses réunions d'équipes et plusieurs activités communes, comme la visualisation de logiciels complexes, le test de protocoles, l'application de techniques de travail collaboratif à la composition robuste de services Web. Durant ces quatre dernières années, plusieurs événements ont animé la vie de l'équipe et ont contribué à faire évoluer son activité.

Tout d'abord le départ de Bruno Marre vers le CEA, où il conduit le développement d'outils de test pour la certification de logiciels critiques : ce départ a été compensé par le recrutement de deux jeunes maîtres de conférences qui s'intéressent respectivement au test de propriétés temporelles et au test d'intégration. Ensuite, la mise en place du projet PCRI In Situ (Interaction Située), en commun avec l'INRIA, ce qui a permis un fort développement des activités en Interaction Homme-machine. Enfin la création du groupe Réseaux, fort maintenant d'un jeune professeur, d'une maîtresse de conférences et de 4 doctorants, qui a vocation à continuer à se renforcer.





Programming and Software Engineering

Head: Marie-Claude Gaudel

The Programming and Software Engineering group is organized in three research teams:

- The Software Engineering team has been known for years for its work on the use of formal methods in software development. Currently, there is a focus on testing based on various kinds of formal specifications with a new orientation towards probabilistic and statistical methods.
- The Human-Computer Interaction team addresses various topics related to interactive systems, including novel interaction techniques, computer-supported cooperative work, information visualization, participatory design and augmented (or mixed) reality.
- The Mobile Network team was created in September 2000 with the goal to develop at LRI some research in wireless and mobile systems. The topics of the team are cellular systems (UMTS), mobility in IP networks, ad hoc networks and network mobility.

The cross-fertilisation among these teams is ensured by a group seminar and by several common activities, such as the visualisation of complex programs or specifications, the test of communication protocols, the use of techniques from computer-supported cooperative work for composing Web services in a robust way. Over the last four years, several important changes have occurred in our group: Bruno Marre, a former CNRS researcher from the Software Engineering team, has left LRI for CEA-LIST where he leads the development of testing tools used for the certification of critical systems. Two assistant professors have been recruited recently to reinforce the team.

A joint project was established between the Human-Computer Interaction team and INRIA Futurs within the framework of PCRI (*Pôle Commun de Recherche en Informatique*).

This new project, called In Situ (*Interaction Située* or *Situated Interaction*) has grown from 5 members in 2002 to about 20 by the end of 2004. As mentioned above, the Mobile Network team was created, and is now very active, with one professor, one assistant professor and numerous PhD students. However, there it needs further recruiting in order to reach critical mass.

Research groups

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Introduction

pcr*i*
pôle commun de recherche
en informatique

Research group members

Personnel as of 01/01/2004

| Full time faculty | | | |
|-------------------|-------------------|-----------------|---------------------|
| <i>Name</i> | <i>First Name</i> | <i>Position</i> | <i>Institution</i> |
| AL AGHA | Khaldoun | MC | Université Paris XI |
| BEAUDOUIN-LAFON | Michel | PR1 | Université Paris XI |
| BOUKHATEM | Lila | MC | Université Paris XI |
| GAUDEL | Marie-Claude | PRCE | Université Paris XI |
| PETITJEAN | Eric | MC | IUT d'Orsay |
| ROUSSEL | Nicolas | MC | Université Paris XI |
| SCHLIENGER | Françoise | MC | IUT d'Orsay |
| VOISIN | Frédéric | MC | Université Paris XI |
| ZAIDI | Fatiha | MC | Université Paris XI |

| Doctoral students | | | |
|-------------------|----------|------|---------------------|
| APPERT | Caroline | AM | Université Paris XI |
| BADIS | Hakim | D | INRIA |
| BEAUDOUX | Olivier | D | AETS-ESEO |
| BEN HAMIDA | Ines | AM | Université Paris XI |
| BENZAID | Mounir | ATER | IUT Marne la Vallée |
| BLANCH | Renaud | AM | Université Paris XI |
| GOURAUD | Sandrine | ATER | Université Paris XI |
| LARD | Jérôme | D | THALES |
| LESTIENNES | Grégory | AM | Université Paris XI |
| MALES | Davor | D | Université Paris VI |
| NARS | Emmanuel | A | Université Paris XI |

| Temporary personnel | | | |
|---------------------|-----------|----------|---------------------|
| AL-MESHHADANY | Thamer | ATER | Université Paris XI |
| PERATO | Laurent | ATER | Université Paris XI |
| COURTOIS | Jean-René | Engineer | Université Paris XI |
| FOURATI | Alia | Engineer | Université Paris XI |
| LANGET | Matthieu | Engineer | CNRS |

| Non-LRI personnel of PCRI project In Situ | | | | |
|---|-------------------|------------------|--------------------|---------------------|
| <i>Name</i> | <i>First Name</i> | <i>Position</i> | <i>Institution</i> | <i>Dates</i> |
| FEKETE | Jean-Daniel | CR | INRIA | since 01/09/02 |
| MACKAY | Wendy | DR | INRIA | since 01/09/02 |
| COSTA-CUNHA | Pascal | AM | | since 01/09/03 |
| DACHARY | Loic | Ingénieur expert | INRIA | 01/03/03 - 31/12/03 |
| EVANS | Helen | Engineer | INRIA | 15/10/03 - 31/12/03 |
| GAUDRON | Nicolas | Engineer | INRIA | 01/03/03 - 30/09/04 |
| HANSEN | Heiko | Engineer | INRIA | 15/10/03 - 31/12/03 |

Note: See the glossary for acronyms.

| Long term visitors | | | | | | |
|--------------------|------------|-------------|----------------------------------|----------|-----------|------------------------------|
| Name | First Name | Nationality | Institution | Arrival | Departure | Funding |
| ZAMBRANO | Nancy | Venezuelian | Central University of Venezuela | 08/01/01 | 30/09/01 | Sabbatical |
| ZHAI | Shumin | Canadian | IBM Almaden Research Center, USA | 01/06/02 | 31/08/02 | Sabbatical |
| QUARFORDT | Pernilla | Swedish | University of Linkoping | 17/06/02 | 31/08/02 | PhD student |
| LYU | Michael R. | Chinese | Chinese University of Hong Kong | 17/03/03 | 21/03/03 | |
| GALVES | Antonio | Bresilian | University of Sao Paulo | 01/06/03 | 30/06/03 | Visiting professor, Paris XI |
| GREENBERG | Saul | Canadian | University of Calgary | 22/09/03 | 21/10/03 | Visiting professor, Paris XI |

Group evolution

Since 2000, three permanent researchers have left the group, while four new assistant professors have been recruited :

Departures

- Bruno Marre, CNRS researcher, left in September 2002, is now CEA-LIST;
- Guy Vidal-Naquet, Professor, left in March 2001, is now at Supelec;
- Mountaz Hascoët, Assistant Professor, left in September 2001, is now at Université de Montpellier (LIRMM).

Arrivals

- Nicolas Roussel, Assistant Professor, 2001
- Eric Petitjean, Assistant Professor, 2002
- Lila Boukhatem, Assistant Professor, 2002
- Fatiha Zaidi, Assistant Professor, 2003
- Michel Beaudouin-Lafon returned in September 2000 from a two-year leave (*détachement*) at University of Aarhus, Denmark.

Research groups

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Members

Research description

The *Programming and Software Engineering group* is organized in three research teams: *Software Engineering*, *Human Computer Interaction*, and *Mobile Network*.

The first team has been working for a long time on the role of formal specifications in software development. The second team studies novel interaction techniques, cooperative work environments, visualisation and the design of interactive systems. The last team is devoted to mobility and communication via wireless interfaces. It was created with the goal of creating an autonomous research group on these topics.

The cross-fertilisation between these teams is ensured by a group seminar and by several common activities. The most recent ones are *visualisation of complex programs or specifications* (a master thesis was defended in september 2004 and will continue into a Ph.D. thesis, see Figure 1), and *test of communication protocols* based on formal descriptions, which is starting now with the arrival of a young assistant professor from INT (Evry).

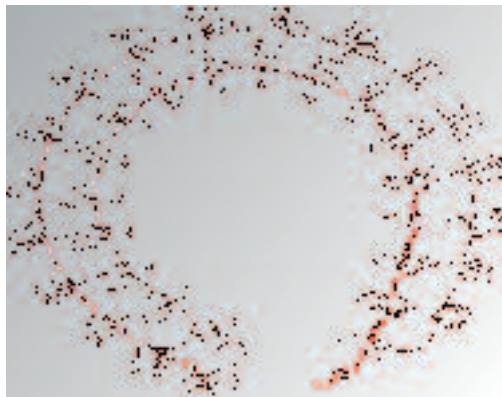


Figure 1: Example of the visualisation of a complex piece of software by the SEQUOIA tool. The size of the red boxes represent the a priori importance of the corresponding part of the software according to a semantic fisheye (Furnas, 1986). The SEQUOIA tool is developed with the InfoVis toolkit [91], and will provide the user interface for the AUGUST tool [86].

The Software Engineering team

Deriving test cases from specifications is now recognised as a major application of formal methods to software development. It is the current focus of this team. Different methods have been proposed for various formalisms: behavioural descriptions such as transition systems, model-based specifications, algebraic specifications, etc.

Based on previous work on testing from algebraic specifications, the team has proposed a general framework for test data selection from formal specifications. A notion of “exhaustive test set” is derived from the semantics of the formal notation and from the definition of a correct implementation (given as a satisfaction relation or a conformance relation). Then a finite test set is selected via some “selection hypotheses”. This approach had been first illustrated by its application to algebraic specifications with the LOFT system and object-oriented Petri nets (CO-OPN2) at EPFL in Switzerland. During the last four years it has been successfully applied to LUSTRE with the GATEL system (in collaboration with CEA-LIST), full LOTOS, and Input/Output automata.

Recently, probabilistic and statistical approaches have been introduced, taking advantage of competences of colleagues in the BioInfo and Algo groups. This work resulted in an

innovative way of implementing statistical testing, using uniform generation of combinatorial structures.

There are around ten groups working on software testing in France. The LRI team has been the first one to study testing based on formal specifications. It keeps a leader role, with frequent meetings of the community in Orsay. At the international level, the team is present in almost all of the program committees in the domain and publishes in the best conferences.

The Human Computer Interaction team

The human-computer interaction (HCI) theme was originally developed to address the design and development of interactive tools for software development. Since then it has evolved to encompass a wider range of topics, including novel interaction techniques, computer-supported cooperative work, information visualization, participatory design and augmented (or mixed) reality. In 2002, a joint project was established between this group and INRIA Futurs within the framework of the PCRI (Pôle Commun de Recherche en Informatique). This new project, called In Situ (Interaction Située or Situated Interaction) has grown from 5 members in 2002 to about 20 by the end of 2004, including the permanent researchers and contract personnel recruited by INRIA and the external collaborators. This makes it one of the largest academic research group in HCI in France and the only one with such a wide coverage of HCI topics.

Over the past 4 years, the main accomplishments of this team are:

- The development of an interaction model called instrumental interaction and its application to the development of novel post-WIMP interfaces;
- The development of tools and techniques for video-based collaboration,
- Fundamental work on evaluation and optimization of pointing performance,
- New research methods for developing new interactive technologies for non-professional users,
- The creation of a novel interface for non-technical users to manage 'communication appliances' small-group networks,
- The development of paper-based applications, in biology and air traffic control, that provide users with the benefits of both physical paper and on-line information, and
- Novel methods of visualising information and benchmarks for comparing them.

An original aspect of In Situ is to practice multi-disciplinary research by associating industrial designers, psychologists and computer scientists. This mix of backgrounds and corresponding research methods has led to several types of cross-fertilization and original research that is well recognized, with participations in many program committees and publications in the best conferences. Such multi-disciplinary teams are mostly found in Scandinavian countries (KTH Stockholm in Sweden, University of Aarhus in Denmark), in the U.K. (see the 6-years Equator project funded by EPSRC) and the U.S.A. (CMU, MIT Media Lab, IBM, Microsoft Research). We have several collaborations with some of these research centres, demonstrating that our research is at the forefront of the field of HCI.

The Mobile Networks team

The third and most recent team in the group was created in September 2000 to develop some research in wireless and mobile systems at LRI. The team works on cellular systems (UMTS), mobility in IP networks, ad hoc networks and network mobility.

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Research description

The team produces high quality research in this domain. Four Ph.D. theses have already been defended and four students are preparing theses. The team publishes in top-level conferences and journals (IEEE, ACM) and the members are very active in normalization and standardization associations. The team collaborates nationally and internationally with several laboratories and industrial companies. Team members are present in the program committees of conferences in the mobile and wireless areas. Khaldoun Al Agha was the chair of three program committees and a guest editor for ACM WINET.

The team has developed algorithms for routing in ad hoc networks based on quality of service. These solutions have been implemented and are heavily downloaded and used by academic and industrial labs. These solutions will soon be presented to standardization. Today, we are considered as the experts in France in this area.

Software Engineering team

- *Permanent members: Marie-Claude Gaudel (head), Bruno Marre (until september 2002), Éric Petitjean (since september 2002), Françoise Schlienger, Frédéric Voisin, Fatiha Zaidi (since september 2003).*
- *Ph.D. students: Sandrine-Dominique Gouraud, Gregory Lestiennes.*

The Software Engineering team mainly develops activities in the area of software testing based on formal specifications [110, 106]. For several years, probabilistic and statistical approaches to software testing have taken some importance in our work [99, 86]. Another novelty is the study of interoperability testing [82]. We also address related research topics such as software reliability, robustness, atomicity and actions compensation. They are not reported here, but they appear in our list of publications.

Testing based on formal specifications

The team has developed for several years a theory of software testing that has led to a general framework for black-box testing based on formal specifications, applicable to arbitrary formalisms. It has been recognized as a pioneering work and a fundamental result in the area of software testing. Among the formalisms considered during the last four years, we present LUSTRE [110] and Input/Output automatas [106].

Testing based on LUSTRE descriptions. LUSTRE is a synchronous language used for the description of control-command embedded systems. The development of a method and a tool for deriving test cases from such descriptions has been realised in the framework of a collaboration with the CEA-List laboratory (*Commissariat à l'Energie Atomique, Laboratoire d'Intégration des Systèmes et des Technologies, Saclay*). Bruno Marre is currently on leave at CEA-List where he manages the development and use of the GATEL tool. Gatel was used by IRSN (*Institut de Radioprotection et de Sécurité Nucléaire*) for assessing the test of critical systems. It is currently experimented by ONERA-Toulouse for Airbus-industrie.

Input/Output Automata with data types. I/O automata or I/O transition systems are popular in the area of testing since they are claimed to provide a realistic basis for dealing with concurrent systems and communication protocols. In [106] we have improved the existing theory for testing based on finite I/O transition systems. As a consequence we have given a more efficient algorithm for test generation. Moreover, we have extended this approach by introducing data types (i.e. guarded transitions and transmissions of values). This leads to infinite I/O transition systems, and raises difficult new problems, among which reachability. Based on our previous work on full Lotos and data types, we have proposed testing strategies that take into account both the topology of the automata and the properties of the data types.

I/O automata are not very realistic, since they only allow the modelling of “input-enabled” systems, i.e. systems that accept any input at any moment. We are currently studying how to enrich the model in order to describe and test systems that do not fulfil this strong requirement.

Probabilistic and Statistical Approaches

In recent years, the general problem of studying and simulating random processes has particularly benefited from progresses in the area of random generation of combinatorial structures. This work constitutes the basis for powerful tools for uniform random generation of complex entities, such as graphs, trees, words, paths... We have started some research for using such concepts and tools for random software testing in collaboration with the bio-informatics group at LRI [99, 86].

We have developed a method for using these tools as soon as there is a graph description of the behaviour of the system under test. It may be the control graph of the program, or some specification, and the graph may be either directly available (Statecharts, Petri nets) or indirectly via some semantics in terms of transition systems, automata, state machines, Kripke structures, etc. Such behavioural graphs can be described as labelled combinatorial structures. Therefore, uniform generation can be used for drawing paths from the set of execution paths or traces of the system under test, or, more efficiently, among some subsets satisfying some coverage conditions. This method is similar to the statistical testing methods developed at LAAS (Toulouse) several years ago. It has the advantage of being fully automated: A tool, AUGUST, has been developed and experimented on the same set of C programs as LAAS. It provides a way to perform intensive testing with an excellent experimental detection power.

We are interested in finding a formal way for assessing this detection power, for instance by estimating the probability of remaining undetected faults. We have started to explore the relationship between these kinds of testing methods and probabilistic verification methods in the area of model checking. We have regular brainstorming meetings on this topic with colleagues from the Complexity team (Algo group).

Interoperability Testing

Interoperability testing of new protocols and services becomes a strategic activity in the telecom industry. Indeed, new trends require to design new protocols and services that combine wireless networks and the Internet such as the WAP system. We have adapted previous work on component testing based on formal specification, namely the hit-or-jump method, to address interoperability and layer protocol testing. We have obtained promising results when experimenting it on WAP protocols. This testing approach, especially the real platform, can be updated to test other protocols such as the GPRS and UMTS protocols.

We are also leading experiments on how to use and adapt the SPIN model-checker for implementing this hit-or-jump method. Interoperability models correspond to huge transition systems; SPIN's algorithms (and probably several other model checker kernels as well) seem to provide relevant and optimised implementation techniques for this method. In the context of interoperability and integration of services, scalability is a key issue and the know-how of the model-checker is probably worth looking at.

Key references

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Research groups

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Research description:
Software engineering team

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- [99] S.-D. Gouraud, A. Denise, M.-C. Gaudel, and B. Marre. A new way of automating statistical testing methods. In *Automated Software Engineering Conference (A.S.E.), I.E.E.E.*, pages 5-12, 2001.
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- [110] B. Marre and A. Arnould. Test sequences generation from lustre descriptions: Gatel. In *Proc. Fifteenth IEEE Int. Conf. on Automated Software Engineering (ASE 2000)*, pages 229-237. IEEE, Sept. 2000.

In Situ PCRI project



- *Permanent members: Wendy Mackay (head), Michel Beaudouin-Lafon, Jean-Daniel Fekete, Emmanuel Pietriga (since October 2004), Nicolas Roussel, Olivier Chapuis (since March 2004).*
- *Ph.D. students: Caroline Appert, Olivier Beaudoux (until July 2004), Renaud Blanch, Pascal Costa-Cunha, Nathalie Henry (since October 2004), Jean-Baptiste Labrune (since October 2004), Jérôme Lard (since June 2004), Emmanuel Nars, Yann Riche (since October 2004).*
- *Non-permanent members: Stéphane Conversy (until September 2003), Jean-René Courtois, Loïc Dachary (2003), Yangzhu Du, Helen Evans (2002-2003), Nicolas Gaudron (2003-2004), Heiko Hansen (2002-2003), Fabrice Haiÿ, Jean-Christophe Latsis, Matthieu Langet.*
- *External collaborators: Yves Guiard (CNRS & Université de la Méditerranée), Catherine Letondal (Institut Pasteur).*

The In Situ project was created in 2002 as a PCRI project between INRIA Futurs and LRI. Two INRIA researchers (Wendy Mackay and Jean-Daniel Fekete) were recruited in 2002 to start the project together with the Human-Computer Interaction team, which had five members at the time. Within two years the team has grown to 21 people, with two new permanent researchers (one from INRIA, one from CNRS), seven new Ph.D. students, five temporary members and two external collaborators who work closely with us.

The In Situ project addresses the problem of how to create effective interactive systems, considering the role of context, both human and technical, as fundamental to the problem. Creating *situated interfaces*, i.e. interfaces that are adapted (or adaptable) to their contexts of use, takes advantage of the complementary features of humans and computers.

The research is organized along three main themes: new interaction paradigms, participatory design and engineering of interactive systems. However these themes are often intermixed in actual projects, which we see as indispensable in order to address real-world problems. More specifically, the In Situ project develops novel interaction techniques, new tools (in the form of toolkits) to develop these techniques and new methods to enhance the design process of interactive systems. In the long run, the project seeks to create a new generation of interactive environments as an alternative to the current generation of desktop environments.

Our group is multi-disciplinary, including computer scientists, psychologists and designers. Working together requires an understanding of each other's methods. Much of computer science relies on formal theory, which, like mathematics, is evaluated with respect to its internal consistency. The social sciences are based more on descriptive theory, attempting to explain observed behaviour, without necessarily being able to predict it.



The natural sciences seek predictive theory, using quantitative laws and models to not only explain, but also to anticipate and control naturally occurring phenomena. Finally design is based on a corpus of accumulated knowledge, which is captured in design practice rather than scientific facts but is nevertheless very effective.

Combining these approaches is a major challenge. We are exploring an integrative approach that we call *generative theory*, which builds upon existing knowledge in order to create new categories of artefacts and explore their characteristics. Our goal is to produce prototypes, research methods and software tools that facilitate the design, development and evaluation of interactive systems [67].

New interaction Paradigms

Post-WIMP interfaces. WIMP (Windows, Icons, Menus, Pointing) interfaces have become the de-facto standard of personal computing. Post-WIMP interfaces build on this standard by developing and integrating novel interaction techniques that are better adapted to the tasks at hand. We have developed *instrumental interaction*, an interaction model based on the metaphor of the tools and instruments that we use to mediate our actions in the real world [65, 69]. We have applied this model to various post-WIMP applications, including a document-based environment where the primary objects are documents rather than applications, and where instruments are independent from the object they operate on [71, 19, 173]. We have also explored end-user development, an approach where users can easily tailor and extend their environment to better suit their needs and work practices [178, 107]. Finally we are working on modelling post-WIMP interfaces in order to better predict their performance in the context of use [52].

Pointing. Pointing is a fundamental action in graphical user interfaces. We have conducted fundamental work, based on Fitts' law (a robust empirical law in Psychology that predicts the minimum time to reach a target of a specified size at a specified distance [30]), to improve pointing. We have extended Fitts' law to zoomable interfaces [102, 16], where pointing requires a complex coordination of panning and zooming, and shown that multiscale pointing performance was inversely proportional to the size of the view used to display a zoomable document, up to a certain size [100, 16]. We have also developed two novel pointing techniques, semantic pointing [78] (Figure 2) and object pointing [101], that exploit the information known to the system in terms of possible targets to improve pointing performance and shown significant gains over traditional pointing.



Figure 2: With Semantic Pointing, objects can have a visual size different from their size in motor space, i.e. they can "feel" smaller (or larger) than they look. This is achieved by dynamically controlling the mapping between mouse movements and cursor movements. Here it is applied to a dialog box: (a) visual appearance, (b) motor space. The default button is made bigger in motor space and therefore easier to select, while non-interactive elements such as labels or dangerous ones such as the Don't Save button are made smaller in motor space and therefore harder to select.

Research groups

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Research description:
In Situ PCRI project

Video-mediated communication. Over the past few years, audiovisual systems have greatly improved in their ability to support formal business meeting, e.g., videoconferencing, but they are still hardly usable for casual interactions. Following up on our previous work on mediaspaces in work settings [40], we have prototyped and patented a new communication device called the well [122] that combines audio and video in an original design. The well supports the emergence of a relaxed atmosphere well adapted to the informal discussions that take place before and after a meeting or during breaks. We are now mostly interested in video-mediated communication in domestic settings. In particular, as part of the interLiving project (see below), we have recently explored asynchronous image-based communication [135] as well as proximity-driven video interaction [17, 124, 154].

Interactive paper. Desktop computers have revolutionised the workplace, but have also generated problems. They often disrupt effective work practices and require many users to juggle both paper and on-line information. Humans like paper because the sensory-motor system is well suited to managing physical objects in the world. Today's computers overload the human visual system, while ignoring most other senses. Yet we need not choose between the physical and the virtual: paper can be an effective input device to a computer, as well as an object in its own right. We have been working with users who face complex tasks involving both off-line and on-line information, including air traffic controllers, research biologists and research historians. We have developed a diverse set of prototypes that allow users to interact with paper as one of their primary interfaces to on-line information [147]. Prototypes include augmented paper flight strips, augmented laboratory notebooks [109, 84] (Figure 3) and tools for interacting with ancient documents from the National Archives.

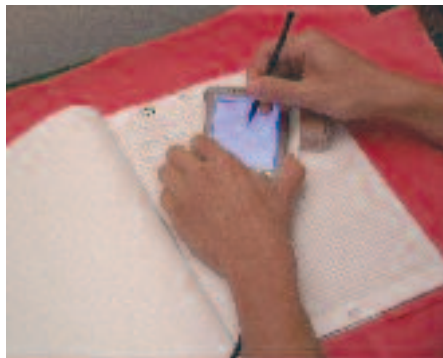


Figure 3: The A-Book uses a PDA to interact with paper. Information written on paper is captured digitally and displayed on the PDA according to its current position, giving the illusion that the PDA is a transparent window onto the sheet of paper.



Familiar data. Computer users are confronted to increasing amounts of files, email, photos and digital information on their hard drives, that they find increasingly difficult to manage. Since computer screen size and human cognitive abilities are limited, interfaces must offer more powerful tools for efficient navigation of this familiar information. In the context of the Micromegas project funded by the French Ministry of Research (*ACI Masses de*

Données), we develop new visualization and navigation techniques that take advantage of the users' knowledge of their on-line data. So far, we have focused on collecting event-logs describing the users' activities with documents, applications and window system. We plan to use these logs to provide users with better navigation cues and to develop multiscale (or zoomable) interfaces to help users manage complexity.

Participatory design

Participatory design involves users during all stages of the design process. Users are not simply consumers of systems, but active participants in their design and interpretation. Sometimes, users can be major innovators, especially with respect to understanding the situated nature of the users' activity with an interactive system. The In Situ project explores and tests novel participatory design methods and techniques that emphasize the role of context and make it explicit in the design process. Wendy Mackay has developed teaching materials, including a DVD on video techniques for participatory design distributed via ACM/SIGCHI and INRIA, and a Participatory Design Toolkit [108]. We have conducted workshops and research design activities in a wide variety of domains including biology (laboratory notebooks, on-line tools, end-user programming), animation (tools for colouring animation), air traffic control (interactive paper flight strips and a touch-output system for managing strips), office work (use of browsers and on-line tools) and archives (historical analysis of prominent authors' drafts, analysis of how researchers examine ancient documents, from the French National archives and Ethiopian manuscripts).

InterLiving, a three-year participatory design project funded by the European IST program, explored the design space of technologies that support communication among family members living in different households [187, 188, 189, 190]. We worked closely with six distributed French and Swedish families (totalling over 80 people) to collaboratively design, prototype and test a series of peripheral communication technologies that help them stay in touch in lightweight ways [126]. The project resulted in new research methods (see technology probes below), a series of implemented and tested prototypes (see communication appliances below) and the design of tangible interface that enables non-technical users to effectively manage small groups (patent applied for).

Technology probes address the problem of how to effectively develop innovative technologies for non-technical users in home settings [104]. Working with users, we collaboratively design and then implement extremely simple, single-function communication devices, which are then linked between households. The approach combines elements of social science, engineering and design. From a social science perspective, we gather data both about the participants and their use of the system. From an engineering perspective, we test the system in a real-world setting and learn about the technical requirements of such systems. From a design perspective, we involve the users in the design process and let these systems serve as a source of inspiration for future ideas. Our experience developing, installing and testing technology probes led us to the concept of *communication appliances* and a strategy for how to create them.

Communication Appliances. The interLiving project produced a series of communication appliances, many of which were tested *in situ* in the interLiving families' homes. Communication appliances are defined as: simple-to-use, single-function devices that let people communicate, passively or actively, with one or more remotely located friends or family. Connections are pre-determined (though changeable) and stay open, allowing communication without explicit dialling or addressing. Communication appliances may share sound, images, video, text or even touch and connections may range from focused, synchronous contact to peripheral awareness of one another.

Research groups

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Research description:
In Situ PCRI project

We collaboratively developed a series of communication appliances, and have filed a patent on an infrastructure component that provides a tangible interface for managing small social networks by non-technical users. The prototypes include VideoProbe [135], for sharing spontaneous snapshots among family members, TableProbe and StoryTable, for collaboratively editing video via a tangible interface, Tok-i-Tok, for sharing sound patterns, and MessageProbe, for sharing zoomable, post-it like messages. We also created the MirrorSpace [17, 124, 154] (Figure 4), which has been exhibited in numerous venues, including the Pompidou Center art museum and the La Villette science museum in Paris.



Figure 4: Participants in different locations see each other via a screen; when far away, the images of both participants are blurred together. Walking toward the screen clarifies the images; allowing the participants to control their level of visual intimacy.

Engineering of interactive systems

WIMP interfaces have been with us for twenty years, and little innovation has made it into products despite the many interaction techniques developed in the labs. The lack of appropriate tools to help developers integrate these advanced techniques into commercial software is probably a major reason for this situation. We have developed experimental toolkits in three areas that we believe are essential for moving towards post-WIMP interfaces: distributed interaction, video and information visualization.

Distributed Interaction. Today, more and more applications are distributed and users access them through a variety of platforms. The Web has become the de facto standard for deploying such applications. Unfortunately, Web browsers support a limited style of interaction: primarily clicking links and filling out forms. We study component-based architectures that leverage novel interaction techniques in distributed applications over multiple platforms. Individual components that implement, e.g. interaction techniques, may be added, removed or substituted dynamically. In the INDIGO project, Object Servers provide application data, together with rendering and interaction rules, to Interaction Servers that manage rendering and user interaction. This architecture natively supports real-time shared editing of application data across multiple platforms.

Video. Supporting communication in collaborative work applications often requires video links, yet it is well known that integrating video into applications is difficult. As a result, the use of video in interactive systems has always been very limited. VideoSpace and its successor Núcleo were designed explicitly to explore new uses of video and new interaction techniques based on video. Rather than focusing on technological aspects such as compression, transport or synchronization, they focus on supporting rapid prototyping and

incremental development of video applications. These toolkits treat video as a first-class object in interactive systems [181].

For example, they allow users to display image streams in HTML documents in place of ordinary static images or to embed these streams into existing X Windows applications. Creating a video link requires only a few lines of code; managing multiple sources and including video processing is not much more complicated. Most of our recent video-based systems, including the *well*, VideoProbe and MirrorSpace, have been implemented with videoSpace or Núcleo. Núcleo has also been used to develop a series of innovative window manager prototypes [123, 153].

Information Visualization. Creating new information visualization techniques using traditional GUI toolkits is cumbersome. We have designed a toolkit to experiment with new techniques in a much simpler and general way than before: the Infovis Toolkit [91, 22]. It is based on specific data structures to achieve a fast action/feedback loop as required by dynamic queries and comes with a large set of components such as range sliders to control and configure the visualizations. InfoViz supports scatter plots, time series, Treemaps, node-link diagrams for trees and graphs and adjacency matrix for graphs, and all visualizations can use fisheye lenses and dynamic labelling (Figure 5). The toolkit, written in Java, supports OpenGL-based hardware acceleration in order to provide high performance. We are now exploring new visualisation techniques for large graphs and new interaction techniques to filter large datasets since existing techniques do not scale well.

We are currently applying the toolkit to several research projects such as real-time program monitoring [98] and large graph visualisation using adjacency matrices [144] [97, 145] [96]. See <http://insitu.lri.fr/~fekete/InfovisToolkit> for more details.

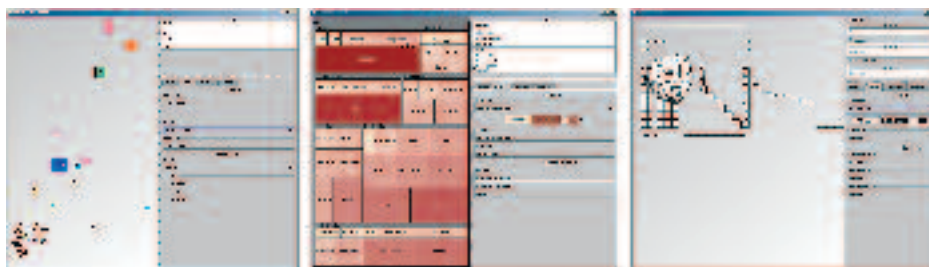


Figure 5: Visualization of scatter plots, treemaps and adjacency matrix (with a fish-eye view) using the InfoVis toolkit.

Key references

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Research description:
In Situ PCRI project

- [104] H. Hutchinson, W. Mackay, B. Westerlund, B. Bederson, A. Druin, C. Plaisant, M. Beaudouin-Lafon, S. Conversy, H. Evans, H. Hansen, N. Roussel, B. Eiderbäck, S. Lindquist, and Y. Sundblad. Technology probes: Inspiring design for and with families. In *Proceedings of ACM CHI 2003 Conference on Human Factors in Computing Systems*, volume 5(1) of *CHI Letters*, pages 17-24. ACM Press, 2003.
- [109] W. Mackay, C. Letondal, G. Pothier, K. Bøegh, and H. Sørensen. The missing link: Augmenting biologist's laboratory notebooks. In *Proc. ACM Symposium on User Interface Software and Technology (UIST 2002)*, volume 4(2) of *CHI Letters*, pages 41-50, Paris, France, Oct. 2002. ACM Press.

Mobile Networks team

- *Permanent members: Khaldoun Al Agha (head), Lila Boukhatem.*
- *Ph.D. students: Hakim Badis, Inès Ben Hamida, Mounir Benzaid, Davor Males.*
- *Non-permanent members: Thamer Al-Meshhadany, Alia Fourati, Ignacy Gawedzki, Tinku Mohamed-Rasheed, Laurent Perato.*
- *External member: Anelise Munaretto.*
- *Temporary members who left: Marcelo Dias de Amorim, Nadjib Achir, Dany Zebiane, Hayder Saleh.*

Research work in the Mobile Networks team addresses problems directly related to user mobility and communication on wireless interfaces. Our goal is to design protocols and algorithms that optimize communication system functionalities. We study algorithms in several ways: theoretically (convergence, performance evaluation, worst case calculation, etc.), by simulation (scalability, dynamic system behaviour, mobility consideration, etc.) and by implementations. The combination of these studies allows us to provide robust and high-performance solutions and has proved very competitive at the international level.

UMTS

UMTS (Universal Mobile Telecommunication System) is the European proposition for the third generation consortium created by the International Telecommunication Union (ITU). The UMTS must eventually replace all second-generation systems, such as GSM and PDC. It must also offer more bandwidth and quality of service. UMTS provides a bandwidth of up to 2Mbps.

The Code Division Multiple Access (CDMA) is the heart of third generation systems in terms of users and services multiplexing. The flexibility of this method provides an adaptive code allocation depending on user's requirements. UMTS features two major modes: FDD-WCDMA and TDD-TD/CDMA. FDD-WCDMA is a common contribution by the Japanese community.

We are working on optimizing code allocation in a cell while using the WCDMA. We have studied the interference generated by orthogonal codes and Pseudo-Noise sequences. This interference can be reduced in order to increase the number of users or services. We proposed and analyzed a scheme that consists in reversing the allocation process. In the UMTS process and in the uplink direction, the services of each user are multiplexed on one scrambling code while our scheme proposes to multiplex all users of the same service on a unique scrambling code.

We have also worked on reducing the quantity of signalling and control information on the radio interface so that more channels are available for data. Our idea consists in using mobile agents as a proxy for users. Each agent follows the user mobility and controls tasks related to the user. Multiple schemes of handover prediction were studied to optimize the UMTS resource allocation.

Mobility in IP

The macro-mobility in IP systems should be handled by the Mobile IP protocol. This protocol provides a nomadic user with the same IP address through the network. However, Mobile IP presents some weaknesses in the case of high user mobility. Consequently, the robustness of Mobile IP is valid only in nomadic contexts. On the other hand, the MANET group of the IETF works on creating standards for ad-hoc networking by using the IP protocol. These protocols offer the possibility of routing packets from host to host via the air interface and only in a restricted area.

Our goal is to combine Mobile IP with ad-hoc networking. In fact, we propose an architecture for mobility where the mobile host can roam in the IP networks with its permanent IP address. When macro-mobility occurs in a different IP domain, Mobile IP must provide a temporary address to the user while for micro-mobility, an ad-hoc protocol has to deliver data to the user by wireless routing. The ad-hoc protocol used in our architecture is OLSR (Optimized Link State Routing). We also develop a fast moving extension OLSR in order to guarantee a robust handoff for high-speed users.

4G and Vertical handoff

The fourth generation mobile systems attempts to federate under the IP label all heterogeneous wireless interfaces. This way, users can easily roam from one system to another without any specific operation. This vertical handover must provide transparent mobility through these incompatible systems. For example, this technique can offer session continuity when moving from UMTS to WI-FI.

Our work consists in reducing the time latency when roaming. Nowadays, transferring a session from one system to another takes several seconds, which is unacceptable for a user in communication. We created the concept of a virtual cell by using multicast facilities in order to reduce the latency and the packet loss.

Ad hoc networks (QoS and Security)

Ad hoc networks are systems that can establish communication sessions between users without using any kind of infrastructure. Hence, the network must be self-organized and dynamically adaptive.

Nodes in ad hoc networks are in constant movement. Delivering packets to a specific destination becomes a complex task. Today, four routing protocols were standardized by the IETF (Internet Engineering Task Force) to offer a solution for routing problems. These solutions are divided into two categories: proactive (routes are always available) and reactive (routes are discovered on demand). OLSR (Optimized Link State Routing Protocol), developed at INRIA, is a proactive protocol based on link state routing mechanisms.

In our work we have addressed issues of quality of service and security. All standardized protocols try to find a route from a source to a destination by considering only one metric: the number of hops. Also, these protocols do not take into account any security consideration and still are vulnerable to attacks. We consider up to four metrics to establish routes, including delay, available bandwidth, jitter, loss probability, etc. This should allow flows

Research groups

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Research description:
Mobile Networks team

to reach their destination with an increased quality of service. We also consider the multi-path routing and path oscillation problems.

Concerning security, we are working on a solution to secure OLSR. Our mechanism must enumerate the most important attacks and provides mechanisms that eliminate all negative effects on routing information. The solution will be based on distributing secure keys to nodes without using any centralized mechanism since this is not feasible in an ad hoc context.

Network mobility

A MONET (Mobile NETWORK) is an entire network that changes, as a unit, its point of attachment to the Internet and thus its reachability within the topology. Possible applications of MONETs are access networks deployed in public transportation (buses, trains, taxis, aircrafts) or networks attached to people Personnel Area Networks or PANs) made of cellular interfaces (cell phone, electronic diary). NEMO (NETwork MOBility) is concerned with managing the mobility of MONET networks and providing a continuous network access to all nodes within it in order to maintain session continuity while moving. Our work aims to show that the Mobile-IPv4 and Mobile-IPv6 protocols, which manage node mobility in the Internet, cannot support efficiently a MONET MOBILE NETWORK. Thus, we have proposed an extension to Mobile-IPv6 that uses a multicast solution to support MONET mobility and to reduce the control traffic. We are also interested in resource reservation aspects in this kind of networks. In fact, users' collective movement in NEMOs applications can be quite predictable, e.g., users in a train. Thus, we plan to use resource reservation techniques to provide users with a better quality of service in terms of parameters such as bandwidth and blocking probability.

Research Perspective

With respect to formal methods, testing and reliability, we plan to continue our work on test derivation from infinite models, i.e. symbolic transition systems, with the use of constraint solving techniques. In addition, our new interests in interoperability-integration techniques and in the use of probabilistic and statistical methods will be emphasized.

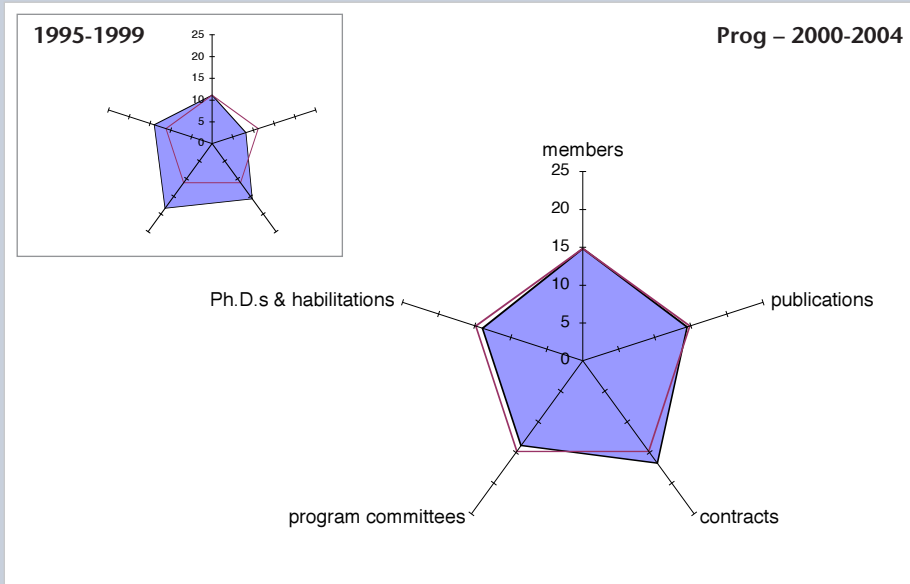
Regarding human-computer interaction and the In Situ project, we envision a slower growth of the team now that it has reached a critical mass. We will continue our efforts to create a stable, multidisciplinary team, which is a challenge in France where disciplinary barriers are still high, especially with non-scientific fields such as art and design. Our research will continue to address fundamental as well as methodological and technical issues and will seek to cover a wider range of interactive systems, in particular in the context of "ubiquitous", "pervasive" or "ambient" computing.

In the area of Mobile Networks, we will continue to work on wireless and mobile networking, with a special emphasis on security and quality of service. We also plan to develop a new activity on user localization using routing information.

Highlights

The two major events over the last four years were the creation of the Mobile Network team and the In Situ PCRI project. The group is also very active in the development and management of Computer Science research in Orsay: Michel Beaudouin-Lafon is director of LRI, Marie-Claude Gaudel has been chair of the Computer Science Department and is now director of PCRI. Other members of the group are in charge of significant responsibilities.

The group is known and recognised for its research at the best international level. This is reflected by the number of international program committees, the number of invited lectures, and the number and quality of publications. In parallel, we have an important contractual activity, both at the national and european levels.



Radar views display a synthetic view of the activity of the group over the 1995-1999 and 2000-2004 periods, by means of five statistics:

- Size of the group at the end of the period (01/01/1999, 01/01/2004),
- Number of publications (peer-reviewed journals, books, book chapters, major international conferences),
- Annualised amount in Euro of new contracts and grants,
- Number of participations in program committees (national and international), and,
- Number of defended Ph.D.s and habilitations.

These statistics are displayed as a percentage with respect to the overall laboratory, together with a reference line corresponding to the size of the group. Data points outside the reference line show above-average performance whereas those inside the line show below-average performance, relative to the laboratory.

As with any statistics, these data must be interpreted carefully. In particular, they are not a direct measure of relative quality of the groups within the laboratory, because different research areas place different values and offer different opportunities with respect to these five measures.

Honors

Prizes and awards

- Michel Beaudouin-Lafon, co-author of Best Long Paper, *Joint HCI-IHM conference on Human-Computer Interaction*, Lille, sept. 2001: «Beyond the 10-bit barrier: Fitts' Law in Multi-Scale Electronic Worlds» [102].

Keynote addresses

International

- Marie-Claude Gaudel, *Dagstuhl seminar on Perspectives in Model Based Testing*, Sept. 6-10, 2004: "Unfolding Symbolic Transition Systems".
- Michel Beaudouin-Lafon, opening keynote at *International Conference on Advanced Visual Interfaces (AVI '04, Gallipoli, Italy, may 2004)*: "Designing Interaction, not Interfaces" [67].
- Khaldoun Al Agha, Panelist in the panel on Mobile Ad-hoc Networks and Dependable Computing, *Mediterranean Ad Hoc Networking Workshop (Med-Hoc-Net 2003)*, Mahdia, Tunisia, 27 June 2003.
- Marie-Claude Gaudel, *6th Workshop on Formal Methods (WMF'2003)*, Campina Grande Brasil, Oct. 2003: Problems and Methods for Testing Infinite State Machines.
- Marie-Claude Gaudel, *The 2002 ARO/ONR/NSF/DARPA Monterey Workshop on Radical Innovations of Software and Systems Engineering in the Future*, Venice, Oct. 2002: "How to Reach Software Ultra-Reliability?"
- Michel Beaudouin-Lafon and Wendy Mackay, invited conference at *Design Forum, ACM Human Factors in Computing Systems (CHI '02)*, Minneapolis, April 2002: "Power and Simplicity".
- Fatiha Zaïdi, *Workshop on protocol and distributed systems testing*, Campinas University, Brazil, Oct 2001: "Open Problems in protocol testing".
- Marie-Claude Gaudel, *Workshop on Concurrency in Dependable Computing*, June 26, 2001 in Newcastle upon Tyne, UK: "Testing Systems from Formal Specifications".
- Marie-Claude Gaudel, *ADA-Europe Conference*, Louvain, May 2001: "Testing from Formal Specifications, a Generic Approach".

France

- Khaldoun Al Agha, *Journée STIC, Université Paris-Sud XI*, 2002: "Réseaux ad hoc MANET".
- Khaldoun Al Agha, *Journée Aristote, École Polytechnique*, 2001: "L'intégration d'IP dans les réseaux mobiles et sans fil de la future génération".

Other honors

- *CSCW Journal* (Kluwer Academic): Michel Beaudouin-Lafon, member of advisory board.

Evaluation of research

Editorial boards

International

- *Science of Computer Programming* (North-Holland): Marie-Claude Gaudel, since its creation in 1982.
- *Formal Aspects of Computing* (Springer International): Marie-Claude Gaudel, since its creation in 1989.
- *Journal of Software Testing, Verification and Reliability* (John Wiley): Marie-Claude Gaudel, since its creation in 1991.
- WINET, ACM Wireless Networks: Khaldoun Al Agha, Guest co-editor, July 2004.
- IJHCS, *International Journal of Human-Computer Studies* (Elsevier): Michel Beaudouin-Lafon since 2004, and guest co-editor with Yves Guiard of special issue "Fitts' law 50 years later, applications and contributions from HCI", Dec. 2004.

National

- *Revue I3* (Cépaduès-Editions): Michel Beaudouin-Lafon, since its creation in 1998.
- *Revue IHM* (EuropIA): Michel Beaudouin-Lafon, since its creation in 2001.

Program committees

Chair

- MWCN, *Fifth IEEE/IFIP International Conference on Mobile and Wireless Communications Networks*, Singapore, 2003: Khaldoun Al Agha, chair.
- Algotel, *5^e Rencontres Francophones sur les aspects Algorithmiques des Télécommunications*, Banyuls-sur-mer, France, 2003: Khaldoun Al Agha, co-chair.
- Med-Hoc-Net, *IFIP first Annual Mediterranean Ad Hoc Networking Workshop*, Sardinia, Italy, 2002: Khaldoun Al Agha, chair.
- CHI, *18th ACM Conference on Human Factors in Computing Systems*, Seattle, USA, April 2001: Michel Beaudouin-Lafon, co-chair for long papers track (350 submissions, 20% acceptance rate).
- Ergo-IHM, *12^e Conférence Francophone sur l'Interaction Homme-Machine*, Biarritz, October 2000: Michel Beaudouin-Lafon, co-chair.

Member (international events)

- WCC, *IFIP World Computing Congress*, Toulouse, August 2004: Marie-Claude Gaudel.
- SBMF, *Brazilian Symposium on Formal Methods*, Recife, Pernambuco, Brazil, November 2004: Marie-Claude Gaudel.
- *Workshops on Architecting Dependable Systems*, 2 twin satellite workshops of ICSE 2004 (International Conference of Software Engineering) and DSN -2004 (Dependable Systems and Networks Symposium): Marie-Claude Gaudel.
- WOCN, *IFIP International Conference on wireless and Optical Communications*.

Research groups

ProgHonors
Evaluation of Research

Networks (WOCN): Lila Boukhatem (2004)

- FATES, *Formal Approaches To Testing*, Satellite Workshop of ASE, Montreal, Oct. 2003, Linz, Sept. 2004: Marie-Claude Gaudel.
- CHI, *19th and 21st ACM Conference on Human Factors in Computing Systems*: Michel Beaudouin-Lafon (2002, 2004).
- UIST, *17th ACM Symposium on User Interface Software and Technology*: Michel Beaudouin-Lafon (2004).
- Multimedia, *12th ACM International Conference on Multimedia*: Nicolas Roussel (2004)
- MWCN, *IEEE/IFIP International Conference on Mobile and Wireless Communications*

Networks: Khaldoun Al Agha (2002),Lila Boukhatem (2003)

- CARI, *Colloque Africain de Recherche en Informatique*: Frédéric Voisin (2000 - 2002 - 2004).
- Med-Hoc-Net, *IFIP Mediterranean Ad Hoc Networking Workshop*: Khaldoun Al Agha (2003, 2004).
- WOCN, *IFIP International Conference on wireless and Optical Communications Networks*: Khaldoun Al Agha (2004).
- ISWCS, *International Symposium on Wireless Communication Systems*: Khaldoun Al Agha (2004).
- ECSCW, *8th European Conference on Computer-Supported Cooperative Work*: Michel Beaudouin-Lafon (2003).
- WMF, *6th Workshop on Formal Methods*, Campina Grande Brazil, October 2003: Marie-Claude Gaudel.
- IDTP, *Sixth IEEE International Conference on Integrated Design and Process Technology*, Pasadena, California, June 2002: Marie-Claude Gaudel.
- FASE, *Fundamental Approaches to Software Engineering*, ETAPS, Grenoble, April 2002: Marie-Claude Gaudel.
- FATES, *Formal Approaches To Testing*, Satellite Workshop of CONCUR'02, Brno, August 2002: Marie-Claude Gaudel.
- ISSTA, *ACM International Symposium on Software Testing and Analysis*, Rome, July 2002: Marie-Claude Gaudel.
- ASW, *International Conference on Applications and Services in Wireless Networks*: Khaldoun Al Agha (2001).

Member (national events)

- DNAC, *De Nouvelles Architectures pour les Communications*: Khaldoun Al Agha (2000 - 2004).
- IHM, *Conférence Francophone sur l'Interaction Homme-Machine*: Nicolas Roussel (2002), Michel Beaudouin-Lafon (2004).
- AlgoTel, *4es et 6es Rencontres Francophones sur les aspects Algorithmiques des Télécommunications*: Khaldoun Al Agha (2002), Lila Boukhatem (2004).

Evaluation committees and invited expertise

International

- French Cooperation between Brazilian and French Universities (COFECUB) : Marie-Claude Gaudel is member of the board.
- National Science Foundation (NSF), USA: Marie-Claude Gaudel, referee.
- Fonds québécois de la recherche sur la nature et les technologies (Québec): Marie-Claude Gaudel, referee.
- National Sciences and Engineering Research Council (NSERC), Canada: Michel Beaudouin-Lafon, referee.
- European Science Foundation (ESF): Marie-Claude Gaudel, referee.
- Christian-Döppler-Forschungsgesellschaft, Austria: Marie-Claude Gaudel, referee.
- Engineering and Physical Sciences Research Council (EPSRC), UK: Michel Beaudouin-Lafon, referee.

- Council of Physical Sciences of the Netherlands Organization for Scientific Research (NWO): Marie-Claude Gaudel, referee.
- Research Grants Council, Hong-Kong: Marie-Claude Gaudel, referee.
- National Information Communication Technology Australia (NICTA): Marie-Claude Gaudel, referee.
- Mid-term evaluation committee of EQUATOR, a 6 years, 10M€ project funded by UK's Engineering and Physical Sciences Research Council (EPSRC): Michel Beaudouin-Lafon.

France

- Orientation Committees of the French Research Network on Telecommunication (RNRT) and the French Research Network on Software Technologies (RNTL): Marie-Claude Gaudel.
- Evaluation Commission of French Research Network on Software Technologies (RNTL): Michel Beaudouin-Lafon, member (since 2000) and co-chair for special area on interactive systems (2002).
- Scientific board of the STIC department of CNRS, Marie-Claude Gaudel.
- Scientific expert for French Ministry of Research: Michel Beaudouin-Lafon (since 1992), Marie-Claude Gaudel, Khaldoun Al Agha (since 2002).
- Scientific Committee of IRCAM research center (Paris): Michel Beaudouin-Lafon (2004).
- Evaluation Committee of CLIPS-IMAG research laboratory (Grenoble): Michel Beaudouin-Lafon (2002).
- Prix ROBERVAL: Khaldoun Al Agha (2003), referee.

Other evaluation activities

- Reviewer for PhD dissertation: Michel Beaudouin-Lafon (7), Khaldoun Al Agha (4), Marie-Claude Gaudel (several times).
- Reviewer for Habilitation: Michel Beaudouin-Lafon (4), Marie-Claude Gaudel (2).

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Volunteer professional service

Management positions in scientific organisations

- *Laboratoire de Recherche en Informatique (LRI)*: Michel Beaudouin-Lafon, Director since 2002.
- *Pôle Commun de Recherche en Informatique (PCRI)*: Marie-Claude Gaudel, Director (2002).
- Department of Computer Science, Université Paris-Sud: Marie-Claude Gaudel, President (1998-2003).
- INRIA Scientific Board: Marie-Claude Gaudel, President (1999-2002).
- National Computer Network for Universities and Research (RENATER): Marie-Claude Gaudel, Chair of the board (2000-2002) and currently member of the board.
- CNRS Network on Models and Tools for Human-Computer Interaction, *Réseau Thématique Pluridisciplinaire Modèles et Outils pour l'Interaction Homme-Machine, RTP16*: Michel Beaudouin-Lafon, co-chair. The network gathers over 200 participants and over 25 French labs from academia and industry.
- CNRS Network on Dependability of Complex Computerized Open Systems, *Réseau Thématique Pluridisciplinaire, RTP21*: Marie-Claude Gaudel, member of the board.
- CNRS Working group on Information Visualization, *Action Spécifique Visualisation d'Information, 2001-2002*: Michel Beaudouin-Lafon, co-chair.

Research groups

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service

Organisation of conferences and scientific events

- MWCN, *Sixth IEEE/IFIP International Conference on Mobile and Wireless Communications Networks*, Paris, 2004: Khaldoun Al Agha, Conference co-chair.
- IHM, *16^e Conférence Francophone sur l'Interaction Homme-Machine*, Namur, Belgium, September 2004: Michel Beaudouin-Lafon, Conference vice-chair.
- OLSR Day (<http://www-rocq.inria.fr/fr/actualites/seminaires/sujet/Hipercom.htm>), April 5, 2004: Khaldoun Al Agha, Organizer and co-chair.
- CFIP, *10^e Colloque Francophone sur l'Ingénierie des Protocoles*, Paris, October 2003: Fatiha Zaïdi, member of organizing committee.
- UIST, *15th ACM Symposium on User Interface Software and Technology*, Paris, October 2002: Michel Beaudouin-Lafon, Conference chair.
- ICNP, *10th IEEE International Conference on Networks Protocols*, Paris, November 2002: Fatiha Zaïdi, member of organizing committee (local arrangement).

Working groups

- Working Group 1.3 of IFIP, Specification of Systems: Marie-Claude Gaudel, member.
- CNRS Working group (*Action Spécifique*) on Plasticity of user interfaces with CLIPS, I3S, ICTT, IS3, LAMIH, LIRMM, LMP, SAP, Trigone, UCL, Xerox (2003-2004): M. Beaudouin-Lafon, R. Blanch, J. Lard, members.
- CNRS Working group (*Action Spécifique*) on Advanced Techniques for Testing Complex Systems with LAAS, LABRI, IRISA and IMAG (2002-2003): Marie-Claude Gaudel, Sandrine Gouraud, Grégory Lestiennes, members.
- CNRS Working group (*Action Spécifique*) on Test and Specification techniques for communication software components with SAMOVAR, LABRI, LAAS, LAMI, LSR/IMAG, FT R&D, CEA (2003-2004): Marie-Claude Gaudel, Grégory Lestiennes, Frédéric Voisin, Fatiha Zaidi, members.

Other professional service

- ACM, *Association for Computing Machinery*, <http://www.acm.org>, 75000 members worldwide: Michel Beaudouin-Lafon, elected member-at-large of ACM Council (since 2000, second 4-year term), member of Publications Board (since 2002), member of Grace Murray Hopper Award committee (1999-2003, chair in 2002).
- ACM SIGCHI, *ACM Special Interest Group on Computer-Human Interaction*, <http://www.acm.org/sigchi>, 5000 members worldwide: Michel Beaudouin-Lafon, member of Publications Board (since 2001), member of awards committee (1999-2003).
- ASTI, *Association des Sciences et Technologies de l'Information*, <http://www.asti.asso.fr>: Michel Beaudouin-Lafon, member of the board (since 2002).
- AFIHM, *Association Francophone d'Interaction Homme-Machine*, <http://www.afihm.org>: Michel Beaudouin-Lafon (founding president in 1994, member of the board 2002-present, vice-president since 2002), Nicolas Roussel (member of the board 2001-2003).
- Steering Committee of ETAPS, *European Joint Conference on Theory and Practice of Software*: Marie-Claude Gaudel, member since its creation in 1998.
- Steering Committee of Med-Hoc-Net, *Mediterranean Ad Hoc Networking Workshop*: Khaldoun Al Agha, member since its creation in 2002.
- Steering Committee of MWCN, *IEEE/IFIP International Conference on Mobile and Wireless Communications Networks*: Khaldoun Al Agha, member since 2002.

Contracts and grants

| Type | Scientific Director | Project Name | Funding institution | Managing institution | Dates | Duration (months) | Total € |
|------|---------------------|--|---------------------|----------------------|---------------------|-------------------|------------|
| IST | MC Gaudel | DSOS | CEE | CEPHYTEN | 06/03/00-05/05/03 | 38 | 50 000 |
| IST | M. Beaudouin-Lafon | INTERLIVING | CEE | CEPHYTEN | 01/01/01-31/12/03 | 36 | 314 592 |
| IST | M. Beaudouin-Lafon | EUD-NET | CEE | UPS/SAIC | 01/07/02 - 31/10/03 | 14 | 17 000 |
| RNTL | M. Beaudouin-Lafon | INDIGO | MENRT | UPS | 11/12/01 - 10/12/04 | 36 | 177 580 |
| RNRT | K. Alagha | SAFARI | Min.Industrie | UPS/SAIC | 03/02/03 - 02/11/05 | 33 | 142 645,78 |
| | K. Alagha | Réseaux sans fil | MEN | UPS/SUBSE | 2002 | | 11 434 |
| ACI | K. Alagha | JE réseaux ah-hoc | Ministère | CNRS | 19/07/02-18/07/05 | 36 | 24 550 |
| ACI | L.Boukatem | Nemo (JC) | Ministère | CNRS | 15/09/03-08/09/06 | 36 | 54 347,8 |
| ACI | N.Roussel | Micromégas (MDD) | Ministère | CNRS | 25/07/03-20/07/06 | 36 | 107 023,41 |
| Subv | K. Alagha | PPF SUPELEC | UPS | UPS/CONTF | 2004 | | 5 853 |
| | B.Marre | CEA | CEA | CEPHYTEN | 2000 | | 15 244 |
| AS | M. Beaudouin-Lafon | Visualisation d'information | CNRS Stic | CNRS | 23/01/01-22/01/02 | 12 | 5 945,54 |
| AS | M. Beaudouin-Lafon | rtp16 interface homme machine | CNRS Stic | CNRS | 16/06/03-15/06/04 | 12 | 3 000 |
| AS | M. Beaudouin-Lafon | rtp16 plasticite des systèmes | CNRS Stic | CNRS | 16/06/03-15/06/04 | 12 | 14 000 |
| AS | MC Gaudel | Technique avancée | CNRS Stic | CNRS | 01/10/01-30/06/03 | 12 | 9 146,95 |
| AS | MC Gaudel | RTP 1 Technique de spécification de test | CNRS Stic | CNRS | 25/06/03-24/06/04 | 12 | 5 000 |

Note: See the glossary for acronyms.

DSoS

Partners: University of Newcastle (UK), Technische Universität Wien (Austria), LAAS-CNRS, INRIA (Rocquencourt), LRI-Université de Paris-Sud, Ulm Universität (Germany), QINETIC (UK).

The overall objective of the DSoS project was to develop significantly improved means for composing a dependable "system of systems" (SoS) from a set of largely autonomous component computer systems. Reusing existing legacy systems in a dependable fashion without the need for extensive re-engineering is a key problem currently faced by industry.

A system of systems provides new emerging services to its users, in addition to the services provided by its component systems. The goal of this project was to ensure that both types of services are provided with a level of dependability matching specified user requirements. Dependability in this context encompasses reliability, security and maintainability, though the project focused mainly on the first of these system characteristics, with some emphasis on timeliness as well as functionality issues.

Long term research project on dependable computing systems funded by the European Union. 36 months (2000-2003). Scientific director for LRI: Marie-Claude Gaudel.

Research groups

Prog

Contracts and grants

InterLiving

Partners: KTH (Sweden, coordinator), INRIA (Rocquencourt), LRI.

The interLiving project (<http://interliving.kth.se/>) studied and developed, together with families, technologies that facilitate generations of family members living together or at a distance. Its main objectives were: to understand the needs of diverse families, to develop innovative artefacts that support the needs of co-located and distributed families, and to understand the impact such technologies can have on families. The project main achievements for LRI were the concept of *technology probe* and the MirrorSpace communication technology.

European project (5th framework program, IST Disappearing Computer program).

36 months (2001-2003).

Scientific director for LRI: Michel Beaudouin-Lafon.

EUD-Net

Partners: University of Bari (Italy, coordinator) and 16 members from France, Germany, Italy, the Netherlands, Sweden and the U.K.

The goal of the EUD-NET Network of Excellence (<http://giove.cnuce.cnr.it/eud-net.htm>) was to help the European Commission prepare a research agenda in the field of end-user development and to increase contacts among highly-qualified research centres, both academic and industrial, in order to speed-up the production of innovative ideas and approaches.

European Network of Excellence (5th framework program).

16 months (2002 - 2003).

Scientific director for LRI: Michel Beaudouin-Lafon.

INDIGO

Partners: LRI (coordinator), ILOG (Gentilly), CENA (Toulouse), W3C (Sophia-Antipolis).

The INDIGO project aims at designing and prototyping a new generation of tools to enable the development of highly interactive distributed graphical applications. The resulting protocols and sample implementations will be submitted to the World-Wide Web consortium for standardization.

Research project funded by national network on software technology (RNTL).

36 months (2001-2004).

Scientific director for the project: Michel Beaudouin-Lafon.

SAFARI

Partners: France Telecom R&D, Alcatel, INRIA, LIP6, LRI, LSIT, LSR-IMAG, SNCF, ENST.

The goal of the project (<https://safari-rnrt.rd.francetelecom.com/>) is to create and provide an infrastructure (protocol and software) for a transparent and auto-configurable access to future multimedia networks based on IPV6. This access must take into account all constraints of existent access networks (fixed, wireless, ad-hoc) and must manage the dynamic behavior of the users.

Research project funded by the national network for telecommunications research (RNRT).

30 months (2003-2005).

Scientific director for LRI: Khaldoun Al Agha.

Jeune équipe CNRS

Partners: LRI (coordinator).

The goal of the project is to analyze the use of small and ultra-mobile laptops and PDAs in ad hoc networks. Routing algorithms are proposed to take into account the capabilities of these miniature hosts.

Grant from CNRS to support young research group (*Jeune équipe*).
36 months (2002-2004).
Scientific director for LRI: Khaldoun Al Agha.

NEMO

Partners: LRI (coordinator), LIP6 (Paris), ENST (Paris).

This project consists in the study of mobility of an entire network (train, bus, aircraft ...) and proposes solutions to optimize resource utilization and the attachment to the Internet. Several algorithms will be proposed in order to improve handover, multicast and resource reservation.

Grant from the French Ministry of Research to support junior researchers (*ACI Jeunes chercheurs*).
36 months (2003-2006).
Scientific director for LRI: Lila Boukhatem.

Micromégas

Partners: LMP (Marseille, coordinator), LRI, INRIA (Rocquencourt and Nancy), Institut Pasteur (Paris).

The goal of the project is to enrich current methods of information visualisation and navigation by exploring new approaches to deal with "familiar data", i.e. data that users know they have but have a hard time accessing. We are studying personal data, e.g., texts, photos, emails manipulated in day to day activities as well as professional data, e.g., scientific data used by biologists.

Project funded by national initiative on Massive Data (*ACI Masses de données*).
36 months (2003-2006).
Scientific director for LRI: Nicolas Roussel.

CEA

Partners : CEA-LIST, LRI.

The goal of this research contract was to define a specialised tool for generating test data from LUSTRE descriptions. Our expertise on data selection and constraint solving was used for the development by the CEA of the GATeL tool.

Research groups
Prog
Contracts and grants

Other contracts

The following contracts were negotiated before the contract holder moved to LRI, and were therefore not managed by LRI.

ARCADE

Partners: France Telecom R&D, Qosmic, Thales, INRIA, LIP6.

The goal of ARCADE was to offer a generic model for the control of IP networks. For each user, an individual profile is personalized. Then, the attribution of network resources is done dynamically and depends on the user behavior. Problems treated in ARCADE are security, quality of service and mobility.

<http://www-rp.lip6.fr/arcade/organisation.html>

Research project funded by national network for telecommunications research (RNRT).

24 months (2001-2002).

Scientific director for INRIA: Khaldoun Al Agha.

SAMU

Partners: Motorola, Cegetel, Renault, Institut Eurécom, PRISM.

SAMU was proposed to optimize services offered by the third generation of mobile systems: UMTS. It consisted of improving the frequency allocation algorithms and mapping quality of service parameters from IP networks to the UMTS radio interface. The service optimization was tested using IP applications in a vehicular environment.

<http://samu.crm-paris.com/main.htm>

Research project funded by national network for telecommunications research (RNRT).

30 months (2000-2002).

Scientific director for PRISM: Khaldoun Al Agha.

I3

Partners: INRIA, LIP6, ENST.

I3 studied and implemented algorithms and protocols for the third generation Internet. This generation can adjust and allocate resources on demand.

Project funded by INRIA (ACI INRIA), 24 months (2000-2001), scientific coordinator: Khaldoun Al Agha.

B.3.8 / Prog

Collaborations

Cooperation agreements

- Collaboration France - Tunisia (2004) funded by INRIA (STIC project), coordinator in France: Khaldoun Al Agha. Partners: LRI, LIP6, INRIA, CRISTAL (ENSI - Tunisia), UTIC (Sup'Com - Tunisia). Modelling and simulation of indoor Wi-Fi and ad-hoc networks.
- Collaboration with France Telecom R&D (September 2003 - August 2006). Supervision of a doctoral student, Tinku Mohamed-Rasheed, under a CIFRE agreement. Thesis advisor: Khaldoun Al Agha.
- Collaboration with Thalès Research and Technology (Jun. 2004 - May 2007). Supervision of a doctoral student, Jérôme Lard, under a CIFRE agreement. Thesis advisor: Michel Beaudouin-Lafon.

Collaborations leading to joint publications

- Collaboration between the In Situ team and Yves Guiard, CNRS Research Director at Laboratory for Action and Perception (Marseille), on navigation in multiscale interfaces: [78, 100, 101, 102, 127, 160, 169]. Yves Guiard is now an external collaborator of the In Situ project.
- Collaboration between Hakim Badis and Jaehoon Paul Jeong, Jung-Soo Park (Researchers at ETRI/PEC in Korea), Youn-Hee Han (Researcher at Samsung Advanced Institute of Technology in Korea) and Kenichi Mase (Professor and Dr. Eng at Niigata University in Japan) on Requirements for Ad Hoc IP Address Autoconfiguration Internet-Draft. [199, 200, 201].
- Collaboration between Fatiha Zaïdi and Ana Cavalli, Institut National des Télécommunications (Evry, France), on Passive Testing [5, 10, 81, 82].

Other collaborations

- Collaboration with the Hipercom project, INRIA-Rocquencourt: Joint Ph.D. students, and joint participation in industrial projects. Khaldoun Al Agha is external member of Hipercom.
- Collaboration between Khaldoun Al Agha, Alia Fourati and Supelec on security in ad-hoc networks.
- Collaboration between Fatiha Zaïdi and Pascale Le Gall, researcher at Université d'Evry, on integration testing.

B.3.9 / Prog

Dissemination and technology transfer

Patents and licences

- Patent on “Communication terminal and system”, inventors: Michel Beaudouin-Lafon (LRI), Nicolas Roussel (LRI), Jacques Martin (CSTB), Jean-Dominique Gascuel (INRIA), Georges Buchner (France Telecom), Hervé Lissek (CSTB). Filed by France Telecom in July 2000 (FR2811501), granted in France in June 2003. International extensions filed for Europe, USA, Australia and Japan. This patent is the result of a former joint project with France Telecom on media spaces.
- Patent on “Communication control device”, inventors: Wendy Mackay (INRIA), Michel Beaudouin-Lafon (LRI), Nicolas Gaudron (INRIA). Patent filed by INRIA in August 2004 (PCT FR 0402135). This patent is the result of the InterLiving IST project on communication technologies for families (see above).

Software licensing and distribution

CDMA simulator

Code modulation, authors: Géraud Allard and Khaldoun Al Agha. Free software.

<http://www.lri.fr/asspro/groupeReseaux/site-simulateur/index.html>

Qolyester

OLSR-IPV6 protocol for ad hoc networks with QoS, authors: Ignacy Gawedzki and Khaldoun Al Agha. Free Software. <http://qolsr.lri.fr>

Research groups

Prog

**Collaborations
Dissemination and
technology transfer**

OLSR

RFC 3626 simulation model under OPNET, authors: Hakim Badis and Khaldoun Al Agha.
<http://qolsr.lri.fr>

VideoSpace

A toolkit for using image streams in interactive and collaborative software, author: Nicolas Roussel. Freely available under the GNU Lesser General Public License (LGPL).
<http://insitu.lri.fr/~roussel/projects/videoSpace/>

Ametista

A toolkit for exploring new window management techniques, author: Nicolas Roussel. Freely available under the GNU Lesser General Public License (LGPL).
<http://insitu.lri.fr/~roussel/projects/ametista/>

Popularisation of research results

- Marie-Claude Gaudel is a member of the Scientific Board of the Club *Science et Citoyens* in Bobigny-Drancy. She participated in several meetings and the *Journées Science et Citoyens de la région Ile de France* in May 2004.
- MirrorSpace (a work that started as part of the interLiving project) appeared in the national newspaper *Libération* on 28 February 2003. It was exhibited at the Pompidou Center art museum, the La Villette science museum and several other Contemporary Art galleries in Paris in 2003 and 2004.
- Frédéric Voisin made a presentation about test generation (“Automatisation de la génération de jeux de test”) at the 1st Forum Intertronic, Paris, March 2003.
- Marie-Claude Gaudel organised and chaired a panel on the reconfiguration of scientific disciplines for the 2003 congress of the Centre d’Alembert, in Orsay.
- Sandrine Gouraud introduced children (6/7 years) to computer science (hardware, programmation) at school within the framework of the regional project called *projets scientifiques parainnés: un enseignant, un chercheur: a teacher, a researcher (2001-2003)*.
- Grégory Lestiennes introduced children (10/11 years) to computer science at school within the framework of the regional project called *projets scientifiques parainnés: un enseignant, un chercheur: a teacher, a researcher (2001-2002)*.
- Nicolas Roussel gave a talk in February 2002 to students of an engineering school (EISTI) visiting LRI as members of the Club *Science et Citoyens* from Cergy Pontoise.
- Marie-Claude Gaudel organised a science café (*Bar des Sciences*) on security and safety of computer systems at the French annual science fair (*Fête de la Science*) in 2002.
- Sandrine Gouraud, Nicolas Roussel, Renaud Blanch and Stéphane Conversy presented some of the technologies developed for the interLiving project at the French annual science fair (*Fête de la Science*), ferme du Moulon, Gif-sur Yvette, October 2002.
- Sandrine Gouraud presented SiReMa, a tool used to simulate and analyse Manhattan networks, at the French annual science fair (*Fête de la Science*), ferme du Moulon, Gif-sur Yvette, October 2000.

Summer schools, tutorials, invited seminars

International

- Michel Beaudouin-Lafon. "Instrumental Interaction". 6 hours course, *Spring School on Multimodal and Mobile Interfaces*, Anzere, Switzerland, March 2004.
- Khaldoun Al Agha. "WLAN and WPAN : an overview on Wi-Fi and bluetooth". 4 hours tutorial, *IFIP MWCN'03: International Workshop On Mobile and Wireless Communications Networks*, Singapore, October 2003.
- Nicolas Roussel. "The next five years in telepresence". Invited panelist for the workshop on Immersive Telepresence, *ACM Multimedia Conference*, December 2002.
- Fatiha Zaïdi. "Interoperability Testing. Séminaire". *ICU laboratories*, Korea, July 2001.
- Fatiha Zaïdi. "Test Methods for Communication Protocols and Services". 2 hours tutorial, *International Conference on Software Engineering Applied to Networking and Parallel/Distributed Computing (SNPD'2000)*, May 2000, Reims, France.
- Khaldoun Al Agha. "Wireless local area networks: WiFi". 3 hours tutorial at *IFIP Med-Hoc-Net'03, Mediterranean Ad Hoc Networking Workshop*, Mahdia, Tunisia, June 2003.

National

- Alia Fourati. "OLSR: Attaques et conséquences". *OLSR Day, Hypercom seminar*, INRIA & LRI, April 2004.
- Davor Males. "Synthèse de la sécurité et de l'ingénierie dans les réseaux sans fil". *Winter school DNAC 2004, De Nouvelles Architectures pour les Communications*, Fortalezza, February 2004.
- Alia Fourati. "La sécurité du routage dans les réseaux ad hoc". *Winter school DNAC 2004, De Nouvelles Architectures sur les Réseaux*, Fortalezza, February 2004.
- Davor Males. "Sécurité dans les réseaux sans fil et ad hoc". *Winter school DNAC 2004, De Nouvelles Architectures sur les Réseaux*.
- Khaldoun Al Agha. 3 hours classes, *Winter School, DNAC 2002 and 2004, De Nouvelles Architectures pour les Communications*.
- Hakim Badis. "QOLSR, comment sélectionner les MPR pour une meilleure QoS". *OLSR Day, Hypercom Seminar*, INRIA & LRI. April 2004.
- Sandrine Gouraud, "Génération de test statistique structurel". *Lande project seminar*, IRISA Rennes, January 2003. - Hakim Badis. "QOLSR: Le protocole de routage OLSR avec QoS". *Hypercom student seminar*, INRIA Rocquencourt, April 2003.
- Nicolas Roussel. "Usages de la vidéo pour la communication médiatisée". *Invited ARTEM seminar*, Nancy, France, December 2003
- Nicolas Roussel. "Usages de la vidéo pour la communication médiatisée". *Tutorial at IHM 2002, Conférence Francophone d'Interaction Homme-Machine*, Poitiers, France, November 2002.
- Michel Beaudouin-Lafon. "L'interaction homme-machine : retour vers le futur". *Colloquium at INRIA Rocquencourt*, 20 March 2001.

Research groups

Prog

Dissemination and
technology transfer

Training and education (doctoral and post-doctoral)

Defended habilitations

| <i>Name</i> | <i>Date defended</i> | <i>Current position</i> |
|------------------|----------------------|--------------------------------|
| AL AGHA Khaldoun | 03/10/02 | Professor, Université Paris XI |

Defended doctorates

| <i>Name</i> | <i>Date defended</i> | <i>Current position</i> |
|----------------------------|----------------------|--|
| ROUSSEL Nicolas | 17/07/00 | Assistant Professor, Université Paris XI |
| CASALTA Didier | 22/09/00 | Independent consultant |
| CONVERSY Stéphane | 29/09/00 | Assistant Professor, ENAC, Toulouse |
| LETONDAL Catherine | 27/09/01 | Research engineer, Institut Pasteur, Paris |
| AL-MESHHADANY Thamer | 23/09/03 | Lecturer (ATER), Université Paris XI |
| PERATO Laurent | 23/09/03 | Lecturer (ATER), Université Paris XI |
| GOURAUD Sandrine-Dominique | 24/06/04 | Post-doc, IRISA |
| BEAUDOUX Olivier | 29/06/04 | Assistant Professor, ESEO, Angers |
| BENZAID Mounir | 09/07/04 | Assistant Professor, ISAIP, Angers |

Graduate courses

- DEA I3 (Information, Interaction, Intelligence), Paris XI:
 - Foundations of Human-Computer Interaction: Michel Beaudouin-Lafon (1999-present).
 - Computer-Supported Cooperative Work, DEA I3: Nicolas Roussel, Michel Beaudouin-Lafon (1999-present).
- DEA ID (Informatique Distribuée) , Paris XI:
 - Mobile Networks: Khaldoun Al Agha, Lila Boukhatem, (2000-present)
 - Test of Computing Systems: Marie-Claude Gaudel and Bruno Marre.

Publications

International peer-reviewed journals

- [1] N. Achir, M. Dias de Amorim, O. M. Duarte, and G. Pujolle. Active bandwidth sharing for multi-layered video in multi-source environments. *Networking and Information Systems Journal*, 3(1), June 2000.
- [2] K. Al Agha. Resource management in wireless networks using intelligent agents. *International journal of network management, Wiley*, 10(1), January-February 2000.
- [3] K. Al Agha, P. Jacquet, and N. Vvedenskaya. Analysis of a priority stack random access protocol in W-CDMA systems. *IEEE Transactions on Vehicular Technology*, 51(3), May 2002.
- [4] K. Al Agha, G. Pujolle, and D. Zeghlache. VCB: an efficient resource sharing scheme for cellular mobile systems. *Telecommunication Systems, Kluwer*, 19(1):101 - 110, January 2002.
- [5] E. Bayse, A. Cavalli, M. Núñez, and F. Zaïdi. A passive testing approach based on invariants: Application to the wap. *Computer Networks*, 2004. 27 pages, in press.
- [6] M. Benzaid, P. Minet, K. Al Agha, C. Adjih, and G. Allard. Integration mobile-IP and OLSR Ad-Hoc networking for futur wireless mobile systems. *ACM WINET Journal on Wireless Networks, Kluwer*, 10(4), July 2004.
- [7] L. Boukhatem, A.-L. Beylot, D. Gaiti, and G. Pujolle. Channel allocation with and without handover queuing in LEO satellite systems based on an earth-fixed cell coverage. *IEICE Transactions on Communications, E86-B(7)*, July 2003.
- [8] L. Boukhatem, A.-L. Beylot, D. Gaiti, and G. Pujolle. TCRA : A time-based channel reservation scheme for handover requests in LEO satellite system. *International Journal of Satellite Communications and Networking, Wiley*, 21, April 2003.
- [9] L. Boukhatem, D. Gaiti, and G. Pujolle. A time-based reservation scheme for managing handovers in satellite systems. *ACM International Journal of Network Management, Wiley*, 13(2):139 - 145, March - April 2003.
- [10] A. Cavalli, A. Mederreg, and F. Zaïdi. Application of a formal testing methodology to wireless telephony networks. *Journal of the Brazilian Computer Society*, 2004. 17 pages, in press.
- [11] H. Chaouchi and A. Munaretto. Adaptive QoS Management for IEEE 802.11 future Wireless ISPs. *ACM WINET Journal*, 10(4), Jul 2004, Kluwer Academic Publishers. Special Issue on Ad Hoc Networking.
- [12] M. Dias de Amorim and O. M. Duarte. Improving the quality specification of multi-layered applications. *Networking and Information Systems Journal*, 3(6), December 2000.
- [13] M. Dias de Amorim, O. M. Duarte, and G. Pujolle. Virtual layering and efficient merging in non-cooperative multicast trees. *Journal of the Brazilian Computer Society*, 7(2), March 2001.
- [14] M. Dias de Amorim, O. M. Duarte, and G. Pujolle. Improving user satisfaction in adaptive multicast video. *IEEE/KICS Journal of Communications and Networks*, 4(2), September 2002.
- [15] M. Dias de Amorim, O. M. Duarte, and G. Pujolle. Distinguishing video quality through differential matrices. *ACM Multimedia Systems Journal*, 9(1), July 2003.
- [16] Y. Guiard and M. Beaudouin-Lafon. Target acquisition in multiscale electronic worlds. *International Journal of Human Computer Studies (IJHCS)*, Elsevier. in press.
- [17] N. Roussel, H. Evans, and H. Hansen. Proximity as an interface for video communication. *IEEE Multimedia*, 11(3):12-16, July-September 2004.

Research groups

ProgTraining and Education
Publications

National peer-reviewed journals

- [18] M. Beaudouin-Lafon. Ceci n'est pas un ordinateur. Perspectives sur l'Interaction Homme-Machine. *Technique et Science Informatique*, 19(1-2-3):69-74, 2000.
- [19] O. Beaudoux. Un modèle de composants (inter)actifs centré sur les documents. *Revue Information, Interaction, Intelligence*, 4(1):41-58, 2004, Cépadués éditions.
- [20] C. Cavalli, A. Mederreg, F. Zaïdi, P. Combes, W. Monin, R. Castanet, M. MacKaya, and P. Laurençot. Une plate-forme de validation multi-services et multi-protocoles - résultats d'expérimentations. *Annales des Télécommunications*, 2004. 24 pages, in press.
- [21] M.-C. Gaudel. Méthodes formelles, preuves et tests. *Technique et Science Informatique*, 19(1):239-246, 2000, Hermès Science.
- [22] M. Hascoët and M. Beaudouin-Lafon. Recherche et visualisation d'information. *Revue Information-Interaction-Intelligence*, 1(1):77-108, 2001, Cépadués-éditions.

Other journals

- [23] K. Al Agha. La qualité de service dans les réseaux ad hoc. *Plein Sud - Spécial recherche ; université de Paris-Sud XI*, 2004.
- [24] K. Al Agha and G. Pujolle. L'alternative IP Mobile et IP Cellulaire. *Informatique Professionnelle, Gartner*, (213), April 2003.

Books

- [25] K. Al Agha. *Les Réseaux mobiles et sans fil*. Hermes - traité, 2004. in press.
- [26] K. Al Agha, G. Pujolle, and G. Vivier. *Réseaux de mobiles et Réseaux sans fil*. Eyrolles, 2001.
- [27] D. Males and G. Pujolle. *Wi-Fi par la pratique, 1^{ère} édition*. Eyrolles, 2002.
- [28] D. Males and G. Pujolle. *Wi-Fi par la pratique, 2^e édition*. Eyrolles, 2004.

Edited books

- [29] M. Beaudouin-Lafon, editor. *Actes 14^e conférence francophone sur l'Interaction Homme-Machine (IHM 2002)*, ACM International Conference Proceedings Series, Poitiers, France, Nov. 2002. ACM Press. 306 pages.
- [30] Y. Guiard and M. Beaudouin-Lafon, editors. *Fitts' law 50 years later: Applications and contributions from HCI*, Special issue of International Journal of Human Computer Studies (IJHCS). Elsevier, dec 2004.
- [31] J. Jacko, A. Sears, M. Beaudouin-Lafon, and R. Jacob, editors. *Proceedings of ACM Conference on Human Factors in Computing Systems, CHI 2001*, volume 3(1) of *CHI Letters*, Seattle, USA, Apr. 2001. ACM Press. 560 pages.

Book chapters

- [32] N. Achir, M. Dias de Amorim, O. M. Duarte, and G. Pujolle. *Video Data*. Hermes-Penton Science, 2002.
- [33] H. Badis and K. Al Agha. *Advances in Wireless Networks and Mobile Computing*. Kluwer Academic Publishers, 2004. in press.
- [34] M. Beaudouin-Lafon. Contexte et interaction : vers l'informatique située. In H. Prade, R. Jeansoulin, and C. Garbay, editors, *Le Temps, l'Espace et l'Evolutif en Sciences du Traitement de l'Information*. Cépaduès Editions, 2000. Ecole thématique Nouveaux défis en sciences de l'information : documents et évolution, GDR-PRC I3, Marseille, septembre 2000.
- [35] M. Beaudouin-Lafon and W. Mackay. Prototyping development and tools. In J. Jacko and A. Sears, editors, *Human Computer Interaction Handbook*, pages 1006-1031. Lawrence Erlbaum Associates, 2002.
- [36] J.-D. Fekete. Le format pdf. In *Techniques de l'ingénieur*. Techniques de l'ingénieur, 2004.
- [37] J.-D. Fekete. Le langage postscript. In *Techniques de l'ingénieur*. Techniques de l'ingénieur, 2004.
- [38] Y. Ghamri Doudane, A. Munaretto, and H. Chaouchi. Qualité de service dans les réseaux ieee 802.11. In *Traité IC2 : Internet ambient*. Eds. Hermes, 2004. in press.
- [39] A. Munaretto. Qualité de service dans les réseaux ad hoc. In *Traité IC2 : Réseau de mobiles et sans fil*. Eds. Hermes, 2004. in press.
- [40] N. Roussel. Web-Based Mediaspace. In B. Furht, editor, *Handbook of Internet Computing*, chapter 9, pages 205-226. CRC Press, Boca Raton, Florida, June 2000.
- [41] B. Shneiderman, C. Plaisant, and J.-D. Fekete. *Designing the User Interface*, chapter Software Tools. Addison Wesley, 4th edition, May 2004.

Major international peer-reviewed conferences

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