



BISON **IST-2001-38923**

*Biology-Inspired techniques for
Self Organization in dynamic Networks*

Dissemination and Use Plan

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Abstract

In this document we describe the mechanisms we will adopt to ensure that the outputs of the project are best exposed to academia and industry and outline possible paths towards their exploitation and commercialisation.

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1 Overview

1.1 Overview of Expected Results

In general, the expected results of BISON consist of techniques and tools for synthesizing biology-inspired solutions to technological problems in dynamic networks, as well as an open-source software infrastructure for experimentation.

Among the specific expected results for project BISON, we identify the following that could either be disseminated or exploited:

- Structure and functions of dynamic networks (month 6, dissemination)
- Abstract models for candidate CAS (month 6, dissemination)
- Models for basic services (month 12, dissemination)
- Models for advanced services (month 12, dissemination)
- Structure/function CAS matrix (month 12, dissemination)
- Simulation environment for ad-hoc and overlay networks (month 18, exploitation)
- Implementation of basic services (month 24, exploitation)
- Implementation of advanced services (month 24, exploitation)
- Demonstrators (month 36, exploitation)

1.2 Approach to Dissemination and Use

The core principal of our dissemination policy is to ensure that research innovations are published in a timely manner and that promising directions for commercial exploitation are identified swiftly. This core policy will be implemented through the following mechanisms:

- Setting up and maintaining a project web site
- Organizing research meetings on topics that are central to the project
- Fostering clustering activity with other related projects in the complexity area
- Publicizing the technological results in academic and industrial forums, including the Networks of Excellence such as EXYSTENCE
- Publicizing the project results widely to the general public and business communities, including the Santa Fe Institute's Business Network
- Identifying opportunities for commercial exploitation of the results and devising appropriate exploitation plans, and
- Developing teaching material for graduate-level courses on dynamic network technologies as well as participating in Research and Training Networks.

1.3 Market Projections

The industrial partner of the BISON project (Telenor) is one of the major and innovative players in the pan-European mobile telecommunications arena. With more than 10 million subscribers (2001), this partner has a strategic interest in being on the forefront of developing new mobile technologies and services. Dynamic network structures such as P2P, Grid and ad-hoc networks, which are the subject of study in BISON, promise to play a significant role in near-future ICT technology. For example, P2P networks have already reached the level of commercialization; and firms such as Gartner Consulting and Frost & Sullivan predict huge growth in P2P network applications in the next few years. Many major players such as IBM, Sun, Intel, Microsoft and HP have made and are making a significant R&D investment in P2P technologies. Grid systems are expected to offer to small enterprises an appealing combination of huge computing capacity and low price, and are receiving R&D investment from IBM, Sun, Microsoft and HP-Compaq. Finally, there is little doubt that mobility will be an ever more attractive feature of future computing and telecommunications systems.

In considering possible advantages to European telecom operators from the BISON project, it is worth remembering that the customer does not buy technology or network structures, but rather buys functions and services. Hence it can be advantageous to view future possibilities in terms of functions, rather than structure or technology, both at the most general and specific levels. First, it is clear that the telecom operator will strategically benefit if the Complex Adaptive Systems (CAS) methods developed in the BISON project are successful. Such methods will enable the operator to offer an integrated and flexible set of services that are not available today. End-users will find themselves always able to connect, to navigate, and to discover, with a reach extending over the entire Network, which in turn will incorporate the present Internet as well as smaller LANs, telephone systems, sensors, and other devices distributed in the environment. All of this should and will be perceived as a single, flexible, functioning system for the end-user. In other words, the ultimate vision is that the CAS methods developed by BISON will come to be important contributions to the building of a ubiquitous Internet-scale operating system.

Telenor is in an excellent position to contribute to the commercialisation of innovative technology arising from the BISON project. Telenor R&D has close connections with the business units of Telenor Communications, and is presently engaged in development projects, financed by the business units, aimed at the commercial implementation of (among others) ad-hoc routing, and peer-to-peer file sharing among mobile terminals. Hence, it is a relatively small step from the research activities of BISON to their exploitation and possible commercialisation.

2 Description of Dissemination Plan

In the next few sections we outline possible forums for presentation of project results, including plans for meetings to be organized by the consortium. A list of conference CFP's and Journals will be maintained in the project web site and kept updated according to forthcoming deadlines for submission.

2.1 Conferences and Workshops

An initial list of possible conferences and workshops for targeting project results is as follows:

- International Workshop on Peer-to-Peer Systems (IPTPS)
- IEEE International Conference on Peer-to-Peer Computing
- International Conference on Mobile Computing and Networking (MOBICOM)
- ACM International Symposium on Mobile Ad Hoc Networking and Computing (MOBI-HOC)
- ACM/USENIX International Conference on Mobile Systems, Applications, and Services (MobiSys)
- International Workshop on Biologically Inspired Approaches to Advanced Information Technology (Bio-ADIT)
- International Workshop Autonomic Computing Systems
- International Conference on Parallel Problem Solving from Nature (PPSN)
- International Workshop on Engineering Self-Organising Applications (ESOA)
- International Workshop on Global and Peer-to-Peer Computing (GP2PC)
- IEEE/ACM International Symposium on Cluster Computing and the Grid (CCGRID)
- ACM Principles of Distributed Computing (PODC)
- IEEE Symposium on Reliable Distributed Systems (SRDS)
- IEEE International Conference on Dependable Systems and Networks (DSN)
- IEEE International Conference on Distributed Computing Systems (ICDCS)
- International Symposium on Distributed Computing (DISC)
- International Conference On Principles of Distributed Systems (OPODIS)
- IEEE INFOCOM
- IEEE International Conference on Parallel and Distributed Computing Systems (PDCS)

2.1.1 Consortium-Organized Meetings

The consortium is planning to organize two scientific meetings during the project's lifetime. The first event, which is in an advanced state of preparation, will take place at the mid-term mark for the project (June 2004) while the second event will take place in Santa Fe (USA) during the project's final year (Spring 2005) and will be a vehicle for showcasing the projects results and accomplishments to a wide audience through the Santa Fe Institute's Business Network.

Further details for the meetings are as follows:

Meeting Name: Self-* Properties in Information Systems (SELF-STAR)

Dates: May 31 – June 2, 2004

Location: Bertinoro, Italy

Organizing Committee: Ozalp Babaoglu, Mark Jelasity, Alberto Montresor (University of Bologna), Christof Fetzer (AT&T Bell Labs), Maarten van Steen (Free University, Amsterdam), Aad van Moorsel (HP Labs, Paolo Alto), Stefano Leonardi (University of Rome, "La Sapienza")

Brief Description: The meeting will bring together an interdisciplinary group of researchers to discuss the state-of-the-art and open problems in the study of life-like properties in information systems including self-organization, self-configuration, self-management and self-repair.

Sponsorship: BISON, COSIN, EXYSTENCE NoE Topical Workshop (to be confirmed)

Meeting Name: To be decided

Dates: Spring 2005

Location: Santa Fe Institute, USA

Organizing Committee: To be headed by Jim Crutchfield

Sponsorship: BISON, SFI Business Network Program

2.1.2 Program Committee Membership

During the first six months of the project, consortium members have served (or are serving) on the following conference Program Committees:

- Alberto Montresor, AP2PC 2003: Second International Workshop on Agents and Peer-to-Peer Computing, Melbourne, Australia, July 2003.
- Alberto Montresor, DBISP2P 2003: Workshop On Databases, Information Systems and Peer-to-Peer Computing, Berlin, Germany, September 2003.
- Alberto Montresor, P2P 2003: 3rd IEEE International Conference on Peer-to-Peer Computing, Linköping, Sweden, September 2003.
- Alberto Montresor, Bio-ADIT 2004: The First International Workshop on Biologically Inspired Approaches to Advanced Information Technology, Lausanne, Switzerland, January 2004.
- Ozalp Babaoglu, DBISP2P 2003: Workshop On Databases, Information Systems and Peer-to-Peer Computing, Berlin, Germany, September 2003.

- Ozalp Babaoglu, DOA 2003: Symposium on Distributed Objects and Applications, Catania, Sicily, Italy, November 2003.
- Ozalp Babaoglu, ISDA 2003: Conference on Intelligent System Design and Applications Conference, Tulsa, Oklahoma, August 2003.
- A. Deutsch, 2nd WS on Computational Biology in Saxonia, Dresden, Germany, March 2003.
- A. Deutsch, International Conference on Linking Biological and Mathematical Models of Cancer Growth, Magdeburg, Germany, June 2003.
- A. Deutsch, European Conference on Mathematical and Theoretical Biology, Dresden, Germany, July 2005.

2.2 Publications

An initial list of possible journals for targeting project results is as follows:

- Nature
- Science
- Artificial Life
- Complex Systems
- IEEE ACM/IEEE Transactions on Networks
- ACM Transactions on Computer Systems
- ACM-Springer Distributed Computing
- IEEE Transactions on Mobile Computing
- IEEE Transactions on Wireless Communications
- IEEE Journal on Selected Areas in Communications
- IEEE Pervasive Computing
- Elsevier Physica D: Nonlinear Phenomena
- Physical Review Letters
- ACM SIGMOBILE Mobile Computing and Communications Review
- Kluwer Mobile Networks and Applications
- Kluwer Journal on Wireless Networks
- BT Technology Journal

- International Journal of Wireless Information Networks
- Journal of Heuristics
- INFORMS Operations Research
- Mathematical Biology and Medicine

2.3 Current Publications

A few preliminary project results have either been accepted for publication or have been submitted to the following outlets:

- A. Montresor, O. Babaoglu. The BISON Project. In *IEEE Computational Intelligence Bulletin*, vol 1, no. 1, December 2002.
- A. Montresor, H. Meling, O. Babaoglu. Towards Self-Organizing, Self-Repairing and Resilient Large-Scale Distributed Systems. In *Future Directions in Distributed Computing*, Springer-Verlag Lectures Notes in Computer Science, vol. 2584, pp. 119–123, 2003.
- V. Maniezzo, L. Gambardella, F. de Luigi. Ant Colony Optimization. To appear in *New Optimization Techniques in Engineering*, G. C. Onwubolu, B. V. Babu (eds.), Springer-Verlag.
- A. Montresor, O. Babaoglu. Biology-Inspired Approaches to Peer-to-Peer Computing in BISON. To appear in *Proc. of the Third International Conference on Intelligent Systems Design and Applications*, Tulsa, Oklahoma, August 2003.
- G. Canright, K. Engo. Automated security analysis. To appear in *Proc. of Large Installation Systems Administration (LISA 2003)*.
- G. Canright, K. Engo. Archipelago: A Network Security Analysis Tool. Submitted to the Norwegian Computer Science Conference (NIK) 2003.
- G. Canright, K. Engo. A graph theoretical model of computer security: from file access to social engineering. Submitted to *International Journal of Information Security*.
- A. Deutsch, S. Dormann. Cellular automaton models for biological pattern formation. Birkhauser, Boston, to be published in 2003.
- T. Walther, A. Grosse, K. Ostermann, A. Deutsch, T. Bley. Mathematical modeling of regulatory mechanisms in yeast colony development. submitted to *Journal of Theoretical Biology*.
- A. Deutsch. Mathematical modelling and simulation of interacting cell systems with cellular automata. In *Computational fluid and solid dynamics*, K. J. Bathe (ed.), Elsevier, 2003.

2.4 Web Presence

The project has had a web presence at URL <http://www.cs.unibo.it/bison/> since November 2002. The site is maintained by the coordinating partner (Bologna) with contributions from all consortium members.

2.5 Clustering and Standardization

All project partners are currently institutional members of the EXYSTENCE Network of Excellence in Complex Systems and have been involved in a new Network proposal under FP6.

The project maintains close relationships with COSIN, one of the other FET projects in the complexity area. A concrete result of this collaboration will be the SELF-STAR meeting that includes Stefano Leonardi in the Organizing Committee and will be co-sponsored by BISON and COSIN.

2.6 Other

The project has been presented to a wide audience both by its coordinator and other partners at various occasions, including the EXYSTENCE Launch Meeting in Torino:

- Ozalp Babaoglu, "Presenting Project BISON", EXYSTENCE Network of Excellence Launch Meeting, Torino (Italy), November 2002.
- Luca Gambardella, "BISON: ants in ad hoc networks", Is Mobile Ad hoc Networking part of the future of mobile networking in Europe? Exploratory Workshop of The European Science Foundation, Monterosso al Mare, La Spezia (Italy), 10/12 October 2002
- Luca Maria Gambardella, "Ant Colony Optimization for ad-hoc networks", First Mobile Information and Communication Systems, MICS Workshop on Routing for Mobile Ad-Hoc Networks, Zurich, February 13, 2003.

Finally, the consortium is engaged in training and graduate-level education activities in the Complex Systems area through the following courses:

Course Title: Models and algorithms for complex information networks

Lecturer: Prof. Stefano Leonardi (University of Rome, "La Sapienza")

Dates: March 8–20, 2004

Location: Bertinoro, Italy

Context: BISS2004: Bertinoro Spring School for Graduate Studies in Computer Science (organized by the co-ordinator of BISON, Prof. Babaoglu)

Contents: We will address several topics related to the modelling and the analysis of complex information networks. We will present studies describing the graph structure of the Web and of the Internet, and stochastic graph models aimed to capture the properties of these complex networks. We will also describe algorithmic techniques that exploit the topological structure for Information retrieval and for inferring relationships between the components of networks. We will finally discuss economical inspired methods to design mechanisms and distributed algorithms for resource allocation and optimization in networks operated by selfish distributed agents.

Course Title: Topology management in dynamic overlay networks (tentative)

Lecturer: Dr. Mark Jelasity (University of Bologna)

Dates: Fall 2004

Location: Bologna (Italy)

Context: PhD program of the Department of Computer Science, University of Bologna

Contents: To be defined.