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Modified Expanding Ring Search in Common Node Scenario for AODV

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***Abstract*—Mobile ad-hoc networks (MANET) are a collection of nodes without any static infrastructure. Ad-hoc networks establish connections between nodes without the help of centralized nodes but with the help of its neighbour nodes. The nodes are movable and can change its position frequently, so it maintains a dynamic interconnection between nodes in the network and adapts to dynamic topologies. MANETs are characterized by dynamic mobile nodes, with limited battery sourced power. These mobile nodes also act as routers taking its roles such as finding new routes, acting as an intermediate node, deciding best routes and keep a connection with mobile nodes. Any mobile node in the network can make the connection directly to any node within its transmission range, but due to its limited power, its transmission range also limited. Reactive routing protocols are effective than proactive routing protocols on MANETs since it can reduce extra overheads. However, reactive routing protocol suffers from excessive flooding in route discovery process. Authors focus on an existing solution called Expanding Ring Search (ERS) which decreases the flooding by manipulating Time to live (TTL) in AODV. ERS is also is inefficient in some scenarios. When the source is far from the destination ERS is worse than flooding [4].Authors proposing a modification in ERS to avoid this problem which will make ERS efficient when the MANET consists a node (common node) that frequently accessed by most of the nodes.**

Keywords Component; Ad-hoc Networks; AODV; MANET; ERS.

I. Introduction

From the Experience of past three decades, the prediction of technology is most of the time accurate. Today more than 99% of things still not connected to the physical world. It is predicted that the phenomenon call 'The Internet of Everything' will connect to everything. The internet of everything connects the physical world to the web. By 2020, 50 billion intelligent devices (things) will be connected to the internet using microsensors on the internet. Wireless sensor networks are the efficient way to connect microsensors. According to the prediction, in future wireless routing protocols will take a major role in MANET. It is important to improve the currently existing protocols like AODV, DSR, OSLR to contribute to the emerging technology.

MANETs can be established in any time anywhere without a pre-configured network in a short time of period. Establishing a communication network in emergency times is useful. Movement of the nodes in MANET is unpredictable so topology of the network is dynamic and the connection between two nodes can frequently be broken.

Ad-hoc networks establish connections between nodes without the help of centralized nodes but with the help of its neighbor nodes [1].Ad-hoc routing protocols can be divided into three types namely Proactive, Reactive, Hybrid. In Proactive, route discovery process and routing table has been updated it's information periodically, In Reactive, the route discovery process and routing table updated when there is need of particular route information. Hybrid protocol acts as both. However, in proactive protocol routing overhead is higher than Reactive. Ad-hoc distance vector routing protocol (AODV) is one of the popular and efficient Wireless routing protocols for Mobile Ad hoc Networks (MANET). AODV is better than protocols like DSR, DSDV, etc. even in the large number of nodes network. When considering throughput, AODV performs better in maintaining a periodic connection by sending data [2].

AODV is an on-demand routing protocol that will do the route discovery only a node need to send a packet. It is quite similar to Bellman Ford distant vector algorithm. AODV maintain the routes as long as its required by a source. Moreover, also it has unicast and multicast capabilities. AODV maintains a neighbor table to send the packets via appropriate neighbor to the destination and keep only one entry per route. The freshness of the routes is determined by its sequence number. AODV is a light weight protocol, avoid the unnecessary control packets and routing overheads and try to keep a short routing table. This characteristic makes this protocol most suitable for mobile devices [3].

II. Expanding Ring Search and research problem

Expanding Ring Search (ERS) is the most popular technique used solves this problem. Since RREQ packets are flooded throughout the network, this algorithm does not work well on large networks. If the destination node is located relatively near the source, issuing an RREQ packet that will pass through every node in the network is wasteful. The optimization AODV uses the

Expanding Ring Search algorithm; this works as follows. The source node searches successively larger areas until the destination node is found.This is done, for each RREQ retransmission until a route is found, incrementing the time to live (TTL) value will be added in every RREQ packet, thus expanding the "search ring'' in which the source is cantered [4][5][7].

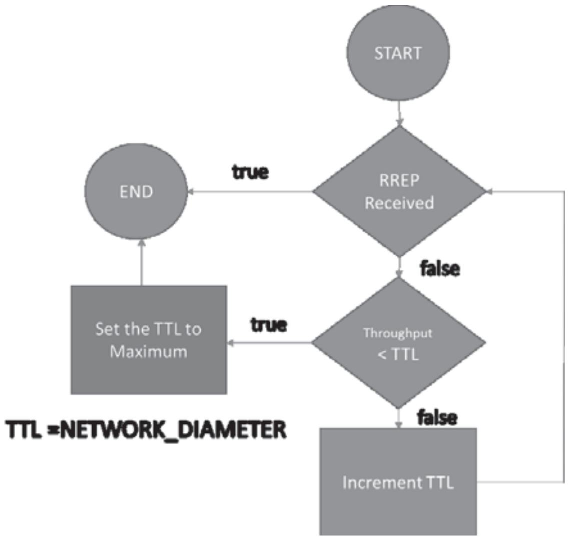

Fig.1.ERS TTL Update algorithm

When the destination is in the largest ring, the system waits until its get to increase to the largest ring. This protocol is good if it is more likely that the destination is closer than further off. However, if the destination is too far apart, it could result in relatively worse performance than flooding. In this research, the primary concern is to reduce the unwanted RREQ packets. Expanding Ring Search is a practical method to reduce the RREQ packets and is inbuilt with a current existing version of AODV. In addition to this, it has more scope in than any other method in reducing routing overhead. Furthermore, this research is a concern in reducing the unwanted RREQ packets in an AODV network using Modified Expanding Ring Search.

III. Proposed Solution

The solution that is proposed here is based on taking advantage of a scenario that will help to reduce RREQ packets using Expanding Ring Search with modification on its algorithm. There are two scenarios mentioned below that would help reduce the RREQ Packet.

- An AODV based local area network (LAN) is connected to internet or external network. If the node is to connect to an external network, it needs to be connected to the gateway router.

- An AODV based local area network (LAN) has a node frequently accessed by all another node. For example, AODV based network is used mode of communicating by army troops. This requires the soldiers must have to be connected to the commander (or control base).

In these two scenarios, one or more nodes should be connected to all other nodes in the network. In this research, such nodes are referred as a common node. A common node always has to know the route to all other nodes in the network. The routing table of the common node is updated continuously. This will create proactive mode in a reactive routing protocol. Information in the routing table can be used as common node to increase the ERS performance.

The idea of Expanding Ring Search (ERS) is to increase the TTL value of Routing Request (RREQ) by an increment value until the source receives a Routing Reply Packet (RREP). However, when it exceeds the TTL_THROUGHPUT, the TTL value is set to NETWORK_DIAMETER. Which would then flood the RREQ all over the network? Refer Fig.1 and the parameters given below;

TTL_START	: Starting value of TTL (Default -
1) TTL_INCREMENT	: Increment value (Default - 1)
TTL_THROUGHPUT	: (Default - 7)
NETWORK_DIAMETER	: (Default - 30)
Hp_count	: Common Node to Source, hop count (Default - NETWORK_DIAMETER)

The common node has information regarding all routes. All other nodes know the route to the common node. Any 2 nodes can communicate via common node. However, it can be either the longest route or shortest route. A huge amount of unwanted RREQ packets can be reduced when TTL exceeds the throughput by setting the TTL value to Hp_count instead of setting to NETWORK_DIAMETER [8]. (Refer the Fig. 2 and parameters given)

IV. Simulation Modal and Parameters

For this simulation, Linux based distributions are used. Ubuntu and Fedora has been chosen as it is an open source based operating system. In order to simulate the implemented protocol, Network Simulator 2 (NS2) is used in the testing environment

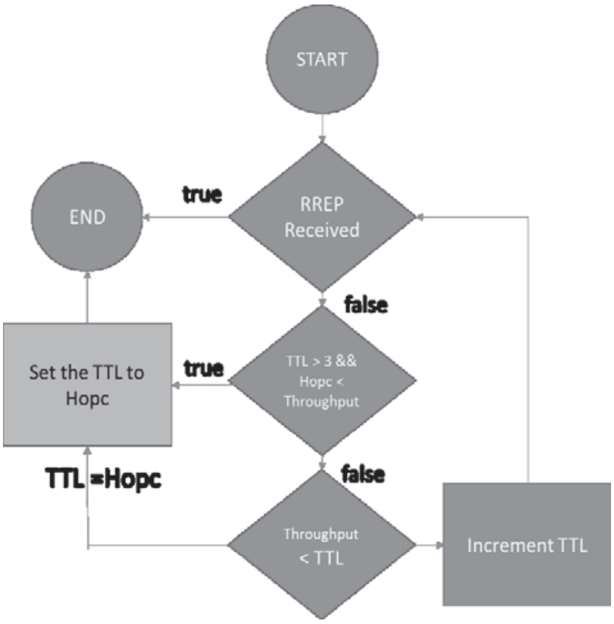

Fig.2. Modified ERS TTL Algorithm

TABLE 1. SIMULATION PARAMETERS

Parameters	Values
Area	1000 x 1000 m
Transmission Range	50 m
Number of nodes	50,100,150,200,250
Simulation Time	200 seconds
Mobility Rate	0 - 20 m/s
Pause time	0 - 10 s
Number of Simulation	5 seconds
Packet size	5 kb
Connection type	TCP
T type	LL
Connection per node	4

Since the solution based on common node scenario the new simulation modal created with a common node. To create common node scenario a TCP connection is made to the common node from all other nodes for 20 seconds at the beginning of the simulation. Location of the nodes at the beginning, movement speed and direction of movement for each node generated randomly. Total simulation time is 200 seconds. After the common node scenario is created every node in the network creates four TCP connections to four different nodes to create a high traffic and result in a long variance. Refer "Table 1" for further detail.

V. TESTING, RESULTS AND DISCUSSION

The implementation tested in network simulator. The results may vary in real time environment. However, simulations in real devices are costly. Same workstation has been used for all the tests due to the result can be varied if it use multiple workstations.

Separate Tcl scripts are created for 50, 100, 150, 200 and 250 nodes. Because node behaviors are randomly generated in each simulation modal, rather than defining manually as it will be complicated when simulating a large number of nodes. The results of these simulations can vary, so 12 simulations are done for each Tcl script (50 - 250). The average has been taken as the results.

A. Received RREQ packets

Fig 3 shows that the forwarded RREQ is decreased up to 30% on modified expanding ring search in common node scenario. The difference increases when node count increases. Because when the number of nodes increases the connections among nodes also increases. Moreover, frequencies of the link breaks are also high. So in existing AODV the count of unwanted RREQ forwarded are also high. However, in the proposed solution RREQ packets have dropped after a certain level TTL, which is much lower than the current AODV TTL.

Fig.3. Received RREQ Comparison

Fig 4 shows that the overall packet delivery ratio is gradually decreasing when the number of nodes increases. Because when the number of nodes are increased, more paths are generated, and packet loss increases. In the research work authors observed significant improvement than existing.

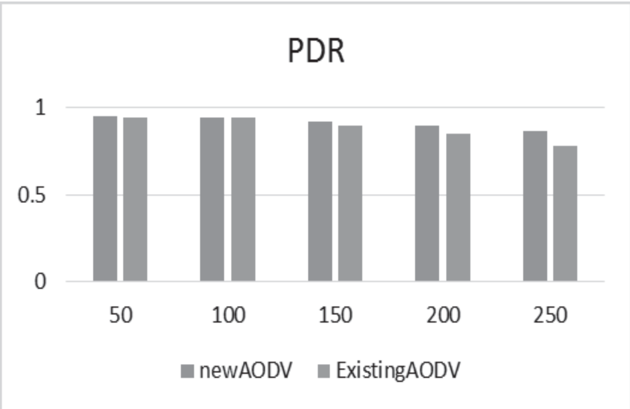

Fig.4.Packet delivery ratio comparison

B. Throughput

Fig.5 shows that the overall throughput is gradually decreasing when the number of nodes increases. The reason behind this is when the number of nodes are increased, more paths are generated and overhead control increases leads to a decrease in the throughput. Using the best path value, a small improvement is obtained. However, in the region of less number of nodes, the throughput is comparatively low than normal AODV.

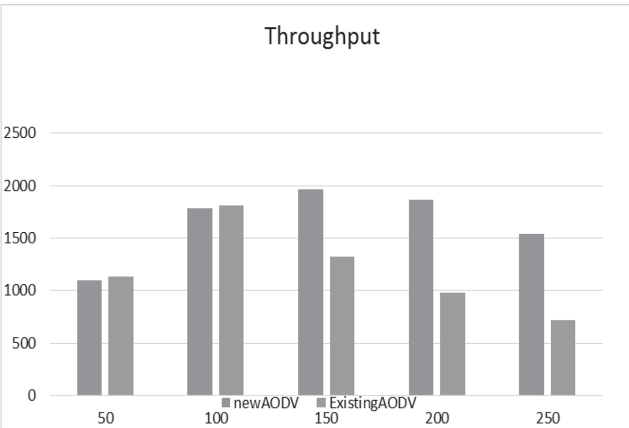

Fig.5. Throughput comparison

From the overall results, could be notice that this new method reduces RREQ packets by more than 40% without the considerable impact of other performance parameters. This new method also gives a small amount of improvement in Packet Delivery Ratio (PDR).

VI. CONCLUSION

The field of wireless sensor network is changing rapidly and growing fast. The challenges procedure increasing day by day, these challenges needed to be met. In addition to this, it is likely that these networks will see extensive use within next couple of years. Since technology is changing rapidly and this progress opens new issues and areas to consider in ad hoc networks. There is no standard algorithm, which will suit all scenarios. Each has its own advantages and disadvantage

The proposed solution is to reduce the unwanted RREQ packets in particular scenarios (common node scenario) only. However, this algorithm does not have an impact or result in any change in the performance in AODV networks. Any solutions that are bound to a particular scenario should not affect the performance of AODV network. If it does, it is required to build a mechanism that can disable or enable this feature.

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REFERENCES

[1] A. Singh,H. Tiwari, A. Vajp ,S. Prakash, “A Survey of Energy Efficient Routing Protocols for Mobile Ad-hoc Networks”, International Journal on Computer Science and Engineering , Vol. 02, No. 09, pp. 3111-3119 (2010)

[2] C.E. Perkins and E.M. Royer, "Ad-hoc On-Demand Distance Vector Routing", Proceedings of the Second Annual IEEE Workshop on Mobile Computing Systems and Applications, pp. 90-100, 1999.J. Clerk Maxwell, A Treatise on Electricity and Magnetism, 3rd ed., vol. 2. Oxford: Clarendon, 1892, pp. 68-73.

[3] C. Perkins, E. Belding-Royer and S. Das, Ad hoc On-Demand Distance Vector (AODV) Routing, 2003.

[4] J. Hassan and S.Jha, “On the optimization trade-offs of expanding ring search,” in Proc. of IWDC 2004, 2004, pp. 489–494.

[5] E.M. Royer, "Routing in Ad Hoc Mobile Networks: On Demand and Hierarchical Strategies", December 2000.

[6] D.N.Pham, V.D.Nguyen, V.T.Pham, N.T.Nguyen, X.Bacd, T.D.Nguyan, C.Kuperschmidt and T.Kaiser,”An Expending Ring Search Algorithm for Mobile Ad-hoc Networks”, IEEE International Conference on Advanced Technologies for communication, 2010.

[7] Q. Lv, P. Cao, E. Cohen, K. Li and S. Shenker, "Search and replication in unstructured peer-to-peer networks".

[8] C. Perkins, E. Belding-Royer, S. Das. “Ad hoc On-Demand Distance Vector (AODV) Routing: www.ietf.org/rfc/rfc3561.txt, July 2003 [Sep. 29, 2016].