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From: Pietro Caputo <pietrocap@gmail.com>

To: random@mail.dm.unipi.it

Subject: [Random] PhD opportunity in Toulouse,
France

Ricevo e inoltro il messaggio relativo a una borsa di dottorato.

Gli interessati sono pregati di contattare Laurent Miclo entro il 6 giugno 2016

PhD opening

Title: Study of the CSMA-QB access protocol

Keywords: Convergence and long-time behavior of Markov processes, functional limit theorems, stochastic networks, independent sets

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Summary of the project

Context. The performance of wireless networks where users share the air as communication medium is strongly limited by the electromagnetic interference phenomenon: two users who are close and communicate on the same frequency will interfere, which may potentially lead to losing the information transmitted. Access protocols are here to mitigate this effect and thus play a key role in the performance of modern
From a scientific standpoint, this is a challenging problem that has attracted considerable attention from

both the computer science and applied probability communities for more than 30 years. Recently, a new class of access protocols – called adaptive CSMA protocols – has emerged, and which seems very promising.

These protocols were for instance shown to enjoy the very desirable property of being maximally stable.

The goal of this project is to advance the state-of-the-art on the particular adaptive CSMA protocols called CSMA-QB protocols (where QB stands for Queue-Based), which to date is very limited. In particular, we will aim to prove theoretical results that shed light on the achievable trade-off between throughput and delay.

Probabilistic model. From a technical standpoint, we will study the following model. Each user of the network is represented by the node of a graph G , called interference graph, and such that two neighboring nodes

cannot be active simultaneously. Packets to be transmitted arrive at each node over time, and the goal is

to choose which nodes are active at every moment.

CSMA-QB solves this problem in the following manner:

when a node is active, it de-activates at a constant rate and when it is active and none of its neighbors is, then it activates at a rate that depends on the number

of packets in its backlog. The dependency is given by a function ψ called activation function.

The general goal of the thesis is to understand the influence of the topology G and of the choice of ψ on the protocol performance. This involves classical probabilistic tools, and we will in particular study the mixing time of Glauber dynamic as well as the stochastic averaging property, both of which play a key role in the analysis of this protocol.