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Improved Energy and Route Failure Protocol (IERFP): A Framework for MANET Routing

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Abstract: The importance of MANET routing algorithm proves their equal share to IP networks. Many application domains are heavily based on wireless devices. The requirement is limited by ability to select the best route and minimum energy consumption depending upon the battery level and reliability pair between two neighbors. The IERF protocol proves with equilibrium for such constraints. AODV is modified using reliability pair factor, path accumulation to improve battery strength and route discovery with minimum failure. The IERF protocol is designed, developed and analyzed using NS 2.35 simulator. The newly designed IERF protocol is superior to other existing MANET protocols.

Keywords: MANET, AODV, RPF, PA, NS 2.35.

I. INTRODUCTION

The mobile nodes in ad hoc mobile network are restricted by battery energy for their operation. To route a packet from a source to a destination involves a number of intermediate nodes. The battery energy of a node is a precious resource that must be used efficiently in order to avoid route and link failures. Thus energy management is important issue in ad hoc network. The life of mobile node can be increased by efficient battery energy management, more ever other requirement also required such as system power management, transmission power management. These management methods are used for increasing the life of mobile node by controlling early depletion of the battery, adjusting the transmission power to decide the sufficient battery energy level of a mobile node. Low battery energy strategies are required to incorporate the protocols used in various layers of protocol stack.

The battery energy of a mobile node at the network layer can be preserved by reducing the energy in communication and computation. The communication related energy is mainly due to transmit or receive packets related functions operated in the mobile nodes. Even when the mobile node is not actively participating in communication, the battery energy keeps discharging. The computation related energy refers to the energy required in calculations that takes place in mobile nodes during routing and power adjustment.

II. AODV ROUTING PROTOCOL

When a mobile node sends a packet to another mobile node, it checks its routing table to see if a route entry exists to the required destination. If a route entry is found, the packet is forwarded along that route only. A mobile node collects the routing information from its neighboring mobile nodes, if the routing information is not available to forward the packet. The source mobile node broadcast a route request control message RREQ packet to its neighbors, if a route does not exist. The neighbors respond to the RREQ packets with a route reply control message RREP packet containing the requested route information. In some cases, the intermediate mobile nodes might not have the requested route information. In this situation, the intermediate mobile node re-broadcast a route request RREQ packets from the source mobile node. This process is repeated until an intermediate mobile node or the destination mobile node replies to the route request RREQ. Due to this recursive re-broadcast of the route request RREQ the destination mobile node might relive multiple copies of RREQ from the same source through different paths. The destination sequence number prevents multiple copies of the same packet getting looped between mobile nodes. The destination mobile node sends a route reply RREP packet back to the source through the path along which it received the first route request RREQ. AODV maintains only the route to the neighbors instead of the entire path the packet has taken. A major drawback of the AODV protocol is that when link failures occur, a large number of control packets are generated. These control packets are responsible to increase the congestion in the active route between a source and a destination mobile node. Consequently the overhead in the bandwidth increases with the increase in the number of control packets which leads to increasing the number of loss packets and packet transmission time delay [1],[2],[3].

III.IERF PROTOCOL ROUTING

The proposed Improved Energy and Route Failure (IERF) protocol is based on AODV protocol. The AODV is well known on demand routing protocol where a source mobile node imitates route discovery when it needs to communicate to a destination that doesn't have route to it. Once a mobile node discovered between two mobile nodes, data transfer occur until the route failure due to high dynamic nature of network. In order to make the existing AODV more intelligent, the improvement in route failures between two mobile nodes and the balance level of battery energy in them is considered to improve the

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routing decision. The design objective of IERF protocol is to determine the best available route from a source mobile node to a destination mobile node along intermediate mobile nodes, if any on basis of reliability pair factor and path accumulation.

The proposed protocol has all the characteristics of the existing AODV routing protocol, since it follows all the steps of the routs discovery and route maintenance similar to the AODV. IERF modifies the existing AODV protocol to reduce the length of the path of routing reply message RREP when link failures occur. Battery energy consumption is an important improvement in IERF protocol used for MANET. A path between a source and a destination mobile node may not available if the energy of an intermediate mobile node along the path is either exhausted completely or at very low level of battery energy. Hence, the stability of a link between two mobile nodes is dependent on the remaining battery energy in the intermediate mobile nodes along the path.

IV. IERF PROTOCOL FRAMEWORK

The mechanism of IERF protocol for MANET is based on AODV protocol. Hence reactive routing is implemented in IERF protocol is composed of two major phases. This is given in Figure 1.

A. Root Discovery

The responsibility of route discovery phase is route discovery from a source mobile node to a destination mobile node. It is initiated if there is no cached route available to a source mobile node. This mechanism further consists of two main building blocks [1].

1) Flooding:

Flooding building block takes the responsibility to distribute the route request messages within the network. The range of flooding is described by Time-to-Live TTL field. A local flooding method is implemented. This is useful in finding a neighbor mobile node in a cache.

2) Caching:

Caching building block is used to efficiently and promptly provide the route to the destination without referring to the destination every time when request send. Multiple cache entries are allowed for the same destination.

B. Root Maintenances

Route maintenance phase is responsible for detecting and repairing route failures. This phase consists of three building blocks.

1) Error detection:

It is used to monitor the status of the route of a mobile node with its neighbor routes of a mobile node with its neighbor

2) Error Handling

It finds the alternative routes to replace an invalid route after a broken link is detected. The mobile node detecting the broken link will attempt to find an alternative route in its own cache or do a localized flooding before asking the source to re-initiate the route discovery.

3) Error Notification

It is used to notify the mobile nodes in the network about invalid routes. The source is the recipient of error message

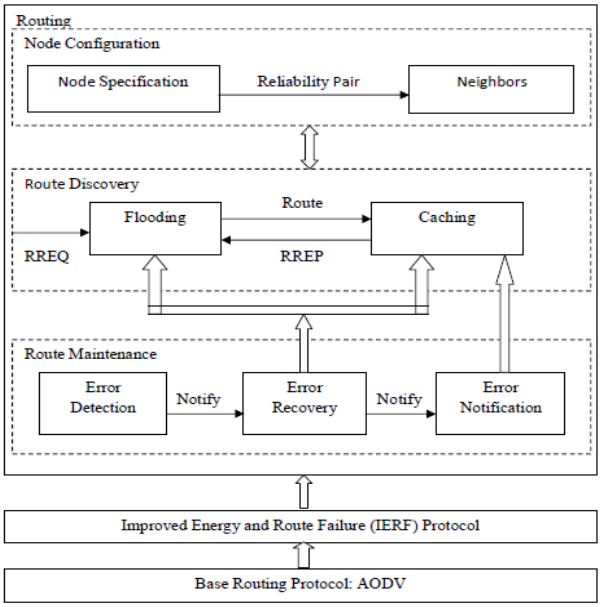

Fig. 1 Framework of IERF Protocol

V. FEATURES OF IERF PROTOCOL

The design of IERF protocol is implanted on AODV protocol with following features:

A. Energy Consumption

The balance energy on each transmission or reception of a data packet is calculated using equation BBE = Current energy – Consumed energy, which is calculated as either Pt+T or Pr*T where Pt is energy consumed in transmitting and receiving packets respectively and T is time [5].

B. Node Reliability Pair

A mobile node establishes communication with its neighbor mobile node. Reliability pair connects two neighbors used for establishing unicast routes [13],[15]. Reliability pair Factor (RPF)is used to determine connectivity status between a pair of mobile nodes using

$$RPF_{ij} = C\,[Min\,(BBEi, BBE_j) + DS] / d_{(ij,o)}$$

where C is proportionality constant, BBE_i is balance battery energy at mobile node MN_i, BBE_j is balance battery energy at mobile node MN_j, DS is differential signal strength, and $d_{(ij,o)}$ is distance between MN_i,and MN_j.[6],[7].

C. Path Accumulation

Every intermediate mobile node that does not have a route to the destination forwards the route request RREQ packet after appending its address in the packet. Hence, at any point the RREQ packet contains a list of all the mobile nodes traversed. Whenever a mobile node receives a route request RREQ packet, it updates the route to the source mobile node. It then checks for intermediate mobile nodes accumulated in the path. Hence, at any point the route reply RREP packet contains all the previously traversed mobile nodes which help in formation of path accumulation (PA)[4].

D. Node pruning and discovery

The RPF is calculated to each corresponding neighbor for a mobile node. The mobile nodes disposed to initiate route

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setup and identify its neighbors with the RPF less than or equal to reliability pair threshold.

VI. IERF PROTOCOL ANALYSIS AND RESULTS

The code is implemented using C++ in NS-2.35.The route reply message RREP packet format and routing table of a mobile node of AODV is modified by adding values to the reserved bit field, the first six bits are used balance battery energy and route failures parameters between mobile nodes using. The test is conducted with varying number of mobile nodes=90, traffic connections=18, mobile node speed=50m/sec, pause time=20sec, and packet size=128 bytes in 500 x 500 m2 topology area for 300 seconds simulation time for TCP/FTP traffic. The behavior of IERF protocol is compared with Ad hoc On-demand Distance Vector (AODV), Ad hoc On-demand Multipath Distance Vector (AOMDV), Dynamic Source Routing (DSR), and Destination-Sequenced Distance Vector (DSDV). The performance metrics used in simulation are packet delivery rate, packet loss rate, routing overhead, energy consumption, throughput, delay, routing load, and hop count [8]. The performance analysis of IERF protocol with other protocols of MANET routing pprotocols is given in Figure 2 and Figure 3.

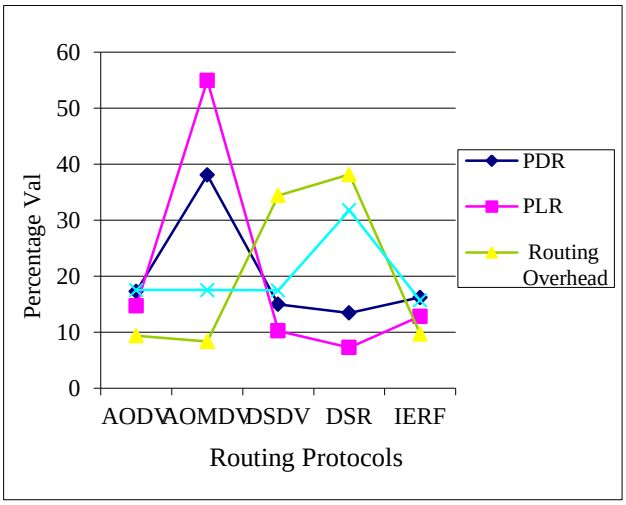

Fig. 2 Performance analysis of Protocol with IERF

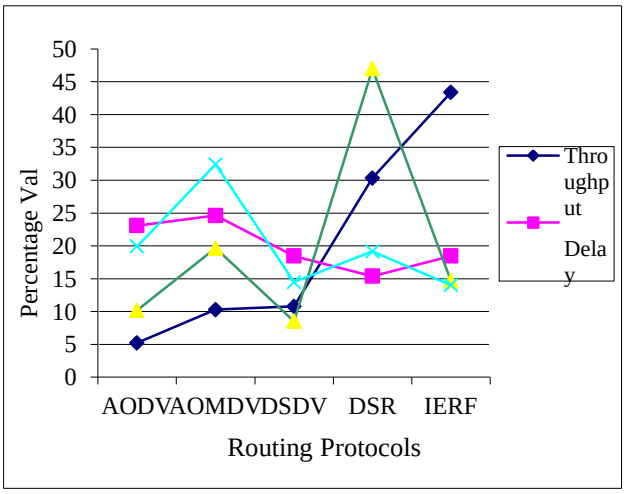

Fig. 3 Performance analysis of Protocol with IERF

VII. CONCLUSION

We have applied energy bits which are used to calculate the balance battery energy at each mobile node and failures bits to calculate route failures between mobile nodes along the path to reach the destination. It is observed that the shortest route easily determine by summing up of energy values of all mobile nodes along the accumulated path and failures values between the mobile nodes. Further to mention that the IERF protocol is resulted to prove excellent than other protocols used for comparison.

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REFERENCES

[1] Monika Kalyane, and Dr. Sanjay Thakur, "MAMET: Analysis and Improvement of AODV Protocol through Path Accumulation and multipath routing", International conference on computer science and Engineering (CSE), 7th April 2013, Banglore, ISBN: 978-93-82220/80839.

[2] P.Samundiswary, S. R. Anandkumar, "Throughput Analysis of Energy aware Reactive Routing Protocol For Wireless Sensor Network", International Journal of Soft Computing and Engineering (IJSCE) ISSN:2231-2307,Volume-2,Issue-1,March 2012

[3] S. Subathra, J. Abiramy, and S. Sukanya, "Energy efficient OAODV routing protocol in Mobile Ad-Hoc Network", IJREAT International Journal of research in Engineering and Advanced Technology, Vol. 1, Issue 1, March, 2013,ISSN: 2320-8791

[4] Yogesh Chaba, Yudhir Singh, and Anil Kumar, "AODV with secure Route Accumulation for improved Routing in WiMax", IJCSI International Journal of Computer

[5] R. Vihayapriya, Dr. P T Vanathi, "Energy efficient adaptive multiple routing for wireless sensor networks", IAENG International Journal of Computer Science, 34:1, IJCS_34_1_8, 15th August, 2007

[6] Rajeshekhar C. Biraday, and Sunilkumar S. Manvi, "Information priority Based multicast Routing in MANETs," International Journal of wireless & mobile Networks (IJWMN) Vol. 3 No. 3 June 2011.

[7] Surbhi Purwar, Shiva Prakash," Reliable pair protocol for Link Stability in MANET", IRACST – International Journal of Computer Networks and Wireless Communications (IJCNWC), ISSN: 2250-3501 Vol.2, No.3, June 2012

[8] Shivshankar, Varaprasad G. Suresh H. N. Devaraju G.and Jayanthi G. "Performance Metrics Evaluation of Routing Protocols in MANET", International Journal of Advanced Research in Computer and Communication Engineering Vol. 2, Issue 3, March 2013.

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