



FACULDADE · DE · CIÊNCIAS UNIVERSIDADE · DE · LISBOA

LASIGE - LARGE-SCALE INFORMATIC SYSTEMS LABORATORY

ANNUAL REPORT

2001

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1 INTRODUCTION AND GENERAL REMARKS

1.1 Infrastructure

The year 2001 has witnessed the continuation of the activities set up in 2000, with a consolidation and reinforcement of the infrastructure set up in that year. As a result of an internal reorganization, LASIGE now hosts four research groups:

- the Navigators on Distributed Systems group -- -- <http://www.navigators.di.fc.ul.pt>
- the XLDB group (formerly Massively Distributed Information Systems) -- <http://xldb.fc.ul.pt/>
- the Human-Computer Interaction and Multimedia group -- <http://hcm.di.fc.ul.pt/>
- the Dialnp - DIstributed ALgorithms and Network Protocols group - <http://dialnp.di.fc.ul.pt>

As before, the permanent or long-term research staff of LASIGE is hosted in facilities of the FCUL (Faculty of Sciences) as members of FCUL faculty. Besides these implicit physical resources, LASIGE has now its own installations inside the DI (Dept of Informatics) premises.

These facilities, organized in open space, include: 3 offices for visiting scientists or short-, mid-term research assistants or associates, the secretarial and administration facilities, a meeting room with video and smart-board projection, and the laboratory, with several tables hosting the equipment of the research groups, and serving as working positions for students and researchers. The unit acquired a set of equipment to allow it to be autonomous with respect to computing services, document production, and meeting support. LASIGE has its own server to provide accounts and storage space for researchers. Connectivity is assured through the Informatics Department → FCUL → FCCN networking infrastructures.

2001 has witnessed the formal start of several projects (national and international) – see list of project in the following sections, the and approval of several proposals from a call from FCT, and the preparation of several initiatives concerning participation in FP6 Integrated Projects and Networks.

1.2 Staff

Navigators		XLDB		HCIM		DialNP	
Paulo Veríssimo	PhD	Mário Jorge Silva	PhD	Nuno M. Guimarães	PhD	Luís E. Rodrigues	PhD
Nuno F. Neves	PhD	Ana Paula Afonso	MSc	Luís M. Carriço	PhD	Hugo Miranda	MSc
António Casimiro	MSc	António Ferreira	MSc	Pedro A. Antunes	PhD	Filipe Araújo	MSc
Miguel P. Correia	MSc	Francisco Couto	MSc	Teresa Chambel	MSc	Alexandre Pinto	BSc
Nuno Neves	MSc	Paulo Baptista	MSc	Carlos Duarte	MSc	Ricardo Almeida	BSc
Pedro Martins	BSc	Daniel Gomes	BSc	Manuel Amorim	Undgr	Nuno Carvalho	Undgr
Paulo Sousa	BSc	Norman Noronha	BSc	Hugo Simões	Undgr	Pedro Vicente	BSc
Lau Cheuk Lung	BSc	Miguel Costa	BSc			Sandra Teixeira	Undgr
		Bruno Martins	BSc			Sérgio Formigo	Undgr
						João Martins	BSc
Ana Maria Afonso (BSc), Administration and Management Support							
	PhD's	7		Other Collaborators	16		
	MSc's	11		Admin & Mngmt	1		
				Total (end of 03/2002)	35		

The non-permanent staff of LASIGE as continued to grow in 2001, for the following reasons:

- the number of international (EU IST) and national projects currently run by LASIGE allowed us to hire the relevant researchers composing the teams.
- the scholarship program for young students, aimed at recruiting the best students of the DI, has allowed us to keep a pipeline of four such students since 2000.

Considering this expansion, LASIGE is now providing physical space and infrastructure for a significant number of students and researchers. The distribution of space between Faculty-office space and LASIGE space is illustrated below.

Dra. Ana Maria Afonso, who is taking charge of coordination of administrative and logistical activities has worked with LASIGE for the whole of 2001. We are aware that, without further funding sources, this represents a significant drain from our current FCT allowance. However, this is a jointly agreed cost by all the groups, assuming the importance of an efficient and professional management of R&D activities.

FCUL Faculty Members : 18							
Paulo Veríssimo	PhD	Mário Jorge Silva	PhD	Nuno M. Guimarães	PhD	Luís E. Rodrigues	PhD
Nuno F. Neves	PhD	Ana Paula Afonso	MSc	Luís M. Carriço	PhD	Hugo Miranda	MSc
António Casimiro	MSc	António Ferreira	MSc	Pedro A. Antunes	PhD	Filipe Araújo	MSc
Miguel P. Correia	MSc	Francisco Couto	MSc	Teresa Chambel	MSc	Alexandre Pinto	BSc
		Paulo Baptista	MSc	Carlos Duarte	MSc		
LASIGE Staff (using LASIGE physical and technical resources) : 17							
Nuno Neves	MSc	Daniel Gomes (*)	BSc	Manuel Amorim	Undgr	Ricardo Almeida	BSc
Pedro Martins	BSc	Norman Noronha (*)	BSc	Hugo Simões	Undgr	Nuno Carvalho	Undgr
Paulo Sousa	BSc	Miguel Costa (*)	BSc			Pedro Vicente	BSc
Lau Cheuk Lung	PhD	Bruno Martins (*)	BSc			Sandra Teixeira	Undgr
						Sérgio Formigo	Undgr
						João Martins	BSc
Ana Maria Afonso (BSc), Administration and Management Support							
(*) Four member of LASIGE have used ICAT office space during 2001							

1.3 Information dissemination and marketing

The information dissemination and marketing has been carried out and supported by the on-going activities of the Unit, namely:

- Projects (see projects in proper section)
- Talks, Invitations, Workshops – see below

The LASIGE Web site has been maintained, and used to support some of the initiatives taken during the reporting period - 2001 (recruiting, meetings, etc.). The URL is <http://lasige.di.fc.ul.pt>, with links to the groups pages and other sites related with LASIGE.

1.3.1 Talks and Visits sponsored directly by LASIGE in 2001

(2001-02-15)

Cactus: A Framework for Dynamic Fine-Grain Customizable QoS

Matti A. Hiltunen, AT&T Labs - Research

Cactus is an implementation framework that supports the construction of distributed services and communication protocols with fine-grain customizable service properties and Quality of Service (QoS) attributes, including fault tolerance, timeliness and security. With Cactus, a service is realized as a composite protocol that is constructed from smaller micro-protocol modules, each of which implements a service property or QoS attribute. This talk gives an overview of the Cactus approach, prototype implementations, and the collection of example services constructed using these prototypes. The example services range from a configurable transport protocol (CTP) to a transparent QoS customization component for CORBA (CQoS). I will also describe recent work on supporting coordinated adaptation in networked systems using Cactus. Much of this work was done while the speaker was a research scientist at the University of Arizona. More information about the Cactus project can be found at the project web site: <http://www.cs.arizona.edu/cactus/>.

(2001-05-29)

Distributed State Machines and Disk Paxos

Leslie Lamport

Compaq Systems Research Center

The state-machine approach to designing a fault-tolerant distributed system is reviewed. Disk Paxos, a new algorithm for implementing this approach, is described. It achieves fault-tolerance by replicating disks rather than processors.

(2001-10-21)

Learning in Concept Space: Beyond the multimedia- and 3D metaphors.

Piet Kommers, University of Twente

Multimedia information and even the student's complete immersion in virtual environments, have sharpened our idea that the confrontation with information and (fictitious) realities is just a prerequisite for learning; not the final solution. In a number of demonstrations the essence of 'conceptual awareness' will be highlighted. It's origin is the notion of constructivism that understanding and expertise mainly grow on the basis of 'fundamental experiences'. The nature of such an experience is currently defined in ongoing experiments, but already we assert that the learning task needs an existential basis: the student needs to be involved as the outcomes have significant impact on his/her future. For instance: If you know that you will actually fly in the airplane you are designing, it makes you keen on the basic laws of aerodynamics, stability of constructions etc. Less dramatic, but still important, is the consequence in terms of finance, social status and the convenience of 'understanding' rather than guessing.

The start of existential learning is often in the conceptual representation of one's prior knowledge and intuition. Recent research into cognitive style and long-term effects brought our attention to the crucial role of short-term memory capacity. In this presentation further elaborations of the relevance of metacognition will be made. The final discussion will focus at the right direction for future research agendas.

1.4 Connections to industry and external institutions

LASIGE maintains a fair amount of connections to local and international industry, which derive mainly from the projects it is associated with. As examples, we can name: Altitude Software (ex-Easyphone) (PT), Critical (PT), INXL (PT), IBM Zurich Research Lab (CH), Tradezone (UK), NHS Trust (UK), Rockwell-Collins (FR), CISA (UK), Deutsche Telekom (DE), FCCN (PT), GMD (DE), CESSI (FR), CTT (PT), ParaRede (PT), Octal (PT), SONAE (PT), PRAXIA (PT), RTP (PT).

During 2001, other specific links have been established:

- Research project with support from Microsoft Research – Multicast Probabilistic Protocols to Support Large Scale, Multiuser Applications. A visit to Microsoft Cambridge Labs has been made in 2001.
- Professor Luís Rodrigues has been cooperating with Prof. Rachid Guerraoui's group at EPFL (Lausanne CH), where he stayed for 6 months during 2001.

2 DESCRIPTION OF ACTIVITIES AND ACHIEVEMENTS

Type of result/act	Books	Theses	Chapters	Papers (Intntl)	Papers (Nat)	Prototypes	Roles in Sc. Events	On going Theses	On going Projects
2001	1	3	2	22	7	4	17	16(D)+19(M)	17
2000	-	5	1	27	8	1	16	13(D)+25(M)	15
1999	-	3	5	15	7	1	17	12(D)+17(M)	9

(quantitative) Summary of Results and Activities in 2001 (figures for 1999 and 2000 are presented for reference)

2.1 Publications

2.1.1 Books

1. Distributed Systems for System Architects Paulo Veríssimo, Luís Rodrigues, Kluwer Academic Publishers. ISBN 0-7923-7266-2

2.1.2 Theses

1. João Carlos Negrão Ventura. Análise do tempo de resposta da composição de micro protocolos - Analysis of the Micro Protocol Composition Response Time, FCUL, June 2001 (in portuguese), MSc Thesis. Advisor : Luís Rodrigues
2. Hugo Alexandre Tavares Miranda. Plataformas de suporte ao desenvolvimento e composição de malhas de protocolos, FCUL, May 2001 (in portuguese), MSc Thesis, Advisor : Luís Rodrigues
3. José Bidarra de Almeida. Multimedia Hyperspaces – Hiperespaço Multimédia, Universidade Aberta, October 2001 (in portuguese), PhD Thesis. Advisor : Nuno Guimarães

2.1.3 Chapters of books and Papers in collections

1. C. Costa, P. Antunes, and J. Dias, "Integrating Meeting Results in Organizations," in *Enterprise Information Systems II*, B. Sharp, J. Filipe, and J. Cordeiro, Eds. Kluwer Academic Publishers, July, 2001.C.
2. C. Costa, P. Antunes, and J. Dias, "A Model for Organizational Integration of Meeting Outcomes," in *Contemporary Trends in Systems Development*, Maung K. Sein, Bjørn-Erik Munkvold, Tore U. Ørvik, Wita Wojtkowski, W. Gregory Wojtkowski, Joze Zupancic, and Stanislaw Wrycza, Eds. Kluwer Plenum, 2001.

2.1.4 Papers in journals and conferences with referees

2.1.4.1 International Journals and International Conferences

Journals

1. F. Araújo, B. Ribeiro and L. Rodrigues, "A Neural Network for Shortest Path Computation", in IEEE Transactions on Neural Networks, Vol. 12, N. 5, pp. 1067-1073, Sep. 2001.
2. P. Antunes and T. Ho, "The Design of a GDSS Meeting Preparation Tool" *Group Decision and Negotiation*, vol. 10, no. 1, January, pp. 5-25, 2001. (ISSN: 0926-2644).
3. Teresa Chambel, Nuno Correia, and Nuno Guimarães, "Hypervideo on the Web: Models and Techniques for Video Integration", *International Journal of Computers & Applications*, Acta Press, Vol. 23, #2, 2001, pp.90-98, ISSN: 1206-212X

Conferences

4. A. Casimiro, M. Correia, Recent Advances on the Timely Computing Base Model, Fast Abstract at the International Conference on Dependable Systems and Networks, Göteborg, Sweden, June 2001.
5. A. Casimiro, P. Martins, P. Veríssimo and L. Rodrigues, Measuring Distributed Durations with Stable Errors, in Proceedings of the 22nd IEEE Real-Time Systems Symposium (RTSS 2001), London, UK, December 3-6, 2001.
6. A. Casimiro, P. Veríssimo. Using the Timely Computing Base for Dependable QoS Adaptation. Proceedings of the 20th IEEE Symposium on Reliable Distributed Systems, New Orleans, USA, October 2001.
7. A. Pinto, H. Miranda, L. Rodrigues, Light-Weight Groups: an implementation in Ensemble in Proceedings of the Ersads 2001, European Research Seminar on Advances in Distributed Systems, 14-18 May 2001, Bertinoro (Forli), Italy.
8. C. Costa and P. Antunes, "Meetings as Genre Systems: Some Consequences for EMS Design," in *Proceedings of Group Decision & Negotiation 2001*, F. Ackermann and G. Vreede, Eds. La Rochelle, France: Faculty of Technology, Policy and Management, Delft University of Technology, 2001, pp. 261-263. (ISBN: 90-5638-078-8).
9. C. Costa, P. Antunes, and J. Dias, "EMS/PDA: Connecting Meetings with People in Organisations," in *Proceedings of the 24th Information Systems Research Seminar in Scandinavia, IRIS 24*. Ulvik in Hardanger, Norway, 2001.
10. C. Costa, P. Antunes, and J. Dias, "The Meeting Report Process: Bridging EMS with PDA." Third International Conference on Enterprise Information Systems, ICEIS 2001. Setubal, Portugal: ICEIS Press, 2001, pp. 821-826. (ISBN: 972-98050-2-4).

11. C. Palma and L. Rodrigues, Supporting views in network management systems in Proceedings of the IFIP/IEEE 12th International Workshop on Distributed Systems: Operations & Management, October 15-17, 2001, Nancy, France.
12. D. Powell, A. Adelsbach, C. Cachin, S. Creese, M. Dacier, Y. Deswarte, T. McCutcheon, N. Neves, B. Pfitzmann, B. Randell, R. Stroud, P. Veríssimo, M. Waidner, MAFTIA (Malicious- and Accidental-Fault Tolerance for Internet Applications), in Supplement of the 2001 International Conference on Dependable Systems and Networks, Göteborg, Sweden, pages D32-D35, June 2001.
13. F. Araújo and L. Rodrigues, Quality of Service in Indirect Communication Systems, in Proceedings of the Ersads 2001, European Research Seminar on Advances in Distributed Systems, 14-18 May 2001, Bertinoro (Forli), Italy.
14. H. Miranda, A. Pinto, L. Rodrigues, Appia, a flexible protocol kernel supporting multiple coordinated channels in Proceedings of the 21st International Conference on Distributed Computing Systems (ICDCS-21) April 16-19, 2001, pp 707-710. Phoenix, Arizona, USA (Poster session).
15. J. Rodrigues, H. Miranda, J. Ventura, L. Rodrigues, The design of RTAppia in Proceedings of the Sixth IEEE International Workshop on Object-oriented Real-Time Dependable Systems, pp. 261-268, Rome, 8-10 January 2001.
16. J. Ventura, J. Rodrigues, L. Rodrigues, Response Time Analysis of Composable Micro-Protocols, in Proceedings of the 4th IEEE International Symposium on Object-Oriented Real-Time Distributed Computing (ISORC 2001), Magdeburg, Germany, May, 2- 4, 2001, pp 335-342.
17. M. Antunes, H. Miranda, A. Rito Silva, L. Rodrigues and J. Martins, Separating Replication from Distributed Communication: Problems and Solutions, in Proceedings of the International Workshop on Distributed Dynamic Multiservice Architectures (DDMA), in conjunction with the 21st International Conference on Distributed Computing Systems, ICDCS-21) April 16-19, 2001, pp 103-108. Phoenix, Arizona, USA.
18. Miguel Correia, Paulo Veríssimo, Nuno Ferreira Neves, The Architecture of a Secure Group Communication System based on Intrusion Tolerance, Proceedings of the IEEE International Workshop on Applied Reliable Group Communication (WARGC), Phoenix, USA, April 2001.
19. Norman Noronha, João P. Campos, Daniel Gomes, Mário J. Silva, José Borbinha, A Deposit for Digital Collections, 5th European Conference on Research and Advanced Technology for Digital Libraries, September 2001.
20. P. Antunes, C. Costa, and J. Dias, "Applying Genre Analysis to EMS Design: The Example of a Small Accounting Firm." Seventh International Workshop on Groupware, CRIWG 2001. Darmstadt, Germany: IEEE CS Press, 2001, pp. 74-81. (ISBN: 0-7695-1351-4).
21. Paulo Batista, Mário J. Silva, Web Access Mining from an On-line Newspaper Logs, 12th International Meeting of the Euro Working Group on Decision Support Systems (EWG-DSS 2001), May 2001.
22. Teresa Chambel, "Interactive Videos in Mathematics" (invited talk), in Proceedings of International Workshop on Electronic Media in Mathematics, Coimbra, Portugal, 13-15 September 2001.

2.1.4.2 National Workshops and Conferences

1. Bruno Martins, Mário J. Silva, Is it Portuguese? Language detection in large document collections, CRC'01 - 4ª Conferência de Redes de Computadores, Covilhã, November 2001.
2. João Campos, Mário J. Silva, Versus: A Model for a Web Repository, CRC'01 - 4ª Conferência de Redes de Computadores, Covilhã, November 2001.
3. Miguel Costa, Mário J. Silva, Ranking no Motor de Busca TUMBA, CRC'01 - 4ª Conferência de Redes de Computadores, Covilhã, November 2001.
4. Daniel Gomes, Mário J. Silva, Tarântula - Sistema de Recolha de Documentos da Web, CRC'01 - 4ª Conferência de Redes de Computadores, Covilhã, November 2001.
5. João Martins, Ricardo Almeida, Hugo Miranda, Luís Rodrigues, Coerência num sistema transaccional de replicação de objectos em grande-escala, Actas da Quarta Conferência sobre Redes de Computadores (CRC'01) Novembro, 2001, Covilhã, Portugal
6. Maria João Monteiro, Sandra Teixeira, Hugo Miranda, Luís Rodrigues, Um serviço de replicação transparente de servidores CORBA utilizando sincronia virtual, Actas da Quarta Conferência sobre Redes de Computadores (CRC'01) Novembro, 2001, Covilhã, Portugal
7. Pedro Vicente, Hugo Miranda, Luís Rodrigues, Protocolo Híbrido de Ordem Total Uniforme com entrega Optimista, Actas da Quarta Conferência sobre Redes de Computadores (CRC'01) (Poster), Novembro, 2001, Covilhã, Portugal.

2.1.4.3 Other Publications (technical reports)

1. David Powell and Robert J. Stroud (Editors). MAFTIA Conceptual Model and Architecture. Technical Report DI/FCUL TR-01-10. Department of Computer Science, University of Lisbon. November 2001.
2. Miguel Correia, Paulo Veríssimo and Nuno Ferreira Neves. The Design of a COTS Real-Time Distributed Security Kernel (Extended Version). Technical Report DI/FCUL TR-01-12. Department of Computer Science, University of Lisbon. December 2001.
3. Nuno Ferreira Neves, Paulo Veríssimo (Editors), First Specification of APIs and Protocols for the MAFTIA Middleware, Technical Report DI/FCUL TR-01-6, Department of Computer Science, University of Lisbon. September 2001.
4. Paulo Veríssimo, Nuno Ferreira Neves (Editors), Service and Protocol Architecture for the MAFTIA Middleware, Technical Report DI/FCUL TR-01-1, Department of Computer Science, University of Lisbon. January 2001.
5. Teresa Chambel and Nuno Guimarães, "Learning with Video in Hypermedia", Technical Report DI/FCUL TR-01-16, Department of Computer Science, University of Lisbon, December 2001.
6. Daniel Gomes, Tarântula - Sistema de Recolha de Documentos na WWW, Relatório do Estágio Profissionalizante da FCUL, Julho de 2001.

2.2 Prototypes

1. The Real-Time Linux implementation of the Timely Computing Base. This is a software prototype, aimed at providing middleware services to user applications with real-time requirements. The first version has been released during 2000. **Location:** LASIGE (demonstrable)
2. Appia: a framework for protocol composition (<http://appia.di.fc.ul.pt/>) **Location:** LASIGE
3. DROP – A prototype software system to crawl operator-defined web sites periodically and store collected pages in a local repository, developed for the National Library of Portugal (Biblioteca Nacional – BN). **Location:** LASIGE and BN
4. Tumba – Tumba is a public search engine for the Portuguese Web, available from <http://www.tumba.pt> **Location:** LASIGE

2.3 Organisation of and presence in events

Members of LASIGE have taken part on the international program committees of several conferences, as listed below. Overall, 16 presences can be counted in 2001 (same amount as 2000). LASIGE also actively sponsored and/or participated in the organisation of several events, national and international.

2.3.1.1 Presence in International Program Committees

1. (**Luís E. Rodrigues**) The 22nd IEEE International Conference on Distributed Computing Systems (ICDCS '02), Vienna, Austria, July 2002, (Vice Program Chair)
2. (**Luís E. Rodrigues**) Seventh IEEE International Workshop on Object-oriented Real-time Dependable Systems (WORDS 2002), January 7-9, 2002 San Diego, CA
3. (**Luís E. Rodrigues**) CRC'01, 4^a Conferência sobre Redes de Computadores, Tecnologias e Aplicações, 29-30 November 2001, Covilhã, Portugal
4. (**Luís E. Rodrigues**) FIP/ACM International Conference on Distributed Systems Platforms, Middleware 2001, Heidelberg, October 2001
5. (**Luís E. Rodrigues**) ERSADS'01. European Research Seminar on Advances in Distributed Systems Spring School and Workshop, Italy, April 2001, Member of Scientific Committee.
6. (**Luís E. Rodrigues**) The 4th IEEE International Symposium on Object-Oriented Real-Time Distributed Computing ISORC 2001
7. (**Luís E. Rodrigues**) DSN 2001 - International Conference on Dependable Systems and Networks, Goteborg, Sweden, 20 Junho 30 - 4 Julho de 2001
8. (**Luís E. Rodrigues**) International Workshop on Applied Reliable Group Communication, In conjunction with Int'l Conf. on Distributed Computing Systems 2001, Phoenix, Arizona, USA, April 16-19, 2001. (Workshop Program Co-chair)
9. (**Luís E. Rodrigues**) Review Committee of Euro-Par 2001
10. (**Luís E. Rodrigues**) Review Committee of MONET, Mobile Networks & Applications Journal
11. (**Luís E. Rodrigues**) Review Committee of Journal of Parallel and Distributed Computing

12. **(Pedro Antunes)** Group Decision and Negotiation, La Rochelle, France, 4-7- June 2001 - Member of the Program Committee
13. **(Pedro Antunes)** CRIWG 2001. 7th International Workshop on Groupware, Darmstadt, Germany, 6-8 September 2001– Member of the Program Committee
14. **(Nuno Guimarães)** Workshop New Developments in Digital Libraries Workshop, ICEIS 2001, 3rd Intl Conf on Enterprise Information Systems, Setúbal, Portugal, 7-10 Julho, 2001, AAAI, IEEE
15. **(Nuno Guimarães)** Review Committee of Twelfth ACM Conference on Hypertext and Hypermedia, Hypertext '01, Århus, Denmark, August 14-18, 2001
16. **(Nuno Guimarães)** 6th CYTED-RITOS International Workshop on Groupware, CRIWG'2001, Setembro 2001, Darmstadt, Germany
17. **(Nuno Guimarães)** Webnet 2001, AACE, Orlando, Florida, USA, Outubro 2001
18. **(Nuno Ferreira Neves)** 2001 International Conference on Dependable Systems and Networks, Göteborg, Sweden, June 2001, Nuno Ferreira Neves (Program Committee Member of Student Forum)
19. **(Paulo J. Veríssimo)** IEEE DSN-2001 – International Conference on Dependable Systems and Networks, in forthcoming July 2001, Gotteborg, Sweden, Paulo Veríssimo (Program Committee co-Chair)

2.3.1.2 Participation/Sponsorship in the Organisation of International Scientific Events

- a. **(Luís E. Rodrigues)** Local Organization of the 15th International Symposium on DIStributed Computing" (DISC), Lisboa, Portugal, Outubro de 2001.
- b. **(Luís E. Rodrigues)** Local Organization of the 5th Workshop on Self-Stabilizing Systems", Lisboa, Portugal, Outubro de 2001.
- c. **(Paulo J. Verissimo)** Second EU/US Workshop on Dependability, Cascais, Portugal, January 2001, (Organized and Hosted)
- d. **(Paulo J. Verissimo)** IEEE DSN-2001 – International Conference on Dependable Systems and Networks, in forthcoming July 2001, Gotteborg, Sweden, LASIGE partly supported the PC operation.

2.4 Post-graduate training

Senior members of LASIGE have been or are currently involved in the teaching and advisory work of post graduate studies, both at MSc and PhD level, as listed below.

2.4.1 Table of Doctor (PhD) dissertations

(Dates in parentheses mean probable date of conclusion)

Author	Supervisor	Thesis Theme or Title	Date
Carlos A. Duarte	L. Carriço	Design and Evaluation of Adaptive Multimodal Systems	(2005)
João Rodrigues	L. Rodrigues	Real-time protocol kernels	(2003)
José Pereira	L. Rodrigues	Group Communication with Differentiated Messages	(2002)
Filipe Araújo	L. Rodrigues	Indirect Communication Systems with QoS	(2005)
Ana Paula Afonso	M. Silva	Customisable Information Retrieval Agents	(2002)
Paulo Batista	M. Silva	On the Mining of Web Access Logs	(2003)
António Ferreira	M. Silva	Performance Analysis of Inform. Integration Languages	(2005)
Daniel Gomes	M. Silva	Information Replication in Web Databases	(2005)
Francisco Couto	M. Silva	Relating Biological Information through Literature	(2005)
Teresa Chambel	N. Guimarães	Mechanisms for Hypervideo Design and Construction	(2002)
Carlos J. Costa	P. Antunes	Group Support Systems and Organizational Processes	(2002)
Nuno Gonçalves	P. Antunes	Computation Support to Systems Analysis and Design	(2005)
Hernani Mourão	P. Antunes	Exceptions in WF Systems and their Organizational Impact	(2005)
José Rufino	P. Veríssimo	Field Bus Distributed Systems	(2002)
António Casimiro	P. Veríssimo	Timely Actions in Presence of Uncertain Timeliness	(2002)
Miguel Correia	P. Veríssimo	Configuration and Managmt. of Attack Tolerant Syst	(2002)

2.4.2 Table of Master (MSc) dissertations

(Dates in parentheses mean probable date of conclusion)

Author	Supervisor	Thesis Title	Date
João P Ribeiro	L. Carriço	Design and Dev of an IS for Psychiatric Diag. Support	(2002)
José M Ribeiro	L. Carriço	Cognitive Maps on Medical Diagnosis Support	(2002)
Paulo Pestana	L. Carriço	SW Development Processes for Aero Spatial Systems	(2002)
Victor Lopes	L. Carriço	Comparing Local and Distant Learning	(2002)
Mário Guimarães	L. Rodrigues	Information publish/subscribe using multicast protocols	(2002)
Alexandre Pinto	L. Rodrigues	Modular support for light-weight groups	(2002)
João Campos	M. Silva	Data Storage for Semi-Structured Data	(2002)
Norman Noronha	M. Silva	Semantic Web	(2002)
Ana Grave	M. Silva	ERP Systems in Mobile Enviroments	(2002)
Bruno Martins	M. Silva	Clustering Web Documents	(2002)
Miguel Costa	M. Silva	Indexing Web Document Collections	(2002)
Cláudia Carvalho	N. F. Neves	Public Key Infrastructure of the Justice Department	(2002)
Manuel Mendonça	N. F. Neves	A Protocol for Secure Updates of Point of Sale Applications	(2002)

Ana Lindo	N. Guimarães	Workflow Systems Analysis and Construction	(2002)
Pedro Pereira	N. Guimarães	Coordination and Collaboration in the SAP system	(2002)
Paula André	P. Antunes	A Collab Env for Cartogr. and Geological Data Acquisition	(2004)
Gonçalo Pombeiro	P. Antunes	Integration of Soft Systems Methodology and UML	(2004)
Nuno M. Neves	P. Veríssimo	Intrusion Detection Systems	(2002)
Pedro R. Martins	P. Veríssimo	Concretização de uma Timely Computing Base	(2002)

2.4.3 Participation in Post-Graduate Programs

Course	Prepared & Taught by	Where
Análise de Sistemas	Pedro Antunes	PG FCUL
Computação Móvel	Mário J. Silva	PG FCUL
Confiabilidade e Segurança de Sistemas de Informação	Paulo Veríssimo	PG FCUL
Configuração e Gestão de Sistemas Distribuídos	Paulo Veríssimo & Teresa Chambel	PG FCUL
Processos de Desenvolvimento de Software	Luís Carriço	PG FCUL
Protocolos em Redes de Dados	Luis Rodrigues	PG FCUL
Publicação Digital	Mário J. Silva	PG FCUL
Segurança e Confiabilidade em Sistemas Informáticos	Nuno Ferreira Neves	PG FCUL
Segurança em Sistemas e Redes	Nuno Neves & Paulo Veríssimo	PG FCUL
Sistemas Informáticos Industriais	Paulo Veríssimo & António Casimiro	PG FCUL
Sistemas Hipermédia	Luís Carriço	PG FCUL
Tolerância a Falhas Distribuída	Luis Rodrigues	PG FCUL
Trabalho Cooperativo	Pedro Antunes	PG FCUL
Seminário em Redes e Sistemas Distribuídos	Nuno Ferreira Neves & Luís Rodrigues	PG FCUL
Tópicos Avançados em Sistemas de Informação	N.Guimarães & P.Antunes & L.Carriço	PG FCUL
PG FCUL : Post Graduate Programmes at FCUL		

INA – National Public Administration Institute

Since 2000, a group that includes 8 LASIGE Members, coordinated by Mário J. Silva, has been lecturing a 2-weeks course covering Recent Advances in Distributed Systems, for technical personnel from the Portuguese Public Administration. The course is offered through INA (the National Institute of Administration). Throughout 2001, four sessions were organized, totalling about 80 attendants.

2.5 Participation in R&D and consulting projects

Members of LASIGE have been involved in a number of projects and consulting actions during 2001, as listed below. Some new projects have started in 2001. Overall, LASIGE has hosted 13 projects, many with international collaboration.

Project Name	Funded by	Start/End Date/Year
1. CaberNet	EU-IST	2000- ...
2. CORTEX	EU-IST	2000-2002
3. DEAR-COTS	FCT	2000-2002
4. DEFEATS	FCT	2000-2002
5. DROP	(BN)	2001
6. Electronic Democracy	FCT Sapiens	2001-2002
7. GLOBDATA	EU IST	2000-2002
8. IPSOM	FCT Sapiens	2001-2003
9. MAFTIA	EU-IST	
10. MICRA	FCT	
11. MOOSCo	FCT Sapiens	2001-2002
12. SAVE	FCT Sapiens	2000-2001
13. SemP2P	Microsoft Research	2001-2003
14. SHIFT	FCT	2001-2002
15. TOPCOM	FCT	1999-2001
16. XMLBASE	(previous contracts)	2000- ...
17. TUMBA, WAM, ARIA, ReBIL	(previous contracts)	2001- ...

MAFTIA: Malicious- and Accidental-Fault Tolerance for Internet Applications

Objectives: MAFTIA will investigate the 'tolerance paradigm' systematically, to propose an integrated architecture built on this paradigm, and to realise a concrete design used to support the dependability of many applications.

Methodology: Work will be done on three broad categories of objectives related to, (i) the architecture of MAFTIA: providing a framework that ensures the dependability of distributed applications in the face of a wide class of faults and attacks, (ii) the design of mechanisms and protocols: providing the required building blocks to implement large scale dependable applications: this will be addressed by means of four subclasses of objectives, dependable middleware, large scale intrusion detection systems, dependable trusted third parties and distributed authorisation mechanisms (iii) the assessment of our work: rigorously defining the basic concepts developed by MAFTIA and verifying results of the work on dependable middleware.

Team at LASIGE: Paulo Veríssimo, Nuno Ferreira Neves, Miguel Correia, Nuno C. Neves

Partners: LASIGE, University of Newcastle (U.K.), Defence & Evaluation Research Agency (UK), Universitat des Saarlandes (D), LAAS-CNRS (F), IBM Zurich Research Laboratory (CH).

Funding: European Commission - IST Programme (Project Number IST-1999-11583), total project award amount: 252MEuro.

DEAR-COTS: Distrib. Embedded Architect. using Commercial Off-The-Shelf Components

Objectives: The specification of an architecture based on the use of commercial off-the-shelf (COTS) components able to support distributed computer controlled systems where safety and timeliness are major requirements.

Methodology: The project is addressing two main questions: how to apply the distributed computing technology to the solution of computer controlled problems using COTS field-buses? How to support inter-working and interconnection of several field-bus clusters and the possibility of remotely access these clusters interface for supervision and configuration? The architecture will be validated through the development and test of a prototype, which will be integrated in a semi-industrial environment, with stringent safety and timeliness requirements.

Team at LASIGE: Paulo Veríssimo (coordinator), Luís Rodrigues, António Casimiro, Miguel Correia, Pedro Martins.

Partners: LASIGE (Coordinator), IST-UTL, IDMEC-FEUP, and CIEA-ISEP.

Funding: FCT (PRAXIS/P/EEI/14187/1998), total project award amount: 38,750 Euro

MICRA: A Model for the Development of Mission Critical Applications

Objectives: This project aims to investigate the steps needed for the definition of a new time model suitable for mission-critical applications. Assumptions about the system timeliness will be formalized and a Timing Failure Detector will be developed in order to perfectly detect all violations of timeliness.

Methodology: The project will investigate those issues and a proof-of-concept prototype application will be built and validated.

Team at LASIGE: Paulo Veríssimo (coordinator), Luís Rodrigues, António Casimiro, Miguel Correia, Pedro Martins.

Partners: LASIGE, CISUC-FCT/UC

Funding: FCT (PRAXIS/P/EEI/12160/1998), total project award amount: 39,500 Euro

TOPCOM: Topology-Aware Reliable Group Communication in Geographically Large-Scale Systems

Objectives: The project will integrate the topology-aware protocols defined by the Navigators group in the Ensemble system. The goal of the project is twofold: in first place, it intends to implement and test a mature distribution of the Navigators' protocols and, in second place, to contribute to the validation of the Ensemble framework.

Methodology: The project is divided in four technical tasks. The first task is the definition of a modular composition of the Navigators protocols to support an implementation in Ensemble. The second task is the implementation itself. The third is the performance evaluation and the fourth will analyse the feedback from the implementors in order to propose relevant adjustments and extensions to Ensemble.

Team: Luis Rodrigues (coordinator), Paulo Veríssimo, António Casimiro, Filipe Araújo, Alexandre Pinto.

Partners: LASIGE

Funding: FCT (PRAXIS/P/EEI/12202/1998); total project award amount: 23,500 Euro, **1999-2001**

SHIFT: Group Communication with Differentiated Messages

Objectives: The project intends to study the use of knowledge on the application semantics to improve the efficiency of group communication systems. The starting point of the project is the definition of semantic reliability, recently introduced by the project partners. The project intends to design and implement new algorithms and protocols that exploit the notion of semantic reliability. The project aims to study the use of this concept under different system assumptions and for different application classes with diverse consistency requirements.

Methodology: The project will first design models, create the algorithms and implement the protocols to offer services based on the notion of semantic reliability.

Team at LASIGE: Luís Rodrigues (coordinator), Hugo Miranda, Filipe Araújo, Alexandre Pinto.

Partners: LASIGE, U. Minho (Algoritmi)

Funding: FCT (Sapiens 32869/1999); total project award amount: 23,500 Euro, **2001-2002**

MOOSCo: MOO with Separation of Concerns

Objectives. The MOOSCo project, Multi-user Object-Oriented environments with Separation of Concerns, addresses the difficulties in applying a component-based approach in a vertical and integrated manner, from analysis to implementation, to the design of this class of systems. The project will define an architecture that will be applied in the MOOs context. MOO environments constitute a challenge for object-oriented distributed systems theory and practice due to its unique requirements for dependability, scalability, adaptability, usability, dynamic changes, non-functional domains to be considered, and efficiency. The project intends to design and implement an architecture to the support of multi-user object-oriented environments. The architecture is based on component composition and addresses three abstraction layers: user models, middleware abstractions, and infrastructure communication protocols.

Methodology: The project workplan is divided into several parts: (1) Identify the user models that are relevant for MOOs in order to classify the variabilities inherit to the MOO applications. (2) Design composable and customizable middleware abstractions to support user models and their variabilities and allow the construction of MOO application that are easily tuned and can evolve. Implement those abstractions as an object-oriented framework. (3) Design composable and customizable infrastructure protocols, offering different quality of service, to be used by the middleware abstractions. (4) Integrate the results from the previous tasks in a coherent architecture. (5) validate the results applying it to a concrete MOO system.

Team at LASIGE: Luís Rodrigues (coordinator), Pedro Antunes, Hugo Miranda, Alexandre Pinto.

Partners: LASIGE, INESC

Funding: FCT (Sapiens 33127/1999); total project award amount: 23,500 Euro, **2001-2002**

GLOBDATA

Objectives. The overall objective of the project is to design an efficient software development tool and support system to provide application developers with a global view of an object database repository with transactional access to geographically distributed persistent objects independent of their location. The aim is to create a set of mechanisms to handle replica consistency maintenance, data distribution, and transaction commitment and synchronization. These mechanisms are provided in a coherent tool called COPLA.

Methodology: COPLA makes use of standard proposals for distributed application creation like those on OMG's CORBA. At the level of communication support, COPLA will rely on a configurable group communication tool.

Team at LASIGE: Luís Rodrigues (coordinator), Hugo Miranda, João Martins, Pedro Vicente, Ricardo Almeida, and others.

Partners: ITI, LASIGE, UPN, GFI, EIKON

Funding: EU (IST-1999-20997). Total project award amount: 1.094.281 Euros , **2000-2002**

CORTEX: CO-operating Real-time senTient objects: architecture and EXperimental evaluation

Objectives: The key objective of CORTEX is to explore the fundamental theoretical and engineering issues necessary to support the use of sentient objects to construct large-scale proactive applications and thereby to validate the use of sentient objects as a viable approach to the construction of such applications..

Methodology: The CORTEX project is divided into four technical work packages and three other work packages specifically devoted to project management, assessment and dissemination of the results. Upstream is the programming model definition (WP1), which is then refined by concurrently addressing the interaction model and the adequate system architecture (WP2 and WP3), including the necessary middleware services. The demonstrator (WP4) will consolidate the results of the previous work packages, and provide a final evaluation of the project's findings. Due to the nature of this project, specifically oriented to advanced research on new technologies and paradigms, the work will progress accordingly to a spiral methodology, where results are cyclically improved and refined. Therefore, during the course of the project we plan to produce intermediate deliverables with preliminary definitions and specifications, not necessarily coinciding with the end of particular tasks. The other three work packages are obviously outside of this production cycle, at least in the early stages, since they are not concerned with conceptual problems

Team at LASIGE: Paulo Veríssimo, António Casimiro, Pedro Martins, Paulo Sousa

Partners: LASIGE, Trinity College Dublin (IRL), University of Lancaster (U.K.), University of Ulm (D)

Funding: European Commission - IST Programme (Project Number IST-2000-26031), total project award amount: 2094MEuro.

DEFEATS - Distributed Fault and Attack Tolerant Systems Configuration

Objectives: Project DEFEATS aims to develop: (1) a framework for the configuration of dependable distributed services (including attack tolerance); and (2) a decomposition of attack tolerance mechanisms in reusable blocks and a set of guidelines for their composition. Other contributions will be the integration of a meta-level scheme with configuration, and the design of a dependable configuration platform. Comprehensive approaches to this set of problems are not known in the literature.

Methodology: Project DEFEATS has two lines of work. In the first place, the project will research mechanisms to build attack tolerant services and define a set of building blocks and guidelines to compose such services. The set of blocks will include attack-tolerant intrusion detection and attack-tolerant authentication services. Communication will be based on a group communication system, since such systems are particularly well suited for replicated services. In the second place, the project will define a framework for the configuration of dependable systems resilient to both accidental and intentional malicious faults, using the defined building blocks. There are several issues that will be considered: (1) the definition of a meta-level scheme to transparently configure a service in order that it is dependable; (2) the dependability of the configuration platform itself (including attack tolerance); (3) the interference between the dependability of the platform and the services that run over it. A demonstration prototype of an instantiation of the framework will be implemented and feedback will be taken for its further refinement.

Team at LASIGE: Paulo Veríssimo (coordinator), Nuno Ferreira Neves, Miguel Correia, Nuno C. Neves.

Partners: LASIGE

Funding: FCT (POSI/1999/CHS/33996), total project award amount: 29,500 Euro

CaberNet Network of Excellence in Distributed and Dependable Computing Systems

Objectives: The mission of CaberNet is to coordinate top-ranking European research in distributed and dependable systems, to make that research accessible to governments and industries and to further the quality of education concerning such systems. CaberNet addresses all aspects of the design of networked computer systems. These systems can range from embedded systems used to control an aircraft in flight to globe-spanning applications searching for information on the World-Wide Web.

Methodology: The Distributed and dependable systems research is fundamental to all these areas. CaberNet has demonstrated that the topic of distributed and dependable computing systems is particularly appropriate for a Network of Excellence since, by its very nature, it provides an arena for investigating: (i) the problems of large scale distributed systems from an unusually broad perspective, and (ii) the contributions to the operation of a NoE that such distributed systems make. One of the major benefits of the Network of Excellence will be in what it facilitates rather than what it provides. In particular, the partners will be able to work together more effectively on collaborative projects of wider interest and relevance than simply the conduct of advanced research. During the lifetime of this network we plan to consolidate and to build on the considerable momentum that we have achieved to date. Further, having established a genuine Europe-wide community of research groups in distributed and dependable computing systems, we now aim to define a shared vision of the future of RTD in this research area.

Team at LASIGE: Navigators Group.

Partners: A currently very large group of research groups across Europe

Funding: European Commission - IST Programme.

DROP

Objectives: Technology transfer; build a digital deposit system for the National Library of Portugal. Includes innovative system for harvesting periodic and non-periodic publications from the Web.

Team: Mário Gaspar da Silva (coordinator), João Campos, Norman Noronha, Daniel Gomes.

Funding: Biblioteca Nacional de Lisboa, 8 million escudos.

XMLBase

Objectives: The main goal of XMLBase is the research of analysis, design and implementation methods for systems for managing semi-structured data distributed over the Internet.

Team: Mário Gaspar da Silva (coordinator), Daniel Gomes, António Ferreira

Funding: Starting September 2002, will use funds received from FCT (received 35,000.00 euros grant)

TUMBA

Objectives: Technology transfer. Development of a Web search engine for the Portuguese Web.

Team: Mário Gaspar da Silva (coordinator), João Campos, Norman Noronha, Daniel Gomes, Bruno Martins, Miguel Costa

Funding: Funded with profits from previous contracts until December 2001; in December 2001 received funding of 39,900.00 euros for plus equipment and housing services worth 40,000.00 euros (FCCN)

WAM

Objectives: Research and develop new clustering algorithms for the identification of user profiles in digital libraries and e-commerce sites in general.

Team: Mário Gaspar da Silva (coordinator), Paulo Batista, Bruno Martins.

Funding: : Funded with profits from previous contracts.

ARIA

Objectives: Research information retrieval methods that make use of context information to improve relevance of search results. Context information can be automatically extracted from the environment of the users that place the queries, to guide searches and rank search results.

Team: Mário Gaspar da Silva (coordinator), Ana Paula Afonso, Miguel Costa, Bruno Martins.

Funding: Funded with profits from previous contracts

ReBIL

Objectives: Research; Quantify the correlation between actual biochemical data with (enzyme) sequences present in CAZy (a carbohydrates database). The project aims to connect two different classifications, structural and functional, through a set of enzymes annotated on both classifications.

Team: Mário Gaspar da Silva (coordinator), Francisco Couto, Pedro Coutinho (Tech Univ Lisbon).

Funding: Funded with profits from previous contracts

Electronic Democracy

Objectives: The widespread connection of people to the Internet creates a natural potential for developing and improving interactions between people, and between people and organizations. One of such interactions is voting. This project aims at developing electronic voting systems for expressing the opinion of communities in the digital society.

Methodology: An electronic voting system raises several issues subdivided in three layers. At a first layer, the system should match several application needs and expectations. At this layer the main issues are to design and provide different packets tailored for specific applications. In a second layer the project will consider the algorithmic aspects of the electronic voting. The different packets should be built from a set of reusable components, namely libraries of voting algorithms and libraries of mechanisms for gathering data from users. There are many well-known voting algorithms, but in this project we aim at providing innovative and multiple voting schemes. The final layer deals with the interaction protocols required by the electronic voting system. This raises several technical issues concerning the overall system's behaviour, in the fields of secure communication and anonymity.

Team at LASIGE: Pedro Antunes

Partners: INESC, Portugal.

Funding: National (FCT).

SAVE

Objectives : SAVE, designed in the sequence of a former project, UNIBASE, aims at (a) definition and evaluation of solutions form the creation of multimedia information structures, as well as open design methodologies for learning/teaching processes, (b) identifying methods and paradigms of navigation and exploration of multimedia materials by different and heterogeneous communities of users, (c) measure the efficacy of the new materials in the teaching/learning processes.

Team at LASIGE : Nuno M. Guimaraes, Teresa Chambel. Luis Carriço

Partners : Universidade Aberta e Instituto de Comunicação Multimédia, LASIGE

Funding: National (FCT), 20.000 €, 1 Year

IPSOM

Objectives : Design and development of supporting environments and supporting tools for indexing and search on sound/speech databases, with a particular emphasis on Sopken Books, originally produced for visually impaired users.

The project proposes an evolutionary process that includes digitization, sound and text alignment, and reuse of the materials in heterogeneous contexts, both the original context related with visually impaired users, and other multimedia environments.

Team at LASIGE : Nuno M. Guimaraes, Teresa Chambel, Luís Carriço, Hugo Simões, Manuel Amorim

Partners : INESC Lisboa, National Library (Biblioteca Nacional)

Funding: National (FCT). 2001-2003, Global Project Funding :

SemP2P

Objectives: This project is studying the design, implementation and application of semantic probabilistic multicast protocols in the context of multi-player games. The knowledge about the semantics of the messages exchange among clients and servers is used to minimize the traffic overhead usually associated with probabilistic approaches, while preserving the highly decentralized and fault-tolerant characteristics of such protocols.

Team: L. Rodrigues, H. Miranda, S. Formigo, J. Pereira (U. Minho), A.-M. Kermarrec (Microsoft Cambridge)

Partners: U. Minho, Microsoft Cambridge

Funding: Microsoft Cambridge 2002-2003

2.6 Basic and secondary education support actions

(Luís E. Rodrigues) A Licenciatura em Informática da FCUL. Participação no painel, "As necessidades do mercado de trabalho", VIIIa Semana Informática do IST. Abril de 2001.

(Luís E. Rodrigues) A vida e morte de um pacote IP. Dias Abertos da FCUL. Faculdade de Ciências da Universidade de Lisboa, 20 de Março de 2001

(Teresa Chambel) Participação como moderadora no Debate "O Presente e o Futuro do Ensino a Distância", Instituto de Formação (AFCATE) / FCUL, Faculdade de Ciências, 17 de Outubro de 2001.

3 CONCLUSION

3.1 Self Assessment of the fulfilment of LASIGE objectives and plan

The objectives of LASIGE have been consolidated in the year 2001 in three main vectors:

- a. the scientific production has been effective, and has grown steadily with respect to the previous years,
- b. the human and physical infrastructure of LASIGE has been further stabilized and used as with a high degree of efficiency to support the research activities,
- c. the strengthening of the links with external institutions, companies and public organizations has continued, through a relevant number of projects that have continued through 2001 and started in that year.

3.2 Self Assessment of the recommendations from the Advisory Board

The recommendations of the Advisory Board identify the following lines of action (see report in Annex):

1. Strategy building
2. Branding
3. Business model and revenue model
4. Technology transfer
5. Interpenetration of groups

These headings have been addressed with different levels of intensity and with different levels of impact.

The “strategy building” orientation has been pursued informally in the acquisition of critical mass to support LASIGE activities and projects. For a number of internal and external reasons, the number of senior staff has only grown moderately. The participation in projects and the consolidation of the LASIGE permanent staff (closely linked to the Faculty of Sciences staff) is a critical factor in this area.

Branding efforts have been carried out in local and external activities, namely organization of scientific events and focused participation in R&D projects.

The business and revenue model has not evolved significantly in this past year but examples of bilateral projects with national and international institutions are starting to emerge and may prove successful in the future. Also, some degree of technology transfer has been achieved in these bilateral projects.

The interpenetration of the groups has been slightly improved and 2002 is witnessing a further effort in the submission of joint project proposals.

3.3 Future prospects

The future of LASIGE is influenced and guided by the following external realities:

1. **LOCAL** The facilitation and positive impact of the FCUL dynamics in the Informatics and Computer Science domain. While external and temporary collaborators are welcome and desired at LASIGE the permanent staff of this research unit is mainly composed by faculty staff. The year of 2002 will surely witness a growth of the number of PhD's, from 7 to around 12, both due to the graduation of current PhD students and due to the integration of new staff. Along this line of evolution, the needs for physical space will become more and more pressing and FCUL has a role to play here.
2. **NATIONAL** LASIGE expects a continuation of the current policies and mechanisms for funding research that have been put in place in the last years by the portuguese FCT. A change in these policies will require adequate adaptations of the funding and organizational model. Working under the present conditions, LASIGE will continue to exploit nationally the following lines:
 - a. National FCT Calls for Projects
 - b. National Funding for PhD Scholarships
 - c. Existing cooperation agreements with foreing Science Funding Agencies
3. **INTERNATIONAL** The main driving factor for LASIGE activities are the European Union Framework Programmes, namely the 6th FP that is being designed at the time of this report. The research and development configurations motivated by that programme will have a clear impact on the LASIGE work.

Globally, the guidelines for the future of LASIGE are well defined in the Advisory Board's recommendations. Locally, a steady growth in critical mass and resources is required, while maintaining the productivity and quality of the research results that have been achieved so far.

4 ANNEXES

4.1 Report of the Advisory Board

4.2 Financial Report of 2001