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Effective Suppression of Unnecessary Hello Messages to Provide Energy Efficiency for On-Demand Routing Protocols In MANET

A. Ashokraj[1],A. Selvakumar[2]

Department Of Network Engineering, Arunai Engineering College, Tiruvannamalai, Tamilnadu, India

Department Of ECE, Arunai Engineering College, Tiruvannamalai, Tamilnadu, India

ABSTRACT: The aim of this project is to propose an adaptive Hello messaging scheme for neighbor discovery by effectively suppressing unnecessary Hello messages. The proposed scheme dynamically adjusts Hello intervals, and does not increase the risk that a sender will transmit a packet through a broken link that has not been detected by Hello messaging; we call this the probability of failure of detection of an unavailable link (*PFD*). To estimate this risk, we exploit an average event interval, that is, an average time gap between two consecutive events (i.e., sending or receiving a data packet) on a node. If a node is not involved in a communication for a given period, it does not need to maintain the status of the link; Hello packets broadcasted during this period are unnecessary. It will reduce the energy consumption. Ant colony optimization technique is involved in this paper for discover the neighbour node efficiently.

KEYWORDS: PFD, MANET, Ant Colony Optimization , Neighbour Node Discovery

I.INTRODUCTION

A mobile ad hoc network (MANET), sometimes called a mobile mesh network, is a self configuring network of mobile devices connected by wireless links. The Ad hoc networks are a new wireless networking paradigm for mobile hosts. Unlike traditional mobile wireless networks, ad hoc networks do not rely on any fixed infrastructure. Instead, hosts rely on each other to keep the network connected. It represents complex distributed systems that comprise wireless mobile nodes that can freely and dynamically self-organize into arbitrary and temporary, ‘‘ad-hoc’’ network topologies, allowing people and devices to seamlessly internetwork in areas with no pre-existing communication infrastructure. Ad hoc networking concept is not a new one, having been around in various forms for over 20 years. Traditionally, tactical networks have been the only communication networking application that followed the adhoc paradigm. Recently, the introduction of new technologies such as the Bluetooth, IEEE 802.11 and Hyperlan are helping enable eventual commercial MANET deployments outside the military domain. These recent evolutions have been generating a renewed and growing interest in the research and development of MANET.

A Mobile Ad-hoc network, or MANET, is a collection of wireless mobile hosts forming a temporary network. The construction of temporary networks with no wires, no communication infrastructure and no administrative intervention required. Such interconnection between mobile computers is called as Ad-hoc Network. In Latin, Ad-hoc literally means "for this" further meaning "for this purpose". Among the various network architectures, MANET has attracted a lot of attention. An ad-hoc network is a Local Area Network (LAN) that build spontaneously as devices connect. The network has no base stations, access points, remote servers, etc. Such constraints make routing a challenging task in MANET.

In such an environment each node may act as a router, source and destination, and forwards the packets to the next hop allowing them to reach the final destination through multiple hops. Each device in a MANET is free to move independently in any direction, and will therefore change its links to other devices frequently.

The network is an autonomous transitory association of mobile nodes that communicate with each other over wireless links. Nodes that lie within each other's send range can communicate directly and are responsible for dynamically discovering each other. In order to enable communication between nodes that are not directly within each other's send range, intermediate nodes acts as routers. These nodes are often energy-constrained, that is, battery powered devices with a great diversity in their capabilities. Devices are free to join or leave the network and they can move randomly, resulting in rapid and unpredictable topology changes.

II.RELATED WORKS

Previously, the author proposed two approaches for suppressing Hello messages when they are not required: an on-demand mechanism (reactive Hello protocol), and a monitoring activity mechanism (event-based Hello protocol). The reactive Hello protocol enables Hello messaging only when it is demanded using a Hello request-reply mechanism, but increases delay due to additional packet exchange before communication. The event-based Hello protocol enables only active nodes (i.e., those either sending or receiving data packets) to broadcast Hello packets based on a threshold called an activity timer. However, a threshold that is set too high rarely reduces the Hello messaging overhead, whereas a low threshold results in local connectivity information loss. Thus, there is an outstanding need to effectively suppress unnecessary Hello messaging while minimizing the risk of losing local connectivity information.

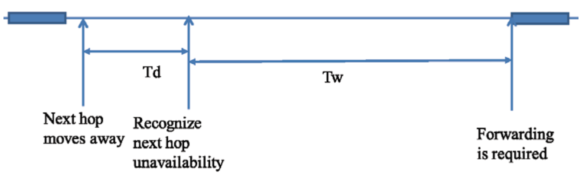

Fig. 1. The time parameters of the link connectivity.

AODV and DYMO protocols are modified into AODV-AH and DYMO-AH (adaptive hello). The ideal behavior of a network regarding local link connectivity is that if a node moves away, its neighbor nodes recognize a link failure before a packet to send arrives. T_d represents the time for link failure detection based on periodic Hello packet messaging.

The average T_d is given as

$$T_d = (ALLOWED\ HELLO\ LOSS - 0.5) * HELLO\ INTERVAL$$

A conventional scheme updates link availability information as soon as it recognizes a link failure with one of its neighboring nodes. However, link failure information does not actually need to be updated until its neighbor is involved in communication such as forwarding a packet. T_w represents the time interval between when a link failure is recognized and when the link is actually needed. During T_w, multiple Hello packets are superflous. Moreover, if a node has moved into an area where no active nodes are in its neighborhood and keepsbroadcasting Hello packets, energy is consumed unnecessarily. To avoid this problem, Hello packets should be suppressed .

The proper solution, however, depends on determining the correct Hello interval. Here, only case (1) can incur a link error. In case (2), the link availability does not need to be updated. To prevent a link error in the former case, the sender must know the availability of its link to the next hop node prior to forwarding a packet. In other words, the link connectivity information from the next hop node obtained by the last received Hello packet should be valid or refreshed before a packet is forwarded. Setting the *HELLO INTERVAL* without considering the event interval of a node can increase the risk of sending a packet through an unavailable link.

III.EVALUTION

Ant colony optimization technique involved in this paper to provide effective aproach on neighbour node discovery. swarm intelligence is a relatively new approach to problem solving that takes inspiration from the social behaviors of insects and of other animals. In particular, ants have inspired a number of methods and techniques among which the most studied and the most successful is the general purpose optimization technique known as ant colony optimization. Ant colony optimization (ACO) takes inspiration from the foraging behavior of some ant species. These ants deposit pheromone on the ground in order to mark some favorable path that should be followed by other members of the colony. Ant colony optimization exploits a similar mechanism for solving optimization problems. From the early nineties, when the first ant colony optimization algorithm was proposed, ACO attracted the attention of increasing numbers of researchers and many successful applications are now available. Moreover, a substantial corpus of theoretical results is becoming available that provides useful guidelines to researchers and practitioners in further applications of ACO.

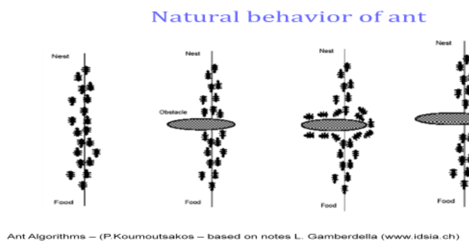

Fig.2. Behaviour of ant

The model proposed by Deneubourg and co-workers for explaining the foraging behavior of ants was the main source of inspiration for the development of ant colony optimization. In ACO, a number of artificial ants build solutions to the considered optimization problem at hand and exchange information on the quality of these solutions via a communication scheme that is reminiscent of the one adopted by real ants. Different ant colony optimization algorithms have been proposed. The original ant colony optimization algorithm is known as Ant System [6]–[8] and was proposed in the early nineties. Since then, a number of other ACO algorithms were introduced. The steps are involved in ACO, Span adaptively elects "Coordinators" from all nodes in the network. Span coordinators stay awake constantly and perform multi-hop packet routing within the ad hoc network. while other nodes remain in power –saving mode and periodically check if they should wake up and become a coordinator. Span achieves four goals.

A. it ensures that enough coordinators are elected so that every node is in radio range of at least one coordinator.
ii) it rotates the coordinators in order to ensure that all nodes share the task of providing global connectivity roughly equally.
iii) it attempts to minimize the number of nodes elected as coordinators, thereby increasing network lifetime, but without suffering a significant loss of capacity or an increase in latency.
iv) it elects coordinators using only local information in a decentralized manner, each node only consults state stored in local routing tables during the election process.

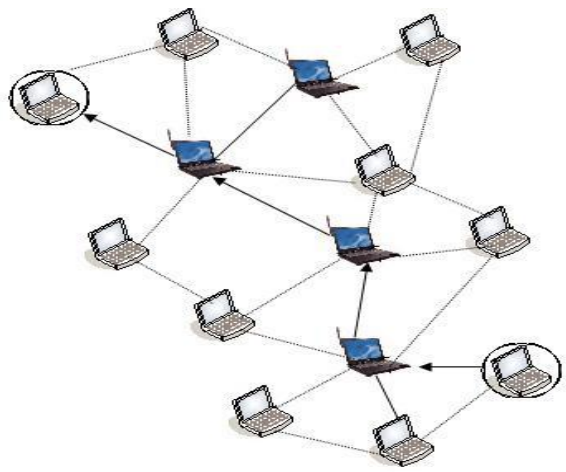

Fig.3. node connection


Source and Destination nodes


Coordinator nodes


Non-coordinator nodes

For Designing a Span involves following three operations as

1. Coordinator Election
2. Coordinator Announcements
3. Coordinator Withdraw

ACO is simulated and analyzed using the network simulator 2 to provide energy efficient results.

IV. SIMULATION

A. *Energy Efficiency*

We Compute the energy consumed in the simulation and compute how much lower this is than the same simulation with unmodified AODV. We calculate the percentage energy saved as $(Er-Es)/Er$ where Er is the total energy consumption for unmodified AODV and ABIRP

B. *End to End delay*

This includes all possible delays caused by buffering during route discovery latency, queuing at the interfaces, queuing transmission delays and propagation and transfer times of data packets. This is the average overall delay for a packet to traverse from a source node to a destination node.

C. *Packet Delivery Ratio*

It is the percentage of ratio between the number of packets sent by sources and the number of received packets at the sinks or destination. This performance evaluation parameter measures effectiveness, reliability and efficiency of a protocol. In this paper exhaustive simulation experiments are carried out with different mobility rates for comparison among ABIRP, and AODV.

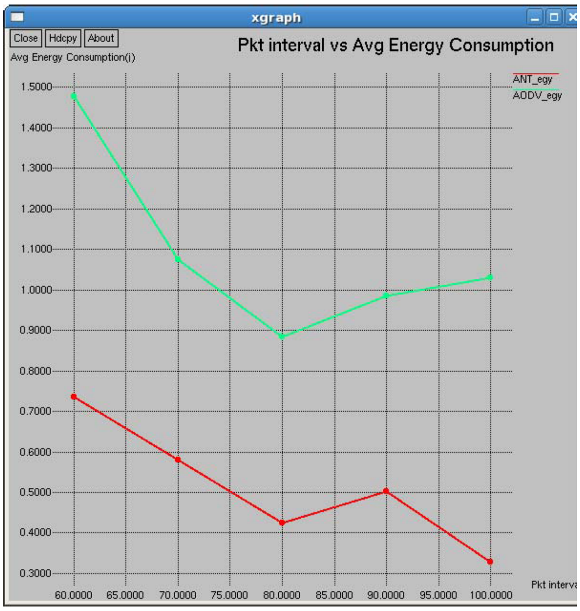

Fig. 4.Packet interval VS Average Energy Consumption

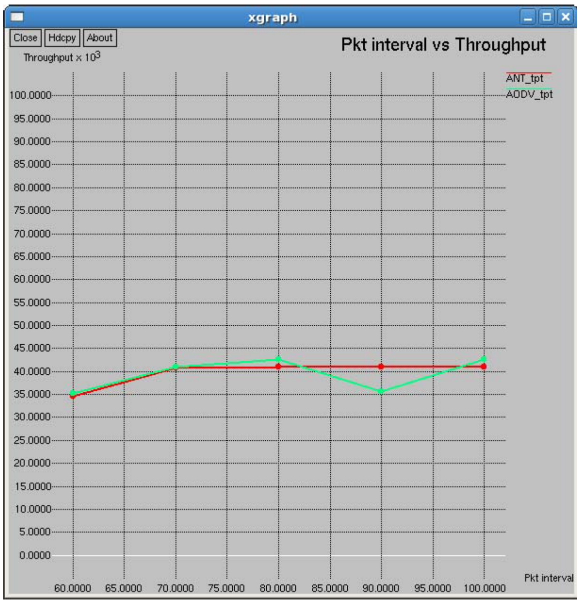

Fig. 5. Packet Interval VS Throughput

V. CONCLUSION

In this project we proposed an adaptive Hello interval to reduce battery drain through practical suppression of unnecessary Hello messaging. Based on the event interval of a node, the Hello interval can be enlarged without reduced detectability of a broken link, which decreases network overhead and hidden energy consumption. A conventional scheme updates link availability information as soon as it recognizes a link failure with one of its neighboring nodes. However, link failure information does not actually need to be updated until its neighbor is involved in communication such as forwarding a packet. Ant colony optimization technique is involved in this project to effectively discover the nighbour node which is used to adoptively supress the unwanted hello messages. We modified AODV with the proposed scheme, which we called AODV with adaptive Hello (AODV-AH).

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