



BIONETS E-News

Bio-Inspired Networks and Services

www.bionets.eu

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Dear BIONETS members,

As always, we welcome your comments and suggestions. If you would like to participate or contribute to the content of the E-Newsletter, please feel free to contact us at bionets-website@create-net.org

BIONETS News

- **ICT 2008: Demonstration of Autonomic Services for Future Internet**

Proposed exhibition will demonstrate two approaches for building autonomic services for the Future Internet. The exhibition will jointly present the results of two projects, CASCADAS and BIONETS, funded by the EC within the SAC framework.

BIONETS will demonstrate some of the key technologies developed inside the BIONETS project to match the peculiar needs and features of the "Digital City" application scenario: a sensor-rich environment, in which data/services are accessible through an ubiquitous digital infrastructure. User-tailored services will be provided through a "Personal Scout", a personal device able to interface with the environment, as well as with other users, through some form of proximity communications, and to provide context-aware services to end-users.

- **AUTONOMICS 2008**, Turin, Italy, 23-25 September 2008, www.autonomics.eu
The BIONETS partners are involved in the organization of the second edition of the Auto-

nomics conference on autonomic communications and computing systems. Besides the main track, the conference also includes 2 workshops. The first one is focused on innovative service technologies, and will feature speakers from the most active ICT companies in the field. The second one is the 3rd SAC-FIRE workshop and aims at strengthening collaboration among the projects funded within such EC-launched initiatives.

- **BIONETICS 2008**

The 3rd International Conference on Bio-Inspired Models of Network, Information, and Computing Systems will be organized in Hyogo, Japan, on 25-28 Nov. 2008.

- **Workshop on FIRE, Paris, 10 September 2008**

This FIRE Launch Event marks the starting point of the 14 research projects which have been selected under the first call. The workshop is meant to discuss the research scenario behind FIRE, its expected impact, and the multiple ways to improve synergies and added value with other research initiatives, be they worldwide, at EU or national levels.

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New Deliverables & Publications

Note: for more details and PDF version, where available, please check the project Web site www.bionets.eu

SerWorks Architecture v1.0

Type: Deliverable (D1.1.3/3.1.3)

One of the most innovative aspects of the BIONETS project is given by the notion of merging networks and services in what we call SerWorks. In SerWorks, a service-oriented architecture is applied to network-level functionalities, providing an integrated architecture enabling the run-time generation of network protocols according to the current environmental conditions as well as to the requirements of the higher-level running services. In such a way, service-tailored network protocols can be built on-the-fly, potentially achieving better performance and providing an additional degree of flexibility to the resulting system. In order to do so, we draw concepts and techniques from service-oriented architectures and extend them to the networking framework. In this way, a unified architecture, able to encompass both services and networking, can be introduced.

In this deliverable, we introduce the first version of the SerWorks architecture, presenting the main SerWorks concepts and components, together with a description of the way the components interact in order to allow system's operations.

Application of game theory and statistical physics models to BIONETS architecture protocols and services

Type: Deliverable (D2.2.5)

Deliverable D2.2.5 is concerned with paradigms in game theory and in statistical physics and in their potential applications to BIONETS architecture, protocols and services. It presents both our theoretical contributions to those paradigms as well as contributions that mainly apply the paradigms. The deliverable contains 6 chapters; two on game theory and four on physics and related paradigms. The game theory part includes contributions to the fundamentals of game theory which we have developed for working in the context of decentralized non-cooperative decision making in large complex systems. The motivation has been to adapt game theory to autonomous networks of which BIONETS is a representative. We describe in the deliverable a rich number of fundamental contributions as well as actual scenarios in wireless networks that make use of them. In Section 2.3, the issue of cooperation of U-

nodes in retrieval and dissemination of information from T-nodes is examined in two specific application models. We consider both cases where, in a set of U-nodes, its members have conflicting or coinciding preferences for T-node information objects. In the first case, we study incentives necessary for cooperation, which are based on bilateral object exchanges. In the second case, we propose a scheme for distribution of retrieval tasks among the U-nodes that have the same preferences. This application study is related to research conducted in WPs 1.2 and 1.3 for algorithm design and evaluation, as all strategies can be applicable in designing protocols for information retrieval and dissemination in a BIONETS environment. Interestingly, this report is one of the first attempts in the literature to show how physics methods (mainly random matrix theory, free probability and entropy methods) can be used for the analysis and design of wireless networks. Hence, when the dimension of the network grows, nodes can be mapped as particles which interact in a large physical system. These physical systems are known to behave according to certain deterministic laws. In the same vein, we show that BIONETS also behave according to some predictable laws for which we are able to extract the parameters of interests (the density of nodes, the signal to noise ratio, the distribution of the deployment of the nodes, to name just a few examples). We also develop a whole new theory named free deconvolution (based on free probability) which enables BIONETS to extract information on the network based on a few observables quantities. The paradigm from road traffic engineering is concerned with routing in highly dense ad-hoc network where the density is so high that one may approximate the nodes and links by a continuum. This problem has been previously studied using tools from electrostatics and optics. Another relation to physics is that we use potential theory to transform a problem of individual optimization by infinitely many sources to an equivalent one in which there is a single decision maker. It a

Advanced Service Life-Cycle and Integration

Type: Deliverable (D3.2.4)

In deliverable D3.2.4 we present the status of the work in several topics researched in the BIONETS WP3.2. We illustrate the BIONETS service evolution by presenting it at the composition level as well as providing a framework for the cooperative evolution of services. This deliverable also presents the refinements of self-management concepts, containing the

specification of semantic injection in the BIONETS service architecture, semantic service specification, and a summary of the achievements in migration support for evolutionary services. We present a framework for the cooperative evolution of services. We explain the principles of the approach for atomic stateless services, and then show how this approach can be extended to stateful services or service assemblies.

We introduce the modelling of Service Cells (SCs) and Service Individuals (SIs) to demonstrate SI evolution. We aim at transforming already existing service individuals in order to create functionally equivalent SIs that may differ in their non-functional properties.

Outcomes of service probes implementation and evaluations

Type: Deliverable (D3.4.1)

Deliverable D3.4.1 concludes all activities in work package WP3.4. The purpose of this work package was to practically validate different ideas and concept that are discussed in SP3. In particular three concepts were selected and investigated with regard to their applicability in the BIONETS Service Framework: 1) Implementing BIONETS Service Architecture by the use of a Grid Component Framework, 2) Varying service individuals through graph-based GP to compensate unavailable Service Cells, 3) Applying Fraglets to diffuse messages in opportunistic networks. All these service probes were evaluated successfully. Thus, the results can be used to refine the specifications in WP3.1 and WP3.1. Additionally, the utilizability of the checked concepts for prototyping needs to be discussed in WP5.

Pervasive Ubiquitous Peer-to-Peer context-aware Application

Type: Deliverable (D5.3.4)

The design and implementation of a Pervasive Ubiquitous P2P context-aware application corresponds to task T5.3.4 of Workpackage 5 (Prototyping and Validation) of the BIONETS project. T5.3.4 is concerned with the development of a middleware specifically tailored to the diffusion of user-centric information, such as contextual and entertainment data, in opportunistic communication environments. The main objectives of this task can be summarized as follows. First, we want to implement and experiment a subset of the BIONETS networking framework components. Now that the project is in a more mature stage, this prototyping activity will provide a valuable feedback to the many algorithms and techniques developed and evaluated at the networking level.

Second, we want to investigate which are the constraints coming from real-world applications. BIONETS-like systems are expected to support pervasive application scenarios, where users access services and information through their mobile handset while moving around during their daily activities. Implementing and experimenting realistic (although simplified) future pervasive application scenarios will allow us to better understand which are the additional constraints that need to be taken into account when designing this type of systems.

Third, we want to evaluate how far we are, in terms of state-of-the art technologies, from BIONETS-like application scenarios.

Journal Publications

- Hisao Kameda and Eitan Altman, "Inefficient Non-cooperation in Networking Games of Common-Pool Resources", in IEEE JSAC Special Issue on "Game Theory in Communication Systems", 2008

Book Chapters

- S. Alouf, I. Carreras, A. Fialho, D. Miorandi and G. Neglia, "Autonomic Information Diffusion in Intermittently Connected Networks", in *Autonomic Computing and Networking* (to appear).
- D. Miorandi, I. Carreras, F. De Pellegrini, I. Chlamtac, V. Simon and E. Varga, "Chemical Relaying Protocols", in *Bio-inspired Computing and Communication Networks*, Eds. Y. Xiao and F. Hu, Auerbach Publications (to appear).

Conference Publications

- F. De Pellegrini, I. Carreras, D. Miorandi and C. Moiso, "R-P2P: a Data Centric DTN Middleware with Interconnected Throwboxes", in Proc. of AUTONOMICS, Turin, Italy, Sept. 2008 (to appear).
- I. Carreras, F. De Pellegrini, D. Miorandi, D. Tacconi and I. Chlamtac, "Why Neighbourhood Matters: Interests-Driven Opportunistic Data Diffusion Schemes", in Proc. of CHANTS (ACM MOBICOM Workshop), S. Francisco, US, Sept. 2008 (to appear).
- L. Ferrari, A. Manzalini, C. Moiso, I. Carreras, "Distributed Service Framework for Digital Cities", in Proc. of TAAC, Budapest, Hungary, Jul. 2008.
- A. Bassoli, J. Brewer, K. Martin, I. Carreras and D. Tacconi, "undersound and the Above Ground", Proc. of MMW (Poster Presentation), Vienna, Austria, May 2008.
- D. Miorandi, I. Carreras, E. Altman, L. Yamamoto and I. Chlamtac, "Bio-Inspired Approaches for Autonomic Pervasive Computing Systems", in the

BIOWIRE Workshop Notes, Lecture Notes in Computer Science, Springer, 2008.

- A. Al Hanbali, M. Ibrahim, V. Simon, E. Varga, I. Carreras, "A Survey of Message Delivery Protocols in Mobile Ad Hoc Networks", in Proc. of Inter-Perf, Athens, Greece, Oct. 2008 (to appear).
- E. Altman, R. El-Azouzi, Y. Hayel and H. Tembine, "An Evolutionary Game approach for the design of congestion control protocols in wireless networks", in Proc. of PHYSICOMNET, Berlin, Germany, Apr. 2008.
- S. Sarkar, E. Altman, R. El-Azouzi and Y. Hayel, "Information Concealing games", in Proc. of IEEE Infocom Phoenix, Arizona, USA, Apr. 2008.
- E. Altman and Y. Hayel, "Stochastic Evolutionary Games", in Proc. of the 13th International Symposium on Dynamic Games and Applications, Wroclaw, Poland, Jun. 2008.
- E. Altman, K. Avrachenkov and A. Garnaev, "Fair resources allocation in wireless networks in the presence of a jammer", in Proc. of ValueTools, Athens, Greece, Oct. 2008.
- O. Ryan and M. Debbah, "On the limiting moments of Vandermonde Random Matrices", in Proc. of PHYSICOMNET, Berlin, Germany, Apr. 2008.
- A. Silva, R. Couillet, S. Wagner and M. Debbah, "Physical Limits of Information Transfer", in Proc. of Inter-Perf 2008, Athens, Greece, 2008 (to appear).
- E. Altman, P. Bernhard and A. Silva, "The Mathematics of Routing in Massively Dense Ad-Hoc Networks", in Proc. of the 7th International Conference

on Ad-Hoc Networks and Wireless, Nice, France, Sept. 2008.

- E.Jaho, I.Koukoutsidis, I.Stavrakakis, I.Jaho, "Cooperative replication in content networks with nodes under churn", in Proc. of IFIP Networking, Singapore, May 2008.
- I. Koukoutsidis, E.Jaho and I. Stavrakakis, "Cooperative Content Retrieval in Nomadic Sensor Networks", in Proc. of IEEE MOVE (INFOCOM Workshop), Phoenix, AZ, USA, Apr. 2008.
- T. Meyer, L. Yamamoto, C. Tschudin, "An Artificial Chemistry for Networking", in the BIOWIRE Workshop Notes, Lecture Notes in Computer Science, Springer, 2008.
- T. Meyer, D. Schreckling, C. Tschudin, Lidia Yamamoto, "Robustness to Code and Data Deletion in Autocatalytic Quines", invited for submission to Transactions on Computational Systems Biology (to appear).
- Juan J. Ramos-Munoz, Lidia Yamamoto, Christian Tschudin: "Serial Experiments Online", SIGCOMM Computer Communication Review, vol 38, n. 2, March 2008.
- P. Dini and D. Schreckling, "Notes on abstract algebra and logic: Towards their application to cell biology and security", in Proc. of DEST, Phitsanulok, Thailand, Feb. 2008.
- Roberto G. Cascella, "Costs and Benefits of Reputation Management Systems", in Proc. of WoWMoM, Newport Beach, CA, USA, Jun. 2008.

Open CfPs and Submission Deadlines

- **INFOCOM**

Submission deadline: Aug. 29
Web site: www.ieee-infocom.org/

- **Percom**

Submission deadline: Sept. 15
Web site: www.percom.org/

- **ACM GECCO**

Submission deadline: Jan. 1

Web site: www.sigevo.org/gecco-2009/

- **Computer Networks Special Issue**

Submission deadline: October 1st
Special Issue on Interdisciplinary Paradigms for Networking
Web site: www.elsevier.com/locate/comnet

Upcoming Conferences and Symposia

- **Sigcomm**

Seattle, WA, USA, Aug. 17 - 22, 2008

- **UBICOMP**

COEX, Seoul, South Korea, Sept. 21 - 24, 2008

- **AUTONOMICS**

Turin, Italy, Sept. 23-25 2008

- **BIONETICS**

Hyogo, Japan, 25-28 Nov. 2008

- **Valuetools**

Athens, Greece, Oct. 20 - 24, 2008

- **Unconventional Computation**

Vienna, Austria, Aug. 25-28 2008

- **Globecom**

New Orleans, US, Nov. 30 - Dec. 4 2008

- **FIRE Launch Event**

Paris, France, Sept. 11 2008