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

- BIONETS approach to autonomic communications was presented on the August issue of *Pipeline*, `www.pipelinepub.com`, in an article on Autonomic Networks.

- Representatives of the BIONETS team took part in the FIRE (Future Internet Research Experimentation) concertation meeting which took place in Brussels on June 13th. More details on such relevant initiative (with an opening in FP7 call 2) can be found at:
  `http://cordis.europa.eu/fp7/ict/fire/`

Upcoming Project Meetings

1st BIONETS Code Camp

Barcelona, ES, Sep. 26–28, 2007

The code camp, jointly organized by TUB and SUN, is focused on the integration of software solutions created in the BIONETS context. So called Code Camps proved to be an effective instrument to strengthen communication of ideas in large-scale projects and the early prototyping of corporate systems. The first BIONETS Code Camp will give us the opportunity to firstly learn about applications, frameworks, and tools developed in the project, or existing solutions which may help us to achieve the BIONETS objectives on the proof-of-concept level. Secondly, it will lead to sketching a software design that integrates solutions currently available in the project - from the network layer up to the service layer. We regard these steps as crucial on the way towards a plausible, integrated demonstration for future Technical Reviews. The Code Camp will take place on SUN headquarters, on Av. Diagonal, 640

Contents of this issue:

(6th Floor), 08017 - Barcelona, Spain.

BIONETS JWPM

Budapest, HU, Dec. 2007

The next BIONETS JWPM will be held in Budapest, HU, in Dec. 2007, co-located with BIONETICS 2007,

`www.bionetics.org`. The JWPM will be organized by BUTE. More details will be distributed soon to the consortium partners.

New Deliverables & Publications

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

Architecture, Scenarios, and Requirements refinements

Type: Deliverable (D1.1.2)

This deliverable presents an enhanced version of the network requirements and high-level architecture detailed in D1.1.1. In particular, it provides a more formal description of the various concepts involved, presenting a first architecture for the three kinds of nodes encompassed in BIONETS systems. Also, architectural considerations on the interworking with infrastructured IP networks are presented. Particular attention has been devoted to the inclusion of security features as a basic building block of the system's architecture.

Disappearing Network Autonomic Operation and Evolution

Type: Deliverable (D1.2.2)

This document presents the results of studying several aspects of current networking technology (disappearing networks) that are expected to play a major role in the deployment of the bio-inspired service centric architecture envisioned by the BIONETS project. It is important to understand that the new architecture will use networking and link layers element in order to establish the services, and thus the characteristics of these layers, their ability to support the proposed architecture and their security aspects are very important aspects of the new networking paradigm. We start by describing important elements of the link layer with respect to the communication and information dissemination in the network. This is followed by an analysis of the support needed by the service from the lower layers, and the required security aspects. An important part of the document deals with applying the new bio-inspired

technique directly into the networking layer, thus demonstrating the multilevel benet of the concepts developed in the project.

BIONETS simulation framework and initial performance analysis

Type: Deliverable (D1.3.2)

Innovative mathematical models developed for the BIONETS environment are analyzed in this deliverable presenting a comprehensive performance evaluation for the first time in the BIONETS project, which will give an important feedback on the design of the system properties. The main focus is on the efficiency of the information dissemination algorithms with respect to reliability of these algorithms, scalability and induced overhead. The algorithms are compared by employing the BIONETS simulation platform, a simulation framework that will be used by every partner. The key objective of the simulator is to provide a tool for all partners, so they can test the implementations of early ideas and algorithms from any Work Package. The deliverable furthermore contains the theoretical studies carried out in WP1.3.1, as the work on the mathematical models continues in parallel with the performance evaluation of the earlier models.

Paradigms and Foundations of BIONETS Research

Type: Deliverable (D2.1.1)

This document is the fruit of the collection of paradigms and foundations that had been identified as being relevant to the design, analysis and optimization of autonomous wireless networks, in general, and to the Bionets architecture and services, in particular. Although this paradigm collection is the deliverable of SP2.1, it contains also

- Contribution from other workpackages

- Chapters that are the result of integration between workpackages

Each chapter in this document contains a survey on a given paradigm. We further included in the chapters the specific contribution of the Bionets project to the foundations and paradigms surveyed.

Architecture definition of autonomic control loop based on social modelling
Type: Deliverable (D2.2.3)

The objective of this deliverable to analyze the Social Network Analyis classical approach to find out how it can be applied to the "islands" of Bionets nodes to define management mechanisms based on social cooperation among nodes for supervision issues. This deliverable is developed within WP2.2 "Paradigm Applications and Mapping" activities where Social Network Analysis (SNA) can be used as a high-level investigation to characterize relationships and peer-to-peer interactions between U-Nodes. However, this deliverable does not claim to cover entirely all the aspects introduced; it is intended to provide a starting point for more detailed further analysis.

Refinement of Service Architecture and Requirements
Type: Deliverable (D3.1.2)

The goal of this document is to provide the first refinement of the BIONETS service architecture and service requirements specification, based on the research activities carried out in work packages WP1.2, WP3.2. The main advances have been made in the areas of BIONETS service life-cycle. In this document, we clarify the impact of the life-cycle studies in WP3.2 to the overall service architecture. In addition, after the previous architecture deliverable [BIONETSD311], some advances have been made in the areas of communication and interaction framework for service architecture and application scenario analysis. In this deliverable, we concentrate on presenting the overall service architecture framework, including the main functionalities for the communication between services and underlying infrastructure. Also the concepts of Service Cells, Service Individuals, Mediators and Interaction framework are elaborated. The application scenario analysis has been complemented in the Amendment of Deliverable D311, which was published in May 2007. In the amendment, four proposed application scenarios are analysed in more detail in terms of their evolutional and bio-inspired features. Thus, the revision of the application scenarios is not presented in the deliverable at hand. The work on the integration of the BIONETS network and service architectures started in project month M19. This deliverable, in addition to deliverable [BIONETSD122], provides the initial

framework for the integration of such components. The preliminary security considerations for service architecture were handled briefly in the deliverable [BIONETSD311] and work on WP4 is currently ongoing to identify enhanced mechanism also for service architecture. In this document, we do not address any changes for the security requirements, which were previously introduced in [BIONETSD311].

Specification of service evolution
Type: Deliverable (D3.2.2)

In this document we refine the notion of evolutionary services within the context of atomic service cells and composite service individuals. First of all, we clarify the definition of evolution, and the difference between evolution and adaptation, which sets the scope for evolutionary services in SP3. Then we clearly partition the evolution of atomic service cells from that of composite service individuals, since these present a different set of challenges. Evolving service cells involves how to optimize their internal parameters, or to reprogram them with new functionality, all this automatically, online, and without disrupting the operation of the service. We report on some lessons learned from evolving protocol parameters in SP1, which can also be useful for SP3. We also report the current state of our research on evolving functionality with the fraglets chemical programming language. An evolution framework is being implemented in fraglets. This required some extensions of the language in the first place. After that we identified some problems, mainly in designing efficient genetic operators for fraglet code. We are now working towards the solutions, and some preliminary ideas are discussed in this document. Evolving composite service individuals is essential in BIONETS, since not all software can realistically be generated from scratch by evolving isolated cells. We must then deal with how to compose services dynamically from a set of ready-made cells, by optimizing the choice of internal components. The importance of service descriptions, hierarchical compositions, and semantic information is highlighted. One of the main research challenges in this context is to integrate this top-down view of service composition with a typically bottom-up evolutionary framework. Other research challenges include the automatic spread and migration of services, defining the geographic distribution of populations of services according to available resources, demand, cost and other constraints. Both cell and composite evolution revealed to be much more complex than initially foreseen. The main difficulties encountered have been reported here, and we are currently working actively to solve the main ones. Simplifying assump-

tions are mandatory in order to make progress. For instance, in cell functionality evolution we are currently working with only one node, not in a network; we try to evolve solutions to simple benchmark problems first, before moving towards more complex scenarios including distributed ones. This is because the evolution of programs expressed in a chemical language poses new challenges for which the genetic programming community does not have all the answers. In composite individuals the role of semantic information, how to represent and automatically manipulate it, as well as the exact syntax and content of service descriptions have to be further specified before one can figure out whether or how evolution could happen in this context. This involves solving the dichotomy between top-down composition mechanisms and bottom-up emergent evolution properties. This document proposes some preliminary solutions to this problem.

BIONETS advanced security mechanisms
Type: Deliverable (D4.2)

This deliverable sheds some light on the numerous security problems BIONETS has to face. It refines the first drafts of the security architecture which have been sketched in [1, 2, 3] and gives a global understanding on how this architecture is integrated in BIONETS. Of course, this refinement preceded an enhanced analysis of the security requirments which have partially been assembled in [4, 5]. A first version of this conglomerate is also available in [3]. This work forms the basis for the research presented in the remainder of this document which outlines mechanisms that are foreseen to be employed in BIONETS in order to support secure communication and the secure deployment of service. For this purpose the document provides four main parts which reflect the four mainstreams of research conducted in our work package. They comprise the topics: mechanism for privacy, anonymity and authenticity, trust and reputation mechanism, autonomic security mechanisms, and research on secure data dissemination approaches. Before concluding the document we also provide a rough threat and risk analysis of the proposed mechanisms.

BIONETS service framework
Type: Deliverable (D5.2)

This document describes the service framework prototype implementation developed for the BIONETS project, based on the basic requirements described by deliverables 3.1.1 and 3.2.1. The service framework provided facilitates the creation, deployment, execution and deprecation of services in such a way that the user of the framework can remain oblivious of the underlying network structure. For this purpose we provide the Service API, built on top of the Distributed Lookup Server. The Service API provides a high level interface for the service framework, providing easy access to the service features and providing interchangeability of the underlying structure. The Distributed Lookup Server provides the "mechanics" of the service framework. It is a complex system providing a multitude of capabilities, including distributed service lookup, service lease/expiration, web management and secure communication.

Journal Publications

• D. Miorandi, E. Altman and G. Alfano, "The Impact of Channel Randomness on Coverage and Connectivity of Ad Hoc and Sensor Networks", to appear in IEEE Trans. Wireless Comms., 2007
• Bassoli, A., Brewer, J., Martin, K., Dourish, P. and Mainwaring, S., "Underground Aesthetics: Rethinking Urban Computin", to appear in IEEE Pervasive Computing, Special issue on Urban Computing - Jul-Sep '07.

Book Chapters

• Roberto Battiti, Mauro Brunato. "Reactive Search: Machine Learning for Memory-Based Heuristics". In: Teofilo Gonzalez (ed.), Approximation Algorithms and Metaheuristics, Taylor and Francis, in press, 1Q2007.
• L. Pelusi, A. Passarella, and M. Conti, "Encoding for Efficient Data Distribution in Multi-hop Ad hoc Networks", in Handbook of Wireless Ad hoc and Sensor Networks, A. Boukerche, Editor, Wiley and Sons Publisher (to appear).

Conference Publications

• Arie Orlovsky and Danny Raz, "Decentralized Enforcement of Security Policies for Distributed Computational Systems", in Proc. of the 22nd Annual ACM Symposium on Applied Computing, SAC 2007, Seoul, Korea, March 11 - 15, 2007.
• N. Bonneau, M. Debbah, E. Altman and A. Hjorungnes, "Wardrop Equilibrium for CDMA systems". To appear in the proceedings of the third workshop on Resource Allocation in Wireless Networks, Limassol, Cyprus, April 16, 2007.
• N. Fawaz, M. Debbah and D. Gesbert, "Capacity and Positioning in Dense Scattering Environments". To appear in the proceedings of the 8th IEEE International Workshop on Signal Processing Advances for Wireless Communications, Helsinki, Finland, June 17-20, 2007

• Suarez, M. Debbah, L. Cottatellucci and E. Altman, "Optimal decoding order under target rate constraints". To appear in the proceedings of the 8th IEEE Workshop on Signal Processing Advances in Wireless Communications, Helsinki, Finland, June 17-20, 2007.

• E. Altman, Y. Hayel and H. Kameda, "Evolutionary dynamics and potential games in non-cooperative routing". To appear in the proceedings of the workshop on Wireless Networks: Communication, Cooperation and Competition (WNC3 2007), Limassol, Cyprus, April 16, 2007.

• I. Carreras, D. Miorandi and I. Chlamtac, "From Biology to Evolve-Able ICT Systems", to appear in Proc. of IEEE SMC (workshop on eNetworks), Oct. 2007.

• S. Alouf, I. Carreras, D. Miorandi and G. Neglia, "Embedding Evolution in Epidemic-Style Forwarding", to appear in Proc. of BioNetworks (IEEE MASS) 2007.

• D. Tacconi, I. Carreras, D. Miorandi, F. Chiti, A. Casile and R. Fantacci, "A System Architecture Supporting Mobile Applications in Disconnected Sensor Networks", to appear in Proc. of IEEE Globecom 2007.

• I. Carreras, D. Tacconi, D. Miorandi and I. Chlamtac, "Multi-Resolution Data Management for Opportunistic Networking",in Proc. of MDM07.

• D. Tacconi, I. Carreras, D. Miorandi, I. Chlamtac, F. Chiti and R. Fantacci, "Supporting the Sink Mobility: a Case Study for Wireless Sensor Networks", in Proc. of IEEE ICC07.

• F. De Pellegrini, D. Miorandi, I. Carreras and I. Chlamtac, "A Graph-Based Model for Disconnected Ad Hoc Networks", in Proc. of IEEE INFOCOM07.

• F. Baude, D. Caromel, L. Henrio, and P. Naoumenko. "A flexible model and implementation of component controllers". In CoreGRID workshop on Grid Programming Model, Grid and P2P Systems Architecture, Grid Systems, Tools and Environments, June 2007.

• H. Tembine and E. Altman, "Asymmetric Delay in Evolutionary Games", to appear in Proc. of Inter-Perf, Nantes, France, Oct. 23-25, 2007.

• H. Tembine, E. Altman and R. El-Azouzi, "Delayed Evolutionary Game Dynamics applied to the Medium Access Control", to appear in Proc. of BIONETWORKS, Pisa, Italy (in conjunction with the 4th IEEE International Conference on Mobile Ad-Hoc and Sensor Systems MASS 2007), Oct. 8, 2007.

• E. Altman, K. Avrachenkov, N. Bonneau, M. Debbah, R. El-Azouzi and D.S. Menasche, "Constrained Stochastic Games in Wireless Networks", to appear in Proc. of IEEE Globecom General Symposium, Washington D.C., 2007.

• Eva Yaho, Ina Yaho and Ioannis Stavrakakis, "Distributed Selfish replication under Node Churn," poster session, MED-HOC-NET'07, June 13-15, 2007, Corfu, Greece.

• Antonis Panagakis, Athanasios Vaios and Ioannis Stavrakakis, "Study of two-hop message spreading in DTNs", 5th Intl. Symposium on Modeling and Optimization in Mobile, Ad Hoc, and Wireless Networks (WiOpt), April 16-20, 2007, Limassol, Cyprus.

• Lidia Yamamoto: "Code Regulation in Open Ended Evolution", poster presentation,10th European Conference on Genetic Programming, EuroGP 2007, Valencia, Spain, April 2007.

• Carsten Jacob, David Linner, Stephan Steglich, and Ilja Radusch: "Autonomous Context Data Dissemination in Heterogeneous and Dynamic Environments". Proceedings of the 4th Consumer Communications and Networking Conference (CCNC) 2007, 11-13 January 2007, Las Vegas, NV, USA.

• H. Pfeffer, D. Linner, I. Radusch, and S. Steglich, "The bio-inspired Service Life-Cycle: An Overview", in Proc. Third International Conference on Autonomic and Autonomous Systems (ICAS), June 19-25, 2007, Athens, Greece, to appear.

• Martin, K. and Bassoli, A., "Imaging Spatial and Social Relationships Under the City", position paper for the workshop Imaging the City, CHI 2007 (25th Conference on Computer Human Interaction), San Francisco, 28 April-3 May 2007.

• E. Varga, T. Csvorics, L. Bacsardi, M. Berces, V. Simon, S. Szabo: "Novel Information Dissemination Solutions in Biologically Inspired Networks", The 9th International Conference on Telecommunications- ConTEL 2007, Zagreb, Croatia, June 13-15, 2007

• L. Bacsardi, M. Berces, E. Varga, T. Csvorics, V. Simon, S. Szabo: "Strategies for Reducing Information Dissemination Overhead in Disconnected Networks", The 16th IST Mobile and Wireless Communications Summit, Budapest, Hungary, 1-5 July, 2007

• L. Buttyan, L. Dora, M. Felegyhazi, I. Vajda: "Barter-based cooperation in delay-tolerant personal wireless networks", in Proceedings of the First IEEE WoWMoM Workshop on Autonomic and Opportunistic Communications, IEEE Computer Society Press, 2007, IEEE Computer Society Press, June, Helsinki, Finland

• Mauro Brunato, Roberto Battiti, Alberto Montresor. "GOSH! Gossiping Optimization Search Heuristics." Learning and Intelligent Optimization Workshop LION2007, Andalo (Italy), February 12-17, 2007.

• Cascella, Roberto and Battiti, Roberto. "Social Networking and Game Theory to foster Cooperation". 2nd ENISA Workshop on Authentication Interoperability Languages. June 2007. Paris, France.

Open CfPs and Submission Deadlines

- **BIONETICS**
  Submission deadline: Aug. 15
  Web site: www.bionetics.org

- **IEEE PERCOM**
  Submission deadline: Sep. 4

  Web site: www.percom.org

- **WiOpt**
  Submission deadline: Oct. 1
  Web site: www.wiopt.org

Upcoming Conferences and Symposia

- **ACM SigComm**
  Kyoto, JP, Aug. 27-31

- **ACM MobiCom**
  Montreal, Canada, Sep. 9-14

- **IEEE SMC**
  Montreal, Canada, Oct. 7-10

- **IEEE MASS**
  Pisa, IT, Oct. 8-11

- **InterPerf 2007**
  Nantes, FR, Oct. 26

- **AUTONOMICS 2007**
  Rome, IT, Oct. 28-30

- **IEEE GLOBECOM 2007**
  Washington, DC, Nov. 26-30

- **BIONETICS 2007**
  Budapest, HU, Dec. 10-12