INRIA Sophia Antipolis - Méditerranée

2012 AMBITIONS
For over 40 years, INRIA, the French national institute for research in computer science and control, operating under the dual authority of the Ministry of Research and the Ministry of Industry, has been the special place where the spearhead of the national research strategy in ICST (Information and Communication Science and Technology) is drawn up. The publication of the fourth 2008-2012 strategic plan for the institute opens up a new cycle of innovations for the whole of society.

The institute’s research activity is today based on four priorities: complex systems modeling (MODELING), software development to ensure security and reliability of computer systems (PROGRAMMING), designing new communications networks (COMMUNICATING) and interaction between the real and virtual worlds (INTERACTING). By using these areas, INRIA develops a long-term vision of fundamental research in computer science and applied mathematics in France.

Since 1994, each strategic plan has presented choices which have resulted in well known technological and scientific breakthroughs: the development of the Internet and web (1994 – 1997), and the convergence of computer science with life sciences (2003 – 2007) are two major examples.

Faced with Internet use which is undergoing radical change and the growing predominance given to internet users, INRIA’s ambition is to develop new technological databases to correct the Internet’s structural weaknesses and make a real transition towards a web of knowledge and services.

A new revolution is now being played out, positioning ICSTs at the center of the transformation of investigation, experimentation and design methods in engineering and research.

There are major economic and social challenges. With its partners, INRIA’s ambition is reflected by a desire to concentrate its four priorities on three areas of application:

- Computational engineering and especially designing onboard software for physical objects (airplane, bank card, etc.)
- Computational sciences or how to contribute to bringing together ICST and life sciences, material sciences and environmental sciences
- Computational medicine towards developing models for medicine and laboratory medicine

The INRIA Sophia Antipolis - Méditerranée research center naturally applies the Institute’s strategic orientations which are broken down into areas as detailed in this document.
Identity

Founded in 1983, at 1st January 2009, the Sophia Antipolis - Méditerranée research center had a workforce of approximately 500 people (including almost 400 scientists), 362 of whom are paid by INRIA (researchers, engineers, technicians, administration staff, doctoral students, post doctoral students, guest professors…).

These people are divided into 8 services and 32 research project-teams, 30 of which are INRIA project-teams (EPI) where almost half are shared with one or several partners (Nice Sophia Antipolis University, the Universities of Provence and Montpellier, CNRS, INRA, CIRAD, École des Ponts ParisTech, Mines Paris Tech…) within joint research units (ASB, DAB, ISS, IUSTI, LIRMM, LJAD, LIENS,…). The center’s main site is based at Sophia Antipolis with a branch in Marseille (1 project-team) and is developing an increased presence in Montpellier (3 project-teams). The scientific contribution of the center to INRIA’s Strategic Plan is primarily focused on the three following themes:

- Ubiquitous computing and communications,
- Computational medicine and biology,
- Modeling, simulating and interacting with the real world.

Among other things the center’s status, influence and attractiveness are reflected by a significant number of recruitments, the reception of many foreign scientists, a very active international policy and its expertise in the industrial world:

- 260 recruitments in 2008, including 116 foreigners and 130 interns a year, including 80 foreigners
- In 5 years, 1st year doctoral students: increase from 35 to 65% of foreigners
- 43 nationalities represented
- In 5 years, organization of around one hundred international conferences (5000 delegates)
- 115 European contracts signed in 10 years (including 40 currently in progress) representing almost €26M
- 40 projects for the French National Research Agency (ANR) in progress (including 17 signed in 2007 representing funding in the order of €2M)
- 16 teams associated with foreign laboratories (Canada, Finland, India, Russia, USA)
- 6 projects in the “EuroMéditerranée 3+3” program
- Agreement with Conicyt (Chile) to accommodate Chilean students
- 160 pieces of software and around twenty patents lodged
- 16 technology companies created

For all these activities, at 1st January 2009, the center had a budget of almost €28M including almost €7M of its own resources (public and private research contracts).

The center works in close collaboration with the companies located in its geographical area but also across other regions. It is involved with the work of 9 competitiveness clusters and it is a founding member of the world SCS cluster (Secured Communicating Solutions). It plays a major role in the Sophia Antipolis technology cluster by actively participating in associations such as Telecom Valley, but also through the center’s fifteen or so spin-offs, some of which have become international leaders in their business sector. It is involved in the development of the Montpellier cluster, within the framework of a partnership with Agropolis Foundation. Finally, the center is home to the head office of ERCIM (European Research Consortium for Informatics and Mathematics) and the European development team of the W3C (World Wide Web Consortium).
Development and prospects

On a scientific level, the center’s major development is its very strong involvement in the Institute’s “Computational Sciences for Biology, Medicine and the Environment” research domain. At 1st January 2009, out of the 29 Institute teams attached to this domain, 8 were from the Sophia Antipolis - Méditerranée research center (5 on the Sophia-Antipolis site and 3 on the Montpellier site).

Equipped with its 32 research project-teams and the quality of its research support personnel, the center wants to be a verbose partner within the socio-economic networks (education and research establishments, companies, associations, local authorities) of the regions where it is heavily present. The purpose of this desire to participate and enrich these networks is to increase the attractiveness of the regions where the Center is established in order to make them places of excellence for driving research activities in ICSTs and to hope for positive benefits in terms of jobs and the creation of wealth in these regions.

From this ambition, the Sophia Antipolis – Méditerranée research center issues the main objectives for the development of research into computing, control and applied mathematics which are broken down below.

On the Nice Sophia Antipolis site, the Center has strengthened its partnership with Nice - Sophia Antipolis University through the signing of a site agreement in order to create synergies in the establishments’ policies as well as on scientific, development and international policy aspects. The scientific aspect does not only involve the creation of INRIA project teams shared within the different University laboratories but also regular consultation on the actions implemented by the establishments to promote the penetration of ICSTs within other disciplines and associated resources (participation of the doctoral and master schools, temporary assignments and research professors on assignments elsewhere).

The center has three main objectives for all those involved in ICST in the Sophia-Antipolis site area:

- participate in the development of the ICST Campus with Nice - Sophia Antipolis University and the EURECOM Institute to develop it into an excellence cluster on the theme of computing and communication networks,
- build synergy between ICST research and medical research, in particular with the faculty of medicine at Nice - Sophia Antipolis University, the Antoine Lacassagne Center and the CHU, but also with the neurosciences community in Marseille,
- actively work with a network of companies and offer suggestions to the local network of companies (Telecom Valley, Persan).

The Montpellier site aims to make its presence sustainable by reasonably increasing the number of its project teams around two main aspects:

- on the one hand, computational plants in close association with INRA and CIRAD, with the main objective of successfully involving INRIA in the Agropolis Foundation, and support for the Thematic Networks for Advanced Research (RTRA) “Agriculture and sustainable development”, focused on the theme “Computational Plants and Ecosystems”.
- on the other hand, computational medicine with the Montpellier 1 and 2 universities through the LIRMM and the Propara Center (mutual insurance center for neurological reeducation).

The center manages an active partnership policy with players from the Mediterranean basin, in particular strongly supporting the EuroMéditerranée 3+3 program, but also all of INRIA’s international programs (associated teams, internships, sabbaticals, explorers).

Finally, with its partners in the Provence-Alpes-Côte d’Azur region (PERSAN, Departmental Council of the Alpes-Maritimes, Paca Region) the center will manage an active policy to promote scientific culture in particular in secondary schools and the political world.
Scientific priorities

The Sophia Antipolis - Méditerranée research center wants to continue high level research within the framework of the priorities of the Institute’s strategic plan and has set itself three major scientific objectives.

**COMPUTATIONAL MEDICINE AND BIOLOGY**

**INRIA Strategic Plan area: COMPUTATIONAL MEDICINE – COMPUTATIONAL SCIENCES**

The Center aims to design, implement and control computational and computer models of living systems ranging from microbial ecosystems to human body organs and forests and to identify parameters using multimodal measurements (imaging, biological and biochemical signals, etc.). These models are called computational because they make it possible both to describe a living system and simulate it on a computer. This research requires the study and development of new mathematical and algorithmic tools in cooperation with several connected disciplines (biology, medicine, physics, chemistry, etc.) and involves the geometrical and statistical modeling of complex forms, the modeling of complex physiological processes, the construction of multi-scale representations, the resolution of inverse problems and data assimilation by deterministic or stochastic methods. The center will focus on four aspects:

- computational modeling of biological, anatomical and physiological systems,
- imaging and medical robotics which with the help of (i), aim to assist with diagnosis and customized therapy,
- computational neurosciences, from the modeling and measurement of neuronal activity to the design of bio-inspired calculation and communication systems,
- the modeling of plants and ecosystems for sustainable development.

**MODELING, SIMULATING AND INTERACTING WITH THE REAL WORLD**

**INRIA Strategic Plan area: MODELING – INTERACTING**

Computational simulation has become a key element in understanding, modeling, designing and controlling physical, biological and social phenomena. Well established in sophisticated industrial processes (space systems, transport, energy, etc.) modeling and computational simulation will be used increasingly in ever more diverse sectors (risk management, industrial security, urban planning, surgical interventions, physical rehabilitation, gaming, etc.). For many of them, the fundamental dimension of interactivity is overlaid. This interaction between the virtual and real worlds therefore requires virtual and enhanced audiovisual environments to be created and rendered and the conditions for real-time haptic interactions with users to be met, including the conditions for their evaluation. On another level, robotics is another field in which modeling and simulation are becoming increasingly important for applications such as “robot-human” interaction, especially in view of the development of new service robotics. The center will focus on four aspects:

- stochastic or multi-scale modeling for the simulation of complex or very large sized phenomena,
- geometrical modeling, multi-modal interactive rendering and development of technological platforms for proving tools,
- construction of real-world models from data, images, sound and video from the real world,
- rehabilitation robotics in immersive environments.

**UBIQUITOUS COMPUTING AND COMMUNICATIONS**

**INRIA Strategic Plan area: COMMUNICATING**

Highly heterogeneous networks and mobile entities can be deployed quickly and their complexity is increasing. Their proper functioning and the transparency of their uses are vital issues for our societies because the services and applications using them require a ubiquitous, safe and reliable network. Operating these heterogeneous, complex networks is a major scientific challenge which requires the development of pure and applied research in architecture and protocol design as well as network dimensioning, optimization and planning. These must be based on algorithms, performance assessment, simulation, formal methods and experimentation platforms. With a view to using these networks correctly and efficiently, the center’s research focuses on three main aspects:

- security, reliability (software security, proof of ownership of executable code, etc.) and robustness (failure tolerance),
- new network architectures (networks-on-chips, peer-to-peer, self-organized networks, overlay networks, grids, etc.) and exploring resources,
- integrating knowledge and services into service and community networks through the semantic Web.
### The center’s project-teams at 1st January 2009

#### Field: Computational Sciences for Biology, Medicine and the Environment

<table>
<thead>
<tr>
<th>Project-teams</th>
<th>Computational Sciences for Biology, Medicine and the Environment</th>
</tr>
</thead>
<tbody>
<tr>
<td>ABS: Algorithms and structural biology</td>
<td>Frédéric Caizels</td>
</tr>
<tr>
<td>ASCLEPIDS: Analysis and simulation of biomedical images</td>
<td>Nicholas Ayache</td>
</tr>
<tr>
<td>COMORE: Modeling and control of renewable resources</td>
<td>Jean-Luc Gouzé</td>
</tr>
<tr>
<td>DEMAR: Artificial Movement and DEambulation</td>
<td>David Guiraud</td>
</tr>
<tr>
<td>MERE: Modeling and water resources</td>
<td>Claude Lobry</td>
</tr>
<tr>
<td>NEUROMATHCOMP: MATHeMathematical and COMPutationals NEUROscience</td>
<td>Olivier Faugeras</td>
</tr>
<tr>
<td>ODYSSEE: Computer and biological vision</td>
<td>Rachid Deriche (temporary)</td>
</tr>
<tr>
<td>VIRTUAL PLANTS: Modeling of plant development: From genes to phenotype</td>
<td>Christophe Godin</td>
</tr>
</tbody>
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#### Large-scale Initiative Action

| Large-scale Initiative Action | Electro-mechanical modeling of the heart | Hervé Delingette |

#### Field: Perception, cognition, interaction

<table>
<thead>
<tr>
<th>Project-teams</th>
<th>Perception, cognition, interaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>ARIANA: Inverse problems in earth monitoring</td>
<td>Josiane Zerubia</td>
</tr>
<tr>
<td>ARIDAS: Advanced Robotics and Autonomous Systems</td>
<td>Patrick Rives</td>
</tr>
<tr>
<td>AXIS: Usage-centered design, analysis and improvement of information systems</td>
<td>BrigitteTrouse</td>
</tr>
<tr>
<td>COPRIN: Constraints solving, optimization and robust interval analysis</td>
<td>Jean-Pierre Merlet</td>
</tr>
<tr>
<td>EDELWESS: Exchanges, Documents, Extraction, Languages, Web, Ergonomics, Interactions, Semantics, Servers</td>
<td>Olivier Corby (temporary)</td>
</tr>
<tr>
<td>PULSAR: Perception Understanding Learning Systems for Activity Recognition</td>
<td>Monique Thonnat</td>
</tr>
</tbody>
</table>

#### Field: Networks, systems and services, distributed computing

<table>
<thead>
<tr>
<th>Project-teams</th>
<th>Networks, systems and services, distributed computing</th>
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</thead>
<tbody>
<tr>
<td>MAESTRO: Models for the performance analysis and the control of networks</td>
<td>Philippe Nain</td>
</tr>
<tr>
<td>MASCOTTE: Algorithms, simulation, combinatorics and optimization for telecommunications</td>
<td>Jean-Claude Bermond</td>
</tr>
<tr>
<td>OASIS: Active objects, semantics, Internet and security</td>
<td>Denis Caromel</td>
</tr>
<tr>
<td>PLANETE: Protocols and applications for the Internet</td>
<td>Walid Dabbous</td>
</tr>
<tr>
<td>INDES: Distributed and secure computing</td>
<td>George Drettakis</td>
</tr>
<tr>
<td>LOGNET: Logical Networks: Self-organizing Overlay Networks and Programmable Overlay Computing Systems</td>
<td>Luigi Liquori</td>
</tr>
</tbody>
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#### Field: Applied mathematics, computing and simulation

<table>
<thead>
<tr>
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<th>Applied mathematics, computing and simulation</th>
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<tbody>
<tr>
<td>APICS: Analysis and Problems of Inverse type in Control and Signal processing</td>
<td>Laurent Baratchart</td>
</tr>
<tr>
<td>NACHOS: Numerical modeling and high performance computing for evolution problems in complex domains and heterogeneous media</td>
<td>Stéphane Lanterri</td>
</tr>
<tr>
<td>ORPAL: Optimization and control, numerical algorithms and integration of complex multidiscipline systems governed by PDE</td>
<td>Jean-Antoine Desideri</td>
</tr>
<tr>
<td>SMASH: Simulation, modeling and analysis of heterogeneous systems</td>
<td>Richard Saurel (temporary)</td>
</tr>
<tr>
<td>TOSCA: TO Simulate and CALibrate stochastic models</td>
<td>Denis Talay</td>
</tr>
<tr>
<td>TROPICS: Program transformations for scientific computing</td>
<td>Laurent Hascoët</td>
</tr>
</tbody>
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#### Field: Algorithms, programming, software and architecture

<table>
<thead>
<tr>
<th>Project-teams</th>
<th>Algorithms, programming, software and architecture</th>
</tr>
</thead>
<tbody>
<tr>
<td>GALAAD: Geometry, algebra, algorithms</td>
<td>Bernard Mourrain</td>
</tr>
<tr>
<td>GEOMETRICA: Geometric computing</td>
<td>Jean-Daniel Boissonnat</td>
</tr>
<tr>
<td>AOSTE: Models and methods of analysis and optimization for systems with real-time and embedding constraints</td>
<td>Robert De Simone</td>
</tr>
<tr>
<td>MARELLE: Mathematical, Reasoning and Software</td>
<td>Yves Bertot</td>
</tr>
</tbody>
</table>

| Team | Plasma, Turbulences, Modeling, Approximations and Simulations | Hervé Guillard |
The creation of technology companies is a favored resource ensuring the transfer of research and new technologies to an industrial partner who will develop and market the innovation. The technology companies stemming from INRIA are bringing products based on INRIA research prototypes to industrial standards or are spreading the Institute’s know-how. Since 1984, INRIA is at the origin of the founding of 91 companies, including 16 at the Sophia Antipolis – Méditerranée research center. Of course, some of these start-ups are built on technologies designed by the joint INRIA project-teams with other partners, but the INRIA technology transfer team has consistently played a key role in indentifying a project and seeing it though to maturity, supporting it during its incubation in cooperation with the INRIA subsidiary (IT Translation) or with the Paca-Est Incubator.

Technology companies stemming from the center

January 2009

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Technology companies stemming from the center

January 2009

ActiveEon
www.activeeon.com

Auckland
www.auckland.fr/

Esterel technologies
www.esterel-technologies.com

Ergomatic consultants

Focus Imaging
www.mediantechologies.com

Geometry Factory
www.geometryfactory.com

Ilog
www.ilog.fr

Istar
www.infoterra.com

Keeneo
www.keeneo.com

QuantifiCare
www.quantificare.com

Realviz
www.realviz.com

UDcast
www.udcast.com

Vulog
www.vulog.com

Publisher of Open Source Solutions for distributed and parallel computing in order to speed up applications and virtualization
Creation date: 2007

Internet auction site
Creation date: 1999

Purchased by the British group QXL in 2002

Design software for reliable systems
Creation date: 1999

Ergonomics for computing systems: design of user interfaces and man-machine interaction in computing systems
Creation date: 1990

Publication of automation software for analyzing medical images in three dimensions
Creation date: 1992

Taken over by the company Median in 2002

Geometrical C++ software components
Creation date: 2003

C++ and Java software components
Creation date: 1987

Bought by IBM in 2008

Aerial and space image processing
Creation date: 1998

Measurement of the evolution of diseases based on the analysis of medical images
Creation date: 2005

Publisher of behavior recognition software and Intelligent Video Surveillance
Creation date: 2001

Measurements of the evolution of diseases based on the analysis of medical images
Creation date: 1996

Taken over by the company Autodesk in May 2008

Software and image processing solutions for the content creation sector
Creation date: 2000

Convergence of IP networks through digital satellite and wireless connections
Creation date: 2006

Creation of software and services for urban mobility

Companies who have ceased trading:

• Activia Networks
Created in April 2000, Activia Networks was a supplier of open and interoperable network solutions for routing and content exchange for Internet operators (ISP, hosting companies, backbone operators). It ceased trading in 2004.

• Connexité
Connexité supplied a system for the development and re-engineering of programs written in FORTRAN, based on INRIA’s Centaur system. It has ceased trading but its technology was taken over by the company Simulog in its product Foereys. Simulog was bought by the company Asetek in 2003.

• Infobjects
Created in 2000, Infobjects developed the ObjectDRIVER software making it possible to transform any database into a virtual database suited to new applications. The company ceased trading in 2005.