**Francisco Vázquez Gallego** received his B.Sc. in Electronics Engineering (1995) and his M.Sc. degree in Telecommunication Engineering (2000) from the Universitat Politècnica de Catalunya (UPC). He has more than 15 years of experience in R&D, working in multidisciplinary projects for space and industrial applications. He has participated in the development and manufacturing of prototypes and flight equipment for the European Space Agency (ESA), within the micro-gravity field and life-support systems, in projects like MARES (Muscle Atrophy Research & Exercise System, for NASA/ESA), EPU (Experiment Preparation Unit, for ESA), High Resolution Digital Still-Camera for Aerial Photography (for Institut Cartogràfic de Catatalunya, ICC), HAEMOSCAN and MULTIGEN (for ESA). Francisco has a broad and proven experience in the design and implementation of Machine-to-Machine (M2M) networks, embedded systems, and electronics. Since January 2010, he is working at the M2M department of CTTC as Senior Researcher and collaborates in several industrial and public funded research projects. His main research interests are focused on wireless communications and include the design, theoretical analysis, modelling and implementation of energy-efficient protocols for wireless networks, MAC protocols, Distributed Queuing (DQ) access, M2M networks, and baseband digital signal processing algorithms (physical layer) in FPGA.

## Abstract

This thesis aims at contributing to overcome two of the main challenges for the deployment of highly dense wireless M2M networks in data collection scenarios for the Internet of Things: the management of massive numbers of end-devices that attempt to get access to the wireless channel; and the need to extend the network lifetime to reduce maintenance costs. In order to solve these challenges, two complementary strategies are considered. Firstly, the thesis focuses on the design, analysis and performance evaluation of random and hybrid access protocols that can handle abrupt transitions in the traffic load and minimize the energy consumption devoted to communications. And secondly, the use of energy harvesting (EH) is considered in order to provide the network with unlimited lifetime. To this end, the second part of the thesis focuses on the design and analysis of EH-aware MAC protocols, and proposes new performance metrics that take the variability and the unpredictability of the harvested energy into account.

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PhD Dissertation

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