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Energy Efficient Multipath OLSR in Mobile Adhoc Networks

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Abstract - *Mobile Adhoc Networks is a wireless network, which is self- configuring of mobile nodes communicated by wireless link. Now a days MANETs is a wider area for the research in which energy efficiency is the key feature to research where minimum power consumption is required in the network. Optimized Link state Routing (OLSR) protocol is a table driven, proactive protocol, which provides an immediate route between nodes when needed. In this paper, OLSR protocol has modified with the technique of energy efficiency. In this technique, the routing table is modified by saving multiple shortest path for immediately next shortest link available in case of first link goes down without running route discovery algorithm. So there is less overhead and less energy consumption in the network. At last implementation detailed is given by comparing original OLSR protocol and modified OLSR protocol with the graphs of Throughput, Packet Delivery ratio, energy efficiency, Normalized routing load, and End-to-End Delay Parameters of the network.*

Key Words: OLSR, Multipoint relaying, Routing protocol, energy efficiency, Multipath routing.

1.INTRODUCTION

1.1 MANETs

Mobile Adhoc Networks (*1*) are the types of wireless networks which are infrastructure less. It is a decentralized wireless network. In MANETs every node are itself router. In MANETs nodes are in mobile nature, because of that the network topology is changed frequently .MANETs have following characteristics: Infrastructure less(No any mediator network device is required for communications), Multi-hop routing(there is no default router available, nodes are themselves router, so shares information via many hosts), Dynamic topologies(In mobile Adhoc networks, because nodes can move arbitrarily, the network topology changes frequently, which is responsible to link failure, partitioning.). MANETs have following Characteristics : (1) Military battlefield, (2) Collaborative work, (3) Local level , (4) Commercial sector,(5) Personal area network and Bluetooth.

1.2 Optimized Link State Routing Protocol (OLSR)

Optimized Link State Routing protocol (OLSR) (*3*) is the link state protocol, so it provides the link immediately when required because of its proactive nature. OLSR floods link or control messages to keep updated of the every node in the network and maintains table up-to-date. Instead of transmitting the control messages to each node, OLSR will transmit it to particular selected nodes who are Known as multipoint relays. The multipoint relays task is to disseminate the messages in the network.

1.2.1 Multipoint Relays (MPRs)

The main perception of the MPRs is to decrease the flood of the broadcast packets in the network. It reduces replica of retransmission, in same region. Multipoint relays are a subset of nodes, which are selected by its neighbors. Each MPR node in the network retransmits its packets to the two hop neighbor. The multipoint relays (MPRs) of the node are following in figure 1.

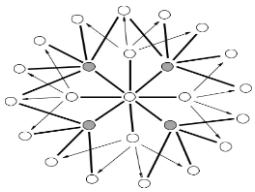

Fig -1: Multipoint relays (*3*)

1.2.2 Protocol Functioning

The OLSR protocol contain various functions those are responsible to perform the task of routing. these functions of the protocol are discussed follow :

1) **Containing Neighbor node Information (neighbor discovery)** (*4*) : In this function, the HELLO messages is broadcasts by Each node periodically with containing its neighbours' information and its link position. These

are sent to one hop neighbours. HELLO message structure is shown following:

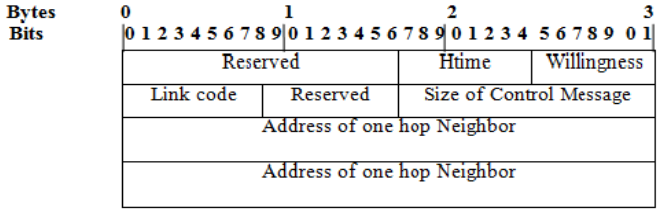

Fig -2: Hello Message (4)

2) Link state declaration (*4*) : Link state routing protocols are based on nodes flooding the network with information about their local links. In OLSR link state emitted describes link to neighbor nodes. This is done using TOPOLOGY CONTROL(TC) message. The format of a TC message is shown in figure 3.

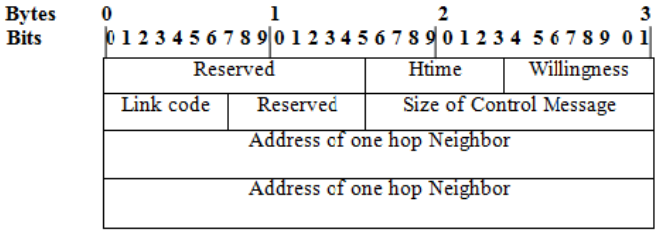

Fig -3: Topology Control Message (4)

1.2.3 OLSR Table Calculation

1) Topology table: Every node contains a topology table from TC messages. It contains the MPR nodes information. The topology table is shown below in figure 4:

Destination address	Destination's MPR	MPR Selector Sequence number	Holding time

Fig -4: Topology Table (4)

2) Routing table: A Routing table contains final result of the OLSR protocol from the Topology table. A routing table stores the shortest path which is calculated from Topological table. The format of the routing algorithm is shown in figure 5.

Destination address	Next hop address	Distance

Fig -5: Topology Control Message (4)

If there any modification in table of neighbor node or in topology table, a routing table is recalculated after every change.

2. PROPOSED WORK

Proposed work will modify OLSR for the purpose of less energy consumption by altering the hello message by adding residual energy field. Prior to send hello message, each node adds its own residual energy within hello message and adds residual energy field within TC message.

Each node sends Hello message for finding hop count and each node creates neighbor table of one hop count and 2 hop count. Based on this table, each node selects MPR. MPRs are selected nodes that have more than one hop as well as high residual energy. After selecting MPR, only MPR nodes broadcast route-request. For sending route-request MPR nodes send TC (topology control) message. TC message contains MPR list, therefore each node will get an idea about complete topology. Over here, we will modify TC message and also verify residual energy of MPR. After receiving TC message, each node maintains topology table and routing table and will store multiple shortest path in routing table from topology table with 1st path contains high energy MPR and 2nd path contains second highest energy MPR.

If any link will goes down then router immediately get 2nd path with another MPR. So in case of failure of link, no need to re-calculate residual energy and to run algorithm. Therefore here time and energy will consume less.

3. RESULT AND SIMULATION

OLSR routing protocol has been modified by numerous techniques of energy efficiency. Here one Improved Method has proposed to store multiple shortest path in routing table, which will decrease redundancy of re-run routing algorithm to find shortest path from the topology table and will consume less energy.

In this work, residual energy will count of MPR nodes and Packet will forward to that MPR nodes who have high residual energy and only that nodes will forward the packet entire nodes in the network.

so it will improve Throughput as well as Packet Delivery Ratio.

3.1 NS2 (Network Simulator 2)

NS2 provides users with an executable commandns which takes on input argument, the name of a Tcl simulation scripting file.

Users are feeding the name of a Tcl simulation script (which sets up a simulation) as an input argument of an NS2 executable commands. In most cases, a simulation trace file is created, and is used to plot graph and/or to create animation.

NS2 consists of two key languages: C++ and Object-oriented Tool Command Language (OTcl).

While the C++ defines the internal mechanism (i.e.,a backend) of the simulation objects, the OTcl sets up simulation by assembling and configuring the objects as well as scheduling discrete events (i.e., a frontend).

The C++ and the OTcl are linked together using TclCL.

Mapped to a C++ object, variables in the OTcl domains are sometimes referred to as handles.

Conceptually, a handle (e.g.,nas aNodehandle) is just a string (e.g., o10) in the OTcl domain, and does not contain any functionality.

Instead, the functionality (e.g., receiving a packet) is defined in the mapped C++ object (e.g., of classConnector).

In the OTcl domain, a handle acts as a frontend which interacts with users and other OTcl objects.

It may defines its own procedures and variables to facilitate the interaction.

Note that the member procedures and variables in the OTcl domain are called instance procedures (instprocs) and instance variables (instvars), respectively.

3.2 SIMULATION PARAMETERS

Table -1: Simulation Parameters

Parameters Type	Values
Network Simulator	NS2.35
Number of Nodes	50, 100, 250, 500
Simulation Area	1000 X 1000m^2, 1250 X 1250 m^2
	1500 X 1500 m^2, 1750 X 1750 m^2
Maximum Connections	20
Transmission Range	250m
Bandwidth	2 Mbps
Simulation Time	300s
Node Movement Speed	1,5,10 m/s
Pause Time	10ms
Mobility Model	Random direction
Node Placement	Random
Routing Protocol	OLSR
Traffic Type	CBR
Data Packet Size	512bytes
Initial Energy	100 J
tx Power	1.5 W
rx Power	1 W
Idle Power	0.1 W
Sleep Power	0.5 W
MAC Protocol	802.11

Simulation parameters given above are taken to analyze the result for the proposed work.

3.3 SIMULATION RESULTS

In this proposed system we compared the simulation result of Original OLSR protocol and Modified OLSR protocol for Mobile Adhoc Network. From the simulation result we can analyze that energy efficiency of the Modified OLSR protocol is less than Original OLSR. The following given graphs shows the comparison results of Original and Modified OLSR protocol with different nodes 50, 75, 100, 125.

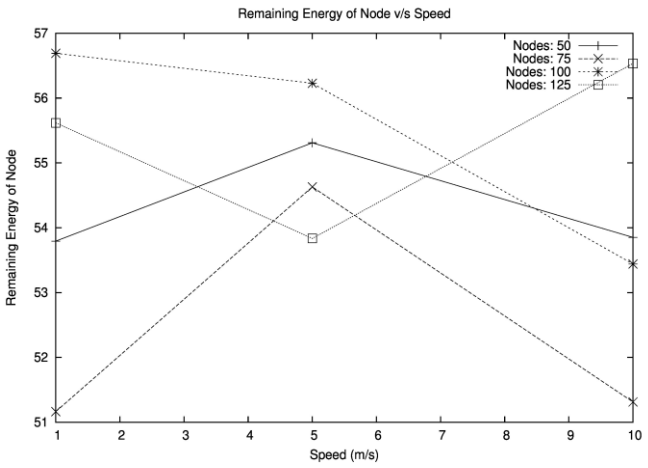

Fig- 3.1: Original OLSR Energy Efficiency

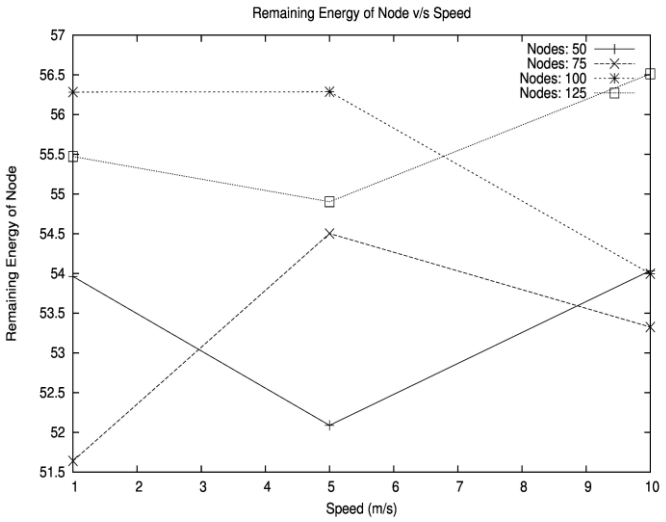

Fig- 3.2: Modified OLSR Energy Efficiency

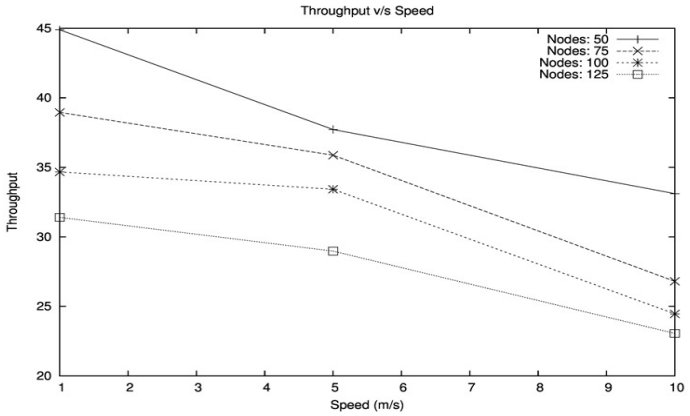

Fig- 3.3: Original OLSR Throughput

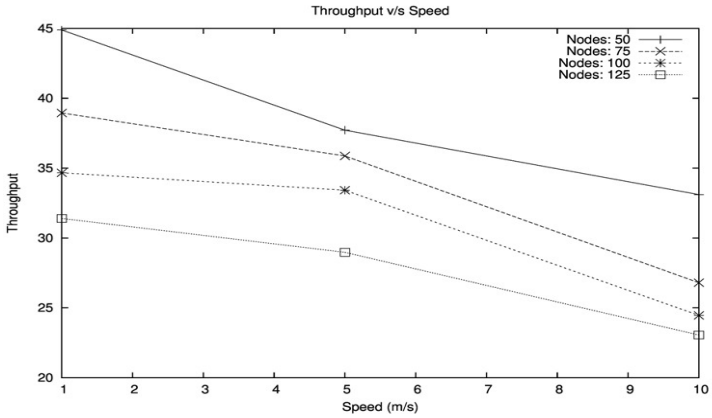

Fig- 3.4: Modified OLSR Throughput

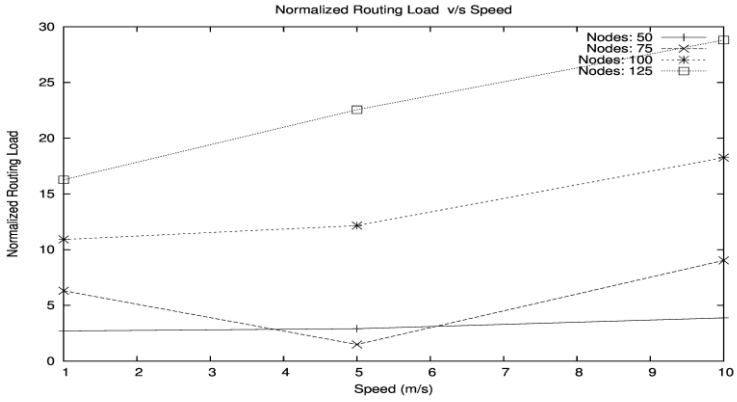

Fig- 3.5: Original OLSR Normalized Routing Load

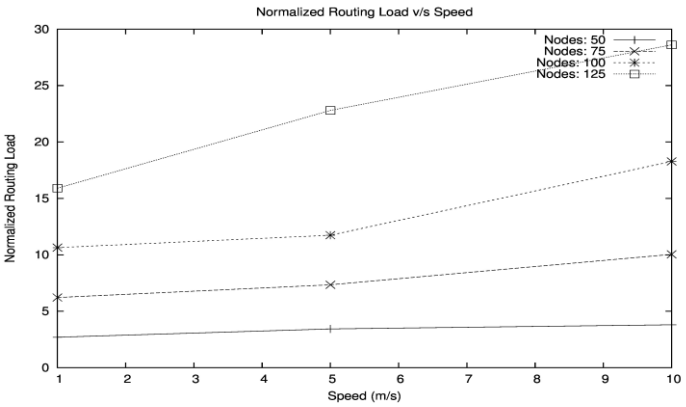

Fig- 3.6: Modified OLSR Normalized Routing Load

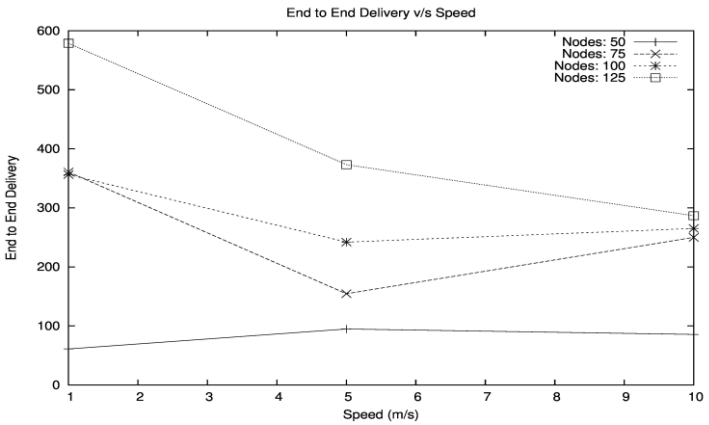

Fig- 3.9: Original OLSR End to End Delay

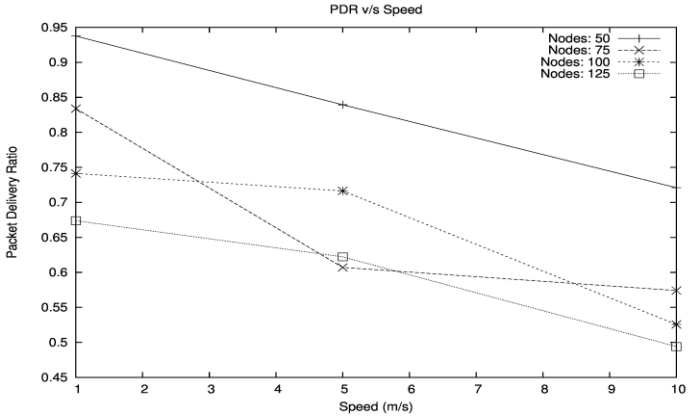

Fig- 3.7: Original OLSR Packet Delivery Ratio

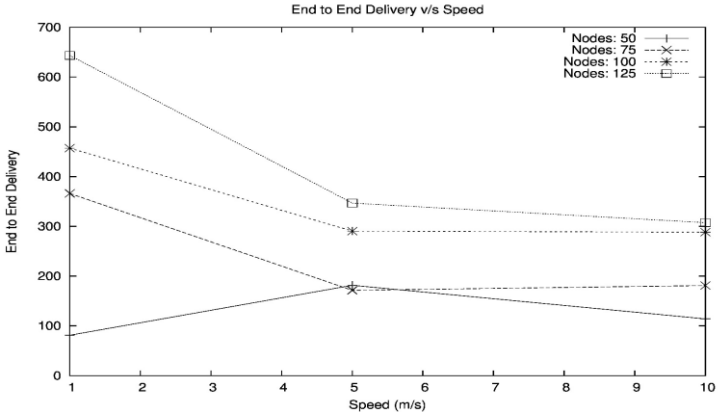

Fig- 3.10 : Modified OLSR End to End Delay

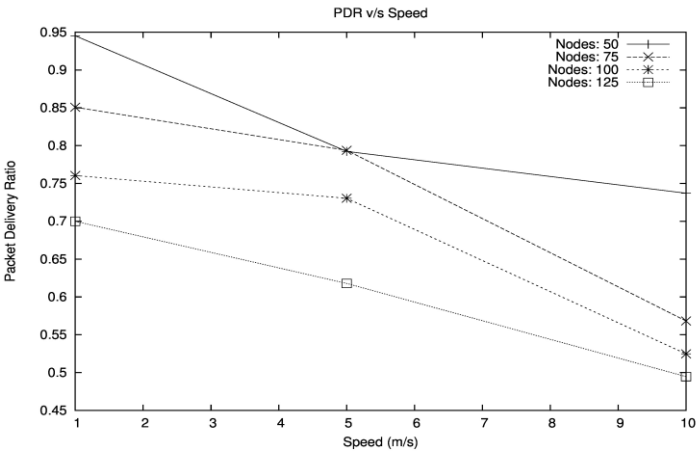

Fig- 3.8: Modified OLSR Packet Delivery Ratio

4. CONCLUSION

MANET is a very large field to research and growing very fast in the world of technology, that's why demand of efficiency in MANET goes higher day to day. OLSR is the most suitable protocol to find the shortest path in MANETs. For Mobile wireless network, the overall performance of a routing protocol is coupled with many elements, like choice of bodily technology, Link State layer behavior, etc. the general behavior of a protocol specifies its working domain for which it could be suitable.

OLSR protocol is proactive or table driven in nature, as a result it favors the networking context where this all-time-saved records is used increasingly, and in which direction requests for new destinations are very frequent. Additionally, many improved OLSR technology are supplied to devour the least electricity at the same time as locating the shortest fine path in the Network.

this paper presents the more than one energy efficiency modified techniques in OLSR protocol. additionally contrast amongst all strategies and here offered their advantage and downside of each. Also found the better one from them and from that found the future conclusion for energy efficiency in MANETs.

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