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Simulation Performance of DSR Routing Protocol in MANET by Varying the Nodes Mobility

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Abstract: ***In modernistic years, the examination field of Mobile Ad Hoc Networks has grown rapidly owing to the development of low-cost and wide-ranging wireless systems. Because of its differentiating features and broad variety of applications, MANET is becoming popular. In a MANET, nodes or access point within the propagation range of each other can deliver packets instantly, but nodes which are not in the range of each other must depend on some other node to deliver packets. Network nodes functions not only as hosts, but also as routers that transmit information to or from other network nodes. A MANET can also exhibit the multihop characteristic where "Store and Forward" mechanism is used for transmission of information. MANET's dynamic nature opens up the network to attacks and security issues as there are distinct mobility patterns for distinct nodes. In this research article, the authors evaluate the different network performance parameters for the DSR routing protocol in a dynamic node mobility MANET environment, i.e. 20m / Sec, 40m / Sec, 60 m / Sec.***

Keywords: DSR; MANET; Mobility Patterns; Multihop; Store and Forward.

I. INTRODUCTION

Recently, there has been an increase in sales of mobiles and laptop which lead to the exploration in the field of mobile computing. A MANET is a multihop, infrastructure-less, self-configuring, and temporary communication network which consists of mobile nodes which are connected via wireless links without any central administration[4].At any moment or spontaneously, nodes in MANET can leave and join the network without being disturbed by the third party. The validity of the connection between the two nodes is based on collaboration between the middle nodes.

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MANETs are subject to multiple kinds of attack and safety problems that need to be focused by the scientists as a consequence of nodes mobility. A MANET is much more helpless to multiple attacks due to the lack of centralized administration and flexible route configuration between the nodes to relay the packets temporarily [9]. There are numerous attacks in MANET which includes active attacks and passive attacks. To provide reliability proper security mechanism must be adopted.

The following is the organization of this paper. Section 2 covers all aspects of MANET's applications. Section 3 provides a brief description of MANET's difficulties and features. Section 4 introduces routing protocols, in particular DSR routing protocols. Section 5 provides a thorough simulation performance of the NS2.35 simulator DSR protocol and at last part concludes this paper and provides some future recommendations.

A. CHARACTERISTICS of MANETs

MANET has a large number of characteristics which are discussed in table given below:-

Table I: Characteristics of MANETs [6] [7]

S.No.	Characteristics	Explanation
1.	Infrastructure-less Networks	There is no need for MANET installation with established and earlier established infrastructure.
2.	Multi-Hop Nature	If nodes are within each other's communication range, data are immediately transferred, but if not, the data are transferred between middle nodes.
3.	Dynamic Topology	Nodes are free to move arbitrarily with different speeds and topology of the deployed network is temporary, it may alter randomly at any moment of time.
4.	Power Backup	In a MANET, devices have the limited power and needs to be replaced once it utilizes the power.
5.	Bandwidth	Wireless connections continue to have considerably less capacity and limited bandwidth.

B. APPLICATIONS of MANETs

An Ad-Hoc framework is an auto-organizing application composed of mobile devices that form a peer to peer network where communication is feasible due to device closeness within a physical range.

For ad-hoc applications, MANET can be used to build the fundamental infrastructure. Some of the typical applications are discussed in table given below:-

Table II: Applications of MANETs [6] [7]

S.No.	Application	Illustration
1.	Military System	An efficient communication and coordination is provided between soldiers, vehicles and Base Stations in the battlefield.
2.	Emergency Conditions	Due to a large extent of flexibility and ease of deployment, MANETs are used during the emergency situations like earthquakes, floods, etc.
3.	Educational Areas	Virtual classrooms, momentary interaction during conferences or presentations in university and campus environments.
4.	Wireless Sensor Networks and Game Technology	Used to link sensor equipment low-cost and low-power. Multiuser and network games that are required temporarily are implemented.
5.	Personnel Area Networks(PAN)	Used to connect the personnel communicating devices, creating a network for sharing the information.

C. CHALLENGES in MANETs

Regardless of MANET's appealing applications and features, we can introduce several problems and problems that need to be closely studied before a broad business deployment can be anticipated. These problems and difficulties must be overcome by the MANET setting. These difficulties constitute the problems that are open and unresolved.
Some of the challenges which are faced in MANET is discussed and shown in the table given below:-

Table III: Challenges in MANETs [6] [7]

S.No.	Challenges	Explanation
1.	Routing	The topology is continuously changing which lead to a major issue related to decision about the routing protocols.
2.	Battery Constraints	The devices used in the MANETs have the limited battery backup i.e., a restriction is there in their lifetime.
3.	Dynamic Topology	Membership in dynamic topology can disturb the connection of confidence between nodes. If some nodes are identified as corrupted, the confidence may also be troubled.
4.	Limited Bandwidth	Wireless connectivity continues to be substantially smaller than infrastructure networks. In addition, after taking into account the effect of multiple connection, distortion, noise, and interruption conditions, etc., the presumed wireless transmission output are often much smaller than a radio's peak rate of transmission.
5.	Security threats	Because mobile broadcasting is subject to snooping and arbitrary network architecture is created through node cooperation, mobile ad hoc networks are generally subjected to numerous security offenses.

II. ROUTING PROTOCOLS

The optimal strategy for offering a path to node in the MANET from starting point to departure point is routing protocols. The figure below shows three elementary routing protocols in MANET:-

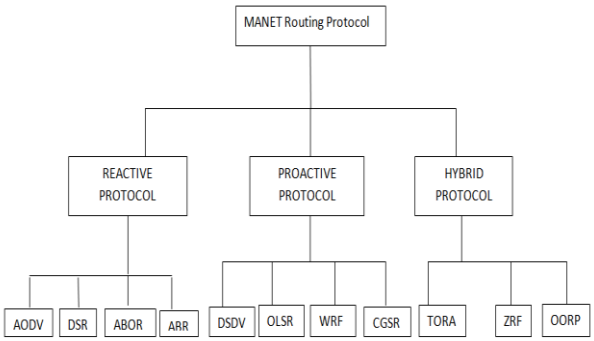

Fig. 1. Classification of Routing Protocols in MANETs

Routing protocols are grouped into three classes, first class is Reactive protocols, and second class involves Proactive protocols, and hybrid protocols are included in third class. Whenever a link or router is required, i.e. these protocols are on demand, the Reactive protocol tables are retained on demand. In these protocols, the operating costs are less because the tables are not upheld all the time. Examples of reactive protocols are AODV, DSR, etc. The data of each node are recorded or stored in the table in the proactive protocols. Retaining table's expense is more as they are constantly being revised. Examples of proactive protocols include DSDV, OLSR, etc. Hybrid protocols incorporate the features of both reactive and proactive protocols. ZRF, OORP, etc. are the examples of hybrid protocols [7].

III. DYNAMIC SOURCE ROUTING PROTOCOL

DSR protocol is a routing protocol used in MANETs that is easy and effective. Dynamic source routing protocol (DSR) is a source-based on-demand protocol intended to limit the bandwidth utilized by control packets in ad hoc wireless networks by removing the regular table-update messages needed by the table-driven strategy [1]. During the route building stage, the basic approach of this protocol (and all other on-demand routing protocols) is to create a path by flooding the network's Route Request packets. Two operations are used by the dynamic source routing protocol for establishing the route: Route Discovery and Route maintenance [7].

Route Discovery: This procedure is launched by the source node for route setting. This mechanism is used to discover the best path from the source node to target node for relaying data packets.

Route Maintenance: This operation is used to check whether a route or link is not lost between any two nodes.

This is ensured by taking acknowledgement from every node regularly. This will allow early retransmission of corrupt or lost data packets.

IV. SIMULATION SETUP AND RESULTS

The motive of this research paper is to investigate, analyze, simulate and a comparative study for DSR routing protocol in MANETs by varying the speed of nodes i.e., 20m/Sec, 40m/Sec and 60m/Sec. The DSR protocol performs or behaves differently in different environment based on its properties. By analyzing and simulating this protocol we get to know where it is lacking and what strategies, researchers can formulate to improve its performance compared to other routing protocols. For experimental purposes in this paper, investigators use the ns2.35 simulator to perform the simulations which is installed on ubantu 16.04LTS. For simulation following parameters have been used which are mentioned in the table given below:

Table IV: Simulation Parameters

Parameter	Values
Area	500*400
Routing Protocol	DSR
Number of Nodes	17
Nodes mobility	20m/Sec, 40m/Sec, 60m/Sec
Traffic	CBR
Simulation Time	50 Seconds
Channel Type	Channel/Wireless Channel
MAC Type	Mac/802_11
Antenna Model	Antenna/Omni Antenna
Max Packets	50

The scenario of simulation is shown in following screenshots:-

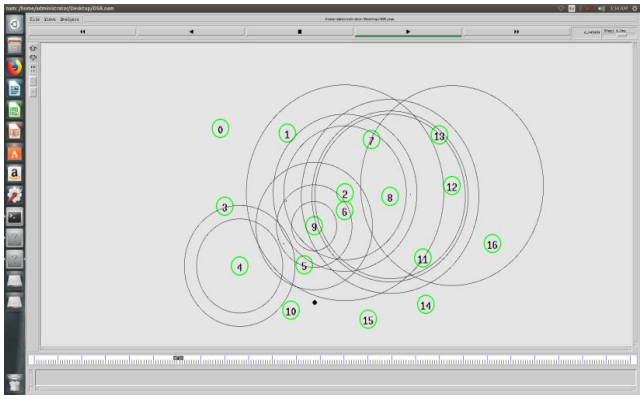

Fig. 2. Scenario in DSR with 20m/sec and 17 nodes

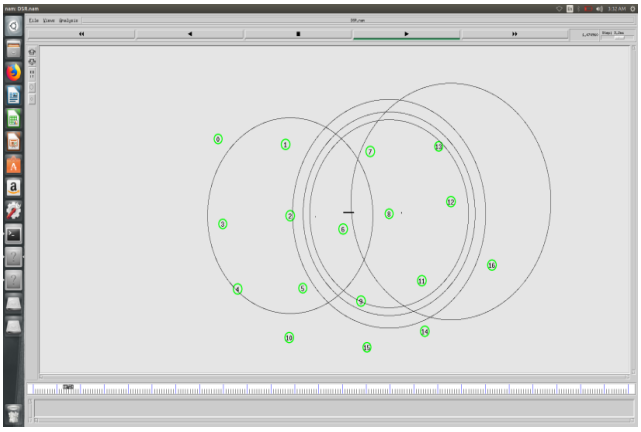

Fig. 3. Scenario in DSR with 40m/sec and 17 nodes

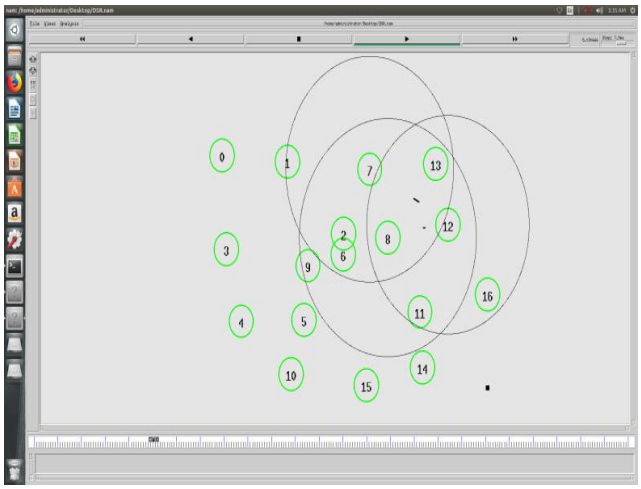

Fig. 4. Scenario in DSR with 60m/sec and 17 nodes

A. PACKET DELIVERY RATIO

PDR is the proportion of node-received packets to node-sent packets. The protocol having the high packet delivery ratio performs well in comparison to other protocols. It is calculated as:

Packet delivery Ratio = (Received packets/Sent packets)*100

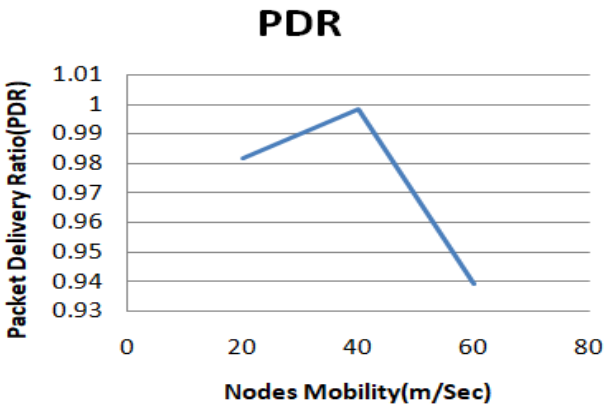

Fig. 5. Packet Delivery Ratio in DSR with 20, 40, 60m/Sec nodes mobility

From the graph, we anlayse that the PDR value starts increasing from 20m/Sec to 40m/Sec because packet loss is less, but as the speed of the nodes are increased further then the packet loss is more because the links or connection are not properly established.

B. AVERAGE THROUGHPUT

The complete amount of packets in simulation time supplied or received by the target node is the throughput. The average throughput is calculated as:
NumOfRecd/(spTime-sTime)*(8/1000)

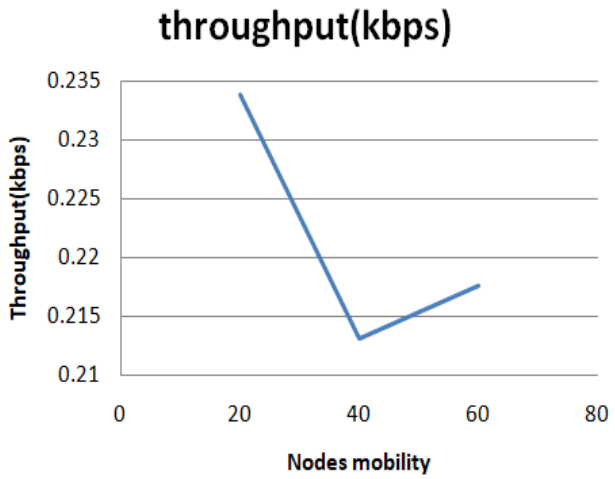

Fig. 6. Average Throughput in DSR with 20, 40, 60m/Sec nodes mobility

From the graph, we conclude that the average throughput will decrease with increase in mobility of nodes, but after a threshold throughput increases gradually with an increase in node's mobility. The protocol having higher throughput performs better in comparison to others.

C. TOTAL RESIDUAL ENERGY

It is the quantity of energy remaining from the total available energy after absorbing a certain amount of energy. The total residual energy is calculated as:
Residual Energy=Total available energy – consumed energy

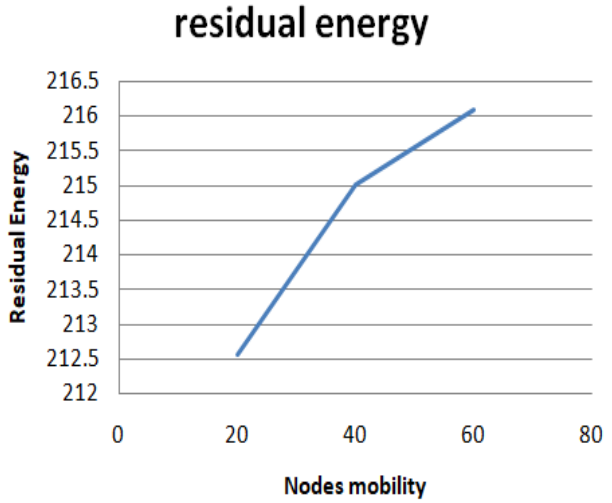

Fig. 7. Residual Energy in DSR with 20, 40, 60m/Sec nodes mobility

From the graph, we investigate that the residual energy increases by increasing the nodes mobility.

D. INSTANT THROUGHPUT

It provides a closer look to the throughput by providing throughput at every second of simulation The xgraph is given showing instant throughput at 20, 40, 60 m/Sec mobility of nodes.

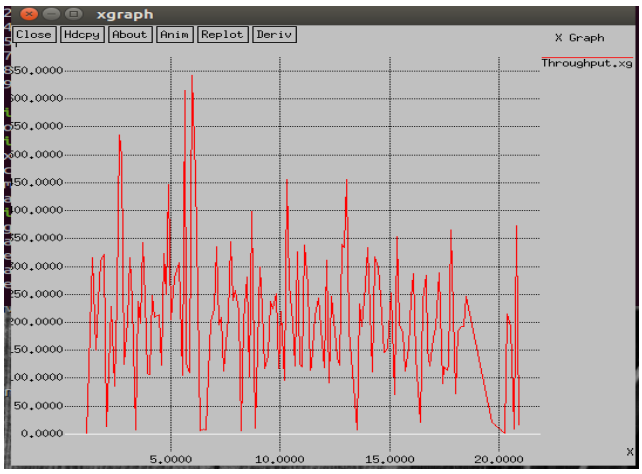

Fig. 8. Xgraph for Instant Throughput in DSR with 20m/Sec speed

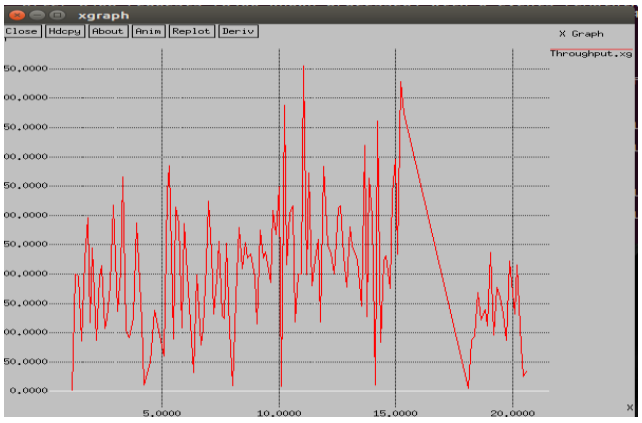

Fig. 9. Xgraph for Instant throughput in DSR with 40m/Sec speed

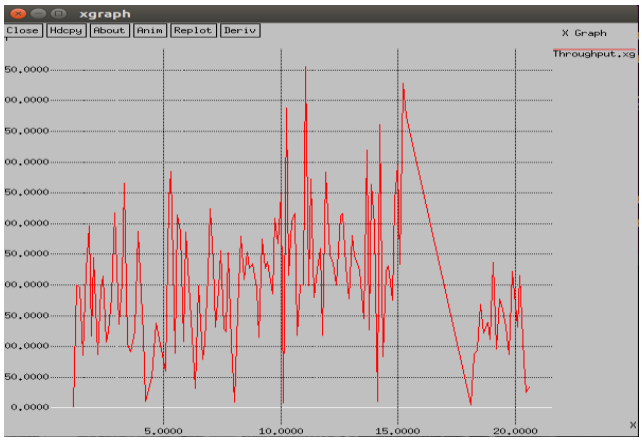

Fig. 10. Xgraph for Instant Throughput in DSR with 60m/Sec speed

The above three xgraphs shows how the throughput varies at different nodes speed or mobility at each instance of simulation time.

V. CONCLUSION

A overview of how the different performance metrics differ with variable mobility or node velocity is acquired in this study job.

The packet shipping percentage in the DSR protocol is greater than in the other protocol. Higher Packet Delivery Ratio implies the packet lost during sender-to-receiver packet transmission.

VI. FUTURE SCOPE

The researchers can simulate these parameters by taking a different protocol in account and note the results and outcomes. The efficiency of a protocol can be explored by using these performance metrics to take an assault and vary the flexibility of the nodes.

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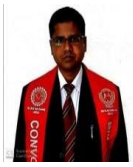

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