Implementation Of Load Balancing in Energy Efficient AODV

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Abstract— The Ad Hoc network is defined by the mobile nature of the nodes and the removal of the requirement for an infrastructure based network i.e. the use of routers and gateways. Ad Hoc networks generally work in clusters i.e. the grouping of wireless mobile devices (computers or embedded devices which is based on efficient communication between all the nodes). Clusters are formed by clubbing together nodes along the wireless links. Cluster Heads are the nodes which communicate with the other nodes that it can cover under its communication range. Cluster Heads form a virtual backbone and may be used to route packets for nodes in their cluster. Nodes, being in an Ad Hoc network, are presumed to have a non-deterministic mobility pattern. Different heuristics employ different policies to elect Cluster Heads. Many of these policies are biased in favor of some nodes. As a result, these nodes shoulder greater responsibility which may deplete their energy faster due higher number of communication made, causing them to drop out of the network. Therefore, there is a need for load-balancing among Cluster Heads to allow all nodes the opportunity to serve as a Cluster Head. This paper present an routing scheme based on pre location to solve the problem. paper.

Keywords—ad hoc, cluster, Communication,AODV, MANETs

I. INTRODUCTION

Ad hoc networks consist of a set of homogeneous nodes (computers or embedded devices) that move in an independent fashion and communicate with the other node in the topology over a wireless channel. Such networks are logically realized as a set of clusters by grouping together nodes which are in close proximity with one another or through another wireless node. An ad hoc wireless mobile network is an infrastructure-less mobile network that has no fixed routers;instead,all nodes are capable of movement and can be connected dynamically in an arbitrary manner.In order to facilitate communication of mobile nodes that may not be within the wireless range of each other,an efficient routing protocol is used to discover routes between nodes so that the messages can be transmitted timely. A lot of routing protocols have been already presented for mobile ad-hoc network. These protocols are generally categorised into 3 types as table-driven routing, on demand routing and hybrid routing protocols. In Table driven

Routing Protocol uses resources to maintain and up-to-date routing information in the form of tables. While on-demand routing protocol does not always maintain routing information at every node ,and it only creates route when a packet is desired to transmit .and The Hybrid Routing protocol incorporates the mixed technology of table driven and on demand routing protocol.

A general Ad Hoc network will have the following features

Mobility: The nodes can reposition themselves in matter of seconds, making the mobility pattern of the nodes non deterministic. This mobility pattern had a major effect on the formation of clusters within the network. This mobility and wireless nature is one of the major features of the Ad Hoc networks and helps it to be deployed in any kind of terrain.

Multi hop Network: Since the nodes work as group, a multi hop network is created so that even if a node is not in direct contact with the cluster head it can still get the information via the intermediate nodes by forwarding the same data. This multi hop networks is generated by the conversion of a normal node to a router or gateway.

Multiple roles for a node: The Ad Hoc networks should be able to organize itself by generating routers, gateways etc. to maintain communication with all the other nodes. This is done by converting a normal node to a router or a gateway.

Energy Constraints: In an Ad Hoc network the nodes are mobile and communicate over a wireless channel. Being mobile the power is used from a battery and the size needs to be kept at a minimum. Hence there is a need to manage the battery power consumption, so that they do not drop out of the network prematurely due to low power.

Out of these the greatest challenge for an Ad Hoc network is resource management and that too particularly the battery life.

Balanced clustering is the key to increasing the network lifetime. Also the Cluster Head consumes the maximum of its battery as compared to the rest of the nodes. Hence, if the number of nodes under one Cluster Head is more as compared to the rest of the Cluster Heads, then this node will prematurely drop out of the network. This dropping out of the cluster head drastically reduces the network life time. Hence the energy consumed in communicating with the different nodes in the networks, formation of the cluster, checking for living nodes etc. must be kept at a minimum. One way of doing this is to optimize the number of communications made by the Cluster Head. This can be done by balancing the number of nodes under all the Cluster Head i.e. making each Cluster Head have almost the same number of nodes under every Cluster Head.

The paper is Organised as follows : Related work is presented in Section II .The proposed Pre-Location Oriented Routing in AODV is presented in Section III. Section IV Presents Implementation Method. Section V is Performance Evaluation and Section V is Conclusion Of paper.

II Related work

Routing being a fundamental issue of wired and wireless networks so a range of protocols have been proposed. There are several strengths and weaknesses of table-driven and on-demand protocols. Neither kind of protocol is perfect for all the situations. In the critical
energy consumption and relative low traffic rate networks, On-demand protocols seem more suitable than table-driven protocols.
Among the numerous On-demand ad hoc protocols, AODV (Ad Hoc On-Demand Distance Vector) combines the strengths of both table-driven and on-demand protocols, and becomes one of the most well-known protocols. Among the numerous On-demand ad hoc protocols, AODV (Ad Hoc On-Demand Distance Vector) combines the strengths of both table-driven and on-demand protocols, and becomes one of the most well-known protocols. This paper focus on the On-demand protocols, and most of the modification and simulation carry out based on AODV This paper focus on the On-demand protocols, and most of the modification and simulation carry out based on AODV.

AODV is an improvement on DSDV and DSR. AODV reduces the amount of control traffic by simply minimizing the number of enquired routes. Instead of building a route for all possible destinations in the network, a node only creates and maintains routes that it really needs. When a route is needed, a node initiates a request in order to locate its interlocutor node.

AODV uses a whole different approach to build its routing information. As a matter of fact, route enquiries are initiated on an on-demand basis .

When a node wishes to send a packet to destination node,it initiates a *discovery* process in order to locate it. If no route is found within a specific period of time, the initiator node assumes that the destination node is unreachable. The discovery process is aborted and the corresponding data packets are dropped. On the other hand, if the
initiator node receives a route as a response to its enquiry, it updates its routing table by creating an entry for the destination node.
Once an entry is created, a *maintenance* process is triggered in order to monitor the status of the just created route— if a route is no longer used, a node deletes from its routing table. If a failure occurs along an active route, the node upstream immediately notifies the earlier hops of such a breakage using a specific type of control packets. In the presence of packets still in need of a route, affected nodes may re-initiate new discovery activities in order to find a replacement route.

III.PRE-LOCATION ORIENTED ROUTING SCHEME

In conventional On Demand routing, if the route is expired, the destination node may still be within the same radius as before, especially for the low and medium mobility situation. But the routinginitialisation doesn't notice that the RREQ packets are rebroadcasted unnecessarily for all the directions (redundant rebroadcast).
Nodes are aware of the destination positions within a certain error. This information can be easily used to orient the new route initialization. "Pre-location Oriented Routing Scheme" As the name indicates, the previous location/route of the destination orients the exploration for new routes. The basic idea is that a source node, which needs to find a route to a destination, remembers where the destination was last "seen" and localizes its route discovery query to within a radius of that previous location.
The implementation follows this process: when the route is expired, the node stores the next hop for the destination in an extra table instead of erasing it immediately.
When new routes need to be set up to the same destination, the source node can send RREQ to the corresponding next hop by looking it up in the table, instead of flooding the RREQs to all the neighbour nodes as in the conventional On Demand protocols.
With respect to the limited memory space and the mobility of the nodes, the extra table should just store the destination node id and the corresponding next hop id. It should also have a lifetime: the route will be deleted at the end of its lifetime.
If the Pre-location Oriented Routing fails (i.e., the destination node moved far awayfrom the previous area), the rest of the neighbour nodes have to be flooded by RREQs.
To carry out the Pre-location Oriented Routing Scheme, extra memory space and CPU calculation time are needed. But comparing with the high proportion reduction of the RREQ flooding packets, these costs are little and acceptable.

IV. Method Of Implementation

In order to apply the Pre-location oriented routing scheme, certain modification have to be done on the AODV codes on

C++ level. The following are the actual modifications for the codes. The modified codes are elaborated :

Create an extra routing table (EXTRA) in the aodv_rtable.h and aodv_rtable.cc:
Create an extra routing table class, which is based on the routing table and consisted of the route constructor, route_lookup, route_entry and route_delete.

In the aodv.h and aodv.cc:
Create a new extra table object in the aodv.h.Add the extra routing table entry and purge.Record the routing to the extra routing table when a routing is added to the routing table.

Set the life time (TIME_TO_LIFE) of the extra routing table, TIME_TO_LIFE= 2 *TIME_TO_LIFE (routing table life time). Purge the entry when the life time is expired.

If link-breakages are detected for neighbours, purge the extra routing table, which is using the neighbour as the next hop (flooding hop).

Modify the routing request sending class:
In order to realise the pre-location oriented scheme, the program will look for the destination in the extra table before doing the whole direction flooding, if the destination is not found, do the conventional flooding, else, broadcast address for flooding (Broadcast Address= 255. 255. 255. 255) is changed to only one of its neighbour according to the extra routing table.

After the waiting for the maximum time-out and the largest searching range, if there is still no RREP coming back, the rest of the directions has to be flooded by resetting the broadcast address.

V. Performance Comparison and Evaluation for Pre-location Oriented Scheme

Three comparisons will be carried out between the conventional AODV and the Energy efficient AODV (applied the Pre-location Oriented Routing Scheme, in section):

1. Energy;
2. Throughput;
3. Packet failure;

In order to give more accurate examination of the performance of the new scheme, Different Number Of Nodes are taken and comparions are made on the basis of parameters taken .

1. Energy

First, comparisons have been made on basis of energy .Energy at each node is greater in eeaodv as compared to aodv.

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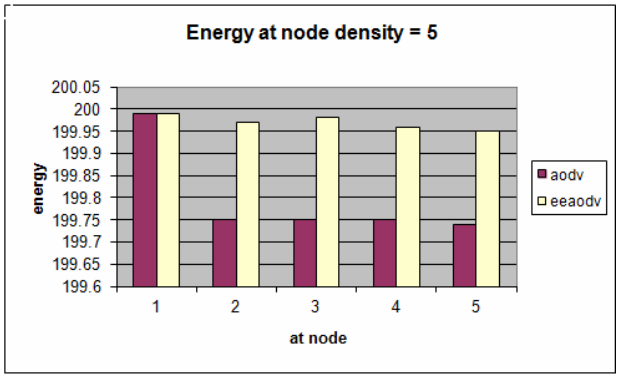
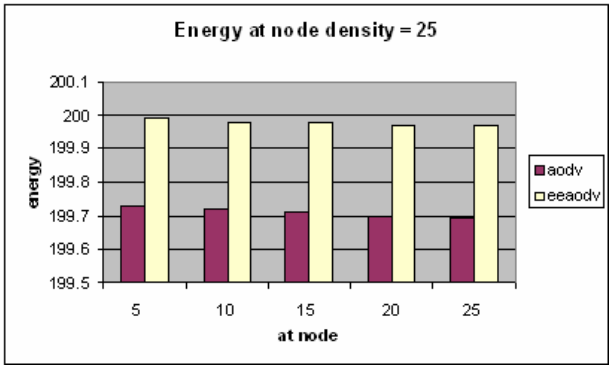
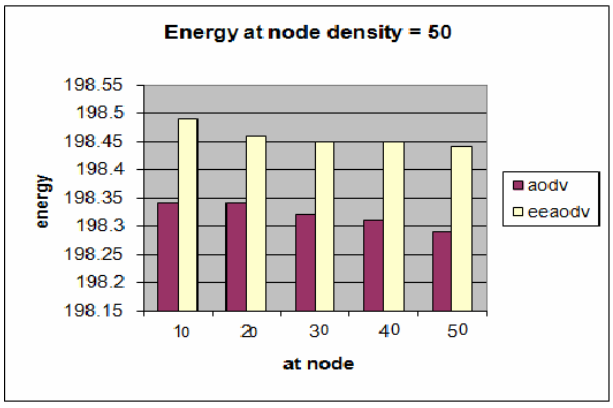
Case I. When node density :5



Case II. When node density :25

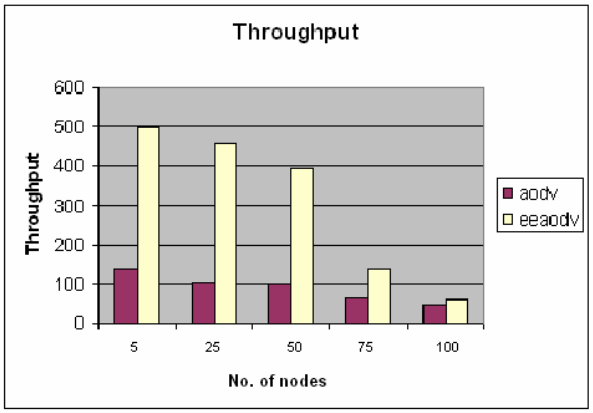


Case III . When node density :50



2.Throughput

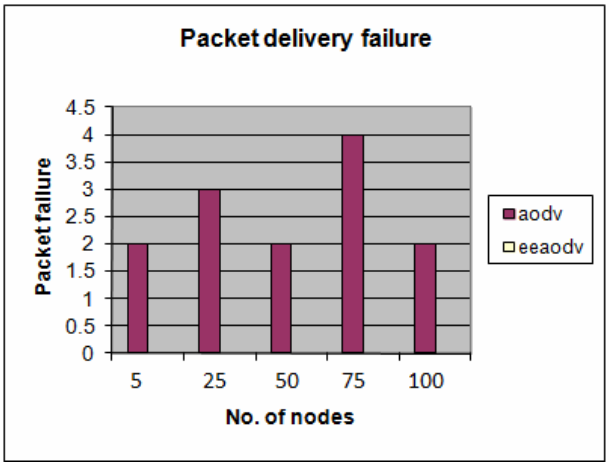
Throughput or network throughput is the average rate of successful message delivery over a communication channel. In other words, it is number of requests processed in a network



In the scenario performed , eeaodv shows higher throughput(i.e. no. of requests processed) as compared to the aodv.

3.Packet Delievery Failure

Packet Delievery Failure refers to the packets dropped in the network while transmitting the packets from source to destination.



In the scenario performed Packet Delievery Failure is found in case of aodv and no packet delievery failure has been found in eeaodv.

VI.Conclusion

By seeing the problems of the conventional schemes, in order to reduce theinformation overhead, a new flooding scheme, named pre-location oriented routing,has been proposed. The simulation result shows that the new scheme cuts down the energy consumption quite well by reducing the routing information overhead, especially for the low-mobility and high-density environments. This is mainly benefited from the pre-location oriented flooding for the route initialisation. The new routing scheme also improves the Throughput performance and "Packet delievery Failure".

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