

TITRE: Energy Conservation Algorithms (E-COAL)
EQUIPE/THEME: CombiAlgo / Algorithmique Distribuee
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MOTS-CLES: energy efficient communication protocols, dynamic networks
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DESCRIPTION du SUJET:

The main objective of this PhD project is the design of energy and time efficient communication protocols in modern type of networks. In particular, we would like to study robust (possibly randomised) energy efficient communication protocols resistant to dynamic changes in network topology, adverse conditions, irregular network performance or network intrusion.

In ad-hoc wireless environments network nodes acting as transmitters and receivers rely on very limited sources of energy. In turn, it is crucial that basic communication primitives such as routing, broadcasting [1], multicast, or synchronisation of local clocks operate protocols based on a reduced but adequate level of energy consumption. One of the greatest obstacles in ad-hoc networks is a lack of awareness or a very limited knowledge of network's topology. Thus it is important to seek appropriate trade-offs between reliability of transmissions (deliveries) and the response time. We will be especially interested in a comparative study of deterministic vs. randomised (probabilistic) energy efficient communication protocols.

In networks performing more complex applications significant energy savings can be accomplished by appropriate scheduling of energy-consuming tasks. For example, in a computer system, one can group tasks to be executed into a small number of contiguous blocks, allowing the system to be powered down in-between these blocks. The constraints that need to be taken into account include task deadlines that need to be met, short response time of tasks, as well as the overhead associated with restarting the system after power-downs [2,3]. Our intention is to extend this general strategy to scheduling workloads in more network

based applications.

The student will profit from being exposed to two different academic systems and from having an opportunity to work with researchers at the two leading European groups in algorithms and network communication. Supervision in Liverpool will be focused on algorithmic aspects of communication primitives, scheduling and processor power management mechanisms, in Bordeaux, on structural properties of networks and more complex network tasks.

[1] L. Gasieniec, E. Kantor, D.R. Kowalski, D. Peleg, C. Su, Time efficient k-shot broadcasting in known topology radio networks, Distributed Computing 21(2), pp. 117-127 (2008)

[2] X. Han, T. Lam, L. Lee, I. To, and P. Wong, Deadline scheduling and power management for speed bounded processors, Theoretical Computer Science 411 (40-42), pp. 3587-3600 (2010)

[3] T. Lam, L. Lee, H. Ting, I. To and P. Wong, Sleep with guilt and work faster to minimize flow plus energy, ICALP'09, pp. 665-676.