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An Approach to Energy Efficient Routing Protocol for Mobile Ad-Hoc Networks

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***Abstract*: Mobile Ad-hoc Network (MANET) consists of wireless mobile nodes that dynamically form a temporary network without depending on any fixed infrastructure. MANET's are distributed and the routing functionalities are carried out by mobile nodes. Energy consumption is considered as one of the major challenge as the mobile nodes do not possess permanent power supply and they rely on batteries. The proposed work emphasizes on the protocols used in MANET which acts as solution to the energy consumption problems. In this paper the reactive MANET protocols; Ad-hoc On-demand Distance Vector(AODV), Ad-hoc On-demand Multipath Distance Vector(AOMDV) and improved AOMDV named as Ad-hoc On-demand Distance Vector with Fitness Function (FF-AOMDV) are proposed. Fitness function is an optimization technique used for optimal route selection for data transmission. The protocols are implemented using Network Simulator (NS2). Secured data transmission is established with RSA algorithm. The performance of AODV and AOMDV routing protocols are compared with different performance metrics.**

***Keywords*: Energy efficient protocol, Mobile ad-hoc network, Multipath routing, Fitness function, RSA algorithm.**

1. Introduction

Nowadays Wireless Sensor Networks (WSN's) are at higher popularity in the research area. WSN belongs to ad-hoc wireless system consisting of small units known as sensors, which are distributed in space. The random spreading of nodes, sometimes gives serious impact in network coverage and connectivity. For a complete monitoring of the whole area, it must be guaranteed that an appropriate coverage with connectivity between the nodes is available. WSN plays a key role in several application scenarios such as agriculture, environment monitoring, military applications, health care, marine and so on.

Conventional methods are not suitable for networks like WSN for direct data transfer; hence a protocol based approach including the conventional methods must be appropriate. Networks have been categorized into infrastructure based and infrastructure less networks. WLAN cellular network is infrastructure based, which is base station centralized. The infrastructure less includes ad-hoc networks that have no centralized access points. MANET is a wireless decentralized network that does not have any built in (or) fixed infrastructure format.

Ad-hoc networks provide optimization of bandwidth, enhancement of transmission quality and control of power which is inherited directly. It supports robust and effective operations for mobile wireless networks. In MANET's, the network topologies are dynamic, random, multi-hop and rapidly changing [1]. The topology consists of bandwidth-constrained wireless links. The network existence is affected by the battery capacity. The links gets disconnected when battery is exhausted. In most of the MANET protocol it has been noticed, the issues regarding the energy consumption and optimal route selection. The design of the protocols is necessary that dynamically adopt itself for the change in the system.

The routing through multipath protocol increases the lifetime of the network and the route, by choosing a best route during single route discovery process from many available routes. Even though the routing with multiple paths is efficient, there are many issues. Optimal path finding from source to destination is one among them, for the larger networks most of the energy is consumed for route discovery process and data transfer. The protocols in MANET transfer the data using intermediate nodes.

In MANET there are various routing protocols that are proposed considering the residual energy and energy consumption (or) both. They permit the establishment of multiple paths between two entities for data transfer [2]. Protocols in multipath routing sends a route request from sender to entire network to know all the routes that are available to the destination. But source node will not find the optimum (or) shortest path to the destination always. So, an energy efficient protocol for MANET's with multiple path routing need to be proposed.

2. Proposed Protocols

In this work, the on-demand routing protocols like AODV, AOMDV and improved AOMDV (FF-AOMDV) are compared. The algorithm and working principles for AODV and AOMDV routing protocol implementation are as stated below.

A. Algorithm for AODV routing protocol

1. Start.
2. If routing table contains a valid route, update the table and transfer the data to intended node.
   Else
   Broadcast a signal to find another node in the network. If node is found, then transfer the data.
3. To check whether a node is ready for transmission (or not), the destination node sends a ready signal.
   Else
   Maintain routes and activate the local route repair.

B. AOMDV protocol working principles

It uses the process of route discovery for making the node to be disjoint. And it aims to find the routes which are disjoint with link and are loop-free. AOMDV protocol is based on destination advertised hop-count. Hop-count depends on the sequence number. The count changes if there is change in sequence number. Alternate reverse paths are examined based on the copies of route requests (RREQ's). The frequent link failures are eliminated. The selection of disjoint paths in AOMDV improves the fault-tolerance.

All the nodes in the network have a separate address and the links are two directional.

Source node initiates the RREQ and RREQ is sent to destination using the intermediate nodes. The destination node will send the reply to the starting node using multiple paths. The route with higher sequence number is used at destination. Additional paths are maintained, after advertising the lengthiest path. The block diagram for proposed system is as shown in figure 1.

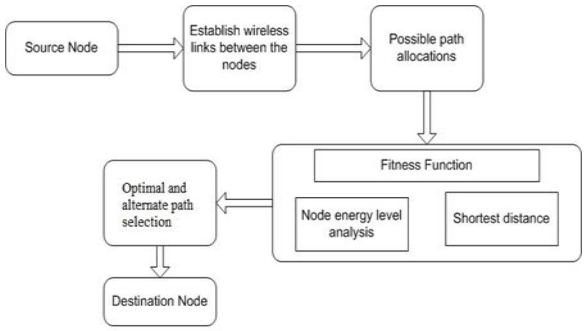

Fig. 1. Proposed system block diagram

3. Experimental Results

The performance of AODV and AOMDV protocols are compared based on the parameters such as number of packets sent, packets received, Packet Delay Rate (PDR), throughput, average E2E delay and normalized routing overheads are formulated and are as in table II. The energy consumption, PDR and delay for AOMDV protocol are analyzed graphically as shown below.

From the performance evaluation of AODV protocol, it is evident that for a network with 25 nodes, the amount of data sent to the received ratio is around 79.207%. PDR shown by the AODV is good, as it is a protocol used for data transfer through single path. The average network delay is quite high and average throughput is quite low. It concentrates to transfer the data over a single path at a time. The normalized routing overheads are high. The AODV performs better when used for single path routing, but designing a multipath routing protocol with same concept is a better option to improve the working efficiency.

AODV has higher routing overheads than AOMDV. As AOMDV has better performance metrics, it outperforms the AODV protocol. Energy consumption is a challenge faced by the protocols in MANET as seen for AOMDV.

The average delay and overheads are reduced. The graphical analysis of AOMDV protocol performance parameters shows that AOMDV is an improved version over the AODV protocol in the following aspects.

The figure 2 gives the comparison of proposed system with the existing in terms of PDR. It is evident from the comparison that, PDR shown by the proposed protocol is higher than the existing system. Throughput provided by the proposed protocol is very much higher than the existing, that makes the proposed more efficient as evident from graph shown in Figure 3. The energy consumed by the existing protocol decreases constantly with the simulation time, whereas the energy consumption of proposed multipath routing protocol AOMDV is implemented.

The performance evaluation of AOMDV protocol shows a PDR of 97.2922%, that makes AOMDV a highly efficient protocol. The average throughput of AOMDV for a network with 25 nodes is high, that makes the protocol the best. The energy consumption of proposed protocol is constant with the time that makes it efficient as evident from the graph shown in figure 4.

Table 1
Comparison of performance

Metrics	AODV protocol	AOMDV protocol
Network size	25 nodes	25 nodes
Number of packets sent	606 bytes	2105 bytes
Number of packets received	480 bytes	2048 bytes
PDR	79.207 %	97.292%
Average throughput	323.18 kbps	572.40 kbps
Average E2E delay	397.621 ms	154.461 ms
Normalized routing overheads	0.904	0.00

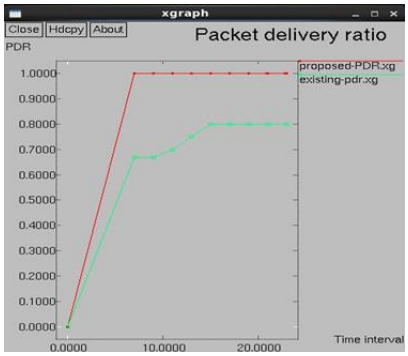

Fig. 2. Packet delivery ratio

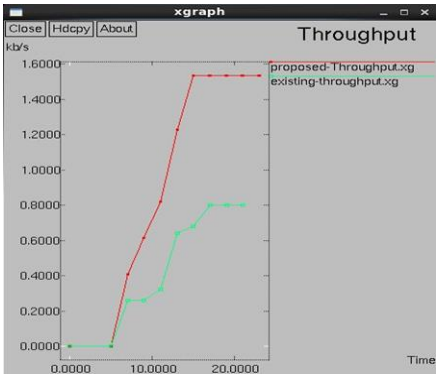

Fig. 3. Throughput

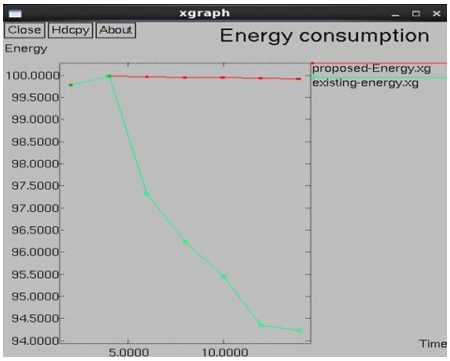

Fig. 4. Energy consumption

4. Conclusion and future scope

In this research, the proposed protocols are simulated using NS-2 with respect to simulation time. These scenarios were tested for different performance metrics. Simulation results showed that the AOMDV routing protocol outperforms AODV protocol under majority of network parameters. Conclusion can be drawn as routing protocols with multiple paths are efficient than the routing protocols with single path based on the analysis of various network metrics. The issue with the energy consumption in AOMDV is solved with design of improved AOMDV protocol. The Highly secured data transmission is established as the message is encrypted using RSA algorithm before transmission and it is decrypted back to original message at the destination.

References

[1] S. Giordano, "Mobile ad hoc networks," Handbook of wireless networks and mobile computing, pp. 325-346, 2002.
[2] S. Zheng, W. U. Weiqiang, and Q. Zhang, "Energy and link-state based routing protocol formanet," IEICE Transactions on information and systems, vol. 94(5), pp. 1026-1034, 2011.
[3] M. K. Marina and S. R. Das, "Ad hoc on demand multipath distance vector routing," Wireless communications and mobile computing, vol. 6(7), 9, 2006.
[4] M. Uddin, A. Taha, R. Alsaqour, and T. Saba, "Energy efficient multipath routing protocol for mobile ad-hoc network using fitness function," May.
[5] S. Giordano, "Mobile ad hoc networks," Handbook of wireless networks and mobile computing, pp. 325-346, 2002.
[6] B. Sun, C. Gui, and P. Liu, "Energy entropy multipath routing optimization algorithm in manet based on GA," Fifth international conference, IEEE, September 2010.
[7] A. Rajaram and J. Sugesh, "Power aware routing for manet using on-demand multipath routing protocol," Journal of computer science issues, vol. 8(4).
[8] C. W. Chen and C. C. Weng, "Power efficiency routing and maintenance protocol in wireless multi-hop network," Journal of systems and software, vol. 85(1), pp. 62-76, 2012.
[9] Y. Chaba, R. B. Patel, and R. Gargi, "Issues and challenges involved in multipath routing with dymo protocol," Journal of information technology and knowledge management, vol. 5, no. 1, pp. 21-25, January-June 2012.
[10] H. Nasehi, N. T. Javan, A. B. Aghababa, and Y. G. Birgani, "Improving energy efficiency in manet by multi-path routing," Journal of information technology and knowledge management, 2013.
[11] O. Smail, B. Cousin, R. Mekki, and Z. Mekkakia, "Multipath energy-conserving routing protocol for wireless ad-hoc networks lifetime improvement," Journal on wireless communication and networking, EURASIP, vol. 1, pp. 1-12, 2014.
[12] D. Manickavelu and R. U. Vaidyanathan, "Particle swarm optimization (pos) based node and link lifetime prediction algorithm for route recovery in manet," Journal on wireless communication and networking, vol. 1, pp. 1-10, 2014.
[13] P. K. Manohari and N. K. Ray, "Eaomdv: An energy efficient multipath routing protocol for manet," IEEE Power, Communication and Information Technology Conference (PCITC), 2015.