Radio Diversity and Resources Management for Wireless Sensor Networks

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Abstract

Providing reliable and time bounded package delivery in a wireless medium is critical for correct operation in a large number of relevant sensor network applications, like for example: industrial automation, remote health care, safety and access control, etc. Yet the uncertain nature of the wireless medium represents a notorious problem to take into consideration.

The ability to provide the desired quality of service (QoS) is closely related to the allocation of physical layer resources (e.g. spectrum, transmit power, coding and modulation scheme) and protocol and system related resources (e.g. buffers, protocol parameters like maximum number of transmission attempts, more generally the behavior of protocols).

Furthermore, we are interested in highly mobile systems which provide a significant challenge for any QoS guarantee, since the Wireless Channel, the interference situation and the topology can change rapidly. Concrete examples are mobile robots, persons carrying mobile body sensor networks and vehicular networks among others.

These new scenarios are characterized by inexpensive radio module architectures, low transmission power (e.g. 0 dBm in IEEE 802.15.4), often mobile and energy constrained devices communicating in increasingly crowded and lightly regulated ISM bands. Thus, packet delivery and timeliness guarantees come at the expenses of complexity, both in communication protocols and network infrastructure.

We aim to study the RF propagation and interference problems in these scenarios to optimize communication protocols and radio resources to achieve new performance trade-offs: reliable, power efficient, capable to adapt resource usage and thus provide the required communication features of these applications.