Abstract – Ph. D.Thesis

Proposal of new techniques for the efficient energy management in TDMA MAC protocols over MANETs

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The present thesis aims at proposing novel techniques and solutions to provide an efficient management of energetic resources of mobile hosts in the context of *Mobile Ad hoc NETworks* (MANETs). Energy issue is a very hot topic in this kind of networks, because the wide mobility requires that their hosts are battery-powered and have, then, limited energy resources. In addition to the sources of energetic overhead, like signaling, collisions, idle listening, energy consumptions are directly related to the basic network functionalities that are the transmission and the reception of data, so a trade-off regulates communication vs. energetic performances. Several mechanisms, techniques and protocols have been proposed in literature to reduce energy consumptions at different ISO/OSI levels. The Data-Link level, and particularly its sublevel MAC (*Medium Access Control*) that is basic for wireless networks, was chosen as main area to be investigated concerning energy consumptions and performance issues.

This thesis deals initially with a deep energetic experimental analysis of some interesting MAC protocols, comparing performances of the two main MAC protocols typologies: in particular IEEE802.11, that is the *de facto* standard for MANETs, among *contention-based* ones and E-TDMA (*Evolutionary Time Division Multiple Access*) among *conflict-free* ones. The very good results got from both energy and communication points of view led us to focus our attention on E-TDMA and generally on *conflict-free* protocols. Several simulation sets were conducted investigating the E-TDMA sensitivity to some of its design parameters in terms of energy consumptions.

These experimental analyses laid the foundation for the results got in the subsequent part that describes the main contributions of this thesis. They consist first of all in the modeling of energetic consumptions related to the phases which E-TDMA is composed of: one control epoch, with FPRP (*Five Phase Reservation Protocol*) and SU (*Schedule Update*) signaling run, and a certain number of information frames. Two novel energy-aware techniques, each for a particular E-TDMA phase, is proposed and tested in ns-2 simulator. In particular the model related to information period is extendible to all the TDMA protocols that have the same TDMA scheme as E-TDMA. The novel *energetic* E-TDMA overcomes results of original E-TDMA in terms of energy consumptions, without degrading its communication performances, for several simulation scenarios, even if in high traffic load conditions, validating the effectiveness of the proposed solutions.