



Post-Doctoral Researcher Position at the Department of Electrical and Computer Engineering of the **University of Cyprus**, on the topic: **Network Research Foundations and Trends**



The Department of Electrical and Computer Engineering of the University of Cyprus has an opening for a post-doctoral researcher, to be employed within the IST-FP6 STREP Project NET-REFOUND (Network Research Foundations and Trends).

About the NET-REFOUND Project: The objective of the NET-REFOUND project is to develop the theory, methods and algorithms suitable for the modeling, analysis and design of future telecommunication networks. The long-term goal is the theoretical understanding of the collective interaction of a multiplicity of communicating nodes beyond the boundaries posed by specific telecommunication standards. This will lead to a quantitative characterization of the fundamental performance limits of these systems and eventually to algorithms for achieving them. Successful completion of the proposed research will lead to methodological approaches that will shape the future telecommunication standards for emerging technologies like wireless sensor networks, vehicular networks, and autonomic computing systems. More information about the project can be found in www.netrefound.org

Job description: The post-doctoral researcher will be expected to perform outstanding research on any topic of his/her choice that is in line with the general aims of the NET-REFOUND project. Some research areas of particular interest are:

- Fundamental Performance Limits and Tradeoffs of Wired and Wireless Networks
- Network Information Theory
- Network Coding
- Connection and Analogies between Networking Theory and Physics
- Interactions of Control Theory and Communications and Control over channels and networks
- Applications of Game Theory on Networks
- Cooperative Communications
- Optimization Techniques for Networks

An ideal candidate will have recently finished a Ph.D. on one of the above topics, and will be interested in continuing and strengthening his/her body of work, perhaps pursuing research directions new to him/her, together with the other members of the project. Note that the scope of the project is very broad, and so it is expected that the post-doctoral researcher will have significant freedom in pursuing his/her research interests. Suitable candidates should have a strong theoretical background on their chosen research topic.

Conditions: The duration of the contract will be for one year, with the option of renewal subject to satisfactory progress and availability of funds. The contract must start at around December 2007 or sooner if the candidate is available. The compensation will be based on the qualifications of the candidate. Excellent command of the English language is required (no other language is needed).

About the host institution: The Department of ECE of the University of Cyprus was established only in 2003, with the first graduating B.Sc. and M.Sc. students graduating in 2007. The department currently employs around 15 faculty and 30 doctoral students, and is on an expansion phase. The University of Cyprus is the first and largest public university of Cyprus, and is located at the capital, Nicosia. You can find more information at the department webpage: <http://www.eng.ucy.ac.cy/ECE/en/index.html>

NetReFound Partners: Except from the University of Cyprus, other partners of the project are the Centre for Research Technology Hellas (Greece), which is also the coordinator, the Technical University of Eindhoven (The Netherlands), the Ecole Polytechnique Federale de Lausanne (Switzerland), the VTT Technical Research Centre (Finland), and the Fraunhofer German-Sino lab (Germany). The postdoctoral fellow will have ample opportunity for visits and short stays at the other partners of the project.

Contact Info: Interested candidates should send, as soon as possible, by email (a) a cover letter with a brief statement of their research interests, (b) a CV (including list of publications), and (c) the contact information of at least three persons that can provide reference letters to Stavros Toumpis (toumpis@ucy.ac.cy) and Charalambos Charalambous (chadcha@ucy.ac.cy)

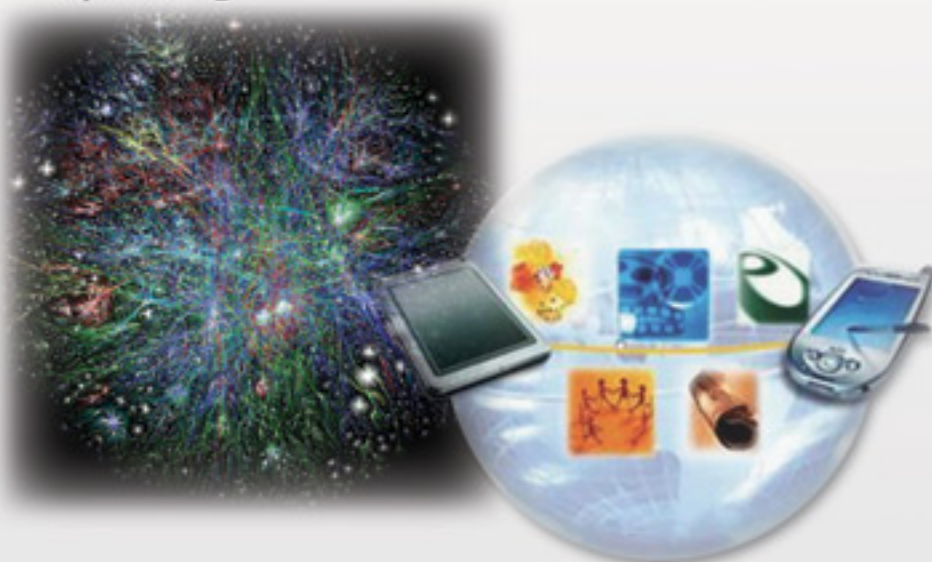
Current Challenges

A significant paradigm shift is expected to take place in the future and will shape the landscape of networking in ways beyond today's imagination. The main features of this paradigm shift are the following:

◆ **Sensorization:** In parallel to existing infrastructure, novel wireless overlay network paradigms will carry the prevailing portion of network traffic. Networking infrastructures will thus be enhanced by sensory devices and will evolve into a highly sophisticated "sensorized universe".

◆ **Suspension of bounds on information dissemination:** The absence of human intervention along the chain of data generation and processing will remove the aforementioned bound in information generation.

◆ **Autonomy:** Wireless devices will be organized within secluded communities and should act autonomously for individually optimal operation as well as network-wide optimality.



The Consortium



Centre Of Research And
Technology Hellas



Technical University
of Eindhoven



EPFL - Ecole Polytechnique
Fédérale De Lausanne



Fraunhofer German Sino
Lab for Mobile Comm
(part of FhG-HHI)



University Of Cyprus



VTT - Technical Research
Center of Finland

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NETwork REsearch FOUNDations

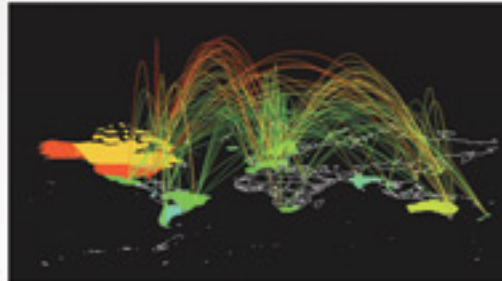
www.netrefound.org

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Project description

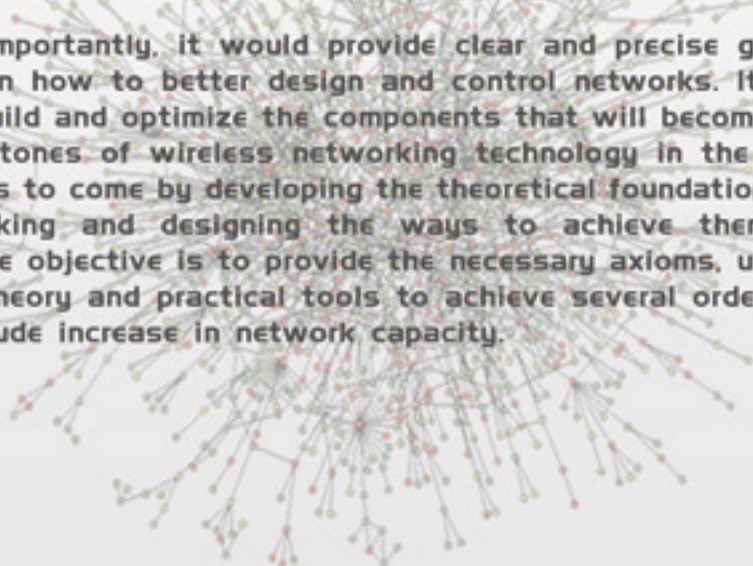
Data networks nowadays cover the planet and are growing increasingly complex as wireless devices with sophisticated modalities are integrated into the communication infrastructure. The objective



of NetRefound is to develop the theory, methods and algorithms suitable for modeling, analysis and design of future telecommunication networks. The long-term goal is the theoretical understanding of the collective interaction of a multiplicity of communicating nodes beyond the boundaries posed by specific telecommunication standards. This will lead to a quantitative characterization of the fundamental performance limits of these systems and eventually to algorithms for achieving them.

Envisioned paradigms can change the way we manage, operate and understand networks and foretell a deep impact in areas such as reliable information delivery, network resource sharing, efficient flow control, network monitoring and security. In order to understand and fully exploit the immense networking possibilities, novel research will lay foundations well beyond the currently existing network theory. In order to achieve that, we will borrow well established techniques from many existing disciplines such as control theory, statistics, economics, social sciences, physics, algorithms, communications theory, etc. The development of a novel network theory will result in a better understanding of how future complex networks will function.

More importantly, it would provide clear and precise guidelines on how to better design and control networks. It will also build and optimize the components that will become the cornerstones of wireless networking technology in the next decades to come by developing the theoretical foundations of networking and designing the ways to achieve them. The ultimate objective is to provide the necessary axioms, underlying theory and practical tools to achieve several orders of magnitude increase in network capacity.



Vision and Objectives

The vision of NetRefound is to come up with the machinery to achieve significant network capacity increase. This machinery will consist of axioms and theories for operating and controlling wireless networks as well as tools with which the performance limits are achieved. The research and technological activities of the project will aim at the following objectives:

- ◆ Identify and explore fundamental performance limits and tradeoffs underlying the operation of envisioned wireless network scenarios. To this end, a foundational theory will be developed.
- ◆ Design and evaluate the performance of tools, algorithms and mechanisms for achieving the promised performance limits under realistic constraints. In particular, network coding and tools from other disciplines will be used. This dimension also consists of ensuring fundamental features of future network paradigms, starting from network element autonomy and cooperation.
- ◆ Validate and assess the tools for achieving the promised objectives.



Expected Results

NetRefound will deliver the following results:

- ◆ Novel foundational aspects of wireless networks to push ultimate performance limits orders of magnitude beyond current ones.
- ◆ A multi-terminal network information theory for optimizing performance limits and enforcing optimal network control. Fundamental tradeoffs among capacity, delay and energy for optimal performance of wireless networks.
- ◆ Foundations and extensions on the technique of network coding to push further the performance limits of networks.
- ◆ Tools from other disciplines such as electromagnetism, optics, physics, information theory to optimize wireless network design, control and performance and use these tools as building blocks for novel network paradigms.
- ◆ Tools and techniques based on game theory and reputation for fortifying autonomous network entity operation in distributed environments.
- ◆ Yardsticks and measurable criteria against which progress will be measured.
- ◆ Experimental evaluation and validation of performance limits and of techniques to achieve them.

