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Local Connectivity of MANETs using AODV protocol with hello interval

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Abstract— **Mobile ad-hoc network (MANET) technology is an essential piece in the path towards a ubiquitous Internet. MANET routing protocol parameter configuration should be further analyzed since it may significantly impact network performance. In this paper, we perform test the local connectivity in MANETs using the Ad-hoc On-demand Distance Vector (AODV) routing protocol. We study the influence of the protocol with hello interval and variation in mobility speed and measure the impact on power consumption and control overhead on both environments in static as well dynamic, suggesting that usage of different settings from those proposed by default increase reactivity after changes with small impact power consumption on network.**

Index Terms— **MANET, AODV, Link connectivity , Performance , Hello messages.**

I. INTRODUCTION

In recent years the use of wireless technology has become increasing popular. A mobile adhoc network has mobile nodes that can communicate with other nodes through wireless links without any infrastructure.Infrastructure-less (ad hoc) networks they do not rely on any stationary infrastructure. The nodes in adhoc networks are mobile and can be connected dynamically in an arbitrary manner. The creation/deletion of nodes dynamically will leads to link breakage very fast. Nodes have to active at all the time either they are in the communication or not. Due to dynamic topology, nodes itself acts as a router as well as host. MANETs are infrastructure less, they support dynamically changing topology, they utilize multi hope routing, they are self organizing and self administrating. Each node in such networks behaves as a router and takes part in discovery and maintenance of routes to other nodes .

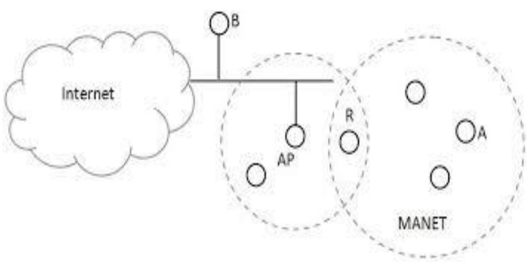

Fig 1: Example of MANET architecture

There are several routing protocols for MANET, although very few are standardized. Routing in MANET is a difficult issue as several factors affect the stability of the network and make the topology highly dynamic. The routing protocols in MANET use several mechanisms to keep track of the changes in the network, for example, link layer sensing of the wireless links, or the usage of Hello messages at the routing level, which is referred to as soft state signaling.In soft state signaling, a node periodically broadcasts Hello messages to keep track of valid links and also to advertise its presence in the network. Traditional protocols use a fixed time interval to send these Hello messages, which is not optimal. For example, if the nodes in a network do not move, the links of the nodes will not change; so sending Hello messages at a fixed rate will only cause unnecessary overhead in the network. On the other hand, if the nodes are moving too fast, sending Hello messages at a fixed rate might advertise the links too late; so when a node sends a packet to a neighbor, that neighbor might not be in the same position anymore, in which case the packet will simply be dropped. The node will then have to exchange more messages to find a way to route the pending packets. In this paper, we can vary the Hello interval to different value with variations of mobility.To verify the effectiveness of the proposed scheme, we evaluate its performance using the network simulator qualnet6.1. The rest of this paper is organized as follows. In Section 2, we give an overview of AODV protocol and link connectivity mechanisms. Section 3 describes the simulator parameter, scenarios used .Section 4 describes the result and discussions .Finally, conclusions and future work are presented in Section 5.

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II. BACKGROUND:LINK CONNECTIVITY MAINTENANCE IN AODV

This section starts with a brief overview on AODV and a description of the Hello message based mechanism for link connectivity maintenance in this protocol. For further details, the reader may refer to the aforementioned reference.

A. *Protocol overview*

Adhoc on demand vector routing protocol

AODV is an adhoc on demand reactive routing protocol. Routing Procedure in AODV consists of two parts, i.e. Path discovery and Path maintenance. AODV uses RREQ (Route Request) and RREP (Route Reply) for discovery of a path while Hello messages and a RERR (Route Error) for route maintenance. To determine whether the routing path is fresh or not, it uses Sequence number. AODV path discovery process uses both the broadcasting and unicasting . As it is an on demand protocol, so whenever a source node has to send data to the destination node, but there is no path exists in its routing table or path is out of date then the source node would broadcasts the RREQ message to all nodes [Liu Chao. Et al., 2007]. Each node receiving a RREQ message will check its own table entry while there exists in the path or not. If the path exists, it will check the contents of the entry to determine whether the path is fresh or out of date by comparing the destination sequence number (a larger sequence number indicates fresh root) if it is larger than the intermediate node will send RREP otherwise it will again broadcast the RREQ message to its neighboring node. The format of RREQ and RREP messages is given in Table 2.1, 2.2. The path maintenance process of AODV works as each node by sending its entire neighboring node a Hello message periodically. If any node does not receive a Hello message from its neighboring node, then it will send a RERR message. Each node receiving a RERR message will remove the corresponding node entry from their routing table. AODV has significant features and an excellent routing process but still there is problem in network communication. In AODV the default value of hello interval is 1sec. But the performance of the network is affected when the value of hello interval is low or high, and also when default value either in static or in dynamic networks. So there's a need to rework on AODV to make it intelligent so that communication between networks is faster.

Table 2.1: RREQ Message [Liu Chao et al.,2007]

RREQ ID	Destination Sequence Number	Source Sequence Number	Destination IP Address	Source IP Address

Table 2.2: RREP Message [Liu Chao et al., 2007]

Destination IP Address	Source IP Address	Source Sequence Number	Destination Sequence Number

B. *Connectivity maintenance: relevant parameters*

We focus on the AODV parameters that control the Hello message link failure detection mechanism: ALLOWED HELLO LOSS and HELLO INTERVAL .The maximum time interval between the transmissions of hello messages is Hello_Interval. After receiving hello message from neighbor, if no packet is received by a node from that neighbor for more than ALLOWED_ HELLO_LOSS * HELLO_INTERVAL time, the node should assume that link is currently broken.Hello_Interval is one of the parameter by which we can find that the neighbor node is in communication or not in active path of network .The format of hello message given in Table 2.3.

Table 2.3: HELLO Message [Krunal Patel et al., 2011]

Destination IP Address	Life time	Hop Count	Destination Sequence Number

Lifetime value is determined by two variables: ALLOWED_HELLO_LOSS and HELLO_INTERVAL that controls connectivity of neighbors. The default value of HELLO_INTERVAL is 1 Sec. And ALLOWED_HELLO_LOSS is 3 packets written in the protocol's header file.

III. Simulation Parameters

To perform the simulation the following parameters are considered

Table 3.1: **Simulation Parameters**

Parameters	**Value**
Simulator	QUALNET 6.1
Data Packet Size	512 bytes
Simulation Time	101 Sec
Environment	1000*1000
Number of Nodes	4
Routing Protocol	AODV
Energy Model	Mica Motes
Number of Packets Sent	100
Traffic Type	CBR
Mobility Model	None/Random way point
Mobility Speed	10,20,30,40,50 m/s
Hello interval	0.05,0.1,0. 2, 0. 5,0. 7,1,1.2,1.5,1.7,2,5 Sec

A. *Simulation Scenario for Impact Measurement*

We have conducted simulation by varying the Hello interval and mobility speed and measure the performance of the network. For this we have conducted 3 simulation scenarios:

Scenario1: hello interval disable in dynamic network.
Scenario 2: hello interval variations in static network.
Scenario 3: hello interval variations in both static and dynamic networks.

B. *Simulation Scenario for local connectivity*

We have conducted simulation by varying the hello interval as well as mobility speed and measured the performance metrics (like total energy consumption, control overhead) under the application CBR (constant bit rate). In order to implement the investigating local connectivity methodology, first of all an environment of 1000*1000 size is created in QUALNET simulator.The impact is studied and analyzed, observing which value of hello interval other than the default gives the better network performance in both environments i.e. Static and dynamic..

IV. Results and Discussion

In this paper work a number of simulation experiments are conducted in order to the local connectivity of MANETs using hello interval. The hello interval and mobility speed is varied to identify which value of hello interval other then default value gives the better network connection. The impact of different values of hello interval and mobility speed is analyzed below.

A. Local connectivity in static and dynamic environment
The Total energy consumed:

a) Hello message disable in static and dynamic network

In Figure 4.1 x-axis represents mobility speed variable and y-axis represents the total energy consumed during data packet transmit and received. when the mobility speed is none the total energy consumed is .013 but as the mobility speed increases the energy consumption also increases, As the hello message are disable in highly dynamic network the total energy consumption increases .

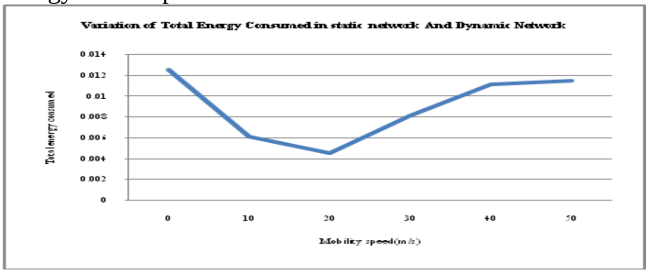


Fig. 4.1: Variation of Total energy consumption in static and dynamic network when hello message disable.

b) Hello interval variations in static network:

In Figure 4.2, x-axis represents the variation of hello interval and the y-axis represents the total energy consumed by nodes during transmission and receiving of data packets in static network. As the value of hello interval increased the energy consumption in static environment is decreased.So energy consumption is in transmission of hello message is decreased.

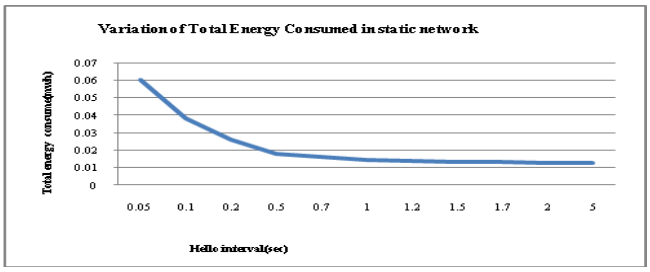
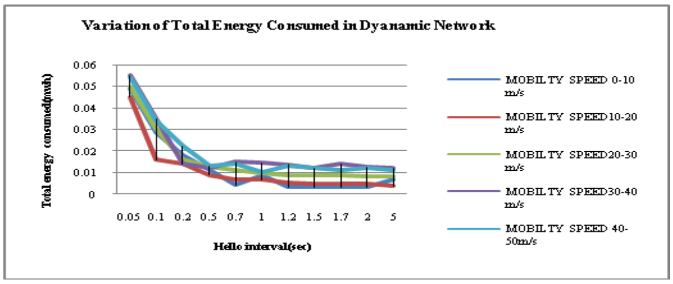


Fig. 4.2: Variation of Total energy consumption in static network with hello interval

c) Hello interval varies with Dynamic network

In Figure 4.3, x-axis represents variation in hello interval and y-axis represents the total energy consumed by nodes during Transmission and reception of data packets. .In a highly dynamic network when the value of hello interval is low more energy is consumed as compared to less dynamic network (or static network). As the value of hello interval is increases the energy consumption decreases due to less transmission of hello messages.

Fig. 4.3: Variation of total energy consumption in dynamic network with hello interval.



V. CONTROL OVERHEAD:

A. Hello interval disable in static and dynamic network:

In Figure 4.4 x-axis represents mobility, speed variable and the y-axis represents the Control overhead with mobility speed variation. When hello interval is disable, in static network control overhead is 0.008and in dynamic network control overhead is high at low mobility, speed and as mobility, speed increases the control overhead is decreased due to no hello message transmission.

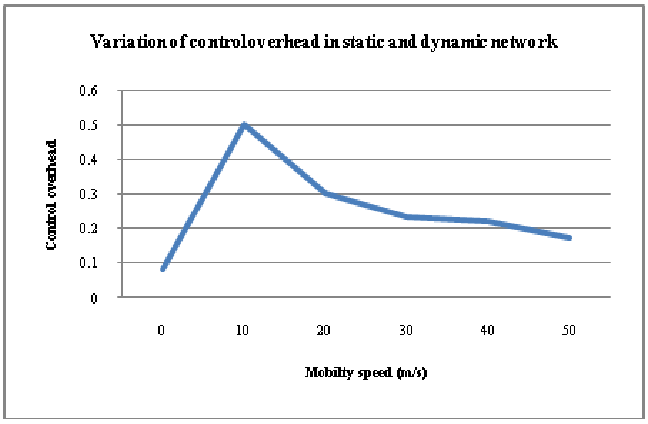


Fig. 4.4: Variation of control overhead in static and dynamic network when hello message disable.

B. Hello interval variations in static network:

In Figure 4.5, x-axis represents the variation of hello interval and y-axis represents the control overhead in static network. As the value of hello interval increased the control overhead is decreasing due to more time interval between two hello messages sent.

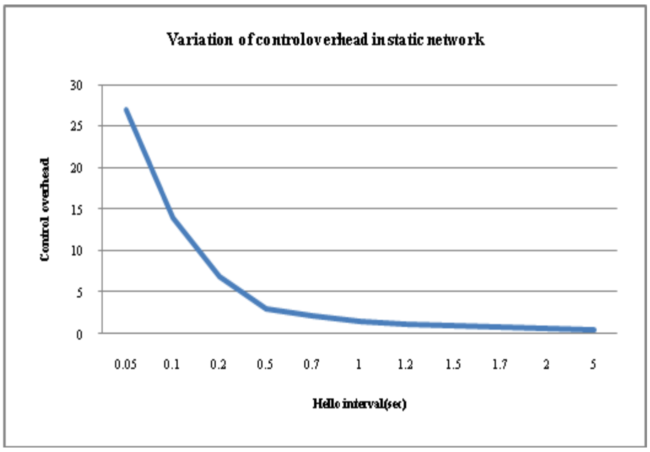


Fig. 4.5: Variation of control overhead in static network with hello interval.

C. Hello interval variations in dynamic network:

In Figure 4.6, x-axis represents variation in hello interval and y -axis represents the control overhead. In a highly dynamic network when the value of hello interval is low control overhead is low as compared to less dynamic network (or static network). As the value of hello interval is increased the messages sent between nodes is decreasing due to more time interval between transmission of hello messages and control overhead is also decreasing.

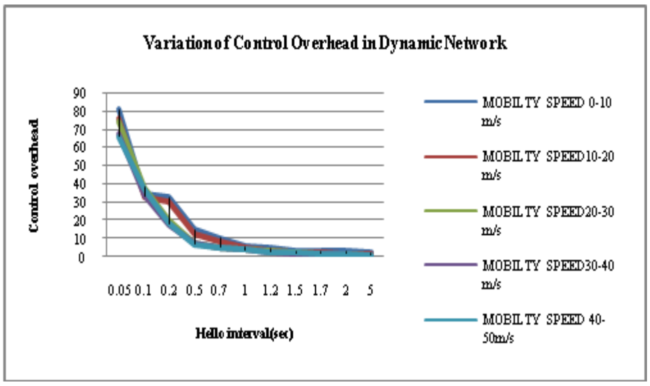


Fig. 4.6: Variation of Control overhead in dynamic network with hello interval.

VI. Conclusion

Local connectivity of MANETs using hello interval is summarized to identify which value of hello interval is required other than default in both static and dynamic networks. It has been observed that in case of the static network value of hello interval is higher to reduce the unnecessary overhead and energy consumption and in dynamic network value of hello interval is small to keep track of changes in the network.

VII. Future Scope

Investigating the local connectivity of MANETs using hello interval can be further enhanced by detecting which exact value of hello interval should give the best performance of an ad hoc network in static as well as in dynamic network to give the best local connectivity of MANETs.

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