



agence d'évaluation de la recherche  
et de l'enseignement supérieur

Section des Unités de recherche

AERES report on the research unit

INRIA Centre de Recherche Bordeaux – Sud Ouest

From the

Institut National de Recherche en Informatique et en  
Automatique (INRIA)

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Le Président  
de l'AERES

Jean-François Dhainaut

Section des unités  
de recherche

Le Directeur

Pierre Glorieux

May 2010



# Research Unit

Name of the research unit: INRIA Bordeaux Sud Ouest

Requested label

N° in the case of renewal

Name of the director: Mr. Claude KIRCHNER

# Members of the review committee

## Committee chairman

Mr. Yves CASEAU (Bouygues Telecom)

## Other committee members

Mr. Michel BEAUDOIN-LAFON (Univ. Paris Sud, LRI)

Mr. Jean-Claude BERMOND (CNRS, I3S, Nice)

Mr. Daniel BOUCHE (CEA)

Mr. Peter DOMINEY (INSERM)

Mr. Christophe FOUQUERRE (Univ. Paris 13, LIPN)

Mr. Bernd FRÖHLICH (Univ. of Weimar, Allemagne)

Mr. Jean-Pierre NADAL (ENS)

## Committee members suggested by CNU, CoNRS, CSS INSERM, CSS INRA, INRIA, IRD

Mrs. Isabelle TERRASSE (EADS)

# Observers

## AERES scientific advisor

Mr. Michel RIVEILL

## INRIA representative

Mr. Claude PUECH



# Report

## 1 • Introduction

- Date and execution of the visit:

The evaluation committee visited INRIA Sud-Ouest in Bordeaux on the 22nd and 23rd of December, 2009.

Those were two very productive and interesting days, thanks to a well-prepared organization. The committee has been quite impressed with the care and the attention to detail that went into this preparation. Everyone was on time and all public presentations had a full audience. These full rooms showed a true interest with the research center as a whole, a very good sign worth being mentioned. Each speaker made the most of their rather short presentation time. The talks and demonstrations were quite effective, with a lot of relevant information being delivered without losing a synthetic view. The only room left for future improvement was given by the few speakers who picked the French language to deliver their talk. Obviously, it will be better for future evaluations to ask everyone to use English.

- History and geographical localization of the research unit, and brief presentation of its field and scientific activities

The INRIA Bordeaux - Sud-Ouest Research Center was created formally on January 1st, 2008. However, it originated from the virtual center called FUTURS which has been established in 2002. Still, it is a young research institution that is still growing.

- Management team

The center director is Claude Kirchner, who is assisted by Jean Roman as a scientific deputy director.

- Staff members (on the basis of the application file submitted to the AERES)

|  | Past | Future |
|--|------|--------|
| N1: Number of researchers with teaching duties (Form 2.1 of the application file)  | 63   | 64     |
| N2: Number of full time researchers from research organizations (Form 2.3 of the application file)                       | 35   | 42     |
| N3: Number of other researchers (Forms 2.2 and 2.4 of the application file)  | -    | -      |
| N4: Number engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)    | 35   | 39     |
| N5: Number engineers, technicians and administrative staff without a tenured position (Form 2.6 of the application file) | 29   |        |
| N6: Number of Ph.D. students (Form 2.7 of the application file)  | 89   |        |
| N7: Number of staff members with a HDR or a similar grade  | 40   | 44     |



## 2 • Overall appreciation on the research unit

### • Summary

These two days, as well as the extensive "Summary of years 2005-2009" document, show that INRIA Sud-Ouest has achieved top scientific results during these first years of existence. The evaluation committee has praised the international collaboration established with the most prestigious institutions.

As a consequence, the international visibility of this new research center is excellent. As always, this visibility stems more from a few star projects than from others, but the overall result is very good for such a young institution. One may see this success as the positive outcome of two prior efforts:

- The "INRIA Futurs" approach that has started the growth of the research center in a seed phase;
- The prior existence of academic excellence, such as the Bordeaux/Pau Labs (IMB, LABRI, LMA ...), which have made Bordeaux and Pau a great "site" to establish INRIA Sud-Ouest.

The committee has also enjoyed very much the "team spirit" which could be felt during these two days. The fact that everyone seems happy to work with one another is a good sign of the successful creation of this research center. It is especially visible with the INRIA support staff, whose dedication and professional pride is praiseworthy.

INRIA Sud-Ouest is a key ingredient to the scientific ambition of the Sud-Ouest region. It acts as a catalyst to the academic excellence of the different labs from the Sud-Ouest universities. More precisely, it brings money and resources to establish transverse research projects. There are two key benefits to such a "matrix organization" (where the labs are the "vertical" structures and INRIA projects are the horizontal ones):

- Stronger and better research projects may be built (because of new money and talents);
- Wider projects that gather contributors from different labs, universities or even sites.

INRIA Sud-Ouest could be seen as a "project hotel", that is, a structure that supports large and strong projects. We use this term without any pejorative innuendo, we could have used "project incubator" as well. This is indeed a worthy objective, and one that has been successfully achieved during these first years. The quality of such a matrix organization requires two things:

- Efficiency and professionalism in the support that is delivered to the projects (something that INRIA does well)
- A careful balance of decision power between the horizontal and vertical structures, since the success of INRIA Sud-Ouest feeds from the excellence of the local academic partners. Here we find that INRIA Sud-Ouest has done an excellent job, but a sustained effort is needed, mostly because the ratio of INRIA research staff / overall research staff is still very different from other, older, INRIA centers.

However, there is consensus that INRIA Sud-Ouest needs to be more than a "project hotel", mostly as the bearer of a "scientific strategy". This strategy, by definition, needs to derive from INRIA national research strategy. This should be acceptable to all "vertical structures" which recognize the value of "new perspectives and great ideas" that may come from a larger institution. However, this strategy also needs to be "localized" in the sense that the "Sud-Ouest edition" must take the local assets and constraints into account. The research strategy of INRIA Sud-Ouest should capture a part of the challenges presented by the national document, according to the skills and resources that are present locally. This includes all the strengths that will be presented in the next section (labs, industrial partners, etc.). The "localization of the research strategy" is a key process for the governance of INRIA Sud-Ouest.

A general contact (accord cadre) was recently signed between INRIA and CPU (Conférence des Présidents d'Université) which states this positive dependency between INRIA and local institution and establishes the principles of win-win collaboration. It should be used as a framework to implement most of the recommendation made in this report.



- **Strengths and opportunities**

A key strength of INRIA Sud-Ouest is the combination of Applied Mathematics and Computer Science that is found here, which actually extends to physics as well. The skills concentration and the level of inter-disciplinary collaboration make it a key opportunity for future developments.

As mentioned above, another strength comes directly from the strong academic partners of the Bordeaux and Pau sites. A very positive point is that most researchers are quite happy with what they see as a dual affiliation (being both from INRIA project X and lab Y). There is strong local support for the presence of INRIA in Bordeaux, as exemplified by the help of the PRES to provide the grounds to erect the new building.

INRIA Sud-ouest benefits from a great industrial network, with many large enterprises such as Total, EADS or EDF, but also a mesh of SME. This is a key asset for this new center. The report shows that many contacts and contracts have been achieved, but there is an opportunity to do even more.

For instance, here are two suggestions that were made by members of the evaluation committee:

- For large scale partner enterprises, there could be an INRIA "account coordination" (either a person - as in an "account representative" - or a process), to ease the access to all the relevant skills and make sure that no interdisciplinary collaborative opportunity is lost.
- For small scale companies, INRIA could play a proactive role to federate young innovative startups with "thematic days". Such a regular event (e.g. once a month or once a trimester) is an opportunity to gather small companies who work in a common field. This approach has been used successfully in other countries (Japan, Korea) as a way to foster collaboration between startups and research institutions.

The "INRIA matrix organization" that was presented by the director seems to work quite well. The organization of INRIA Sud-ouest is embedded into INRIA national organization in such a way that both the support functions and the projects benefit from their national counterparts (organization-wise).

INRIA transverse collaboration between teams from different sites in France that share similar interests, is efficiently supported through AEN (Action Envergure Nationale)

More generally, the membership of INRIA Sud-Ouest within the national INRIA organization is an obvious strength, recognized as such by all regional stakeholders. Not only does INRIA provide means and resources to establish research projects, but the overall influence of a larger scale research institution which brings "fresh air, new talents and new perspectives" has been saluted by various local stakeholders during our evaluation. It also brings increased international visibility to all research projects.

- **Weaknesses and threats**

Team to team collaboration is not strong enough. Obviously there is balance to be found here: INRIA encourages, rightly so, national collaboration between teams that work on similar projects (or colors). We find that local collaboration must be also encouraged since new ideas often emerge from a close proximity of inter-disciplinary teams.

There is, quite naturally, a mismatch between the INRIA Sud-Ouest organization and the University/labs organization. There is no "equivalent" of the heads of the university labs within the INRIA organization. This may generate communication weakness and conflicting authority. It should be noted that there is a similar mismatch with the CNRS organization, which made it difficult to invite a CNRS representative to this evaluation committee (which would still have been quite logical, considering the involvement of CNRS staff within INRIA projects).

This mismatch needs to be addressed on two levels:

- The "scientific strategy" process or "how to pick guidelines for selecting new projects". Here some informal or formal committee is needed to ensure the right level of consultation/ empowerment for all stakeholders
- Coordinating support staff, or how to mix two matrix organization (the site matrix and the INRIA matrix). There is already some coordination effort going on (on business development for instance), but in most cases two supports organization coexist, one from INRIA and one from the university (secretaries, IT support, financial support).



Obviously the strong partnership with TOTAL is a strength, but of such importance that it could become a weakness if it becomes the dominant source of project revenue. It seems important to achieve a perhaps-more-balanced distribution of income.

The new building, which is obviously an opportunity, is seen as a threat by many local stakeholders. There is a fear of "closed building", which may weaken the communication flow between INRIA project researchers and their colleagues from their original university lab. This fear was clearly spelled-out by the PhD students. This is not unexpected with the matrix organization that we described in the previous section; there is no ideal spacing organization by definition. This issue simply requires to be addressed and a mixture of diplomacy and common sense must be applied.

- **Recommendations to the head of the research unit**

The scientific strategy is the key element that makes INRIA Sud-Ouest more than a "project hotel" - it requires a full construction process, with a lot of attention given to all stakeholders - INRIA is a keystone to the "site ambition" of Bordeaux. During these two days, both metaphors of accelerator and catalyst were used to describe INRIA's role in Bordeaux and Pau.

- Bordeaux has shown to have a great ambition for the whole campus as a site, and INRIA Sud-Ouest needs to be a part of this ambition. A site-level strategy requires common governance, which is true for defining a scientific strategy but also to coordinate support functions.
- Lab directors are key stakeholders - their participation should be more visible. The PRES president initiative to foster an informal monthly meeting should be strongly supported by INRIA. It should evolve into some informal "comité d'orientation prospective" that plays a role in the "localization" of the scientific strategy that was mentioned earlier.
- Some form of organization (committee, procedure or process) is needed to coordinate supports staff. Another example that was given to the evaluation committee comes from the assignment of industrial contracts. It seems that assignment rules are not always simple or shared, and that some clarification and cooperation between financial staff might help.

Considering the key role that scientific strategy plays, more work is needed to produce a common vision, built around challenges. Not enough was shown in the report or the talks regarding the vision of the research center or what the key challenges for the next years are. We heard too much of "our next step is to work to improve our method" and not enough of "here are the key issues that, if resolved, would result in a profound change for this area". The search for continuous improvement vs. breakthrough may be a sign of young research teams, but INRIA management must play a proactive role to challenge the project leaders to formalize their vision. The evaluation committee suggested starting from the list of all ongoing PhD topics organized into a thematic map, as an easy way to show what is in store for the next three years.

As stated earlier, we recommend fostering local collaboration. A suggestion to achieve this is to make Visualization into a "local skill area", a theme that may be shared among many projects. This would require to coerce all projects to improve their visualization techniques (some of them are still rather elementary) through the help of resident specialists of this center. This kind of proactive collaboration will require strong encouragement from INRIA's management (which could be seen as a loss of time by both parties!).

To make sure that the new building is indeed an opportunity for the development of the research center, and not seen as a threat from the other labs on the campus, it is extremely important to take as many symbolic actions as possible to assert the "openness" of this new building. Common facilities, such as meeting rooms or the cafeteria, should be made available to as many members of the associated research institutions as possible (not only those who actively participate to INRIA projects). It would make sense, on a symbolic level, to display small-scale logos of the associated research partners (universities, labs and CNRS) at the entrance of the new center. "Whatever works" seems to be the best recommendation for an issue that needs to be resolved locally, but the evaluation committee believes that the new building needs to be seen by everyone as an addition to the site.

Last, there exists for INRIA Sud-Ouest an opportunity to play an active and federating role with the strong local population of PhD students. INRIA could propose training resources to all students on the Bordeaux and Pau campus sites. These could include, for instance, how to give a talk, how to write a research paper, how to improve your English speaking level, and so on. If offered to all PhD students as a contribution to the local "école doctorale", it



could be a win-win move: strengthen the "INRIA brand", especially for those PhD students who are part of INRIA projects, and play into the "Campus Site strategy" with one instance of INRIA initiative that is benefiting to all.

- Production results

(cf. [http://www.aeres-evaluation.fr/IMG/pdf/Criteres\\_Identification\\_Ensgts-Chercheurs.pdf](http://www.aeres-evaluation.fr/IMG/pdf/Criteres_Identification_Ensgts-Chercheurs.pdf))

|  |       |
|--|-------|
| A1: Number of lab members among permanent researchers with or without teaching duties who are active in research (recorded in N1 and N2)     | 106   |
| A2: Number of lab members among permanent researchers with or without teaching duties who are active in research (recorded in N3, N4 and N5) | 17    |
| A3: Ratio of members who are active in research among staff members $[A1/(N1+N2)]$   | 100 % |
| A4: Number of HDR granted during the past 4 years  | 11    |
| A5: Number of PhD granted during the past 4 years  | 66    |
| A6: Other relevant item in the field   |       |

### 3 • Specific comments

- Appreciation on the results

The evaluation committee sees the results of the INRIA Sud-Ouest research center as globally excellent. It especially appreciates the creation of joint projects between Applied Mathematics and Computer Science. These results are equally good from an academic point of view - looking at the significance of the scientific results that have been achieved - and from an industrial point of view - looking at the contracts that were signed with local companies. INRIA Sud-Ouest has achieved a state-of-the-art level in HPC (High-performance computing) skills, which has generated many industrial successes (for instance with the CEA), since it helped to solve hard problems in applied physics. HPC is presented, rightly so, as a unifying common theme that bridges across domains such as "Modeling, Computation & Systems", "Simulation & Visualization" and "Formal Systems". HPC has become one of the "original genes" of this research center, and should be further developed with this orientation of being a "common tool".

The effort to produce software platforms has been quite successful, as can be judged both from the number of downloads or the various awards that they have received. For instance, one may quote Tulip from the Gravite project, Paris from LFANT or MPicha and OpenMPI.

The number of publications and their quality is quite satisfactory, especially for a young institution which has been growing continuously. The committee feels that there is an opportunity for an increased number of A-ranked publications in the future, considering the scientific quality of the work that is being done here.

- Appreciation on the impact, the attractiveness of the research unit and of the quality of its links with international, national and local partners

The overall international visibility is quite good, as was mentioned earlier. The center has received its fair share of awards and its senior members participate to the international academic life (e.g., program committees of international conferences).

It has had a good track record of hiring high level scientists during the previous years. The ability to recruit abroad is less impressive, but this is a general issue which is not specific with this center (it relates to the comparative attractiveness of being a research scientist in France).

INRIA Sud-ouest has benefited from the strong financial commitment of Region Aquitaine towards science. It has also been able to raise funding from industrial partners, such as CEA or TOTAL. The evaluation committee believes





that more European funding could be obtained (although with a considerable effort), which could be a growth opportunity (clearly, there is no need today since the center has managed to secure funding that may be easier to get - from a "paperwork perspective" - but this may become useful tomorrow, for instance applying for STREP).

As was mentioned earlier, INRIA Sud-Ouest has established strong international partnership with prestigious institutions (such as Princeton or Urbana-Champaign); more interestingly they were established at the right level with the key scientists. An opportunity for improvement would be to formalize these partnerships (many of which still appear to be informal collaborations). The evaluation committee suggests establishing the number of papers published with a co-author from a foreign university as a metric to foster the growth of international collaboration in the years to come.

The research activity pursued at INRIA Sud-Ouest has had concrete results on the socio-economic partners, in terms of spin-offs, industrial projects and science-related communication and popularization. Startup spinoffs are clearly in the infancy stage (one out and one in progress); they should be encouraged, following a strong INRIA tradition.

Although industrial projects have been quite successful, as was said earlier, the committee finds that there is an opportunity to better leverage the collaboration with "competitive clusters" (such as "Route des Lasers" or "Aerospace Valley"). The proximity of "Institut d'optique" on the campus could also be an opportunity with respect to competitive clusters.

- **Appreciation on the strategy, management and life of the research unit**

Our appreciation is that the director has done a great job with setting up INRIA Sud-Ouest. His combination of clear and well-articulated goals, on the one hand, and his diplomacy and common sense, on the other hand, have won the difficulties of the balancing act between horizontal and vertical tensions as explained earlier. His introduction and general positioning of INRIA Sud-Ouest with respect to national and regional stakeholders was found to be articulate, relevant and effective. The presentation of the center's goals, during the first morning, was very convincing and could be summarized with four key points: (scientific) excellence, interaction with partners, European development and a successful/happy/efficient culture for the center.

The project creation process has clearly been successful: there is a large number of successful projects, which are reasonably well clustered according the colors ("themes") promoted by INRIA's management. This process is a long-running and careful process, with a natural tension between agility (jumping on opportunities) and vision (making an effective contribution to INRIA's strategy).

Although INRIA Sud-Ouest brought a sizeable addition of support staff to the site, it seems to the evaluation committee that further growth is needed in order to accompany the development of the current projects and the creation of new ones. This is especially true for SED ("Experimentation and Development Center", which is a programming and development skill center). There is clearly an overall shortage of development engineers and staffing the SED is a better option than simply recruiting all of them at the project level. SED plays a key role in sharing and spreading IT/programming "best practices". SED is one of the best ways to solidify the center as a global research organization (as opposed to a "project hotel").

A similar argument could be made for increasing the number of assistants. They play a key part in the well-being of projects and, with 4 statutory positions, are spread too thinly to be effective with their role of weaving the INRIA modus operandi and culture into the projects.

The team members from INRIA Sud-Ouest have shown a true commitment to sharing their passion about mathematics and computer science; they have spent quite some time participating to all kinds of general public events to popularize their discipline (For instance, there is a strong contribution to the interstices web site). This is worth mentioning during times where there are mixed feelings from the French citizens about public research. This continued involvement in the public education should be encouraged; there are opportunities to further demonstrate the value of scientific research to the local population. There is also a strong commitment to teaching, which could be expected considering the high number of university professors, but still noteworthy. The teaching contribution made by the PHOENIX project, as well as the use of student feedback to enrich the project, is a good illustration of this point.



- **Appreciation on the project**

As was said earlier, the superb organization of the evaluation is a token to the good health and organization of this young research center. INRIA Sud-Ouest has made a large communication effort over the past few years, thanks to both its management team and an efficient communication staff (SC). These efforts have been successful and should be upheld for the future.

- **Global appreciation on the future project:**

The scientific project presented in the document and orally is ambitious, but attainable and very sound.

Indeed the center plans to continue and master its development towards the size of a regular INRIA research center (about 500-600 people) in a near future (between 4 and 8 years), which corresponds to doubling the size. That is very ambitious, but in view of the growth of the preceding years it is achievable.

On a scientific point of view the center has clear international ambitions. For that he wants to consolidate the existing projects (in particular develop the HPC main stream expertise). It also wants to create new projects, for example in neurosciences and computational chemistry.

This development will be done with a strong emphasis on industrial relations and in cooperation with all the partners on the site, the aim being to contribute to the development of Bordeaux STIC campus towards a center of excellence. That will be done through a reinforcement of the support services and the construction of a building of 15 000 m<sup>2</sup> (6 000 m<sup>2</sup> being ready end of 2011).

Therefore all the ingredients are there to have a successful project. The process will not be an easy task, as the center has to conciliate national constraints and local ones and intelligent solutions (integrating the various partners) need to be found; however the various actors are aware of that and in view of the past the committee think the center INRIA of Bordeaux and the campus STIC will be a success and might serve as example for other places.

- **Detailed appreciation and recommendations:**

As said above, the objective of doubling the size is ambitious and challenging but attainable.

The first thing to do is to consolidate the existing projects in the 3 colors; some of them need to be reinforced. A special attention should be paid to reinforce the links between the existing teams in particular in the HPC color (modeling and High Performance Computation); this can be done within the development of the research platform PlaFRIM.

A second important and challenging point is to reinforce all the support services in particular the experimentation and development service in view of increasing the industrial relations.

The center also aims at creating new scientific directions and projects. That has to be done within a sustained cooperation with all partners (industrial and academic). The direction is aware that it is the key for success; but special attention should be paid to associate not only the PRES or the national entities but also the laboratories. Of course such development will depend on opportunities (like mobility of researchers from other places) and it is difficult to predict what new themes will be strong in a few years. Among the new scientific directions proposed two seem promising in particular in view of the excellence of the University and the industrial environment: neurosciences and cardio models, and computational chemistry. The two other directions « Security and Safety » and « Sustainable development » are of course very important and crucial subfields; but they should essentially be developed within the existing teams and should actually be one of their main preoccupation. It does not seem necessary, however, to create new teams, unless a whole group is recruited from outside.

The committee encourages the center to continue the collaboration between Mathematics and Computer Science, which is very fruitful and is a strong point of Bordeaux, where INRIA's center plays a role of accelerator for this collaboration. The committee also encourages the center to strengthen the European collaborations.

The center wants to strengthen the industrial relations taking advantage of the competitive clusters Aerospace Valley and Road of lasers and it will surely be successful. The collaboration with SMEs is a challenging but difficult goal and should be encouraged. The center also wants to increase his efforts of « vulgarization » and diffusion of STIC culture towards the population; this is also a very interesting and important objective.

All these objectives are very important and the center is well placed to attain them, especially the goal of excellence at the international level, in view of the quality of its researchers. The reinforcement of the support services and the construction of a new building will help for the success. As written previously, this has to be done



with the help of all the partners and in particular the local ones (PRES, Conseil Régional d'Aquitaine, Industrial clusters...). It should be made easy by the fact that all the partners have the common aim to promote Bordeaux as a campus of excellence in STIC and are willing to have together a win-win strategy.

However it should be noted (and the direction is very aware of that) that there would be difficulties. One of them is the fact the center is both part of INRIA (which has its own strategy and structure) and part of the site of Bordeaux (which has its own vision).

The choices will be surely influenced by the future of the institutes at the national level, in particular of the CNRS which has been almost absent in the last years and could play a more important role. The dissymmetry between the team structure of INRIA and the labs structure of University and CNRS should be overcome by imagining new solutions and, in that sense, the fact Bordeaux is a new center may facilitate the approach and may help to find intelligent and innovative solutions so that Bordeaux might become an example for other places.

The committee is sure that the future will be successful and wishes to the center all the best.

The next part of the document provides with a thematic appreciation, organized according to the "colors" (themes) provided by INRIA during the evaluation.



## 4 • Appreciation area by area

**Title of the team:** Algorithms, Programmation of Networks and of Distributed Secure Systems

The "Algorithms, Programmation of Networks and of Distributed and Secure Systems" color is made up of four teams:

- CEPAGE : Searching et Distributing in Large Scale Heterogeneous Networks (Olivier BEAUMONT)
- LFANT : Light and Fast Algorithmic Number Theory (Andreas ENGE)
- PHOENIX : Programming Language Technology for Communication Services (Charles CONSEL)
- RUNTIME : Efficient Runtime Systems for Parallel Architectures (Raymond NAMIST)

These four groups cover a wide spectrum in the area of distributed systems and, as a consequence, address a fairly loosely connected set of topics. This is not an issue in itself as each of the group as a clear focus and the transversal themes are clear: security, reliability and performance.

- Staff members (on the basis of the application file submitted to the AERES)

|  | Past | Future |
|--|------|--------|
| N1: Number of researchers with teaching duties (Form 2.1 of the application file)  | 8    | 8      |
| N2: Number of full time researchers from research organizations (Form 2.3 of the application file)                       | 9    | 9      |
| N3: Number of other researchers (Form 2.2 and 2.4 of the application file)   | 2    |        |
| N4: Number engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)    | 1    | 1      |
| N5: Number engineers, technicians and administrative staff without a tenured position (Form 2.6 of the application file) | 3    |        |
| N6: Number of Ph.D. students (Form 2.7 of the application file)  | 16   |        |
| N7: Number of staff members with a HDR or a similar grade  | 5    | 5      |

- Appreciation on the results

CEPAGE works on foundations, models and algorithms for programming large-scale distributed platforms. The most visible results are in the theoretical contributions to scheduling, routing and distributed algorithms, with publications in the top conferences and journals in the field. The work on practical validations is of good quality but less strong, in part due to the difficulty of running large-scale experiments on real grids.

LFANT is a newly created team (March 2009) whose team leader has already got impressive results and publications. It mainly focuses on defining fast algorithms in number theory (computing class groups, discrete logarithms), which problems are essential in computer security, and mature enough to be tackled.

PHOENIX is largely recognized for its results on programming language technologies for communication services. Its suite of tools is widely used and a start-up is forthcoming. E.g. the research done on domain-specific languages is considered as of world-class level with A+-publications. PHOENIX has also important industrial relations (Thales, France-telecom, and transfer of technology to a spin-off).



RUNTIME works on efficient runtime systems for parallel architectures and produces a large number of software tools, some of which are widely distributed. Results such as the bubble scheduler and the StarPU runtime system are good examples of how the team has addressed the changing trends in this research area, such as the move towards using both CPUs and GPUs for high-performance computing.

- **Appreciation on the impact, the attractiveness of the team and of the quality of its links with international, national and local partners**

CEPAGE has a good visibility with extensive participation in program committees, participation in the organization of several conferences and a significant number of international collaborations leading to joint publications. With 7 faculty members however, several of whom about to defend a “habilitation”, the group should have more Ph.D. students (7 Ph.D. defended during the period, 4 being pursued). The large number of full-time researchers is a unique opportunity for the group to be more involved in teaching at the “Master Recherche” level.

The two groups LFANT and PHOENIX, even with only one permanent researcher, have a great impact on their respective community. Software developed by LFANT is or will soon be integrated to SAGE and/or Pari/GP, ensuring a large diffusion to the software components.

The impact of PHOENIX activity is important, as may be quoted by talks given on invitation or articles in magazines and newspapers. Besides that, 6 theses were defended in the last 4 years, while 6 new doctorates are involved in the group whose leader has teaching responsibilities related to the domain. Finally, the work on PHOENIX has led to a wide number of patents.

The impact of RUNTIME is most significant through its distribution of software packages, some of which (PM2, MPI implementations) have very good visibility. Probably because of the extensive work required for such developments, the number and level of the publications seems a bit on the low-end, as is the participation in program committees. The group has 8 faculty members but only one has a “habilitation”. This probably explains the small number of theses defended over the period (3), but the current number of Ph.D. students (6) is a good sign that this is changing. The large participation in the Master Recherche program is also a good investment.

- **Appreciation on the project**

The project of CEPAGE stays very much in line with their current work. The main evolutions are towards studying better foundations for mobile agent computing, tackling distributed dynamic databases and developing large-scale software build processes. The latter two are a significant step towards applying the results of the more theoretical work of the group and are a good addition to the research spectrum of the team.

The LFANT scientific project is clearly detailed and scientific risks are correctly anticipated (as the project has currently only one member, the human risk is not to be neglected). The research on algorithms (and the study of their complexity) in the domain of elliptic curves will be pursued and the experience will be used in the domain of hyperelliptic curves. This change of focus is promising for the next four years.

The orientation taken by PHOENIX anticipates the development of internet technology towards orchestration of services, from specification (in GUI) to compilation. Pervasive software development is in fact one of the most challenging area, that includes technology developments as well as theoretical foundations.

The RUNTIME research directions are clearly organized and gear the group towards a better handling of the increased complexity of parallel hardware and the exploration of better programming models. This is a timely move, which also raises the interesting issue of whether and how tools such as compilers can take advantage of these lower-level optimizations.

- **Conclusion :**
  - **Summary:**

All four groups have produced valuable results in their respective areas. CEPAGE conducts work of a fundamental nature on models and algorithms for distributed systems, with many applications. LFANT is a young but promising project on a subject that associates fundamental research as well as development of codes. PHOENIX is widely recognized for its already developed research and tools. The four teams have precise projects to be developed in the short to middle term on significant, well-identified challenges.



### – Strengths and opportunities:

The four groups work on state-of-the-art problems, with CEPAGE and LFANT focusing more on fundamental work while PHOENIX and RUNTIME focus more on practical solutions. The strength of the four teams results from their accurate knowledge and experience in their respective research areas. The algorithms developed by CEPAGE provide a solid foundation for distributed computing and should now be applied to practical applications. For LFANT, the fact that the software Pari/GP is developed in Bordeaux is a concrete opportunity to participate to its development and improvement, while integrating new algorithms written by the team. The tools developed by PHOENIX ensure a large visibility towards industry. The work of RUNTIME addresses critical issues in high-performance computing, such as the increasing complexity of hardware platforms, which should allow the team to have more impact in industry.

### – Weaknesses and threats:

LFANT and PHOENIX rely on only one permanent staff. LFANT was just created 6 months ago, hence one could expect recruitments next year at the permanent researcher as well as software engineer levels. The two kinds of recruitments are essential to guarantee the objectives in the next years. PHOENIX also lacks permanent researchers although the project needs experiences in different areas of software development. In particular, it should be important for the team to develop more theoretical research on programming languages (e.g. static security, complexity analysis ...). CEPAGE and RUNTIME are larger groups with relatively few Ph.D. students. They should ensure that the younger faculty members defend their habilitations and take on Ph.D. advising. Both groups would also benefit from more support at the engineer level. RUNTIME should also focus on publishing in higher-impact venues.

### – Recommendations:

Recruitments are essential for the smaller teams, LFANT and PHOENIX, to properly develop their research activities. These two teams should also increase their collaborations with teams working in their area. Pari/GP is a scientific opportunity for LFANT and the relation between the two groups is a necessity. CEPAGE should increase their effort in applying their results to practical applications, in particular by linking with industry partners. PHOENIX should keep fundamental research and implementations at the same level to maintain a high level of results in the future. RUNTIME should increase contacts with industry for a better transfer of their results, while increasing the level of their publications.

## Title of the team: Modeling and Simulation

The Modeling and Simulation color has a really wide scope. It is subdivided in 3 sub-groups :

Probabilistic Models and Optimization (4 teams)

- ALEA: Advanced Learning Evolutionary Algorithms (Pierre Del Moral)
- CQFD: Dynamic Reliability and Quality Control (François Dufour)
- GEOSTAT: Geometry and Statistics in Acquisition Data (Hussein Yahia)
- REALOPT : Reformulations based Algorithms for Combinatorial Optimization (François Vanderbeck)

Complex Simulations (5 teams)

- BACCHUS: Parallel Tools for Numerical Algorithms and Resolution of Essentially Hyperbolic Problems (Rémi Abgrall)
- CONCHA: Complex Flow Simulation Codes based on High-Order and Adaptive Methods (Roland Becker)
- HIEPACS: High-End Parallel Algorithms for Challenging numerical Simulations (Jean Roman)
- MAGIQUE3D: Advanced 3D Numerical Modeling in Geophysics (Hélène Barucq)MC2 : Modeling, Control and Computations (Thierry Colin)

Biological Models (2 teams)

- ANUBIS: Models and Methods in Biomathematics, Tools of Automatic Control and Scientific Computing (Jacques Henry)
- MAGNOME: Models and Algorithms for the Genome (David James Sherman)



Presentation of the whole color was made by Jean Roman (scientific deputy director of the INRIA Bordeaux-Sud Ovest research center). He provided a clear presentation of the 11 teams keeping the agenda (1 hour), 2 zooms were made after on Magique3D and CQFD teams, and then, related to this color, a presentation on the HPC and GRID platforms was made.

The common point of all this color discipline is that all teams are involved in development of numerical schemes, High Performance Computing (in collaboration also with RUNTIME), and transfer towards Industry. Yet it covers a large variety of domains.

- Staff members (on the basis of the application file submitted to the AERES)

|  | Past | Future |
|--|------|--------|
| N1: Number of researchers with teaching duties (Form 2.1 of the application file)  | 43   | 43     |
| N2: Number of full time researchers from research organizations (Form 2.3 of the application file)                       | 18   | 18     |
| N3: Number of other researchers (Form 2.2 and 2.4 of the application file)   | 13   |        |
| N4: Number engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)    | 3    | 3      |
| N5: Number engineers, technicians and administrative staff without a tenured position (Form 2.6 of the application file) | 7    |        |
| N6: Number of Ph.D. students (Form 2.7 of the application file)  | 51   |        |
| N7: Number of staff members with a HDR or a similar grade  | 27   | 27     |

- Appreciation on the results

The group has a scientific production of high quality, international relevance, and great usefulness for industrial applications. As a result, they publish a large number of articles in scientific literature. Some members of the groups are recognized as world class experts in their discipline. Moreover, they are able to thoroughly understand a wide range of physical problems and to use their expertise in HPC to solve them. Thus, the teams have a number of collaborations of high scientific level, and get substantial funding from industry (for example from Total for MAGIQUE3D).

- Appreciation on the impact, the attractiveness of the team and of the quality of its links with international, national and local partners

The group has received has received a significant number of awards related to scientific achievement and technical tools. The teams benefits from the competences of Bordeaux university laboratories and of INRIA teams, that turns out to be complementary, even if the synergy ought to be enhanced. The attractiveness for PhD and postdoctoral students, from France or from abroad, of this powerful pole in Modeling and Simulation is manifest. As a result, high level students have been recruited, and their motivation and implication in the teams is strong.

- Appreciation on the project

The eleven teams have projects of wide relevance and scientific interest. The teams working in the domain of complex simulations combine high level competence in numerical analysis, conception and efficient implementation of complex algorithms on massively parallel machines, and ability to understand physical and industrial scopes of problems. As a result, they develop, in collaboration with industry or laboratories, efficient and accurate simulation tools, for example in microfluidics (MC2), complex flows (CONCHA), seismology (MAGIQUE3D), as well as numerical schemes for more general hyperbolic equations (BACCHUS). They also address the difficult and important challenge of efficient scaling on machines with a very large number of processors, including heterogeneous architecture, combining for instance "classical" processors and GPU. The success to meet this challenge will be essential in a lot of



industrial and scientific domains; hence the color team will surely play a prominent role in this field. The team also develops new approaches in multiscale data analysis (GEOSTAT) combining physics and signal processing tools. New middle term projects such as simulation in neurosciences (in collaboration with neuroscientists in Bordeaux), cardio modeling, and sustainable development will satisfy emerging industrial and societal demands. Interdisciplinarity, both within INRIA (Maths and Computer science) and through external collaborations (with physicists, biologists,...) is an important ingredient at the source of the team's dynamics.

- Conclusion :

- Summary:

The group has a strong track record in terms of funding, scientific impact in journals, conferences and the production of software tools that are used in the community. Some teams are recent, some less. A better future vision is seen on the recent ones (who have just defined their project) whereas older ones are more focused on continuous improvement of existing tools.

- Strengths and opportunities:

The teams have high international visibility, good international and national collaboration (Princeton, Urbana Champaign, Cerfacs...), and a wide variety of industrial partners: Edf, Thales, Cea-Cesta, Astrium, Total. Software is mostly developed in open source. The need for real experimentation on platform (protocols, networks, physical and numerical issues) is not easy on regional or national platform (lack of reactivity), so involvement in a local infrastructure is a good point (engineers ensuring the development and day to day support of the infrastructure are mostly provided by INRIA).

- Weaknesses and threats:

The partnership with Total provides an important part of funding (however the team is aware of this weakness), the collaboration inside the teams are not sufficiently developed (even if in the partnership with total several were partners and not only in INRIA Bordeaux), maybe lack of link with SME's (where INRIA could provide global offer), HPC and Biology can be good disciplines to begin the networking.

- Recommendations:

Actions directed towards each partner (Cea, Astrium) could have more impact if more centralized (providing a unique service: numerical scheme, hpc accelerator, optimization), federative topic could be: HPC and visualization of results (in link with IPARLA for example).

### Title of the team: Perception, Cognition, Interaction

The Perception, Cognition and Interaction color is made up of four teams:

- FLOWERS: Flowing Epigenetic Robots and Systems (Pierre-Yves Oudeyer),
- GRAVITE: Graph Visualization and Interactive Exploration (Guy Melançon),
- IPARLA: Visualisation and Manipulation of Complex Data on Wireless Mobile Devices (Pascal GUITTON),
- SIGNES: Linguistic Signs, Grammar and Meaning: Computational Logic for Natural Language (Christian Retoré).





- Staff members (on the basis of the application file submitted to the AERES)

|  | Past | Future |
|--|------|--------|
| N1: Number of researchers with teaching duties (Form 2.1 of the application file)  | 12   | 12     |
| N2: Number of full time researchers from research organizations (Form 2.3 of the application file)                       | 8    | 8      |
| N3: Number of other researchers (Form 2.2 and 2.4 of the application file)   | 2    |        |
| N4: Number engineers, technicians and administrative staff with a tenured position (Form 2.5 of the application file)    | 1    | 1      |
| N5: Number engineers, technicians and administrative staff without a tenured position (Form 2.6 of the application file) | 9    |        |
| N6: Number of Ph.D. students (Form 2.7 of the application file)  | 22   |        |
| N7: Number of staff members with a HDR or a similar grade  | 7    | 7      |

- Appreciation on the results

The group has a scientific production of high quality and international relevance. Various A+ publications (Siggraph, InfoVis, IEEE Conference on Computer Vision and Pattern Recognition, Journal of Graph Algorithms and Applications, IEEE IROS, Journal of Logic Language and Information) are complemented by an impressive number of good and very good publications. Various team members are recognized international experts in their domains, which has been demonstrated by their continuous presence in international conference and symposia committees, journal editorship, and their top level publications. There is a strong production in software platforms as well. They develop and maintain quality and stable partnerships, e.g. Flowers with ENSTA, Iparla with ETH Zürich and University of North Carolina; Gravite with the University of British Columbia; and Signes with Hyderabad A. Kulkarni. The teams are successful in getting funding from different regional, national and European sources, including multiple ANR contracts. Likewise, Oudeyer in Flowers was recently awarded and ERC young investigator award.

- Appreciation on the impact, the attractiveness of the team and of the quality of its links with international, national and local partners

The group has received various awards related to scientific achievement and technical tools, and competitions including the IEEE Symposium on Visual Analytics Science and Technology (IEEE VAST 2009) awards with Tulip visualization software from Gravit , Eurographics best paper and student paper awards (2006, 2009) from Iparla. A Signes was awarded the 2009 prize of the European Association for Theoretical Computer Science. Signes also develops Natural language processing resources including Huet's Sanskrit Site (<http://sanskrit.inria.fr>), and the Grail parser (Signes), which contribute to the visibility of the group. They are involved in the organization of important events (e.g. Eurovis2010, Esslli 2009). The recruitment of the Flowers team leader and the creation of this team illustrates the attractiveness of the group.

The cognitive robotics theme is an exciting new aspect which also has high visibility. Research results with potential real-world impact are secured by a number of patents and patent applications. The group makes significant contributions to the local teaching and research structure.

- Appreciation on the project

The four teams have proposed projects that will continue to advance their established strengths, with original cutting edge projects. For example, dynamic graph visualization represents a highly promising direction for Gravit . 3-D vision, modeling, rendering and interaction in the context of mobility is a challenging and forward looking topic for the IPARLA project with potentially large impact due to the increasing use of mobile technology. For Signes, the focus on syntax, semantics and their interface and participation in activities that structure their discipline, including renewal of the GDR "s mantique et mod lisation" are promising for the next four years. In addition, the new project



Flowers will bring a novel dimension of developmental cognitive robotics to the group. This will likely have a positive effect on scientific integration.

- **Conclusion :**

- **Summary:**

- The group has a strong track record in terms of funding, scientific impact in journals, conferences and the production of software tools that are used in the community. The scientific projects are sound.

- **Strengths and opportunities:**

- The strength and success of the internationally highly visible IPARLA team is based on their comprehensive knowledge and high quality research in acquisition, modeling, rendering, vision and interaction in a 3D context. Gravité has an excellent track record in the graph drawing community, and their excellence in combinatorial mathematics as well as visualization techniques and software systems makes this a unique group in this area. In computational linguistics Signes has developed the Grail parser, and the Zen toolkit which is exploited in the Sanskrit Site, both of which are heavily used within the community. Flowers brings significant experience in robot cognitive development, high visibility in the developmental robotics community, and potential for exploitation in a start-up company.

- **Weaknesses and threats:**

- Gravité members have many duties and there seems to be an understaffing with senior researchers. If one or two key members would leave the group, there is the threat of losing their international standing. Their software development Tulip also depends on very few people. IPARLA is very well positioned. However, they could benefit from team members with an excellent background in psychophysiology and perception, since many of their projects have a perception component. This is currently handled by external collaborations, but the direct integration of this expertise into the group could be more effective. The evolution of the computational linguistics community poses the threat for multidisciplinary of being able to maintain expertise in linguistics and theoretical computer science for Signes. A similar threat could be perceived for Flowers as this is also a multidisciplinary project that combines robotics and cognitive development, with challenges related to developing efficient methods for exploration, and abstraction and learning.

- **Recommendations:**

- The main recommendations are related to funding and outreach, both outward and within the center. With respect to funding, the teams should continue to focus on ANR funding and increase their efforts for EU funding which will also contribute to European collaboration. The Gravité teams should continue to open towards disciplines which can benefit from their visualization expertise. For example, dense time-varying signals in neuroscience (EEG, MEG, fMRI) are pushing research in the domain to its limits in terms of analysis and interpretation. Such a domain could provide a strong application link for their visualization techniques.

- IPARLA should further strengthen their vision and machine learning expertise, since this will be a central topic in many interactive applications in the future - in particular in the mobile context. In addition, there is quite some potential for collaborating with the other colors, since their excellent research in simulation and mathematical models should be complemented by IPARLA's expertise in graphics and interaction. This would be also a good test case for the developed tools and techniques on real-world problems. In order to help address the potential threat in

Signes of difficulty in acquiring access to individuals with parallel expertise in computer science and linguistics, it may be possible to benefit from expertise in INRIA. The TALARIS project, INRIA Nancy focuses on areas including Computational semantics and Logics for natural language inference and knowledge representation. Interaction could be of benefit to Signes.

Within the context of the Color, one could consider a group project in which computational semantics from Signes could be fed by grounded robot perception from Flowers, and that the resulting multidimensional ontology could be visualized via Gravité. In general, the level of graphics, visualization, and interaction in the other colors is much less developed and there are many opportunities for high quality - partially interdisciplinary - research between these teams.



Finally, the committee recommends that the four groups establish some semi-formal mechanism for maintaining and fostering interaction. This could be in the form of a monthly seminar in which students from the groups would alternately present their research. The objective is not necessarily to create new collaborations immediately, but rather to establish a scientific culture that can have more concrete results (e.g. cooperation in an EU project) in the future.

| Note de l'unité | Qualité scientifique et production | Rayonnement et attractivité, intégration dans l'environnement | Stratégie, gouvernance et vie du laboratoire | Appréciation du projet |
|-----------------|------------------------------------|---|--|------------------------|
| A+              | A+                                 | A+  | A  | A                      |

Nom de l'équipe : Pôle : Algorithms, Programming of Networks and of Distributed and Secure Systems

| Note de l'équipe | Qualité scientifique et production | Rayonnement et attractivité, intégration dans l'environnement | Stratégie, gouvernance et vie du laboratoire | Appréciation du projet |
|------------------|------------------------------------|---|--|------------------------|
| A+               | A+                                 | A   | non noté                                     | A+                     |

Nom de l'équipe : Pôle : Modeling and Simulation

| Note de l'équipe | Qualité scientifique et production | Rayonnement et attractivité, intégration dans l'environnement | Stratégie, gouvernance et vie du laboratoire | Appréciation du projet |
|------------------|------------------------------------|---|--|------------------------|
| A+               | A+                                 | A+  | non noté                                     | A                      |

Nom de l'équipe : Pôle : Perception, Cognition and Interaction

| Note de l'équipe | Qualité scientifique et production | Rayonnement et attractivité, intégration dans l'environnement | Stratégie, gouvernance et vie du laboratoire | Appréciation du projet |
|------------------|------------------------------------|---|--|------------------------|
| A+               | A+                                 | A+  | non noté                                     | A+                     |