Enhancing Network Survivability using AODV Routing Protocol in Multi hop Wireless Ad Hoc Network

Deepak Kumar Meena[1] Rajnesh Singh[2]
[1]M.Tech Student [2]Assistant Professor
[1,2]Department of Computer & Science Engineering
[1,2]IEC-College of Engineering & Technology Greater Noida, U.P

Abstract— A Multi hop Wireless Ad-hoc Network is a self-configuring network collected of mobile nodes with mesh and tree topology. Now a days Energy efficiency is a big problem of Multi hop Wireless Ad-hoc Network as the mobile nodes depends on the battery power for their functionality and battery if soon used without being optimized for best use then it might be possible that we are not getting the best output in terms of network survivability. This paper presents the energy conservation technique using the enhanced AODV energy efficient routing protocols in multi hop wireless networks to maximizing the life time of networks which is given a name SSEEA. This SSEEA protocol use energy optimal routes to reduce the energy consumption of nodes.

Key words: On-demand Routing; Energy Efficient Routing; Routing Protocols; Power Aware Routing

I. INTRODUCTION

All The boom of wireless networks started from the 1970s and the interest has been rising ever since. The devices in ad-hoc network consists of laptops and personal digital assistants often very restricted in resources such as CPU capability such as the processor speed , storage capability such as hardisk spaces or RAM/ROM, battery power and the bandwidth. This means routing protocols should try to minimize control traffic[1]. The mobile nodes depends on the battery power for their functionality and if battery power cannot be improved in accordance with the future requirements of large networks then the lifetime of the network

A. Key challenges in multihop wireless ad hoc networks are as follows:

- Limited power supply
- Dynamically Changing Topology
- Bandwidth is Limited
- Security
- Mobility-induced route change
- Battery constraints

A diagram of Multi hop Wireless network is illustrated below and the application, challenges and the features are also described.

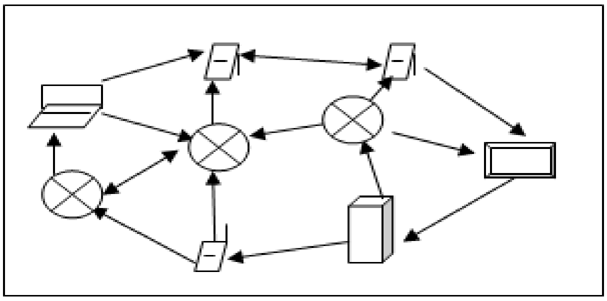

Fig. 1: Multihop Wireless Adhoc Network

Each node in Multihop wireless networks acts as both as router and as a host & even the topology of network may also change rapidly. The issues cannot be resolved related to the energy efficiency if we do not go through the problem areas related to these network[2]. Some of the challenges in MULTIHOP WIRELESS NETWORKS include:

- Unicast routing challenges
- Multicast routing challenges
- Dynamic network topology challenges
- Speed related challenges
- Frequency of updates related challenges
- Network overhead related challenges
- Scalability challenges
- Mobile agent based routing challenges
- Quality of Service challenges
- Energy efficient/power aware routing
- Secure routing challenges

II. ROUTING PROTOCOLS

Transmitting the data packets by taking into consideration the actual amount of energy required to transmit.

A. Table Driven Routing Protocols (Proactive)

In proactive or table-driven routing protocols, every node continuously maintains up-to-date routes to each other node in the network. The information regarding the routing is maintained and periodically transmitted. Difference is in the number of necessary routing-related tables and the methods by which changes in network structure are broadcast. The proactive protocols are not suitable for larger networks because they need to maintain node entries for every node in the routing table(3).

B. On-Demand routing Protocols (Reactive)

With on-demand protocols, if a source node requires a route for which it does not have route information to the destination, then it first initiates a route discovery process which starts by going to one node to the other until it reaches to the destination or an intermediate node has a route to the destination. Now If a node here wants to transmit a packet to another node then this protocol searches for the route in an on-demand manner and establishes the connection in order to transmit and receive the packet(4). The route discovery generally Occurs by the process of flooding where the route request packets throughout the network..

III. METHODOLOGY

The majority of the work in the field of research nowadays is based on energy efficient routing because power is major concern in Multihop wireless ad-hoc networks. Each and every protocol has some disadvantages as well as some advantages. It depends upon the network parameters which decide the protocol to be used. Here we are using AODV routing protocol and considering it to be under controlled circumstances with node size of 50.

A. Ad Hoc On demand Distance Vector Routing

Ad-hoc on demand Distance Vector Routing (AODV) is a reactive (on-demand) routing algorithm, enhancement over DSDV routing protocol algorithm. By creating routes on-demand it decreases the number of broadcasts as opposed to all possible routes as in DSDV[8]. The route table will be checked when source needs to transmit data. AODV is based on hop-by-hop routing approach and it is a loop- free, single path, distance vector protocol(14). There are two main procedures used in AODV:

- Route discovery
- Route maintenance

Route discovery: the route discovery procedure is begins when a source wants a route to be established to a destination to send the data. It checks its routing table to decide if it has a current route to the destination. If found the route, then forwards the packet to next hop node or else it starts a route discovery process. Route discovery starts with the initiation of a Route Request (RREQ) packet(5). Now this Packet contains the following: Source node's IP address, Current sequence number of the Source node, IP address of the Destination, Destination sequence number and the Broadcast ID number. Dissemination is done via flooding, and waits for a route reply (RREP). When the destination node receives a RREQ, it also generate in return a RREP. The RREP is routed back to the source via the reverse path. On reaching of RREP to source, a final forward route to the destination is then established.

Route maintenance: Route maintenance is finished using route error (REER) packets. A route is "expired" if not used recently. routing table entry, indicating a set of neighboring nodes that use that entry to route data packets. These nodes were given route error (RERR) packets when the next hop link breaks. Each ancestor node, in turn, forwards the RERR to its own set of predecessors, therefore, successfully erasing all routes using the broken link(6). Then this RERR is propagated to each source routing traffic through the unsuccessful link, causing the route discovery process to be reinitiated if routes are still needed.

B. Proposed Energy efficient Algorithm

Energy Efficient Routing Algorithms are used to minimize the total power consumption of the route but at the same time also to increase the lifetime of each node(7). The main aim of energy efficient algorithm is to maintain the network functioning as long as possible. In Multihop Wireless Networks energy consumption is done in three states of the nodes which are transmitting, receiving and sleeping state. Nodes consume more power while transmitting than in sleep position. Sleep state means nodes are inactive, that is the state in which they neither broadcast anything nor receive any signals. More energy can be saved by maintaining more nodes in sleep position.

Energy efficient routing protocol such as Sixth Sense Energy Efficient Algorithm (SSEEA) at network layer selects the preeminent path with minimum battery cost or maximum battery capability to enhance the network lifetime. But this algorithm consider the abstract of values of battery cost functions, nodes with slight remaining battery capability may be selected as route resulting in early network failure[9]. Every node has its battery power which can be calculated. The paths with stable nodes will be selected and the node's stability will be checked before it transmit route request with the condition that it should not change certain rate of its neighbors in specific time[15]. If bit denotes the battery cost at any time instant t, f(bit) represents the battery cost function of node ni and, then fi(bit)=1/bit which means that higher the value of the function fi, more the node is unwilling to participate in the route selection algorithm.

Battery cost is defined as

Rj= max fi(bit).

Therefore the final route is given by

E= min (Rj, j ЄA)

E is the energy remaining in the nodes after trecieving and transmission of packets.

C. Improved Energy Efficient Algorithm (SSEEA

Energy efficient algorithm , which is used for AODV here is SSEEA, Sixth Sense Energy Efficient Algorithm. They used HELLO massages of AODV to calculate the difference between transmitting power and receiving power and which gives the value of propagation loss, somewhat modified the original 32-bits destination sequence number field to a new 32-bit value. The received energy is subtracted from the transmitting energy a thus we can get the remaining energy details[10]. We proposed an adaptive low battery alert mechanism to overcome the overuse of the firstly established route. They used 52% or 42% of the new battery capability. The result shows that this new algorithm can improve the network lifetime in both static and mobile networks. The following algorithm is the new proposed algorithm used to enhance the network lifetime and thus increasing the network survivability.

If S(source) wants to send data to D (destination)
then
{
AODV ( ) // finds a route between S and D.
{
For (each node between S and D)
{
Calculate the energy of each node with the help of Energy Model

For each node manage a routing table with one additional parameter node energy.

When any node receives a packet
{
If (Node Energy >Eth)
{
Receive RREQ packet and forward it to next Hop. Route maintenance is done in which the next hop is selected based on remaining energy of a node.
}
Else
{
Drop RREQ Packet It sends a RERR to the last node and source need to call AODV () again

If Nodes goes to Sleep mode, deactivate the node through RAS
}

IV. SIMULATION AND RESULT ANALYSIS

The simulations were performed using network simulator2 (NS-2), The version used is NS 2.35 which is particularly popular in the network community. NS is a part of experience simulator targeted at networking research. If the components have to be developed for ns2, then both Tcl and c++ have to be used[1]. The NS 2.35 version is installed using cygwin which is an alternative to the linux platform and can be used in windows operating system on which NS2.35 can be installed and simulations can be performed using the same commands which are used in linux.

A. Performance Evaluation

There are number of qualitative and quantitative metrics that can be used to evaluate in these protocol(11). These can be compared with use of NS-2 simulator.

B. Routing Overhead

This metric is used to describe that how many routing packets for route discovery and route maintenance needed to be sent so to as to propagate the data packet(12).

C. End-to-End delay:

It is the ration of time difference between every continuous bit rate (CBR) packet sent and received to the total time difference over the total number of CBR packets received(13). The xgraph is used to show the graphical representation of the result. The result are compared to get the average end to end delay.

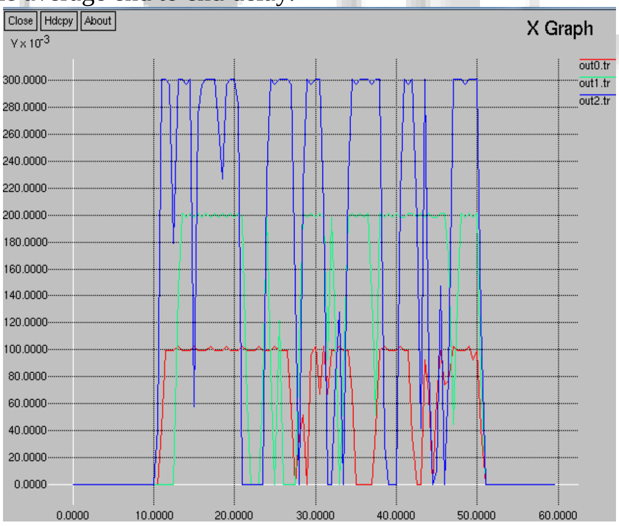

Fig. 2: Xgraph Representation of End To End Delay Results

Time	**End to end delay in SSEA**	**End to End Delay Earlier**
10	1.0	2.0
15	2.1	4.2
20	3.1	6.2
25	4.1	9.4
30	5.1	11.4
35	6.1	12.4
40	7.1	12.5
45	8.1	14.7

Table 1: Comparison of End To End Delay

V. CONCLUSION

In this Paper discussed that how the reactive routing protocol AODV after implementation of the modified algorithm for the energy optimization is used to enhance the network lifetime in Multi hop Wireless ad hoc network. Also through the use of the NS2.35 we have evaluated the results and it is observed that the battery power is used less when a network of 50 nodes is chosen. Thus these extensions in the algorithm have shown significant improvement in the life of the network thus increasing the network survivability and lead to a longer battery life of the nodes. Also they achieve balanced energy consumption in the network.

ACKNOWLEDGMENT

I would like to express my special thanks of gratitude Mr. Rajnesh Singh who guided me and I came to know about so many new things during the research. Secondly I would also like to thanks to Jyotsna Bulchandani who assisted me a lot in finishing this project within the limited time and given useful resources to complete the research work.

REFERENCE

[1] Shipra Gautam, Rakesh Kumar, "A Review of Energy-Aware Routing Protocols in MULTIHOP WIRELESS NETWORKSs", InternationalJournal of Modern Engineering Research (IJMER), Pages-1129-1133, Vol.2, Issue.3, May-June 2012.

[2] W. Heinzelman, J. Kulik and H. Balakrishnan, "Adaptive Protocols for Information Dissemination in Wireless Sensor Networks", Proc. 5th ACM/IEEE Mobicom Conference (MobiCom '99), 1999, pp. 174-85.

[3] Praveen Kaushik ; Jyoti Singhai, "Energy Efficient Routing Algorithm for Maximizing the Minimum Lifetime of Wireless Sensor Network: A Review" , International Journal of Ad hoc, Sensor & Ubiquitous Computing (IJASUC) , vol.2 , 2011.

[4] Vijay Raghunathan, Curt Schurgers, Sung Park, and Mani B. Srivasta, "Energy-Aware Wireless Microsensor Networks" , IEEE Conference on SIGNAL PROCESSING MAGAZINE, 2002, pp. 1053-5888.

[5] Mehdi Golsorkhtabar, Farzad Kavaini Nia, Mehdi Hosseinzadeh, Ynes Vejdanparast , "The Novel Energy Adaptive Protocol for Heterogeneous Wireless Sensor Networks", IEEE , 2010.

[6] S. Lindsey and C. Raghavendra, "PEGASIS: Power-efficient Gathering in Sensor Information Systems", IEEE Aerospace Conference Proceedings, vol. 3, 2002, pp. 1125-1130.

[7] Ossama Younis and Sonia Fahmy, "HEED: A Hybrid, energyEfficient, Distributed Clustering Approach for Ad Hoc Sensor Networks", IEEE Transactions on Mobile Computing, vol.3 no.4, 2004, pp.366-379.

[8] Zhao Cheng, Mark Perillo and Wendi B. Heinzelman, "General network lifetime and cost models for evaluating sensor network deployment strategies", IEEE Transactions on mobile computing, vol. 7, 2008.

[9] Stanislava Soro and Wendi B. Heinzelman, "Cluster head election techniques for coverage preservation in wireless sensor networks", Journal of Ad Hoc Networks 7, 2009, pp. 955–972.

[10] Ye XiaoGuo, Lv KangMeng, Wang RuChuan and Sun LiJuan, "Adaptive Load-Balanced Routing Algorithm" , IEEE International Conference on Digital Manufacturing & Automation, 2011.
[11] Sandip Kumar Chaurasiya, Tumpa Pal and Sipra Das Bit, "An Enhanced Energy-Efficient Protocol with Static Clustering for WSN", International Conference on Information Networking (ICOIN), 2011.
[12] B. Chen, K. Jamieson, H. Balakrishnan and R. Morris, "SPAN: an energy-efficient coordination algorithm for topology maintenance in ad hoc wireless networks", Wireless Networks, vol. 8, 2002, pp. 481- 494J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp.68–73.
[13] Suvarna P. Bhatsangave and V. R. Chirchi, "OAODV Routing Algorithm for Improving Energy Efficiency in MULTIHOP WIRELESS NETWORKS",International Journal of Computer Applications,pages-0975–8887, Volume 51, August 2012.
[14] R.Madhanmohan, K.Selvakumar, "An Adaptive Power Aware Routing in MULTIHOP WIRELESS NETWORKSs" Journal of Computing, pages-2151-9617, volume 4, issue 8, august 2012.
[15] Dr.A.Rajaramand J.Sugesh, "Power Aware Routing for MULTIHOP WIRELESS NETWORKS Using On-demand Multipath Routing Protocol",International Journal of Computer Science Issues, Pages- 1694-0814, Vol. 8, Issue 4, No 2, July 2011.