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An Efficient Secure Data Transmission for Adaptive Hello Messaging Scheme in Manet

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***Abstract*: In mobile ad-hoc networks, a hello protocol is generally used to maintain neighbor relationship between the nodes. According to this, each node broadcasts hello packets at regular intervals to discover its intermediate nodes to forward a packet. When the node moves into an inactive region, the transmission of hello packets to those nodes get wasted which results in energy loss. In this paper, We implement a dynamic hello protocol to suppress those inessential hello packets without affecting the link failure detection. Our simulation results implies that the proposed design decreases the energy consumption and delay without any major difference in throughput.**

***Index terms*—Hello protocol, Mobile ad-hoc network, Neighbor relationship, Energy consumption.**

I. Introduction

Mobile Ad-hoc Networks (MANET) does not lie on a fixed infrastructure for its operation. It is an autonomous transitory association of mobile nodes which communicates each other over wireless links. Nodes that rely within each other's send range can communicate directly and are responsible for dynamic route discovery. To enable connection between several nodes which are not in range, neighboring nodes acts as routers. These nodes are often energy constrained. In this energy constrained, dynamic, distributed multi-hop network, nodes organize themselves dynamically to provide route establishment.Eventhough mobile devices are in off condition, the energy is consumed by No sleep energy bugs [9] .Similarly in MANET, the energy of nodes get drained when they move out of range. Many energy conserving hello messaging schemes were introduced [6] following the dynamic network topology [8]. Those schemes doesn't describes the time of execution [6].Ad-hoc On Demand Distance Vector(AODV) is used for route discovery and maintenance in which the control packets of route request (RREQ) and route reply (RREP) are exchanged between the nodes. It leads to excessive bandwidth and energy consumption. Two hello protocols were discussed to restrain the inefficient hello packets [4]: a reactive hello protocol and a event based hello protocol. Reactive hello protocol exhibits hello messages only to the demanding nodes using control packets (req-reply) which leads to network overhead. Event based hello protocol provides hello messages to the nodes which are in communication range based on threshold time. High threshold results in less delay whereas low threshold results in neighbor information loss.

This paper proposes a dynamic hello interval for route establishment by restraining the hello messages. It regulates the hello interval conservatively without reducing the probability of link failure detection. We implement an average event interval i.e. the time gap between two continuous events (transmission or reception of packets) to notice the communication between nodes. The broadcast of hello packets get wasted when a node doesn't participate in communication. Our proposed system uses a constant risk level for suppression of hello messages. If we are increasing the event interval, the hello interval can also increase without increasing risk of sending a packet through an unavailable link.Therfore hello messages get restrained. Simulation results show that our proposed scheme reduces energy consumption without any overhead.

II. OVERVIEW OF AODV

AODV is an on-demand routing protocol where routes are established only as needed.When a route is needed, it uses a route discovery process to understand a route. Once it determines a route,it is maintained as long as it requires by a maintenance procedure.It uses a software state approach to maintain routes: if a route is not in use, it expires after a specified time.It may use one of the two methods for link failure detection:link layer feedback or hello messages.Due to difficulty in obtaining link layer feedback,it uses hello messages.

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A. Hello messages

Network connectivity may be determined through the reception of broadcast control messages. Any broadcast control message also serves as a hello message, indicating the presence of a neighbor as shown in fig 1. When a node receives a hello message from its neighbor, it creates or refreshes the routing table entry to the neighbor.To maintains connectivity, if a node has not sent any broadcast control message within a specified interval, a hello message is locally broadcast. This results in at least one hello message transmission during every time period. Failure to receive an hello message from a neighbor for several time intervals indicates that neighbor is no longer within transmission range, and connectivity has been lost.

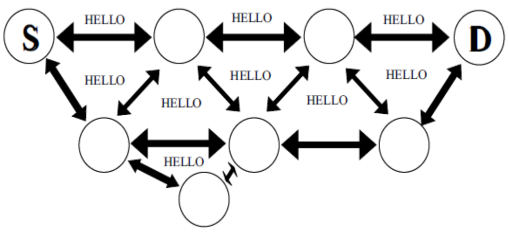

Fig 1.Broadcast of Hello messages

Two variables control the determination of connectivity using hello messages: HELLO_INTERVAL and ALLOWED_HELLO_LOSS.HELLO_INTERVAL specifies the maximum time interval between the transmission of hello messages ALLOWED_HELLO _LOSS specifies the maximum number of periods of HELLO_INTERVAL to wait without receiving a hello message before detecting a loss of connectivity to a neighbor. The recommended value for HELLO _INTERVAL is one second and for ALLOWED _HELLO LOSS is two . In other words, if a hello message is not received from a neighbor within two seconds of the last message, a loss of connectivity to that neighbor is determined.

B. Route Discovery

When a source needs to send packets to a destination, it first must determine a path for communication. The source node begins route discovery by broadcasting a route request (RREQ) message containing the IP address of the destination. When an intermediate node receives the RREQ, it records the reverse route toward the source and checks whether it has a route to the destination. If a route to the destination is not known, the intermediate node rebroadcasts the RREQ. When the destination, or an intermediate node with recent information about a route to the destination, receives the RREQ, a route reply (RREP) is generated.

The RREP is unicast back to the source using the reverse route created by the RREQ. For example, in this figure two nodes have recent information about the destination because hello messages are being used. These two nodes unicast a RREP to the source. As the RREP propagates toward the source, a *forward route* to the destination is created at each intermediate hop. When a RREP reaches the source, the source records the route to the destination and begins sending data packets to the destination along the discovered path. If more than one RREP is received by the source, the route with the lowest hop count to the destination is selected.

C.Route Maintenance

When a link breaks along an active path, the node upstream of the break detects the break and creates a route error (RERR) message. The RERR message lists all destinations that are now unreachable, due to the link break. The node then sends the RERR message toward the source. Each intermediate hop deletes any broken routes and forwards the RERR packet toward the source. When the source receives the RERR packet, it determines whether it still needs the route to the destination. If so, the source creates a RREQ and begins the route discovery process again.

III. TIME ANALYSIS OF LINK CONNECTIVITY

The basic principle behind the local link connectivity shows that when a node moves out of range, its intermediate nodes will detects its link failure before the transmission of packet. Figure 2 explains the time analysis of local link connectivity. Traditional scheme updates its routing information through the intermediate nodes immediately after detecting a link failure. But there is no need of updation until its intermediate node is in need to transmit a packet. DuringT_w, multiple hello packets are broadcasting.

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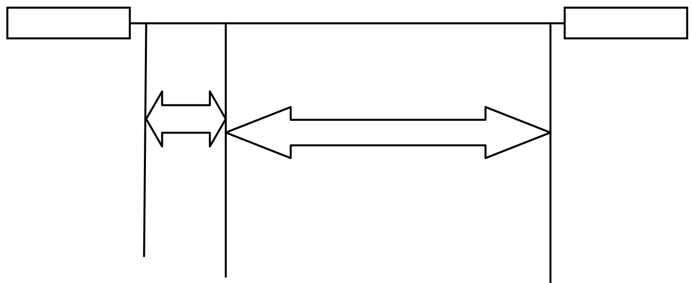

Fig 2.Time analysis

T_d - Time for detection of unavailable link
T_w - Time gap between the link failure is detected and the link is needed

The average T_d is given as

T_d = (ALLOWED_HELLO_LOSS*0.5) * HELLO_INTERVAL (1)

Also if a node moves beyond the coverage area where its neighboring nodes are not in active communication and still broadcasting hello packets continuosly,the battery of the nodes get drained. To overcome this, those hello packets should be suppressed by finding an exact hello interval.

A.Design of dynamic hello interval

Let us consider an event interval whose transmission of packets occurs between two sender and its neighbor. There are two possible situations emerges when the neighbor node moves out of range. (1) The sender is in need to transfer packet. (2) The sender is not in need to transfer. Case (1) causes a link failure. In case (2) there is no need for updating the routing information. To overcome the link failure, the sender must have the routing information before forwarding a packet. The HELLO_INTERVAL should be set by referring to the event interval to reduce the risk of packet transmission through unavailable route. Analyze the distribution of packet transmission of 50 nodes. We find many event intervals are less than a constant HELLO_INTERVAL (1sec) and the hello interval is not changed, if it is less than constant HELLO_INTERVAL.The Cumulative Distributed Function of 50 nodes is shown in the figure. In that, all the traffics follows an exponential distribution where x>1.

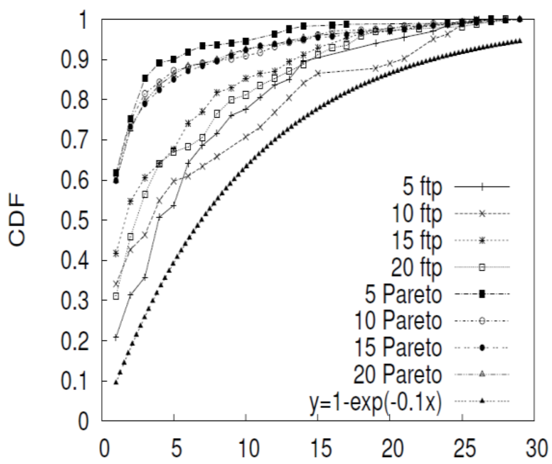

Fig 3. Distribution of event interval

The cdf of x can be written as

$$F(x,\beta) = 1-e^{-x/\beta} \quad \text{where } x>1 \qquad (2)$$

By using exponential distribution, we can predict the probability that an interval is larger than a given interval. This result provides an upper bound. So the probability that an event occurs after a given interval can be neglected. This analysis can be used to adjust the hello interval conservatively.

Traditional hello protocol uses a default the probability of failure of detection of an unavailable link (P_{FD}) which can be varied with respect to β. Here we use P_{FD} as a fixed value (=P_{FD})and make it into a variable. Thus the hello interval can be adjusted with respect to the event interval dynamically. We can equate

$$F(x,\beta) = P_{FD}.$$

Therefore,

$$1-e^{-x/\beta} = P_{FD} \qquad (3)$$

It can be written as

$$x= -\beta \ln (1-P_{FD}) \qquad (4)$$

As the β increases, the event interval also increases. We can use this βto estimate the correct hello interval to minimize the unwanted hello packets. P_{FD} will be smaller in equation (4) since it is the upper bound of an exponential distribution.

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IV. EVALUATION

Our proposed scheme modified the AODV and DYMO.We call this as AODV with dynamic hello(AODV-DH) and DYMO with dynamic hello(DYMO-DH).this section depicts the effect of the proposed scheme on energy use,throughput,Hello packet ratio within various parameters such as node intensity,mobile speed and node density.

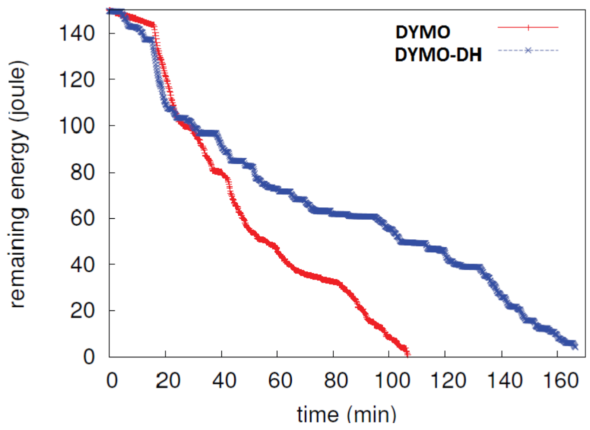

Fig 4. Energy comparison

Figure 4 shows the comparision of energy consumption between DYMO and DYMO-DH.Each node initially has 150 joules. After certain time, DYMO consumes energy quickly. Since the proposed scheme reduces the number of inessential hello messages, energy is saved due to less transmissions and receptions.

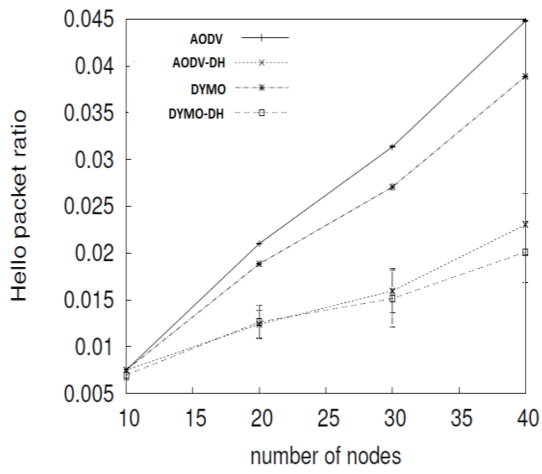

Fig 5.Hello packet overhead

Figure 5 shows the Hello packet ratio. As the number of nodes increases, the hello packet ratio also increases since the number of hello packet broadcasters and the number of received packets increases.

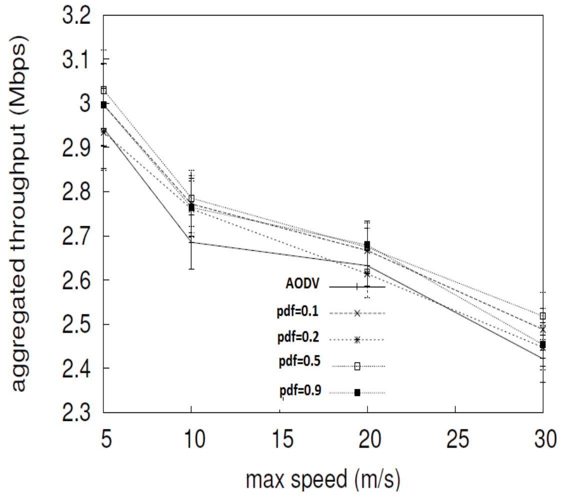

Fig 6. Throughput

Figure 6 depicts the throughput for various speeds and P_{FD}. since the number of affected links is small, high P_{FD} does not make any major changes in throughput. That is successive packets will be forwarded through a valid link. Due to quick

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reset to a default value, there is no throughput drop compared to the existing scheme.Thus high throughput can be obtained.

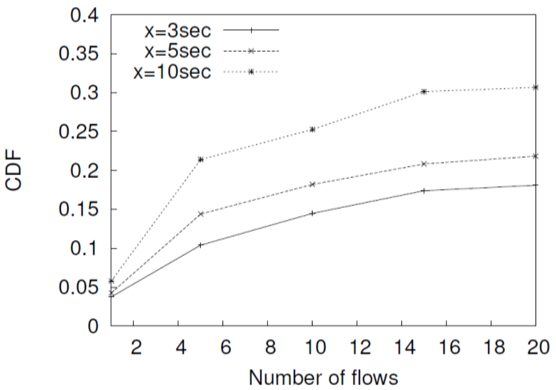

Fig 7.Cummulative distribution

Figure 7 shows the comparision of cdf over number of flows. The cdf of active nodes during **x** seconds are shown. When the number of flows is 10 and x=3sec,85% of nodes do not involve in communication in the recent 3 sec.This reveals that large number of nodes uses longer hello interval.

V. CONCLUSION

This brief aims at reducing the energy consumption by restraining the inessential hello messages. Considering the event interval, the hello interval can be increased without reducing the probability of link failure detection, which reduces the delay and hidden energy consumption.

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