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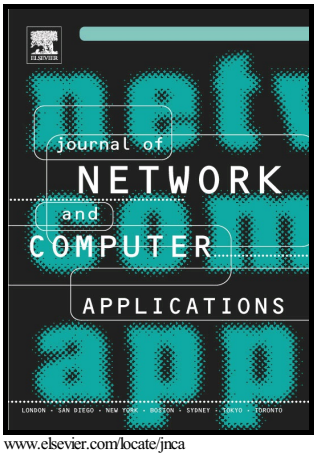

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Abstract

Opportunistic routing algorithms (ORAs) provide a feasible solution to transmit packets in intermittently connected scenarios, where links may be broken due to node mobility or power on/off. To make a smart forwarding decision, most of ORAs have to collect a large amount of control messages, however, few work has focused on how to collect such messages effectively and efficiently. In this paper, we first propose a new hierarchical message collection scheme, called ELECTION to improve the data forwarding performance. ELECTION employs part of the nodes to collect and diffuse the control message. We then design a greedy algorithm to select qualified nodes and theoretically prove that it can achieve the optimum with a probability at least $1 - 1/e$. Finally, by applying ELECTION on real data-sets, the simulation results show that ELECTION reduces cost remarkably compared to the state-of-the-art works, and improves the packet delivery ratio and delay sufficiently under different TTL requirements.

Keywords: message collection, routing protocols, data forwarding, mobile opportunistic networks

1. Introduction

Mobile opportunistic networks (MONs) have been initially designed to support data communications in challenging scenarios, where the infrastructure may be destroyed or does not exist at all. Recently, with the increasing popularity of portable devices, the researcher community pays more attention to the device-to-device (D2D) communications, where the unlicensed spectrums (i.e., 2.4 Ghz) are used to alleviate the heavy traffic in cellular networks. Lots of applications have been envisioned, ranging from the mobile data offloading [1] to the proximity-based services [2].

Opportunistic routing is a basic but key component in D2D communications. It uses a store-carry-and-forward scheme to transmit packets, that is, when a node encounters another node, the former forwards packets to the latter and the latter repeats the same process. In this manner, the packets will be eventually delivered to the destination after a long journey. To optimize this journey, many smart routing algorithms emerged in the past several years, such as the ProPHET [3], SimBet [4] and Hotent [5]. These protocols select qualified relays by employing various control messages including the forwarding probability, social features, or contact locations of nodes etc[1]. Obviously, how to collect such heuristics plays a big role in the routing performance. Existing works take an elaborate way to allocate packet copies, they however disseminate the control messages in an indiscriminate manner. That is, any two nodes can exchange the control message whenever they encounter each other, leading to a splurge on energy consumption and degenerating the routing performance. For example, ProPHET exploited the contact probability of nodes to make forwarding decisions. Only nodes with higher contact probabilities than current carri-

[1] Since different forwarding metrics generally use different information to guide route, we here use the term control message to describe them.