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Efficient Routing for the Extension of Lifetime and Quality of Energy Constrained Ad Hoc Networks

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Abstract. This paper presents two new routing algorithms for maximising the lifetimes of wireless energy-constrained ad-hoc networks. Our approach is based on the homogenisation of energy consumption in the network as opposed to the more traditional approach where the paths are chosen based upon highest energy. Results show the relative merits of the proposed schemes with respect to existing energy-aware protocols and clearly indicated that the two proposed algorithms enable full network connectivity to be maintained for longer. Additionally, the two algorithms mitigate against the effects of inevitable node outages caused by energy exhaustion and offer an improved likelihood of maintaining connectivity when nodes are lost by comparison with other previously proposed algorithms.
Keywords: Ad hoc routing, energy-aware routing, grid topology, energy homogeneity.

1 Introduction

Progressive technology advances have made it possible to build ad-hoc, low power, wireless sensor networks [1] of hundreds and even thousands of devices of low computation, communication and battery power. Potential uses of such devices are manifold. For example, such networks can be used to monitor large geographical areas in remote surroundings, factory and plants or chemical processes, home automation, and personalisation applications.

Typically, devices are battery powered and since every message transmitted and received and the associated computation performed drains the battery, care is required in the utilisation of power.

Power efficient routing algorithms are very important in wireless sensor networks, where communication costs are more expensive than computing costs [2]. Different power-aware routing protocols [3] define the cost as a function of the power required to transmit over links and