Enhanced Dynamic Source Routing Algorithm for Energy Efficiencyin MANET

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Abstract–*A mobile ad-hoc network is grouping of moving devices or nodes which have the service to communicate with each other devices without having any centralized network infrastructure. Due to this environment, nodes may move frequently to the various topology models dynamically. In this structure, the every routing process must deal with so many issues as mainly called energy issues.All the activitiesconsume some amount of energy during the routing process.If there is some problem occurred such as traffic, Hacking, Absent of Nodes, etc., then lot of energy consumed for this issues and it may cause of dead communications between nodes in MANET. In this paper, a new approach (traffic marking) introduced for detecting the traffic highly available nodes using color marking in Token Bucket Marking concept. This used to avoid the energy consumed for idle sleep node, traffics, hacking. This research work simulated using NS2.28Tool.*

Keywords- *MANET, DSR, RREQ, RREP, Color Marking*

I. INTRODUCTION

Mobile ad-hoc networks (MANETs) that contain wireless mobile nodes and independent dynamic self-organize into arbitrary environment ad hoc network topologies. Mobile Ad-hoc Network (MANET) is a collection of communication devices or nodes that wish to communicate with infrastructure less networks. In MANET, Routing is main problem to route the data packets from one source node to one / many destination node in networks. MANET aimed to provide communication capabilities to areas where limited or large Multicast routing. MANET does not use a static network infrastructure. The aim of routing protocols is - Find shortest path, minimum routing overhead, congestion and save energy [1].

Fig1. MANET

The main advantage of the reactive protocol is that if data traffic is not generated by many numbers of nodes availability, and then routing activity is totally absent. The main drawback is the network-wide path discovery required to obtain routing information to maintain for ever. Since discovery is based on flooding, such a procedure is very costly. The main strategy to reduce the energy consumed by unwanted situation is to fulfil the routing process with high energy retained available routes are preferred to the effort of finding the current best path. The natural solution is color marking [2].

II. MANET CHALLENGES

A MANET environment has to overcome certain issues oflimitation and inefficiency. It includes [3]:

- ✓ Power Consumption –All transmission process consumes certain amount of power to communicate between sources to destination.
- ✓ The wireless link characteristics are time-varying in nature - There are transmission problems like fading, path loss, blockage and interference that add to the susceptible behaviour of wireless channels. The reliability of wireless transmission is resisted by different factors.
- ✓ Limited range of wireless transmission – The limitedratio band results in reduced data rates compared to the wireless

networks. Hence optimal usage of bandwidth is necessary by keeping low overhead as possible.

- ✓ Packet losses due to errors in transmission – MANETs experience higher packet loss due to factors such as hidden terminals that results in collisions, wireless channel issues (high bit error rate (BER)), interference, and frequent breakage in paths caused by mobility of nodes, increased collisions due to the presence of hidden terminals and uni-directional links.
- ✓ Route changes due to mobility- The dynamic nature of network topology results in frequent path breaks.
- ✓ Frequent network partitions- The random movement of nodes often leads to partition of the network. This mostly affects the intermediate nodes.

III. TOKEN COLOR MARKING

The token bucket coloring policies, which are widely used for this purpose, prefer short packets and mark them with a higher priority colors to avoid the Collison path.

Traffic marker

a. Color packets by conformance to contract
b. Rate estimator

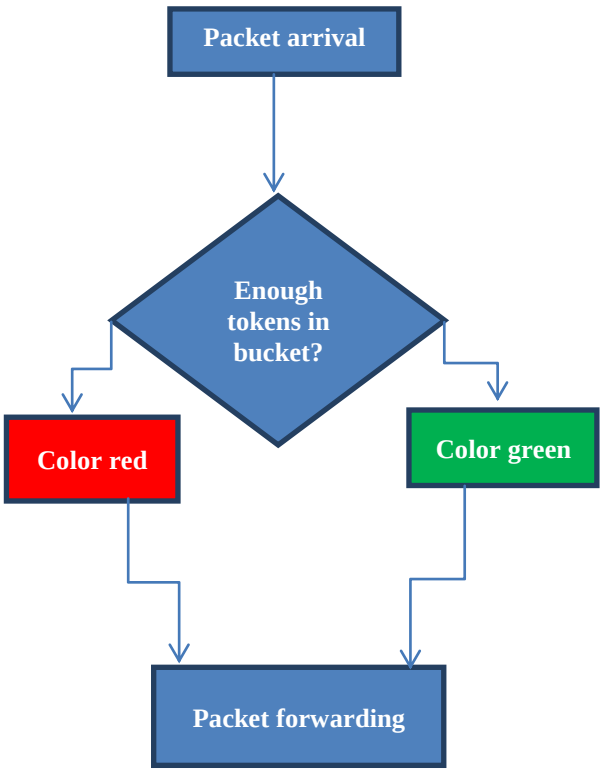

Fig2. Color Marking

IV. LITERATURE SURVEY

Since last 10 years many energy efficient routing protocols have been proposed and utilized for finding the solutions. As it is very difficult to restrict technologies and research digging for optimal solution because every research aspects get updated and requirements are varied, many noticeable enhancement and modifications have been done to convert DSR as an energy efficient routing protocol and serve it as efficient routing protocols like other protocols. But all protocols are not satisfied all the requirements because of day by day requirements are very different. So in the next session here are few important routing protocols which are made after doing some modification in traditional DSR protocol.

Vikas Kawadia.et.al has proposed algorithm to discuss that the Route Request is propagated towards the destination via multiple intermediate nodes. In Global Energy Aware (GEAR), along with the route request it piggybacks the remaining battery power as well as its identity and broadcast it to its neighbour nodes. When the destination nodes receive these different route request (RREQ) from the same source, then it selects the best route on the basis of high remaining/residual battery power out of the all received RREQ. But it does not guarantee the selected path is the best path always. Because it may happen that few routing paths with a better metric may not be considered, if it is arrived some time later than the specified time duration [4].

Stojmenovic I.et.al introduced this protocol [6]Localized Power Aware Routing (LEAR) Protocol is based on DSR routing mechanism. The basic idea of LEAR is to consider only those nodes for the communication which are willing to participate in the routing path. This "Willingness" is the special type of parameter used in the modified DSR to find the route from source to destination. The new parameter can be determined by the Remaining Battery Power (Er). If it is higher than a "threshold Value (thr)", then the node will be considered for the route path and 'Route Request' is forwarded, otherwise the packet is dropped. It means only when the intermediate nodes will have good battery levels then only the destination will receive route request message. So the first message that arrives at the destination will be considered to follow an energy efficient as well as reasonably shortest path.

M. Tarique.et.al,Energy Saving Dynamic Source Routing (ESDSR) [7] protocol is another modified DSR protocol which is aimed to prolong the network life time by using basic two approaches of power consumption, one is transmission power control approach and the second one is load balancing approach. In the first phase it decides the route based on the load balancing approach and in the second phase it dynamically adjusts the transmitting power at every node before it transmits packet.

J.-E. Garcia.et.al,Energy Dependent DSR (EEDSR) [8] is also an energy efficient routing protocol which is based on traditional DSR mechanism. It is almost similar to the LEAR approach but the only difference is that the willingness factor depends upon some other parameters. These parameters decide whether a node should participate in forwarding the packets or not which in turn it prevents nodes from a sharp drop of battery power.

Vahid Nazari.et.al, The Energy efficient DSR (E2DSR) [9] is one of the splendid efforts made so far in order to make DSR as an efficient routing protocol. Because It has introduced many significant parameters as performance matrices which helps in calculating energy consumption in MANET. Even though it has the same objective like other protocols, but it has left a broad scope or the research activities. It is one of the latest energy aware routing protocols designed to reduce power consumption in battery effectively by doing some modifications in DSR. E2DSR has proposed some new structure for the control packets to change the behaviour of the nodes implements a new Energy table and creates a new algorithm for route cache and route selection.

XU Li, WU Zi-we.et.al,It is realized [10] later that the topology control has serious effects on the system performance in various ways. It can affect the traffic carrying capacity as well as can have the contention for the medium. Topology Control Based Power-aware Battery Life-aware DSR (TPBDSR) uses simple pure distributed control where each node adjust its transmitting power through certain range of neighbour that are given with some number. If the node findsits neighbour within or beyond certain range then the transmitting power is getting adjusted. In other word, we can say that the transmitting power gets adjusted according to their neighbour node's position in the network topology which may change dynamically. This strategy also limit the power adjustment period which is denoted by h second, where the value of h may vary with mobility character of the networks.

The most common implementation [12] of source routing is Dynamic Source Routing. DSR is entirely .on-demand., which is it does not require constant information updates in order to build and maintain routes. Its two major services (route discovery and route maintenance) are only invoked when a network node requests them. Span, on the other hand, uses periodic broadcasts to maintain information and elect new coordinators. Nodes may go up or go to sleep irrespective of the routes they are currently servicing. This underlying election process, which currently runs irrespective of routes, would cause many broken source routes and create unnecessary overhead in route recovery.

V. PROPOSED ALGORITHM

Energy consumption is a challenge in MANET. This paper describes a modified DSR approach called EDSR. The residual energy of neighbour node is compared with the average energy of the path and accordingly the node is disabled. This proposed algorithm showed positive results in terms of energy conservation when simulated using 50 nodes UDP traffic. Energy consumption in EDSR reduces to 58 % as consumed by IDSR.There are still various scopes for researchers to optimize DSR. The proposed approach can show interesting results in different scenario. In different application scenario, different approaches can be exploited. Future work can be carried out using different traffic type, different mobility models and changing more than one parameter at a time.

EDSR (N,Nodes)

/* A Mobile Network is defined with N Number of Nodes with random position and energy specifications*/
{
1. Define the Source Node Src and Destination Node Dst

2. Generate the Distance Matrix over the Network Nodes.

3. Generate the Energy Matrix to analyze the energy required between node pairs under distance specification

4. Set curNode=Src [Set source node as current communicating node]

5. While CurNode!=Dst [Repeat Process till destination node not reached]
{
6. Generate the Shortest Path over the Network

7. Identify the Average Energy Available over the Path

8. For i=1 to Length (Path)

{

9. if (Energy(Nodes(i))<AverageEnergy)

{

10. Token Bucket Marking

10.a)Token Bucket Size calculation

10.b)Token Rate calculation

10.c)Token Color marking

11. Status Checking in Token Marking

If (token rate < average queue rate) && (token bucket size > average queue length)
{

Set nodes(i).Status='Green';

else

Set nodes(i).Status='Red';

}

if (TokenStatus=='Red')

{

12. Set Nodes (i).Enabled=False

}

}

}

13. Identify the Effective Neighbor with Maximum Energy called ENode
14. CurNode=ENode
}

The proposed algorithm used to check the Collison to save the path for successful routing to ensure the energy level for each pair of nodes which involves the transformations.

IV.SIMULATION RESULTS

NS2:

A network simulator is software that predicts the behaviour of a computer network. In simulators, the computer network is typically modelled with devices, links, applications etc. and the performance is analysed. Typically, users can then customize the simulator to fulfil their specific analysis needs [13].

Most of the commercial simulators are GUI driven, while some network simulators are CLI driven. The network model / configuration describe the state of the network (nodes,routers, switches, and links) and the events (data transmissions, packet error etc.). An important output of simulations is the trace files. Trace files log every packet, every event that occurred in the simulation and are used for analysis. Network simulators can also provide other tools to facilitate visual analysis of trends and potential trouble spots.Most network simulators use discrete event simulation, in which a list of pending "events" is stored, and those events are processed in order, with some events triggering future eventssuch as the event of the arrival of a packet at one node triggering the event of the arrival of that packet at a downstream node.Simulation of networks is a very complex task. For example, if congestion is high, then estimation of the average occupancy is challenging because of high variance. To estimate the likelihood of a buffer overflow in a network, the time required for an accurate answer can be extremely large. Specialized techniques such as "control variates" and "importance sampling" have been developed to speed simulation [14].

Simulation Procedure:

- Simulation Object Creation
- Tracing (Simulation.Object - NAM)
- Topology Formation
- Communication Agent
- Traffic Model
- Error Model
- Algorithm Designing
- Run the Object

These are all steps for completing the simulation modelling process for entire common research work.

Simulation Parameters:

Table1. List of Simulation Parameters

Simulation Parameters	Options
Initial Node Energy	50 Joules
Node Pause Time	0.1 sec
Transmission Power	0.25nW
Receiving Power	0.25nW
Traffic Agent	CBR
Antenna Type	Omni Antenna
Traffic Source	UDP

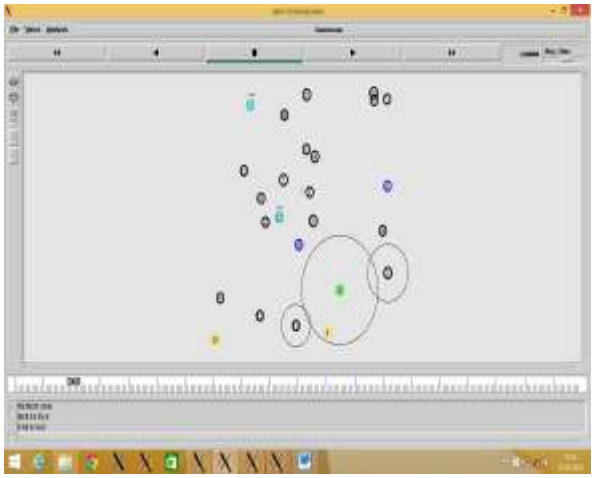

Fig3. Dynamic Nodes Communication

A. Routing Overhead:

Routing Overhear is a node often changes their location within network. So, some stale routes are generated in the routing table which leads to unnecessary routing overhead.

Routing overhead can be calculated throughout the source to destination path for multi transmission because of dynamic routing.

B. Throughput:

It is defined as the total number of packets delivered over the total simulation time. The throughput defined by

Throughput = N/ 1000

Where is the number of bits received successfully by all destinations.

C. End – to – End Delay:

The average time it takes a data packet to reach the destination. This includes all possible delays caused by buffering during route discovery latency, queuing at the interface queue. This metric is calculated by subtracting time at which first data packet arrived to destination.

It defined as

EED = S / N

Where S is the sum of the time spent to deliver packets for each destination, N is the number of packets received by the all destination nodes.

D. Packet delivery ratio:

Packet delivery ratio is defined as the ratio of data packets received by the destinations to those generated by the sources.

It defined asPDR = S1 / S2

Where S1 is the sum of data packets received by the each destination and S2 is the sum of data packets generated by the each source. Graphs show the data packets are successfully delivered during simulations time versus the number of nodes. Performance of the EDSR is increasing in the case of DSR and IDSR.

Fig4. Routing Overhead

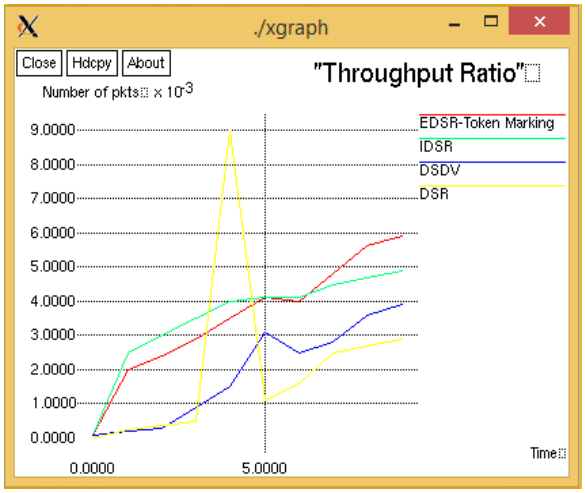

Fig5. Throughput for DSR, DSDV, IDSR, EDSR

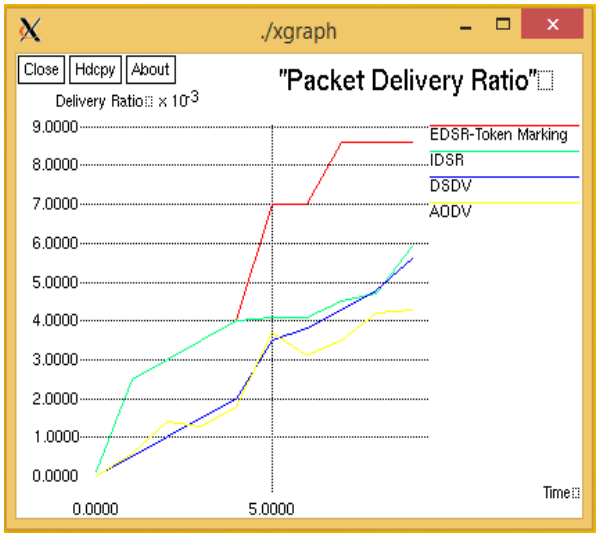

Fig6. Packet Delivery Ratio

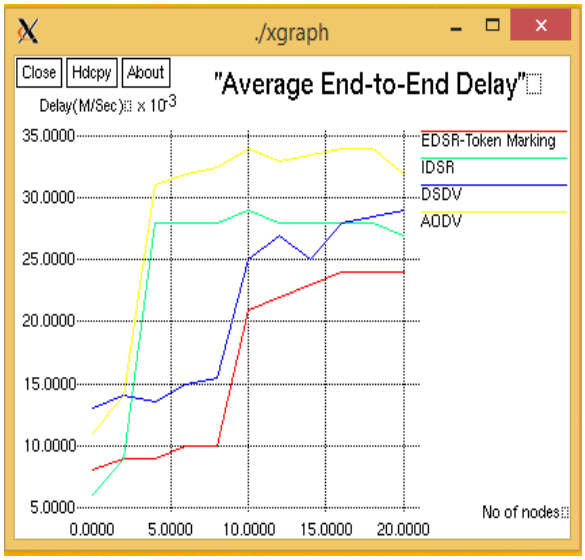

Fig7. Average End-To-End Delay

Table2. Energy Secure% between Traditional IDSR and Proposed EDSR

Computing Parameters	**IDSR**	**EDSR**
Routing Overhead	21%	15%
Packet Delivery Ratio	6%	8.5%
Average End-to-End delay	28%	22%
High throughput	4.7%	6%
Energy Retain (After Completion)	49% (Traditional)	58% (Proposed)

VI.CONCLUSION AND FUTURE WORK

Energy conservation is a challenge in MANET. This paper describes a modified DSR approach called EDSR. The residual energy of neighbour node is compared with the average energy of the path and accordingly the node is disabled. This proposed algorithm showed positive results in terms of energy conservation whensimulated using 50 nodes UDP traffic. Energy consumption in EDSR reduces to 58 % as consumed by IDSR.

There are still various scopes for researchers to optimize DSR. The proposed approach can show interesting results in different scenario. In different application scenario, different approaches can be exploited. Future work can be carried out using different traffic type, different mobility models and changing more than one parameter at a time.

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