# Chapter 6
# Conclusions

Low-power wireless technologies have been major enablers for pervasive computing applications as diverse as environmental monitoring, smart buildings, plant process control, structural health monitoring and more generically any application under the smart cooperating objects and "Internet of Things" umbrella. However, the scalability requirements typically imposed by such applications constrain the cost/energy per node to unprecedented levels. Namely, system designers are usually limited to use low-cost radio transceivers operating at the unlicensed ISM spectrum and with transmission powers two orders of magnitude smaller than commodity wireless technologies, as well as light ultra-compacted application, data processing and middleware software and protocol stacks to cope with very limited memory and processing capabilities. Therefore, communications typically tend to be unreliable and, worse than that, unpredictable.

On the contrary, the quality-of-service requirements of some of these applications are demanding and are expected to be fulfilled. The need for multi-hop routing (particularly in large-scale systems), the harsh environmental characteristics and the application dynamics (e.g. imposed by mobility) in many of these application scenarios turn this problem even more acute. In this line, effects such as noise, interference, shadowing and multi-path distortion need to be investigated, characterized and, if possible, mitigated.

This book aims at providing an overall picture of radio link quality estimation and interference aspects in low-power wireless networks. In this context, we have identified the main characteristics of low-power links, mostly drawn from empirical observations. Then, we analyzed the coexistence of different wireless technologies and interference sources operating in the ISM band and particularly focused on interference measurement, modeling and mitigation techniques. The fundamental concepts and a taxonomy of link quality estimation have been presented, as well as some guidelines for system designers. Building upon the RadiaLE framework, we have made a comparative performance evaluation of the most popular link quality estimators, both based on simulation (TOSSIM) and experimental models. Finally, we elaborated on how link quality estimation can be efficiently tuned and integrated in higher level mechanisms, namely routing and mobility, such that their performance is improved.

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