Effects Of Mobility On Adhoc Routing Protocols Model

Raham Mehmood Niazi, Muhammad Ubaid Mehmood Khan

Abstract: Mobile ad-hoc network (MANET) generally known as the ad-hoc temporary network, used for an exchange of messages from node to node, it doesn't depend on its previous deployed infrastructure. Mobile devices that are a broadcaster in nature are capable of wireless communication and enable the creation of a large ubiquitous adhoc network. Users that are in a range of these nodes forming a MANET can have access to resources at any time and at any place. However, due to the constant traffic of nodes, the link between the nodes is constantly being destroyed, so the architecture faces a dynamically unstable topology. The mobility of nodes can have a dark effect on the topology of MANET. Therefore, understanding the impact of mobility on MANET is very important. The important feature of MANET is mobility of nodes that form a dynamic topology. This paper emphasizes on the effect of mobility on the MANET when using these two protocols; first is DSR (Reactive Protocol) and the other is DSDV (Proactive Protocol). For experimental dedications, we consider 4 mobile models: random waypoints, random point group model, freeways, and Manhattan models. We choose these four types of moving model to indicate the possibility of practical use. The paper will analyze that performance of routing protocols differs according to unstable patterns of mobility, due to node's density, and data transmitted path length.

Index Terms: MANET, ROUTE-REQ, NAM, SDR.

1 INTRODUCTION

THIS Mobile Ad-hoc networks aka MANETs is connectionless wireless networks without any fixed access point [1], forming a temporary network and are characterized by flexible, simple and large-scale technologies for establishing network connections, collecting and processing distributed information. Rescue and battlefield are some of the important scenarios proposed by MANET. [2] [3]. Previous studies state that a random Waypoint is used as a reference model [4][5]. MANET should be used in a variety of applications with different topologies and node configurations in the future. It is expected that different mobility features will have a changed effect on the routine of routing protocols of MANET such as DSDV and DSR. The presentation of each wireless routing protocol is subject to the medium of the dual nodes that carry load packets. We refer to these average network parameters as the "connection average". We refer to these average network parameters as the "connection average". In this case, node mobility is a complex challenge because it leads to frequent changes to the topology, which can result in dropped routes. Mobility is not only a challenge to maintain continuous communications, but also to prevent the beginning of communications activity because the destination point is not easy as a static wired network. Mobile adhoc networks are different in behavior than other networks and there are other ways to examine their advantageous intrinsic characteristics that lead it to form a type of complex network. Let us suppose MANET as a complex network for analyzing its complex network entities properties so we can identify its non-trivial aspects in a detailed manner. In this way you could recognize the manners of the MANET and propose more appropriate clarifications. Mobility shows a significant role in the analysis of MANET characteristics. Node movement indicates how nodes are linked to each other.

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In some of the scenarios when the node goes out of the defined range of other nodes to a different region then it provides a shortcut data path between the originally defined region and the new out of range region.

2 MANET CHARACTERISTICS:

- **Independent and infrastructure-less architecture:** MANET doesn't depend on any already established infrastructure that consists of any centralized base station or access point for its communication with other nodes.
- **Multi-hop Routing**: No default router is attached to each node for maintaining routing information and nodes can traverse through other nodes for transmitting a message to the destination node.
- **Dynamic Topologies:** As MANET topology consists of multi-hopping and can change frequently because node moves in random motion with respect to each other. This leads to frequency routing, network partitioning, and packet loss.
- **Variation in data link and node Capabilities:** Each node belongs to a radio range that is vacant for being sender or receiver operating with different frequency bands. [10,11]. The diversification in the nature of nodes can result in an asymmetric connection between them. Also, each node different hardware and software configuration results in a change of processing power. Designing MANET protocols for the heterogeneous network can be complex as they will demand a dynamic adaption to the varying condition like load/traffic in the network, congested channel, retransmission of messages, and power consumption of nodes. Because mobile node has inadequate battery power and processing power as well.
- **Network scalability**: Presently common network management algorithms are invented for managing

the ubiquitous wireless network. Whereas nodes in MANET may consist of thousand of nodes like in sensor networks and tactical network. [12] The successful deployment of these kinds of networks leads to a critical situation of scalability. The Large network, which provides limited resources to their nodes, is not suitable because they cannot solve many challenges in such area like addressing and routing info of nodes,

management with respect to location, and self-configuration of nodes, interoperability, security and high capacity wireless devices

3 ADHOC NETWORK ISSUES:

The Adhoc network is dynamically made of self-configuring nodes network which are connected to each other without consuming previous infrastructure network or without using any central Access point. One advantage of an ad-hoc network is that nodes are randomly connected to each other so flexibility and convenience are expensive features of this type of network. Adhoc network inherits following wireless communication problems [13]:

- Support is not an absolute or an external limitation and is known to frames that cannot receive network frames;
- Channels are protected from external signals;
- Wireless support is far less reliable than wired support media. Channels have asymmetrical and varying propagation characteristics over time;
- Hidden terminal and exposed may appear.

4 MOBILE ADHOC NETWORK PROTOCOLS:

Mainly two routing protocols are used in MANET. In the first type of protocol Active based routing is used that tries to keep track of control information of one mobile node to other nodes of the network in a consistent and up-to-date manner. Active protocols are low in latency but routing overhead is much higher in it. This is because nodes keep exchanging information about routing and control messages to active nodes. The second protocol is Re-active. The reactive protocol establish link path only when needed through the sender node. When sender node wants to transmit then it initiates a route starter process for the delivery of message till a destination node. It doesn't contain overhead like control check messages or routing info. As a result, it got the lower load on the route but a higher latency than the proactive protocol. DSDV is an active protocol, whereas DSR, TORA, and AODV are the type of passive protocol.

These are the considerable MANET protocols:

4.1 DSDV (destination sequenced distance vector):

DSDV [16][17] is wireless routing protocol through which calculation of shortest path is done using Bellman Ford algorithm. Through this form of protocol, a routing table is issued to each node that contains info about their destination nodes including the info about next hop associated with the target metrics and target sequence number. Compared with DVR, sequence number is an additional characteristic of DSDV, used to distinguish routing info for avoiding the info of loop routing. This info travels in network data unit protocol in two different ways as increment dump and the complete dump. The complete dump contains data units of multiple protocols whereas increment dump just needs single data unit to adjust information for minimizing control overhead.

4.2 DSR (Dynamic Source Routing):

DSR is a category of routing protocol that is centered on reactivating mechanisms. It initiates with demand, this means this is not based on a routing table. It is initiated by source, rather than multi-hop. It doesn't use regular packet switching. DSR even uses tag bundles such as some other on-demand protocols. Therefore, DSR uses demand patterns to detect routes and maintain routes. Reduce network load, save battery power, and avoid major temporary routing updates. Discovery of a route and its maintenance are interim and do not carry control messages. This type of protocol is based on "primary route" where the node must follow the route which will be followed by the node till destination. The route is found in a way by searching the last destination from where the route ended. Then from there, the next route begins. If the last route is not found then the route detection is done. Another important feature of this agreement is its uni-directional link.

4.3 AODV (ADHOC ON DEMAND DISTANCE VECTOR):

AODV is one of the types of routing reactive protocol [19]. Every single node establishes a routing table, but like other protocol, it doesn't maintain destination route information. It stores the routing info as single entry per route to the destination. But it does maintain route info for each new route used within the time interval; therefore the node can send messages to any existing destinations in the routing info table in the same route without using new route request message (ROUTE-REQ) the proliferation of network. In this way, AODV designers try to minimize the routing control message overhead. AODV keeps the record of a sender and destination routing to avoid the looping and infinite counts of loop route that arise in a calculation of routing info. AODVs share behavior according to the requirements of the DSR.

5 MANET MOBILITY MODELS :

Mobility model describes node's mobility and its point of position, speed and its acceleration with respect to time. Mobility pattern plays a great extended role in the efficiency of protocol, therefore the measure of the movement of real-life applications should be modeled in a creative manner. Otherwise, conclusion extracted and measurements of observation might be misleading. Thus it is advisable that when evaluating the performance of MANET protocols, it is required that mobility models should be chosen carefully. Like the movement of nodes in the scenario of the random waypoint is different from other nodes in other mobility models.

Limitation of random way-point model:

A common use of the model of mobility in MANET simulation [7] is the Random Way-point model [3], through this type of mobile model, mobile users movement is autonomously at random speeds to randomly nominated destinations. Random point model can be used as one of the reasons why simulation is widely used. However, MANET can be used for a variety of applications in complex moving models. Therefore, recent studies examined alternative flow mobility models with dissimilar flow features. In this model, node motions can be faster or much less than the other neighborhood nodes around them. Random model is mostly acceptable on the first preference because of its easy configuration. Whereas, we can observe that use of this random point model in most situations was not adequate to capture certain of the features of the mobility.

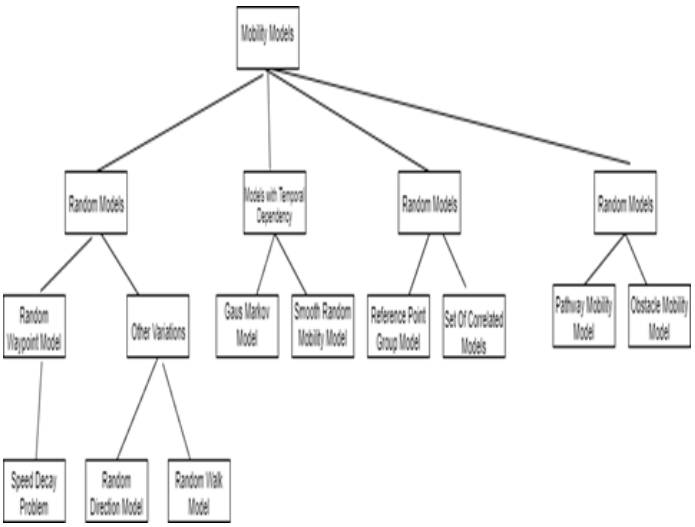

Fig: *MANET Mobility Model Types [25]*

6 RELATED WORK:

The competitive research has been done in the field of mobility models of MANET. The extensive experimental research is done. This research can be categorized as follows

6.1 Comparison of performances of mobility models:

Previous studies lie on the use of random way point used for potential mobility and CBR (constant bit rate), including a freely chosen source-destination couple as a load traffic model. PACKAGE DELIVERY RATIO (The number of received data frames versus the number of routing protocols such as packets sent by DSR [20], DSDV [21], AODV [22], and TORA [27]), OVERHEAD OF ROUTING (no of control messages per routing sent). Arbitrators [24] argued that routing that is on demand like DSR and AODV are much enhanced than table based agreements like high-speed DSDV, while DSDV works well at low turnover rates. Referees [25] conducted a comparative research of these two routing protocols that occur on demand, like DSR and also AODV, through datagrams delivery relationships and source to source Latency (End to End) performance metrics. He pointed out that the DSR outstripped the AODV in conditions demanding not as much. Whereas, the AODV outperformed the DSR with maximum overhead and greater mobility. DSR routing cost less than AODV. The previous studies mainly focused on the measurement of mobility performance, the constraints in the mobility of models were because of greater velocity and its static time. However in our research, we have designed the test suite intentionally to choose the situations that include mobility features of broader range. In basic concepts not only random way-point is used, but similarly other moving models for example; RPGM (Reference point group mobility) [23], freeways models, man hattan model are the routing protocol for the performance evaluation.

6.2 Comparison of performance of models based on realistic scenarios:

Random way model is easy to investigate and implement the simple model. This may be the main reason for using the random way model, for the simulation extensively. Making sure that Random Waypoint is a very common mobility model, research in the present focused on describing other mobile models and protocols for independent measurements. Reference [13] conducted a performance analysis based on the MANET scenario consisting of some models for real-time frame scenarios, for example; meetings, particular event reporting, and disaster aid. To distinguish in between these scenarios, the study uses the relative velocity of mobility nodes in terms of the measure of the movement of nodes. Nodes applications of active and passive protocols are alike to [24]. Reference [26] a mobility model is used through which every node calculates its new forward position that depends on its probability distributive property. In this type of model it doesn't permit major variations that are pointed to the moment. PROACTIVE routing Protocols are superior to reagents in a mean of datagram throughput and source to source delay.

In our previous section we gave attention to mobile features, in the next part of our research paper, we will introduce metrics to grab these features in more detailed manner.

7 Metrics:

Numerous protocols like metrics and independent metrics are used for qualitatively or quantitatively analyzing mobility effect on the performance of protocols. Independent metrics of protocol refers to minimize mobility characteristics and connection diagrams among mobility users. Then the metrics help to explain the effects of movement of different nodes on a routine of routing protocols. The metrics are classified as:

1. Metrics in Mobility
2. Graph Connectivity metrics
3. Protocol performance metrics

8 Use Of Other Mobility Models:

As mentioned earlier, random points models cannot capture the features of spatial dependencies, time dependencies or geographical constraints. In a previous part of this paper, the liquidity metrics were explained to define these qualitative and quantitative features in term to systematically inspect the effect of mobility on the routine of MANET. Hence to analyze the protocols that cover the various mobility models for mobility space design. So instead of random waypoints, we will work with following movement models;

1. Manhattan's model of mobility
2. Free-way movement model
3. Random Point Group Mobility model

Every previous mobility model is having a number of different features than the Random Waypoint and will be explained in more detail in the descriptions of the other three moving models about in what way they mimic practical scenarios. Explanation of each model is complemented by a screenshot of Network Animation (NAM) that provides a graphic illustration of the mobility of nodes in the network. NAM is an animation tool for viewing simulation of a network. It has a Graphical user interface alike DVD player that contains option like play, fast forward, rewind, pause, etc .plus a speed control of the display. The wireless or wired simulators are executed in NS (Network Simulator) that produces NAM files as output. [28]

8.1 Random Point Mobility model (RPGM):

RPGM is being used for soldierly communications in the war fields. In this type of model every group got a central commander, which controls the behavior of the group. Primarily, every fellow of group was evenly dependent on the commander leader

of the group. Then, at every point, each mobile user has a velocity and track, which states the output in a direction that randomly deviates from the leader. This is an example of a terrain that shows the movement of a node of a moving model of a Random mobility group. The figure below refers to a scenario consisting of 16 nodes, and node number 1 and node number 9 are the group commanders. [30]

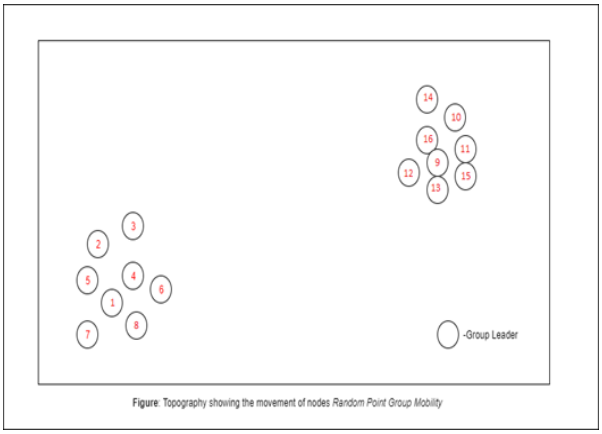

Figure: Topography showing the movement of nodes *Random Point Group Mobility*

Key Features: Every mobile node randomly shifts with the leader's speed (speed and direction). So this model indirectly tells that how much different is the motion of group members from there group commander. The movement of member nodes of this random group can be controlled by using SDR i.e. speed of deviation ratio and ADR i.e. angle of deviation ratio. We can produce different scenarios by just adjusting these two parameters.This mobility model predictably has a strong spatial dependency on slightly less SDR and ADR number.

8.2 Free-way mobility model:

The freeway model simulates the performance of nodes on the freeway that is considered for replacement of overhead conditions or vehicle track line on the highway. Every node is constrained to the free-way track. The swiftness of the node temporarily depends on its last measured speed. Below describes a topographic map showing the mobility of nodes in this model on the highway with twelve nodes. [30]

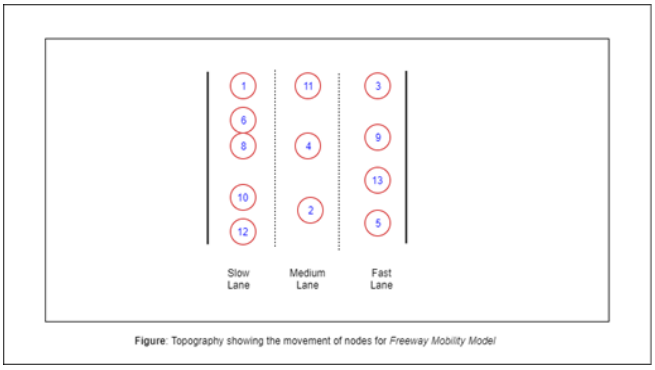

Figure: Topography showing the movement of nodes for *Freeway Mobility Model*

Key features: In freeway model, topographic map is used. Various freeway paths are designed on this map, with two-way lanes on each road. The difference among the Random Way model and Freeway model is as follows:
1) Every node is controlled by the road due to restriction.
2) The speed of a node temporarily depends on its last consumed speed. Due to previous relationships, it is expected that the expressway traffic patterns will have strong spatial dependency and strong time dependency. In addition enforces harsh geographic strictness on mobility of nodes by restricting them for not changing their path lanes.

8.3 Manhattan model of mobility:

Here is stated a Manhattan mobility model that simulates the mobility of the node in the street model. It may be useful to model traffic in urban areas. The scene consists of several horizontally, vertically path lanes. Underneath is a topographic map that shows the movement of the node in Manhattan by 17 nodes. In map below the definition can be moved along the route of the node. [30].

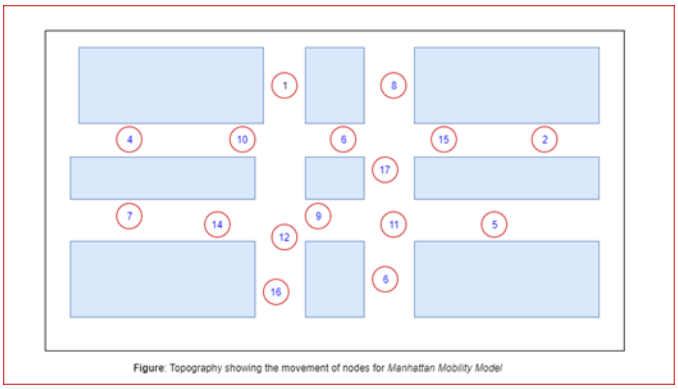

Figure: Topography showing the movement of nodes for *Manhattan Mobility Model*

Important features: Map showed in this modelconsisting of streets in horizontally and vertically manner. Nodes in a map move in a sideways of these streets. At a junction of a horizontal lane of the street and at vertical lane, the mobile node move to the left side, turn on the right side and continue with various chances. In addition to these preceding differences, the relationship between the nodes and intranets tangled in the model of Manhattan is similar as to freeway model which places a geographical limit on the mobility of nodes. [27]

9 Simulation and Results:

9.1 The scenario in Mobility Models for Different Velocities:

The comparison is made on the performance of DSDV and DSR with respect to capacity (bytes per second) with speed change [14], i.e. random waypoints, freeways, and Manhattan RPGM. Available for simulation is the routing protocol from NS-2 in its version (2.27). In these situations, the actions are based on the use of a generator called Mobile Generator [15] to track the number of nodes based on so-called important (Ad-hoc networks affected by mobile mode routing, University of Southern California) The flow model and which scale (area) produces TCL mobility. For each moving model, we changed the maximum allowable speed (Vmax) and got the average return.

1. In Random waypoint Model, mobility works with speed Vmax. So the scene with a high value of Vmax defines the increased mobility. In order to compute the performance routine, ten nodes need to be observed and be an average of.
2. By explaining the situation in RPGM model, Moving the Vmax leader defined by RPGM, as the leader is very mobile, the other node groups are related in space and time

to the leader's movements. For RPGM, 4 groups were randomly trained, through 10 mobile nodes for every one group. 1 node per group is randomly selected as the commander. Altogether, group mobile nodes are within 100 meters of the leader. In order to compute performance, ten nodes are supervised, regardless of whether they belong or not.

3. The mobility of the model in the Freeway model is distinct as the max permissible speed of the mid-band and the fast and slow 10 MTR / s belt speed and the average speed path of -10 MTR / s. Therefore, by increasing the speed of the center channel, you can increase the speed of the entire scene. Firstly, every node will randomly allocate over entire 3 channels. In order to calculate performance, 10 data calls need to be observed.
4. For Manhattan's mobile model, every node has a time starting with 0 till Vmax and moving at that speed all the time, so in this sense, Vmax is the constraint for moving scene. In order to calculate performance, 10 data calls need to be observed.

9.2 The scenario in MANET for Different Nodes:

The Performance of DSDV and DSR is experienced for load data throughput (bps) for all dissimilar nodes numbers (i.e. 20, 40, 60, 80, and 100) of nodes in the system. The selected moving model is a random waypoint and adds background motion. For typical 802.11 MAC layer, each simulated transmission distance is 250m. Every node that is simulated has omnidirectional Antenna. The typical CMU-Pri model is used with the buffer of size 51. A number of nodesfor the simulation run with the time of 500 sec. A regular 700 x 700 meters plan was created. Direction with cannot move, so this topology is 2D and the produced track is a UDP track.

9.3 Scenario for Different Number of Hops:

It can be hard enough for assuming the precise no of hops we have gone through, we measured the performance for DSR and DSDV with respect to load of message throughput in bps. There were not as much of 6 hops and additional 6 hops. For comparison, stochastic movement model is used for 51 nodes. For this case, greater no of hops will be for data path that is about 9 to 11. For assuming a situation with large no node, and the performance or routine of more hops can be compared. The transmission range for each simulation is 250m with a typical 802.11 MAC layer. Every symmetric mobility nodes have omnidirectional antennas. The standard CMU-Pri model is used for the tail size 50. The simulation lasts 500 seconds.

10 Experiment Results and Discussions:

Random Waypoint mobility model:

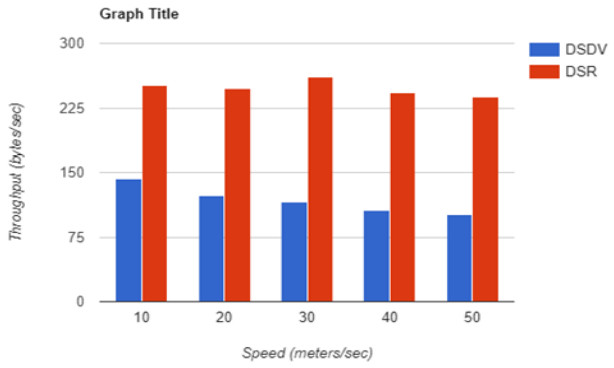

Fig: *Variation in UDP throughput with increase in mobility for Random Waypoint Mobility model*

I. Random Point Group Mobility:

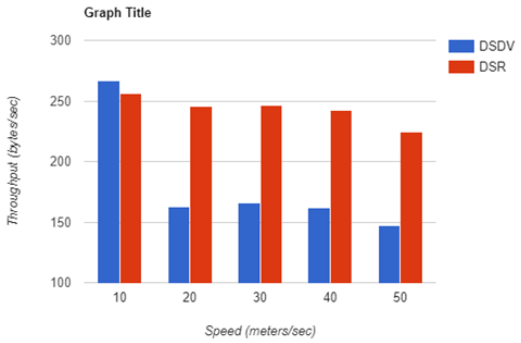

Fig: *Variation in UDP throughput with increase in mobility for Random Point Group Mobility Model*

II. Freeway mobility model:

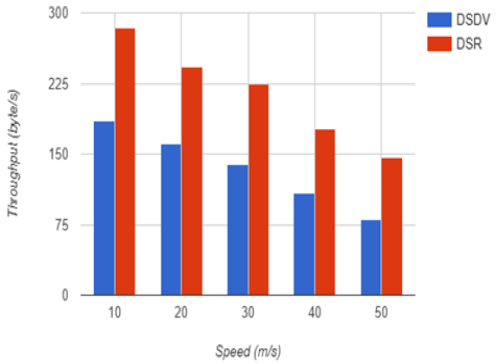

Fig: *Variation in UDP throughput with an increase in mobility for Freeway Mobility Model.*

IV. Manhattan mobility model:

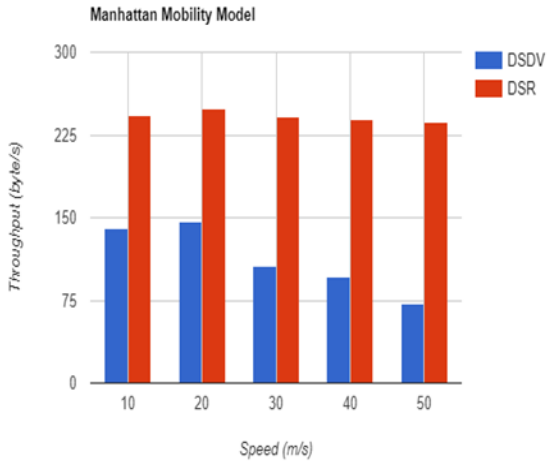

Fig: *Variation in UDP throughput with increase in mobility for Manhattan Mobility model*

V. DSR Vs DSDV for a different number of hops:

	DSR (Bytes per Unit Time)	DSDV (Bytes Per Unit Time)
Less than 5 Hops	254.08	123.84
More than 5 Hops (less than 9)	193.92	24.96

Table. Variation in UDP throughput with increase in number of hops for Random Waypoint Mobility Model

11 Conclusion

We see tremendous growth happening in areas of different types of the network like in wireless networking (infrastructure) and mobile adhoc networks (less infrastructure networks). Through this paper, a debate is done on MANET and its features, advantages, and its model of mobility. The observed outcome shows that for mobility, routing protocols performance diverge greatly among diverse models. Therefore, the consequences of any model cannot be functional to any different model. Therefore, when choosing a routing protocol, we must ponder for the movement of a node. For vastly MANET, for comparison of performances DSR is better than DSDV. Because the DSR invokes the route repair mechanism locally, when a current route is interrupted, the DSR came into know that new routing path to the destination is faster plus there are no repairingtechniques for the routes of DSDV. For the case of DSDV, if any path is not initiating for the destination, then the packet will be ignored. Future research should do more than agreements for the comparison of protocols in the area where mobility is very little and roads are no frequently separated. Pro-active protocols provide better performance for near constant environments. The performances of another route protocolswill better be assessed by considering number of linked routes to improve higher visions of the number of roads connected, as assessed by several mobility models. Through in-depth research on the application, scenarios can be designed which will perfect illustrate real-world presentations..

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