

# International Journal of Innovative Research in Science, Engineering and Technology

(A High Impact Factor, Monthly, Peer Reviewed Journal)

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Vol. 8, Issue 8, August 2019

## Channel State Information based Robust Relay Selection for Large-Scale Energy- Harvesting IOT Applications

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**ABSTRACT:** We consider the relay selection problem in large-scale energy harvesting (EH) networks. It is known that if channel state information (CSI) is available at EH relays, a diversity order equal to the number of relays can be obtained, however, at the penalty of a feedback overhead (necessary to obtain accurate CSI) which is not suitable for energy-limited devices intended, e.g., for Internet-of-Things applications. In this paper, we therefore propose a new EH relay selection scheme which is based on the residual energy at each relay's battery, and on information on the distribution of the channels between relays and the destination.

### I. INTRODUCTION

Typical wireless channels, however, suffer from multipath fading and shadowing, which significantly reduce communication capacity for a given average transmission power and hinder reliable transmission.[3] Although an effective option is to use multiple antennas to obtain spatial diversity gain, in practice, it is difficult equip small IoT devices with multiple antennas due to their size, complexity, and cost. Hence, another concept has been proposed: when the source cannot reliably communicate directly with its destination, other nodes temporarily serve as relays in order to support the communication.[3]

This cooperative diversity approach allows devices to enjoy spatial diversity gain without the need to equip them with additional antennas, and it has been shown that if sufficiently many relays are available, opportunistic relaying can attain a diversity order equal to the number of relays itself[4]. In opportunistic relaying, the best relay among those available is chosen based on the perfect knowledge of the instantaneous channel state information (CSI), where best is defined in terms of the corresponding instantaneous signal-to-noise ratio (SNR) at the destination. However, in a cooperative diversity system, relays consume their own battery order to support other nodes' communication, so that if multiple nodes drain their batteries at the same time, the network life-time or its topology may quickly deteriorate.[7]

### II. EXISTING SYSTEM

Symbol error rate (SER) of a cooperative network with EH relays was derived theoretically, and the advantages of opportunistic relaying was shown for the case in which the selection is based on the current available energy and the CSI[8]

### DRAWBACKS

If channel fluctuation is slow, there is a possibility that the same relay is selected repeatedly, so that its activity surpasses its ability to harvest energy to recharge, such that considering both the relays suitability and its energy state in the necessary selection process.

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A scheme based on the relative throughput gain of each relay and its Energy State Information (ESI) was proposed.[5] This method of relay selection was shown to improve short-term performance, since the harvested energy can be efficiently utilized.

## System Architecture

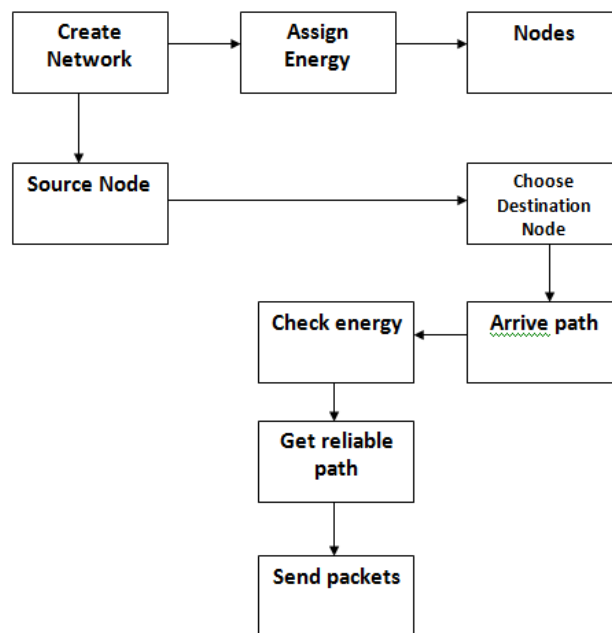


Fig. 1 System Architecture

## Modules

- Node deployment
- Neighbor discovery
- Energy aware routing
- Energy harvest

## Node deployment

We consider a wireless network with  $N$  nodes. Let  $N$  denote the set of all nodes in the network. The communication among all  $n$  nodes is based on a tree topology with the destination as the root. The tree is formed in the initial phase as follows. The destination first broadcast a message with a hop counter. The nodes receiving the message will set the message sender as the parent node, increase the hop counter by one, and broadcast it to their neighbours. Data are transferred along the edges in this communication tree.

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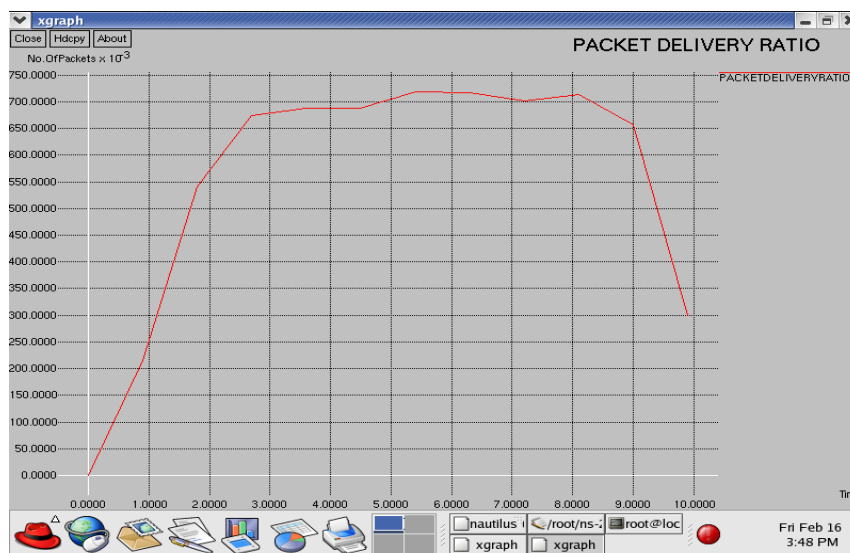
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## III. RESULT AND DISCUSSIONS

### Packet Delivery Ratio



The above graph defines the throughput in the initialization phase. The experiment was running 10 seconds of time. Throughput is the rate at which a network sends receives data. It is a good channel capacity of net connections and rated in terms bits per second (bit/s). The proposed system has high packet delivery ratio in the overall distributed time simulation than the existing system.

### Packet Loss

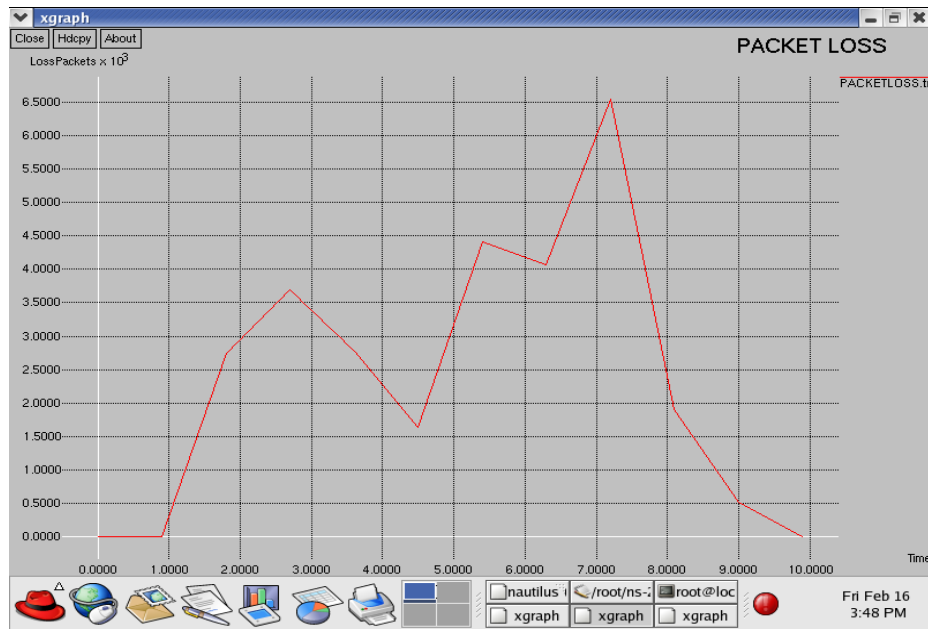
The above graph defines the packet drop in the initialization phase. The experiment was running 10 seconds of time. Packet Loss is where network traffic fails to reach its destination in a timely manner. Most commonly packets get dropped before the destination can be reached. Packet loss is same for both proposed system and exiting system.

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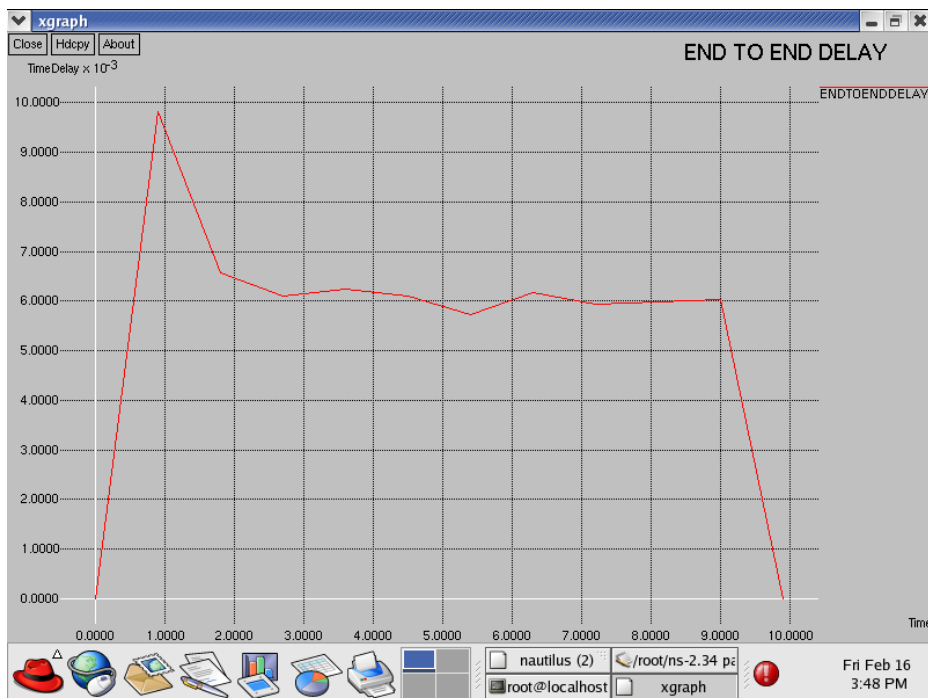
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## End to End Delay

The above graph defines the delay in network. The experiment was running 10 seconds of time. End to End Delay refers to the time taken for a packet to be transmitted across a network from source to destination. End to end delay of packets in proposed system found to little high that the existing system.



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## IV. CONCLUSION

- A new EH relay selection scheme that is based on a residual battery of relays and the CDI of both small-scale and large-scale fading. Furthermore, we derived a simple selection rule and a closed solution for the end-to-end outage probability.
- Proposed system can achieve a diversity order of one, even though each relay can exploit knowledge of the entire distribution between the destination and itself.
- These results show that if we wish to enhance the spatial diversity, it is important to obtain the instantaneous CSI.
- On the other hand, considering the practical limitations of IoT devices, proposed approach is still an attractive option that realizes low-power consumption and highly reliable communications.

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