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Performance Comparison Wireless Network Technology by Random Way Point and Vector Mobility Model Varying by Data Dropped and Retransmission

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Abstract

Mobile Ad hoc Network (MANET) is a one that has decentralized, self-organized and self-configurable network. All mobile nodes are moving arbitrarily. It consists of mobile wireless nodes that communicate themselves without any well defined infrastructure and also do not required any interference of third party base station. MANET's routing protocols are classified in three categories. Proactive, Reactive and Hybrid Routing Protocols are three routing Protocols. But we basically Focus on only one of each routing protocol by varying by Data Dropped and Retransmission. In this paper we analysis performance of routing protocol by using mobility models vector mobility and random way point. We are focusing performance comparison on routing protocols on Optimized Link State Routing (OLSR) is proactive routing protocol also known as table driven protocol, (AODV)Ad Hoc on Demand Distance Vector is Reactive Routing Protocol and also establish a connection on demand and third one is Gathering-based Routing Protocol (GRP) which is hybrid routing protocol. In this paper we have compare two mobility models with above three protocols. In simulation results AODV shows best results by using OPNET 14.5 simulators. We can also compare its performance by using 50 nodes and show its outcome with the help of comparison table.

Keywords: MANET, OLSR, AODV, GRP, Mobility Model, OPNET, Random Way point and Vector Mobility.

1. INTRODUCTION

Mobile ad hoc network (MANET) is an infrastructure less and having no stationary centralized controller. In MANET, all nodes can be mobile, communication between all mobile nodes can be carried out without any centralized control [1] .The nodes dynamically co-operate its routing paths and relay each other for throughput end-to-end communication. For a performance and variation of its working routing protocols, it's very important to study mobility models where it use and how they works for effective communications. It represents the actual movements of nodes. MANET is wide range network and different node has may communicate over the same limited bandwidth. Such infrastructure less mobile network do not have fixed centralized controller such as base stations among the mobile terminals that are coordinating for communications in the network [2].

Generally, MANET mobility models can be divided into two groups: - entity mobility and group mobility models. In entity mobility models all nodes move independently without interference to each other, where as in group mobility, nodes are to cluster to each other moves in a group.
Here, we are focus on two mobility models one is random way point model other is vector mobility model. According to these models we can see visualize that actual working of parameters .They move independently and each node movement according to periods during pauses or have pause phase. In the beginning each are in move phase and then mobile node selects new direction and also speed in move phase for whole network duration keep constant.

2. MANET Routing Protocol

These protocols are mainly classified into three types: - Proactive, Reactive and Hybrid Protocols.
A) Optimized link state routing protocol:-OLSR is a proactive routing protocol an also known as table driven protocol. It stores and updates its routing information permanently in tables; it sends its data from source to destination in table form. Optimized link State routing protocol (OLSR) is an edition that provides complete link state for MANET. It keeps all tracks when needed in routing table in a particular order. It can also be implemented in any ad hoc network; because it has its nature is called as proactive routing protocol. In this Multipoint relays (MPR) is a primary focus point on optimization in OLSR. Each node identifies its MPRs in the network according to networks requirement. It shows the running flow in network. After flooding the messages, it will be received by its two-hop neighbours each node ensured that whenever message is transmitted by MPRs and individually. OLSR protocol selects bi-directional links and do not broadcast the route packets by MPR in the network. Hence, every evading packet transfers over the unidirectional links. These MPR nodes selected source node in the neighbour and each node keeps a list of MPR nodes in the network [3]. This MPR selector selects packets from sending between its neighbour nodes. Each node keeps tracks a routing table in the network. That why this is a reason routing overhead for OLSR provide a shortest route towards the destination in the network other than reactive routing protocols. There is no need to a new route establishment, an existing route does not increase its routing overhead .It reduces delay for its route discovery.
B) Ad hoc On-Demand Distance vector Routing Protocol (AODV):- Ad hoc on-demand vector routing (AODV) is known as on demand based routing protocol, it requires route from source to destination node then only it creates a path. It is one of an advancement protocol of (DSDV) Destination Sequenced Distance-Vector routing protocol. It is also help to minimize traffic in the network by removing extra routing nodes that are not in use. AODV is responsible for build a multi-hop route, when two same nodes want to make a connection in network. AODV have a property of route request (RREQ) that means send request when required route and also route maintenance procedure from DSR and having some attributes like sequence number, periodic updates and hop by hop count from DSDV routing protocol. If two same nodes wish to establish a connection in an ad hoc network then AODV is responsible to build a multi-hop route. AODV uses Destination Sequence Numbers (DSN) that is why it is loop free to avoid counting up to infinity. When a node wants to send a request towards its destination, then it will send DSNs and sequence number. It will find most favourable route according to all routing information. There are three AODV messages implies in ad hoc network i.e. Route Request (RREQs), Route Replies (RREPs), and Route Errors (RERRs) this is for detecting route error, when the source node wants to create a new route then send a message to the destination, their requesting node will broadcast message through RREQ in the network. The RREQ message is requested for broadcast from

source A to the destination node B, it means send message from one node to next node. When the source node A broadcasts its RREQ message to all its neighbour nodes then all these neighbour nodes receives this RREQ message [4] .They creates a reverse route towards source node A. These neighbours will next hop count to source node A. The hop count is incremented by one for RREQ for this. The neighbour node will check our destination will active or not. If it has their destination route, then it will forward a RREP to source node A. Else if it does not indicates an active route towards to the destination then it will again broadcast the RREQ message in the network again and incremented by one hop count value, then it repeatedly for finding the destination node B. The RREQ message is flooded for searching destination node B in the network.

The intermediate nodes forward this RREQ message to all its neighbor nodes immediately and record their address towards in their routing cache. This information will be used for finding a reverse path for RREP message from the destination node towards source node A. The RREP in the network reached to the originator of the request back. This route is only available by uncasing a RREP to the source. The receiving messages are cached from its originator to all its nodes of the RREQ. When a link is failed then it will generates an RERR message. RERR message contains information about all those nodes that are not reachable to its desired destination point.

C) Gathering-based Routing Protocol (GRP):-Gathering-based Routing Protocol combination of both routing protocols proactive as well as reactive. It is supporting for delay sensitive data both voice as well as video also, initially it act as Proactive when it starts working changing into reactive mode. But it consumes lots amount of portion of network capacity. GRP is not suitable for real-time applications because of its dynamic topology, the advantage of this approach is it can change relatively static and active traffic is low dramatically reduce routing overhead when in network . However, the source node A is waiting until a route path node B can be discovered which a destination node and it also increasing the response time. The goal of the proposed routing protocol (GRP) is to rapidly gather information from source node and without spending a large amount of time on overheads. It offers an efficient framework draw on the strengths of proactive as well as reactive simultaneously.

3. Related Work

In a related work we have studied various the performance evaluation on of OLSR, AODV and GRP protocols. In our evaluation we have take parameters are used as Data dropped and Re-transmission for analysis the results that have been obtained in our simulations. In our relative work we have see studied various research papers as given below:-

Bojd et al. proposed new algorithm which is modifies multi hop Dynamic Virtual Router algorithm for overcome the performance of MANETs. It defines the mobility metrics for neighbourhood nodes to estimate its mobility degree. This proposed algorithm significantly that network performance is improved, including with its throughput and overcome delay. The increasing overhead is not remarkable, so that considering this great performance improvement of the algorithm [5]. The main advantage for such types of protocols is to establish a session and also obtain route information quickly. A reactive routing algorithm helps to improve both capacity for a network and packet delay end-to-end in MANETs. The new algorithm is based on the DVR algorithm which is new method for robust communication in MANETs. The new proposed algorithm DVR leads to more stable as establishment for route in network, because it handle break links by using virtual route selection process.

Dais et al. discuss about a comparison between two reactive protocols which are evaluated during

network condition. These two routing protocols are (AODV) Ad-hoc on-demand Distance Vector and (DSDV) Destination-Sequenced Distance-Vector which is establishing connectivity on demand. The simulation results shows that AODV routing protocol has better throughput and delivery ratio than DSDV routing protocol [6]. In MANET can be define as wireless network those mobile nodes are independent, and have the freedom to move independently any where time. It can communicate with each other when they falling in the connectivity range of each other. In conventionally on-demand routing protocols discovers routes to a particular destination direction by broadcasting a Route Request packet (RREQ). On receiving site the RREQ node checks whether a previous packet is received or not. If the packet has been received from drop node then its work manually, otherwise it will send (RREP) route reply back to source node, if it is available. In this (MANET) has been introduced a deep comparison between two reactive routing protocols AODV and DSDV, in simulation environment AODV shows greater throughput and packet delivery ratio as compare to DSDV.

Suraj et al. discusses concept of genetic algorithms and history movement for approach of mobility prediction. This concept was introduced for the improvement of MANET routing algorithms. The purposed lightweight genetic algorithm works on its outlier on the basis of parent selection and heuristics by using weighted roulette wheel algorithm. An Adjacency matrix is obtained, after performing the genetic operations, from which each node is calculated predicted direction by using vector calculations and directed graphs. The technique purposed a new mobility prediction which is completely depend upon on genetic algorithms and does not based probabilistic methods [7]. MANET has a lower stability and has unpredictable results sometimes, that's why the main reason behind they do not have very much popularity. In the study of technique genetic algorithms make mobility prediction on the basis of history. Genetic algorithms have never been used to predict mobility for structure less infrastructure like MANET, but it provides possibilities to make better QoS in ad hoc networks .It has the problem of limited resources like memory storage and computational power. This problem will overcome by using grouping and clustering techniques.

Macon et al. Presents a proposes work on proactive routing protocol, named as MQ-Routing. The aim of behind this work is to increases lifetime of minimum nodes when network topology changes rapidly. The new algorithms modifies Q-Routing algorithm, which was develop via Reinforcement Learning (RL) techniques. This technique introducing new metrics which account for energy introducing in path nodes and paths availability, that are combine dynamically when network topologies and resources change dynamically .A fully proactive approach always assure to usage of protocols and reactivity in mobile scenarios. The simulations provide validate results for proposed algorithm by a comparison of OLSR and Q-Routing protocol [8].In disaster relief scenarios with characteristics MONET FP7-ICT project processing to be considered. In rescue scenarios they have considered (1) All nodes should have homogenous and long lifetime that means have long discharge batteries that rescue team as such as possible to exchange vital information.(2)The communication should be maintained regain due to failure of link mobility nodes . They introduced an example in the introduction of collisions-aware metrics, which reduces collisions and increases its throughput for global network s, especially for standard 802.11 CSMA/CA Wi-Fi links.

Ahmed et al. discuss about the performance of evaluations of the OLSR routing protocol for TCP and UDP traffic management (Their work was supported by NSFC partly in under grant No. 61271246).They have discuss various varying parameters like speed node, density node and pause time, according to which they have perform under different scenarios. For the performance of OLSR the most

widely used for performance metrics are throughput, packet loss and end-to-end delay [9]. In this paper they have assumed independency of geographic dependency, spatial dependency and temporal independency for the performance of Random Waypoint model. In the results prove that TCP performs well considerably as throughput, packet loss and end-to-end delay in different mobility scenarios, while in pause time UDP should be considered as a better choice .

P. Ajindrajit et al. Discuss about how to predict a path length from source to destination using Autoregressive Integrated Moving Average (ARIMA) and Multilayer Perception (MLP) models. The routing protocols play a very critical role for ad-hoc network in communication for MANET. In MANET nodes normally operate with limited battery power supply and also have limiting in their transmission range. Path length can be determined by collecting data based on from three mobility models such as Random Way Point mobility model (RWP), Manhattan Grid Mobility Model(MHG)and) Reference Point Group Mobility Model (RPGM) [10].This paper basically Predicted forecasting accuracy for path length from source to destination for AODV in MANET using ARIMA model and MLP. We also compare the prediction capability and modelling of both ARIMA and

(ANN) Artificial Neural Networks based models in terms of certain statistical performance evaluation techniques. In this it is found that neural networks model MLP based provide better results for outcomes for forecasting the path length then ARIMA models. In their experiment there is optimal number of neurons found in the MLP network to be in the range of 15–25 hidden units.

Wang et al. they have discuss and drawn attention in the research on multi-hop wireless networking which is traditionally based on stationary wireless networks. One of the reason behind it was opportunistic data forwarding is not widely utilized in MANET and have lack of efficiency , light-weight proactive routing scheme have strong source of routing capability[11].In this paper ,propose a light-weight proactive routing protocol(PSR).It can maintain more information that are based on network topology to facilities source routing.

In multi-hop wireless networking, it almost always makes sense to minimize any impact on the network's communication resources for us even if there is penalty in other aspects communications. When a node should come for share its update route information with its neighbour nodes, it delays until end of cycle so that only once update its broadcast information in each node. It would trigger an explosive chain reaction and network overwhelmed then route updates, if the transmit node have any change to its routing tree .

Yuan et al. Present in this paper elaborates ideas and evaluates several perspective data and control planes .They provide integrative analysis of zero-information opportunistic routing protocols (ORP)as in terms of number of hops as per packet. It also represents and analysis information-rich ORPs and quantitative comparison including cumulative energy efficiency and cumulative packet delivery ratio. We finally find some research smartly in directions towards lightweight routing protocol [12].There is many emerging issue remain yet first is infrastructure less or infrastructure based. ORP's mainly focus on some scenarios that have pre-deployed network structure may destroy or may not exist for all. ORP's may provide solution for transmit packets. Separating or integrating routing functions, leading to have burden to each node .Control messages are collect and diffuse by selected backbone nodes in mobile opportunistic networks and other are responsible for relay functions and data forwarding.

Liu et al. propose work on general probing-based on two-hop relay algorithm, which have limited packet redundancy. In such algorithms will works limited packet limit f and probing round τ, each transmitter is allowed to identifying of possible receiver to conduct up τ rounds of probing and each packet delivered

with at f most distinct relays .To understand such working a theoretical framework was introduced to help us for different setting of τ and f. In the terms throughput capacity for per node and end-to-end packet delay, it provide benefit for us to how we can get benefit from multiple probing[13].In two-hop relay routing have advantage of mobility node and sequence of node conduct a contacts to deliver messages from end to end, become promising routing protocol for MANETs. This paper was proposed for general 2HR-(τ, f) routing algorithm which have motive to efficiently utilised wireless resources. A theoretical framework Markov chain was further developed to improve the performance for new relay algorithm, based on as per throughput and end-to-end delay for per node. Extensive theoretical study and simulation provide a framework for the 2HR-(τ, f) algorithm to perform efficiently .A new relay algorithm can provide significantly improvement for throughputs capacity as per node by enabling rounds of receiver probing more.

4. Mobility Models

Mobility models are graphic design which are used for evaluate the performance of ad-hoc networks. It also characterizes various movements in speed and direction with variation of real mobile node that is occurs in regular interval of time. Therefore, many researchers had attempted to design such mobility models that are approximately resemble with real node. In MANET there are various types of mobility models but we mainly focus on only two models that is random way point and vector mobility model [10]. According to these models we can analysis its performance and get outcome as comparison table. There are such as follows:

4.1 Random way point mobility model: - Random way point mobility model is a one of graphic design model in which we can see actual working of real network. In this model, each positional node is selected randomly and moved in linear chain form within fixed area, when it will try to move in next movement before that it will stopped for certain period or pause time. The pause time is directly initialized by its speed and its variation, which is uniformly distributed between in Min Speed and Max Speed.

4.2 Vector mobility model:-This model used to avoid the unrealistic behaviour working nodes in the network, which is impossible physically. It allows changes only partially in the current positions remembering mobility state for nodes, only natural motions are reproduced. This model has various Advantages like implemented easily, simplifying for positional updates and also provides mobility prediction opportunity for specified nodes.

5. Simulation Environment

A) Simulator:-To simulate the protocols OPNET 14.5 modular is used (Optimized Network Engineering Tool). It creates the scenario for random way point and vector mobility model. It simulates mobilize nodes the network graphically and provides mirror imaged structure of actual network. The modular follows object oriented approach as classes with specialization and inheritance.

B) Simulation mode: -In this paper we have considered models based on vector mobility model and random way point mobility model up to 50 nodes as client setup.

In previous related work it will describe that TCP is responsible for end-to-end delivery of packet, but it works only on wired network and also does not support few condition like packet loss or delivery delay. MANET Simply encourages the delivery of data packets into the wired networks as well as wireless

network.

The proposed simulation parameters are summarized in table 1.

Table1. Network Parameters

Parameters	Value
Simulator	OPNET 14.5
Numbers of Nodes	50
Area	3.5 x 3.5 Km
Wireless MAC	802.11
Mobility model	Vector mobility and Random Way Point mobility
Data rates	11 mbps
Simulation Time	5 minutes

6. Performance parameters

The following parameters metrics are proposed on base on various routing protocol:-

a. Data Dropped**:** The total size of higher layer data packets (in bits/sec) dropped by all the WLAN MACs in the network due to:

- Full higher layer data buffer, or
- The size of the higher layer packet, which is greater than the maximum allowed data size defined in the IEEE 802.11 standard

b. Retransmission attempts: Retransmission attempts are the resending of packets which have been either damaged or lost. Protocols which provide reliable communication over such networks use a combination of acknowledgments i.e. an explicit receipt from the destination of the data, retransmission of missing or damaged packets and checksums to provide that reliability.

7. Results Analysis from Both Protocols

In our results we have comparative analysis for random way point and vector mobility model with three protocols:-OLSR AODV and GRP. In these we have following protocols parameters as Data Dropped and Retransmission.

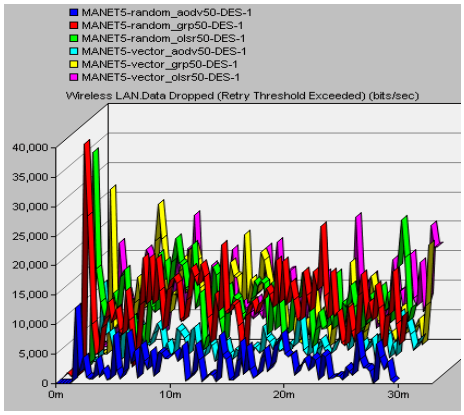

Figure1. Data Dropped (50 Nodes Random Way Point and Vector Mobility)

Data Dropped: - In fig 1 AODV shows minimum data dropped or retry to exceed threshold at maximum value 10,000 in both vector mobility and random way point for 50 nodes but at end vector mobility shows better outcomes than random way point. At maximum value, where as OLSR shows 22,000 in vector mobility as compare to random way point mobility shows 34,500 for 50 nodes. GRP shows

37,000 bps in the 50 nodes of random way point as compare to vector mobility have less value, at maximum value 25,100.

The overall comparison analysis for data dropped is summarized in table 1.

Table1. Comparisons Table

Data Dropped	**OLSR**		**AODV**		**GRP**	
Mobility models	Vector mobility model	Random way point mobility	Vector mobility model	Random way point mobility	Vector mobility model	Random way point mobility
50 Nodes	22,000	34,500	10,000	10,000	25,100	37,000

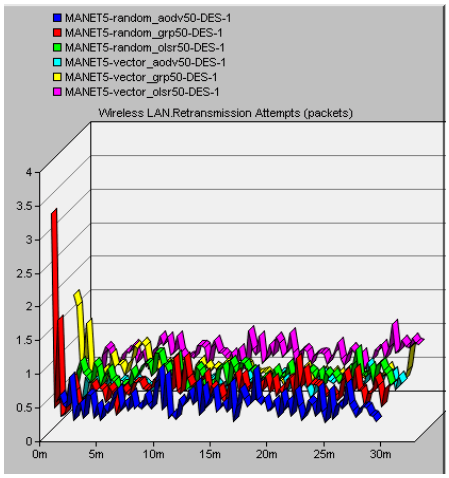

Figure2. Retransmission (50 Nodes Random Way Point and Vector Mobility)

Retransmission: - In fig 2 AODV shows minimum attempts at maximum value 0.5 for retransmission of packets of 50 nodes in both vector mobility and random way point mobility shows0.4 slightly less. OLSR shows average attempts for retransmission. In vector mobility it shows it at maximum value 1.1 but compare to random way point have 0.7 and slightly decrease with increase of nodes 50.GRP shows maximum value initially or with increase of nodes up to 50 it also decrease in both mobility model. In vector mobility have maximum value 1.7 and decrease with increase of 50 nodes at the end 0.4, where as in random way point mobility model at maximum value 3.7 and at end have 0.1.

The overall results observations are summarized for retransmission in table 2.

Table2. Comparisons Table

Retransmission	**OLSR**	**AODV**	**GRP**

Mobility models	Vector mobility model	Random way point mobility	Vector mobility model	Random way point mobility	Vector mobility model	Random way point mobility
50 Nodes	1.1	0.7	0.5	0.4	1.7	3.4

8. Conclusion and Future Work

It is observe in our comprehensive simulation on vector mobility and random waypoint mobility model under three different protocols. It shows significant results regarding performance and behaviour different state and also finds out appropriate condition towards conventional MANET's. To analysis such type of scenarios we have modelled variably the nodes movement by vector mobility model and random way point mobility model. In this paper we are focusing three routing protocol with vector mobility model and random way point mobility model are OLSR, AODV and GRP. Our simulation was conducted on OPNET 14.5 for both mobility model up to 50 nodes improve packet delivery capacity ratio and end-to-end delay in MANETs. In data dropped and retransmission results AODV shows minimum data dropped in vector as well as random way point during transmission up to 50 nodes where as for retransmission it also shows minimum retransmissions attempts. However this method is more robust for communication in MANET. In our above comparison table we can clearly see that AODV in Vector mobility shows minimum data dropped and minimum re- transmission attempts in a network.

In simulation result the mobility nodes achieves a better for retransmissions and data dropped for network. The considering work improve the performance, some promising research and directions towards smart routing protocols.

In our present work, all the nodes are properly synchronized and performed well in both mobility models. According to performance in up to 50 nodes AODV perform well for data dropped as well as retransmission attempts required minimum but In future case when the nodes increase it will be see that how it will affect delay in both mobility models with different three routing protocols .

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