Battery and Power Aware Routing in Mobile Ad Hoc Networks

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Abstract. Ad hoc wireless networks are power constrained since nodes operate with limited battery. In this paper, it proposes the ad hoc network routing which considers both of power consumption and the amount of the battery remainder. To improve the availability of ad hoc networks, routing which considers both at the same time is needed though power consumption and the amount of the battery remainder have been separately examined in the research so far. We propose BPA-DSR (Battery and Power Aware enhancement to Dynamic Source Routing) which searches for the route by the flooding of two times. The path with large amount of the battery remainder is detected by the first flooding, and the location of the neighboring nodes of the route is computed from the received radio power at the same time. Each link of the route is divided into the power saving link and tuned up by the flooding of the second. Simulation results show that the amount of the battery remainder of the proposed method is better than other method (LP-DSR) which is aware of the power consumption. Power consumption of the proposed method is better than that of DSR though it is a little inferior to LP-DSR which detects the route of minimum power consumption. The number of hops of the detected route is suppressed to about 60% of LP-DSR.

Keywords: Ad hoc networks, power aware routing, battery aware routing, dynamic source routing.

1 Introduction

A Mobile ad hoc Network (MANET) is composed of a group of mobile wireless nodes that form a network independently of any centralized administration, while forwarding packets to each other in a multi-hop fashion. Since those mobile devices are battery-operated and extending the battery life has become as important objective, researchers and practitioners have recently started to consider power-aware design of network protocols for the Ad hoc networking environment. As each mobile node in a MANET perform the routing function for establishing communication among different nodes the “death” of even a few of the nodes due to energy exhaustion might cause disruption of service in the entire network.

In a conventional routing algorithm [1-5], which is unaware of energy consumption, connections between two nodes are established between nodes through

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the shortest path routes. This algorithm may however result in a quick depletion of the battery energy of the nodes along the most heavily used routes in the network. Recently a large volume of research has been conducted on the issue of energy efficiency for wireless networks [6-10]. Power aware routing protocols [6-8] are based on the metric that minimizes the total transmit power. Battery aware routing protocols [9-10] are based on the battery remainder. However, the research of the routing protocol which considered both of power consumption and the amount of the battery remainder was very few.

In this paper, we propose the ad hoc network routing which considers both of power consumption and the amount of the battery remainder. To improve the availability of ad hoc networks, routing which considers both at the same time is needed though power consumption and the amount of the battery remainder have been separately examined in the research so far. We propose BPA-DSR (Battery and Power Aware Dynamic Source Routing) which searches for the route by the flooding of two times. The path with large amount of the battery remainder is detected by the first flooding, and the location of the neighboring nodes of the route is computed from the received radio power at the same time. Each link of the route is divided into the power saving link and tuned up by the flooding of the second.

The rest of the paper is organized as follows. Section 2 reviews the related work. Section 3 presents an overview of our power aware routing. Section 4 describes our simulation model and discusses the simulation results. Section 5 concludes the paper.

2 Related Works

2.1 Power Aware Routing

Some routing protocols which focus to the power saving have been proposed. In general, the overall transmission power of the route is decreased by increasing the number of hops and decreasing the distance of one hop because transmission radio power is proportional to n (>2) power of the distance. PCDC (Power Control Dual Channel) [6] achieves high electric power efficiency by constructing the route by using only the power saving link. The power saving link of the node is direct link to the vicinity which is low power than the link with an indirect communication. And, the route is constructed only with the recognized power saving link. However, PCDC has the problem to need location information to recognize the power saving link and a lot of control traffic.

DPER (Directionality-based Power Efficient Routing) [7] is a protocol to decrease power consumption, which divides the space between the source and the destination into some areas, and select the node which can transmit the lowest power as the next hop from an adjacent area where it approaches to the destination. In DPER, the next hop which certainly approaches the destination is selected based on location information on the destination. However, the power efficiency might degrade according to the topology. Moreover, there is a problem which cannot be used if location information on all terminals is not already-known.

LP-DSR [8] is a routing method to enhance DSR. It floods putting power consumption information on the message of RREQ (Route Request). The sum of the