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Optimized Energy Aware Routing in Wireless Ad-hoc Network

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Abstract—The nature of infrastructure-less and decentralization are two importance features of an Ad-hoc network. In Wireless Ad-hoc network, some nodes may become as a critical spot in the network during packet forwarding to most of their neighbors nodes. And these critical nodes can deplete their battery power earlier, because of excessive load and processing for data forwarding. These unbalanced loads turn to nodes failure, network partition and reduce the age ie,. lifetime of the route and reliability of the route. As nodes in wireless nodes operate on limited battery power Energy efficient communication is a vital research topic in wireless ad hoc networks. This paper describes An Optimized Energy Aware Routing approach as an improve QOS of Ad hoc network, utilizing the high energy path based on Route Selection Function. And this algorithm, adapts existing energy aware routing protocol to optimize energy conservation and other performance metrics. The purpose of path Selection process is to improve lifespan of Ad-hoc network and corresponding effect on overall network performance.
Keywords — wireless network, QOS, ad-hoc, traffic aware, remaining energy, AODV

I. INTRODUCTION

Wireless Ad-hoc network [1] enable nodes to set up a network quickly provides an advantage in deployment, cost, size and distributed intelligence over wired networks. It is a challenging task to provide the same type of services and the same quality in wireless mobile environments as in a wired environment. Most of earlier works on routing in ad hoc networks deal with the problem of finding and maintaining correct routes to the destination due to mobility and changing topology. Most of the routing protocols in mobile ad-hoc networks uses minimum-hop routing where the hop count is the path length. A network's capability to provide a particular quality of service between a set of endpoints depends upon the inherent performance properties (e.g. delay, throughput, loss rate, error rate) of the links and nodes, the traffic load within the network and the control algorithms operating at different layers of the network. Ad hoc routing protocols can broadly be classified as Table driven and on-demand routing protocols.

Proactive routing protocols attempt to maintain consistent routing information for all the nodes in the network.In these protocols, each node maintains one or more tables to store routing information, whenever any changes in network topology then they respond by propagating updates messages throughout the network in order to maintain consistent network view. On the other hand, Reactive routing creates routes only when required by the source node. When a node requires a route to a destination, it initiates a route discovery process within the network. The process is completed when a route is found or all possible routes have been examined. Once the route has been established, some form of route maintenance procedure maintains it until the route is no longer desired. Well-known routing protocols studied under on reactive category are AODV and DSR (Dynamic Source Routing) while DSDV (Destination Sequenced Distance Vector routing) represents proactive category. AODV is an enhancement of DSDV because it reduces the number of required broadcasts by creating routes on an on-demand basis, as opposed to maintaining a complete list of routes as in DSDV routing protocol. DSR has higher connection setup delay and its performance degrades rapidly with increasing mobility as compared to AODV. AODV uses the destination sequence number to find the latest route to a destination requiring less setup delay also a fair performance with mobility concern. Traditional routing protocols select the routes based on the metric of the minimum hop count. Such minimum-hop routing protocols can use energy unevenly among the nodes and thus it can cause some nodes to spend their whole energy earlier and make a network partition as degradation in network performance. End to end delay and packet delivery ratio are commonly used performance metrics in wired and wireless networks. Since network topology changes dynamically, bandwidth and battery power are additional important factors to be considered in wireless ad hoc networks.

If energy consumption is to be considered, the best-suited protocols are on-demand protocols where control information transfer is limited and is not as frequently updated as in table-driven protocols or proactive protocols. On-demand protocols floods the route request packets throughout the network do the route discovery. Our main aim is to the make the routing protocol to be aware of residual energy of the nodes efficiently and to increase the delivery ratio without delay.

II. LITERATURE REIEW

The majority of wireless ad-hoc networks routing protocols deals with the problem of finding and maintaining optimal routes to the destination during mobility and changing topology. YuHua Yuan, HuiMin Chen and Min Jia presented a simple algorithm which guarantees strong link ie., connectivity and assumes limited node range. SPF (shortest path first) algorithm is used in this strongly connected backbone network. However, the route found, may not be help to attain efficient energy consumption due to the omission of the optimal links at the time of the backbone connection network calculation.

With table-driven routing protocols, each node attempts to maintain consistent routing information to every other node in the network. This consistency has been achieved by making the nodes to forward the routing table updates to their neighbors'. Thus, it is proactive in the sense that when a packet needs to be forwarded the route is already known and can be immediately used. And in the case for wired networks, the routing table is constructed using either link-state algorithm or distance vector algorithms containing a list of all the destinations, the next hop, and the hop count to each destination.

N Thanthry, S R Kaki and R Pendse have proposed a new metric which consider as the stability of the paths by taking three parameters like "affinity‟, "available bandwidth‟ and "battery level‟ in the routing decisions. It also maintains multipath to achieve load sharing. The routing table in AODV, maintains only one route to the destination node, therefore the source node needs to reinitiate route discovery process as a route fails.

Luo Chao & Liping‟an presented an improved method where each source will maintain some backup routes, which have been found during the initial route discovery process. And when the primary route fails the source node will use the backup route to forward the packets, which will improve the packet delivery ratio and end to end delay. According to different route selection mechanism, energy based routing algorithm can be categories as, minimum energy consumption which attempts to select the route with minimum energy consumption between source to destination, In which some critical nodes taking part in transmission may run out of power and leads to the partition of networks. Another category is maximizing the network lifetime algorithm, it establish the route by avoiding the lower energy node so that it can balance the energy consumption of nodes and enhance the lifetime of networks. The final is mixed optimizing routing algorithm which mix the above two categories.

The majority of existing energy efficient routing protocols for wireless ad-hoc network try to reduce energy consumption by means of an energy efficient routing metric instead of minimum-hop metric, used in routing table computation. By this, a routing protocol can easily introduce a energy aware routing during packet forwarding. These protocols try either to route data through the path with maximum energy bottleneck, or to minimize the end-to-end transmission energy for packets, or a weighted combination of both.

MTPR is known as Minimum Transmission Power Routing (MTPR) uses a simple energy metric, represented by the total energy required to forward the packet along the route. MTPR reduces the overall transmission power consumed per packet, but it does not affect the lifetime of each node of the network. However, minimizing the transmission energy only differs from shortest hop routing if nodes can adjust transmission power levels, so that multiple short hops are more advantageous, from an energy point of view, than a single long hop. With reactive routing, routes are discovered only when a source node desires them. Route discovery and route maintenance are two main procedures: The route discovery process involves sending route- request packets from a source to its neighbor nodes, which then forward the request to their neighbors, and so on. Once the route request reaches the destination node, it responds with a route-reply packet back to the source node in an unicast mode. This route reply packet is forward through the list of neighbors' in a reversed order from which the route-request was received. If an intermediate node receives the route request and if it has route information up- to-date, it stops forwarding and sends a route- reply message back to the source.

Once the route is established, some form of route maintenance process maintains it in each node's internal data structure called a route-cache until the destination becomes inaccessible along the route. All the nodes including source, destination and others in the network learn the routing paths as time passes to know about opportunities in making routing decision. In contrast to table-driven routing protocols, not all up-to-date routes are maintained at every node. DSR & AODV are well known examples of on-demand driven protocols.

III. PROPOSED WORK

The study of literature, inspire us to develop a route selection mechanism which optimized energy of the node. We consider the following modification for designing our algorithm.

A. Control message:

A reserved congestion field and an energy field of node is inserted in the RREQ or RREP. Whenever a node receives RREQ, it appends current energy value in the reserved field and congestion field.

B. Routing table of a node:

Two new fields are added in the routing table entry for each node which stores residual energy and congestion factor. The modified RREQ or RREP message value can be extracted from the route table entry.

C. Path selector function:

When a destination receives route request it will extract the information of CF and PF from the RREQ. The destination will now calculate Distance(Di) and congestion factor of the path of each RREQ received by it on the basis of equation 1and 2 respectively. Now destination will finally select the most energy efficient and less congestion route by the route selection function. For a particular source to destination node there exist routes. The Route Selection Function has four parameters: Distance, Traffic Load, Bandwidth and Remaining Energy.

1) Distance:

The source node finds the shortest distance to its neighbors' node. In Ascending order, the neighbors are placed in routing table.

2) Traffic Load:

To calculate Congestion Factor we define several terms:

CFj : Congestion Factor of node j

VQj : Vacant interface queue size of node j

TQj: Total interface queue size of node j

DQj : No. of data packets in interface queue of node j The congestion factor is calculated by the following equation,

$$CFj = VFj/TQj \quad (1)$$

Where VFj =TQj- DQj

3) Bandwidth:

The bandwidth of the range is high among the neighbors node that should be sort after that the efficient path be selected from source to destination. All the parameters described above are used to select an efficient node for forwarding data from source to destination.

4) Remaining Energy:

Mobile Ad-hoc network consists of battery constrained nodes. Hence the power factor is an important metric to be considered for route selection. Thus, a route with maximum residual battery power in its node can be an ideal path with respect to energy level. Moreover, despite the fact that sometime a path may have a high residual energy level, it may have some nodes with very low energy levels too. So, there is high probability of failure of these low residual energy nodes which make them undesirable.

Residual energy = Initial energy – used energy (2)

IV. PERFORMANCE EVALUATION

We have used NS2 simulator to show the simulation results. In that, we have used mobility model as the Random way point mobility model. And we have 15 nodes distributed in an area of 1000m ×1000m. Each node independently moves within the area specified area. The simulation parameters used to analyze the performance of the existing and proposed protocol are showed in table 1.

Table 1. Simulation Parameters

Parameter	Value
Simulator	NS2(Ver. 2.28)
Simulation Time	10 ms
Number of nodes	30
Routing protocol	AODV
Traffic model	CBR
Simulation Area	1000×1000
Transmission range	250m

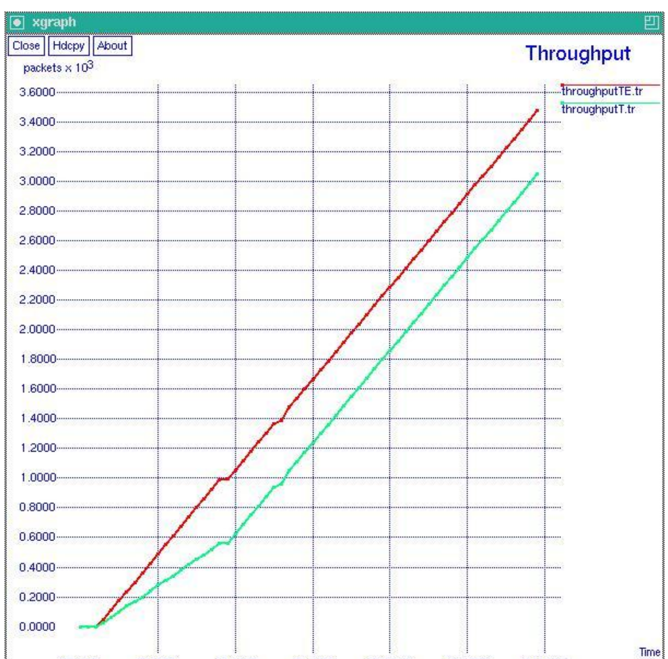

Figure 1. Throughput

A. Throughput

Generally, throughput indicates that the amount of work done per unit time. In this optimized energy aware routing algorithm, the throughput indicates the delivery ratio ie., the amount of data delivered per unit time. The throughput is calculated by using the following equation 3. Fig.1. shows the throughput comparison of existing and proposed system.

$$\text{Throughput} = \text{number of packets received} / \text{Time} \quad (3)$$

B. End-to-End Delay

Packet delay is the difference in end-to-end or one-way delay between selected packets in a flow path with any lost packets being ignored. Fig 2 shows the delay between proposed and existing system.

Figure 2. Delay

V CONCLUSION

In this paper, we proposed a modified algorithm based on Optimizing Energy Aware routing. In this algorithm we have proposed some modifications to the route selection procedure, the destination node will unicast the route reply to the path, having less congestion and maximum energy. This optimized energy aware routing which takes into account the energy and congestion factor to select the most optimal route. Thus, rather than using the traditional metrics such as delay or hop count, we believe the nodes energy and traffic load to be taken in to account as routing metric in a integrated way which can give the better performance in Wireless network.

vI REFERENCES

[1] Bong Chan Kim et al., "An ad hoc routing protocol with minimum contention time and load balancing ",GLOBECOM, IEEE 2003.

[2] Luo Chao, Li Ping"an, "An Efficient Routing approach as an extension of the AODV Protocol", IEEE 2010.

[3] B. Johnson, D.A. Maltz, and Y. Hu, The Dynamic Source Routing protocol (DSR) for Mobile Ad hoc networks for IPv4, IETF RFC 4728, Feb,2007.

[4] Tai Hieng Tie et al., "Maximum Energy Level ad hocdistance vector scheme for energy efficient ad hocnetworks routing", proceedings of the 2009 IEEE 9th Malaysia International Conference on Communications 15- 17 December 2009, Kuala Lumpur Malaysia.

[5] N Thanthry, S R Kaki and R Pendse, "EM- AODV: Metric Based enhancement to AODV routing protocol", IEEE 2006.

[6] Chakeres, J. Macker, T.Clausen "Mobile Ad hoc Network Architecture", draft-ietf-autoconf- manetarch-07.

[7] E. Perkins, S R Das and E Royer, "Ad-hoc On Demand Distance Vector (AODV) Rousting", RFC 3561.

[8] Vahid Nazari Talooki, Jonathan Rodriguez, Rasool Sadeghi, "A Load balanced aware routing protocol forwireless ad hoc networks", IEEE 2009.

[9] Vahid Nazari Talooki, Jonathan Rodriguez, Hugo Marques, " An energy efficient flat routing protocol for Wireless ad hoc networks", IEEE 2010.

[10] Iftikhar Ahmad and Mata Rehman, "Efficient AODV routing based on traffic load and mobility of node in MANET", IEEE 2010 6th International Conference on e merging technologies (ICET).

[11] YuHua Yuan, HuiMin Chen and Min Jia, "An adaptive load balancing approach for ad hoc networks", IEEE 2005