



BIONETS E-News

Bio-Inspired Networks and Services

www.bionets.eu

Issue 4, February 2009

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

- **Joint BIONETS/CASCADAS stand at ICT 2008**

During ICT 2008 in Lyon, we organized a joint BIONETS/CASCADAS exhibition stand. The stand featured a demo of the U-Hopper technology, together with posters and presentations of the BIONETS project. A small can containing the “seeds of future Internet research” was given to all attendees as a gadget, deserving, with merit, the “Best Gadget Award”.

- **Best paper award at of ICCGI 2008**

The paper “Modeling and Controlling Dynamic Service Compositions” from H. Pfeffer, D. Linner, and S. Steglich, received the best paper award at ICCGI 2008. Congratulations to the TUB team!

- **Best student paper award at Inter-Perf 2008**

The paper “The Space Frontier: Physical Limits of Multiple Antenna Information Transfer” from R. Couillet, S. Wagner, A. Silva and M.

Debbah, received the best student paper award at Inter-Perf 2008. Congratulations to the INRIA team!

- **3 BIONETS papers accepted for publication at INFOCOM 2009**

Three BIONETS papers have been accepted for publication at IEEE INFOCOM 2009, one of the most prestigious conferences in the networking community. Congratulations to the teams involved, and have a nice stay in Rio de Janeiro!

- **BIONETICS 2009 will be organized in, Avignon, France**

Three next edition of BIONETICS will be organized in Avignon, France, on the 7-11 December 2009. Eitan Altman (INRIA) will be co-chairing the event together with Yezekael Hayel. We expect this to be the official closing event of the BIONETS project, and we strongly encourage everyone to contribute to its final success!

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Upcoming Project Meetings

BIONETS Review Meeting

Venice, IT, Mar. 1–2, 2009

The third BIONETS project review meeting will be held in Venice, Italy, on the 1–2 February 2009. A tentative agenda of the review meeting is available on BSCW.

Fourth FIRE Workshop

After the third edition held in conjunction with AUTONOMICS 2008, a fourth related event SAC-FIRE workshop will be held in Venice, in conjunction with the SAC projects review. It will help in improving the visibility of the research results of the SAC initiative financed by the European Union, the collaboration between the different SAC and FIRE projects. Info can be found <http://www.bionetics.org/sac.shtml>.

New Deliverables & Publications

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

Evolution and Gene Expression in BIONETS: A Mathematical and Experimental Framework

Type: Deliverable (D2.2.4)

In Deliverable D2.2.4 “Evolution and Gene Expression in BIONETS: A Mathematical and Experimental Framework” we continue the development of a mathematical and experimental framework for biologically inspired computing. We examine the problem from four different points of view: mathematical systems theory and category theory, algebraic structure of automata, logic and temporal logic representations for both of these, and chemical programming languages. The algebraic automata theory approach is motivated by the presence of algebraic structure in automata that are derived from cell metabolic pathways. In order to be able to relate these mathematical theories to the BIONETS computing context, in particular the security architecture and the run-time execution of Service Individuals, they need to be represented in logic. We spend a chapter discussing the connections between category theory and automata theory in order to provide a context for a discussion of their connections with logic. Evolutionary behaviour is fundamentally reliant on the assembly and recombination of " at a highly granular level. We therefore also spend one chapter reporting on progress to date in a Fraglets-inspired chemical language, PlasmidPL, and related concepts of code evolvability. This deliverable is only a status report on work in progress.

Service-Matched Networking

Type: Deliverable (D1.2.3)

This document describes networking solutions that meet the demands of services in a BIONETS environment. The solutions proposed are distinguished by three main characteristics: autonomic-ity, in the sense that they are independent of specific system entities, adaptation and evolution, meaning that they are able to adapt to the environment, learn and obtain new functionalities. Enhancements to the BIONETS architecture that assist and improve the functionality of these services are also proposed, such as the use of static storage nodes and P2P overlays. The deliverable contains the major outcomes from tasks T1.2.1 (Innovative networking functionalities and algorithms (data collection, information dissemination and node cooperation)), T1.2.2 (Adaptation, optimization and evolution of the disappearing network), T1.2.3 (Security and interoperability with traditional networks) and T1.2.4 (Disappearing network middleware architecture), which were concluded at the end of M30.

BIONETS Performance Analysis

Type: Deliverable (D1.3.3)

In deliverable D1.3.3 the new, SerWorks aligned architecture of the BIONETS Simulation Platform is introduced, together with the simulator integration activities spanning across WPs and SPs. The reshaped BIONETS Simulation Platform gives us the opportunity to verify and test the properties of the BIONETS architecture on a wide scale, by simulating a huge number of T-nodes and U-nodes, as it is expected in real-life scenarios. The Simulation Platform was redesigned in a tight cooperation with the SerWorks and the WP5 prototyping task force, sharing the expertise between the different implementation

activities as a joint work between WP1.1 (Requirements and Architectural Principles), WP1.3 (Simulation and Performance Analysis) and WP5 (Prototyping and Validation).

Evaluating the Fitness of Service Compositions

Type: Deliverable (D3.2.5)

In this deliverable we introduce the fitness evaluation of services as another key pillar to enable evolution on service level. Here, the capability of rating services with regard to their environmental context and to compare them with each other allows the selection and deprecation of services on multiple levels within the BIONETS service life-cycle.

Part A deals with the development of a model to describe the non-functional properties of bound service individuals and a corresponding model to represent the preferences of users with regard to the services' environmental context. Moreover, this part introduces a method to evaluate the properties of service individuals against given preferences, resulting in a single value denoting the fitness of a service individual for a given pair of preferences and context. Part B, by contrast, addresses the composition and decomposition of service individuals' fitness values. Finally, part C introduces the handling of two special aspects with regard to fitness evaluation. First, fitness evaluation is scrutinized under the background of service mobility.

Enhanced BIONETS business concepts

Type: Deliverable (D3.3.3)

The objectives of this document are to describe the current understanding of BIONETS architecture and ecosystem as a basis for viable business models and propose how successful business could be built on top of it. In this document we present SWOT analysis of the BIONETS architecture as a platform for a viable business. Key conclusions from that work are that architecture has a great business potential, but the introduction of the architecture to the market is somewhat challenging. The online evolution is also problematic from the business model point of view. We propose some approaches that should be taken in the introduction of the architecture to the market. We also propose that services should take inspiration from games to incentivize users to use BIONETS services.

Adaptive Security in BIONETS

Type: Deliverable (D4.4)

In this report we continue the development and enhancement of a security architecture for BIONETS which is able to adapt its security mechanisms during deployment. For this purpose we identify on four different layers the minimum set of invariants we can base our mechanisms on. Available technologies designed for similar environments as BIONETS and their according deficiencies are identified. Appropriate new solutions addressing these issues are described in this report. They exploit the experience gathered from existing approaches and the particularities of BIONETS.

Journal Publications

- J. J. Ramos-Munoz, L. Yamamoto, C. Tschudin: "Serial Experiments Online", SIGCOMM Computer Communication Review, vol 38, n. 2, March 2008.
- T. Meyer, D. Schreckling, C. Tschudin, L. Yamamoto, "Robustness to Code and Data Deletion in Autocatalytic Quines", in Transactions on Computational Systems Biology, 2008.
- R. Gorrieri, F. Martinelli and M. Petrocchi, "Formal Models and Analysis of Secure Multicast in Wired and Wireless Networks", Journal of Automated Reasoning. Springer, Vol. 41, n. 3, pag. 325-364

Book Chapters

- A. Bassoli, I. Carreras, D. Tacconi, "Social Opportunistic Computing: Design for Autonomic User-Centric Systems", Autonomic Communication, A. Vasilakos, M. Parashar, S. Karnouskos, W. Pedrycz, (Eds.)
- F. Martinelli, M. Petrocchi, "Formal Techniques for Security Analysis in Wireless Systems", Book Chapter in: S. Gritzalis, T. Karygiannis, C. Skianis, (Eds), Security and Privacy in Wireless and Mobile Networking, 2008, Leicester, UK, Troubador Publishing. ISBN: 978-1905886-906.
- T. Zseby, H. Pfeffer, and S. Steglich, "Concepts for Self-Protection", To appear in Autonomic Computing and Networking, M. K. Denko, L. T. Yang, and Y. Zhang, Eds. Springer, 2008.
- I. Chlamtac, D. Miorandi, S. Steglich, I. Radusch, D. Linner, J. Huusko and J. Lahti, "BIONETS: Bio-Inspired Principles for Service Provisioning in Pervasive Computing Environments", in At your service: service engineering in the Information Society Technologies Program, E. Di Nitto, A.M. Sassen, P. Traverso and A. Zwegers (Eds.), MIT Press, 2008.
- L. Pelusi, A. Passarella, M. Conti, "Encoding for

Efficient Data Distribution in multi-hop random networks", in Handbook of Wireless ad-hoc and sensor networks, Boukerche Editor, Wiley and Sons publishers.

Conference Publications

- M. Aezladen, R. Cohen and D. Raz, "Locally vs. Globally Optimized Flow-Based Content Distribution to Mobile Nodes", to appear in IEEE INFOCOM, Rio de Janeiro, Brazil, Apr. 2009.
- G. Alfano, M. Debbah and O. Ryan, "Generalized Free Deconvolution in Random Networks", Information Theory and Applications, San Diego, Feb. 2009.
- E. Altman, P. Bernhard and A. Silva, "The Mathematics of Routing in Massively Dense Ad-Hoc Networks", 7th International Conference on Ad-Hoc Networks and Wireless, Sep. 2008, Nice, France.
- E. Altman, T. Basar and F. De Pellegrini, "Optimal monotone forwarding policies in delay tolerant mobile ad-hoc networks", in Proc. of Inter-Perf, Athens, Greece, October 20-24, 2008.
- E. Altman, G. Neglia, F. De Pellegrini, D. Miorandi, "Decentralized Stochastic Control of Delay Tolerant Networks", to appear in Proc. of IEEE INFOCOM, Rio de Janeiro, Brazil, Apr. 2009.
- E. Altman, A. Kumar, C. K. Singh, R. Sundaresan, "Spatial SINR Games Combining Base Station Placement and Mobile Association", to appear in Proc. of IEEE INFOCOM, Rio de Janeiro, Brazil, Apr. 2009.
- G. Anastasi, E. Borgia, M. Conti, E. Gregori, "HI: an hybrid adaptive interleave communication protocol for relievable data transfer in WSNs with mobile sinks", in Proc. of Persens, Galvestone, Texas, US, 2009.
- F. Baude, L. Henrio, P. Naoumenko, "Structural re-configuration: an autonomic strategy for GCM components", in Proc. of ICAS, Valencia, Spain, April 20-25, 2009.
- R. Cascella, "Costs and Benefits of Reputation Management Systems", in Proc. of WoWMoM 2008, Newport Beach, CA, USA, Jun. 2008.
- R. G. Cascella, Z. Cao, M. Gerla, B. Crispo, R. Battiti. "Weak Data Secrecy via Obfuscation in Network Coding Based Content Distribution." In Proc. of IFIP Wireless Days Conference, Dubai, United Arab Emirates, Nov. 2008.
- R. Cascella, "Enabling Fast Bootstrap of Reputation in P2P Mobile Networks.", to appear in Proc. of AINA, Bradford, UK, May 2009.
- R. Cohen and A. Landau, "Not All At Once! - A Generic Scheme for Estimating the Number of Affected Nodes While Avoiding Feedback Implosion" to appear in Proc. of IEEE INFOCOM mini conference, Rio de Janeiro, Brazil, Apr. 2009.
- R. Couillet, S. Wagner, A. Silva and M. Debbah, "The Space Frontier: Physical Limits of Multiple Antenna Information Transfer", in Proc. of Inter-Perf, Athens, Greece, Oct., 2008.
- R. Couillet, S. Wagner, M. Debbah, "Performance of Dense MIMO Broadcast Antenna Systems", IEEE Wireless Communications and Networking Conference, Budapest, Hungary, Apr. 2009.
- P. Dini, and D. Schreckling, "Notes on abstract algebra and logic: Towards their application to cell biology and security", in Proc. of DEST, Thailand, Feb. 2008.
- A. Fusco, A. Manzalini, C. Moiso, H.M. Blazquez, J.S. Pareta, S. Spadaro, "Autonomic Wireless Communications in Digital Cities: an Experimental Use Case", in Proc. of Mobilware 2008.
- E. Jaho, I. Koukoutsidis, I. Stavrakakis, I. Jaho, "Cooperative replication in content networks with nodes under churn", in Proc. of IFIP Networking 2008, Singapore, May 2008.
- B. Khan, Merouane Debbah, T. Y. Al-Naffouri and Oyvind Ryan, "Estimation of the Distribution Deployment of Sensor Networks", in Proc. of Information Theory and Applications, San Diego, Feb. 2009.
- I. Koukoutsidis, E. Jaho, I. Stav, "Cooperative Content Retrieval in Nomadic Sensor Networks" in Proc. of MOVE (INFOCOM Workshop), Phoenix, AZ, USA, April 2008.
- D. Linner, H. Pfeffer, C. Jacob, A. Kress, S. Krüssel, and S. Steglich, "SmartWare - Framework for Autonomic Application Services" in Proc. of Autonomics, Turin, Italy, September 23-25, 2008.
- F. Martinelli, M. Petrocchi, "Signed and weighted trust credentials in Fraglets", in Proc. of BIONETICS, 2008.
- D. Miorandi, I. Carreras, E. Altman, L. Yamamoto, I. Chlamtac, "Bio-Inspired Approaches for Autonomic Pervasive Computing Systems", in Proc. of BIOWIRE Workshop Notes, LNCS, Springer, 2008.
- L. Yamamoto and D. Miorandi, "Evolutionary and Embryogenic Approaches to Autonomic Systems", in Proc. of Inter-Perf, Athens, Greece, Oct. 2008.
- H. Pfeffer, D. Linner, and S. Steglich, "Modeling and Controlling Dynamic Service Compositions", in Proc. of ICCGI 2008, IEEE Computer Society, 2008 (Best paper award).
- H. Pfeffer, L. Bassbouss, and S. Steglich, "Structured Service Composition Execution for Mobile Web Applications", in Proc. of FTDCS, Kunming, China, 2008.
- H. Pfeffer, S. Krüssel, and S. Steglich, "Fuzzy Service Composition Evaluation in Distributed Environments", in Proc. of I-CENTRIC 2008, Sliema, Malta, Oct. 2008.
- H. Pfeffer, S. Krüssel, and S. Steglich: Community Multimedia Cards, "CoMu Cards", in Proc. of MobiQuitous, 2008. • A. Prakash Azad, E. Altman and R. El-Azouzi, "From Altruism to Non-Cooperation

in Routing Games”, arXiv:0808.4079, Aug. 2008.

- D. Schreckling, P. Dini, “Distributed Online Evolution: An Algebraic Problem?”, to appear in Proc. of CEC 2009.
- H. Tembine, E. Altman, R. El-Azouzi, Y. Hayel, “Battery State-dependent Access Control in Solar-powered Broadband Wireless Networks”, in Proc. of NET-COOP, Paris, Sept. 2008.

Demo Presentations

- I. Carreras, D. Tacconi, M. Anastassova and O. Mayora, “BluePlanner: a personal support for opportunistic mobile environments”, Mobile Experience - In Proc. of MOBILEHCI, Amsterdam, the Netherlands, Sept. 2008

Open CfPs and Submission Deadlines

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| <ul style="list-style-type: none"> • UBICOMP <i>Submission deadline: April. 17, 2009</i> Web site: www.ubicomp.org/ubicomp2009/ • ACM Mobicom <i>Submission deadline: March 5, 2009</i> Web site: www.sigmobile.org/mobicom/2009/ • IEEE GLOBECOM 2009 <i>Submission deadline: March 15, 2009</i> Web site: www.ieee-globecom.org/ | <ul style="list-style-type: none"> • ICAC 2009 <i>Submission deadline (Hot Topics): Mar. 09, 2009</i> Web site: www.caip.rutgers.edu/icac/ • UC 2009 <i>Submission deadline: Apr. 10, 2009</i> Web site: www.uc09.uac.pt • JSAC Special Issue <i>Submission deadline: March 1st</i> Special Issue on Biologically-Inspired Networking |
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Upcoming Conferences and Symposia

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| <ul style="list-style-type: none"> • IEEE INFOCOM 2009 <i>Rio de Janeiro, Brazil, April 19–25 2009</i> • PerCom <i>Galveston, Texas, March 9-13, 2009</i> | <ul style="list-style-type: none"> • EvoStar <i>Tübingen, Germany, 15-17 April 2009</i> • ACM Mobihoc <i>New Orleans, US, May 18–21, 2009</i> |
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