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Impact of FTP, FTP/GENERIC and TELNET Traffic Pattern on the Performance of Routing Protocols (AODV, DSR) in MANET

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ABSTRACT: A Mobile Ad-Hoc Network (MANET) is a collection of wireless mobile nodes that communicates with each other without using any existing infrastructure, access point or centralized administration. Understanding the performance of routing protocols in ad hoc networks is a key feature to determine which routing protocol is best suited for which type of network scenario. So, In this paper, an attempt has been made to evaluate the performance of two well known reactive(AODV,DSR) routing protocols with three traffic Generators FTP and FTP/GENERIC and TELNET by using two performance metrics such as packet delivery ratio, average throughput under different network scenarios like No. of Nodes, Node Speed. The Performance evaluation has been done by using simulation tool GloMoSim (Global Mobile information systems Simulation) which is main simulator.

KEYWORDS: MANET, AODV, DSR, FTP, FTP GENERIC, TETNET, GloMoSim.

I. INTRODUCTION

Communication is one of the major needs of mankind. To receive or send any information, we need some communication network. Gradually, reaching to excellence, concept of Wireless Multi-hop Networks (WMhNs) gives enough liberty of freedom in this aspect. Considering such networks, each node besides doing its prescribed job also acts as a routing device along with being a transceiver. Information coming from one node is passed ssuninterrupted to next node till it reaches its destination. Moreover, these networks can extend up to thousands of nodes as in wireless sensor networks or need very efficient routing as in body area networks where packet drop ratio must tends to zero, or these networks may have high mobility as defined in vehicular ad-hoc networks [9].

II. RELATED WORK

As stated earlier, there have been several performance evaluation and comparison studies, which examine the performance of various routing protocols in MANETs. Each of these studies examines different number and/or categories of routing protocols, with different mobility patterns and traffic conditions. However, in all of the articles mentioned in this section and similar studies published in the past, the traffic sources were considered to send Variable Bit Rate (VBR) traffic and traffic resulting from specific applications has not been taken into account. Although VBR is the common traffic source used for evaluation of protocols' performance, it is not common for a real network to transfer only that kind of traffic, since in most real networks many different applications and types of traffic coexist. Although in some studies the traffic load is varied, it still is generated by non-specific traffic generators as VBR. In this section we present some of the most prominent work done in this field in contrast to our study.

In [1] Network simulator NS-2.34 is used to evaluate and compare the performance of AODV and DSR protocols under VBR traffic. The performance is compared in terms of number of packet received, throughput, routing overhead and network overload when number of nodes is constant.

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In [2] this paper attempts to determine how AODV, FSR, and LAR protocols perform under increased loads. They tested these protocols for three different scenarios (100, 200, and 300 nodes) on different rectangular areas (1500x1000, 2000x1500, and 3000x2000 m^2). The performance evaluation of these protocols is based on the well known GloMoSim.
In [3] Routing algorithms under the analysis have been simulated and their performance is being analyzed. Under the CBR, VBR and Exponential traffic source the entire routing algorithm performed well and produced over 90% throughput under different pause time. For the FTP traffic source the performance of the DSDV is better than the other two algorithms majorly due to the shortest path algorithm and FTP traffic scenario. Under HTTP traffic (Packmime) all the algorithms suffered as the packet interval being not fixed and variable packet size.

III. MOBILE AD-HOC NETWORK (MANET)

A mobile ad hoc network (MANET) is an autonomous, self-configuring network of mobile nodes that can be formed without the need of any pre-established infrastructure or centralized administration. MANETs are extremely flexible and each node is free to move independently, in any random direction. Each node in MANET maintains continuously the information required to properly route traffic. Each node participates in an ad hoc routing protocol that allows it to discover multi-hop paths through the network to any other node. This idea of Mobile ad hoc network is also called infrastructure-less networking, since the mobile nodes in the network dynamically establish routing among themselves to form their own network on the fly [8].

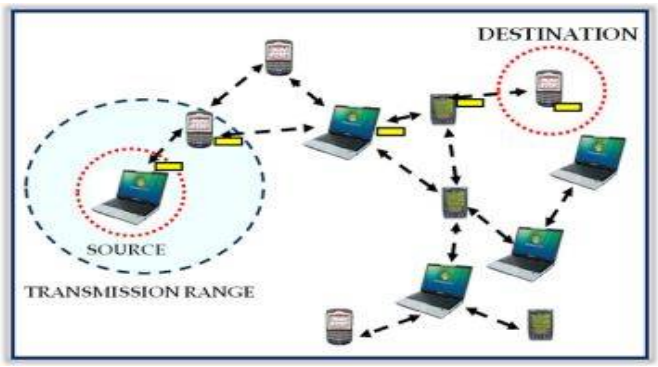

Figure 2.1: Mobile Ad-Hoc Network

IV. ROUTING IN MANET

A Routing Protocol is a protocol that specifies how routers communicate with each other to disseminate information that allows them to select routes between any two nodes on a network. Typically, each router has a priori knowledge only of its immediate neighbors. A routing protocol shares this information so that routers have knowledge of the network topology at large. The specific characteristics of routing protocols include the manner in which they either prevent routing loops from forming or break routing loops if they do form, and the manner in which they determine preferred routes from a sequence of hop costs and other preference factors. There are many protocols already have developed for MANET environments. All these protocols can be classified in different ways. Based on the network structure the routing protocols can be classified as flat routing, hierarchical routing and geographic position assisted routing.

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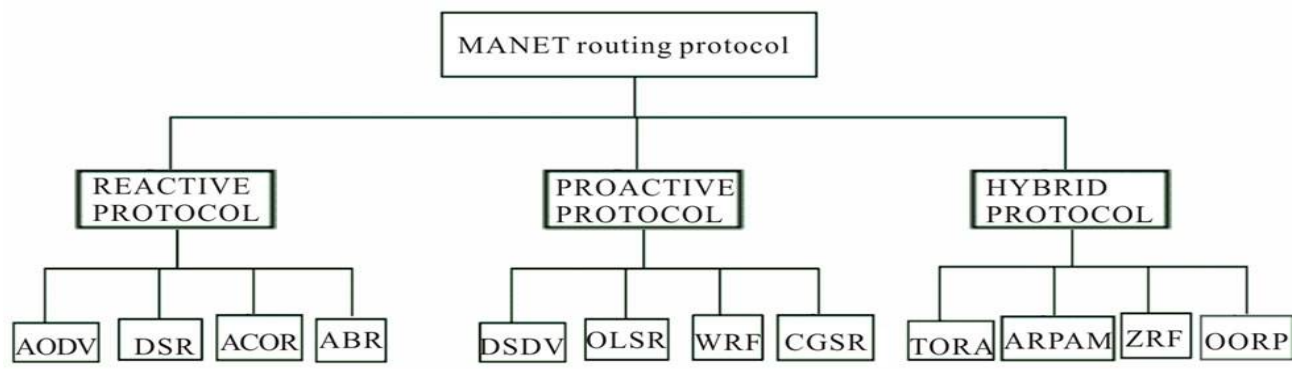

Figure 3.1: Categorization of MANETs Routing Protocols.

Flat Routing protocols can be divided into proactive, reactive and hybrid protocols, depending on the routing topology.

- Proactive Routing Protocols / Table Driven
- Reactive Routing Protocols / On Demand
- Hybrid Routing Protocols

Proactive or table driven routing protocols:

In table driven routing protocols every mobile node maintains the network topology information in the form of routing table by periodically exchanging routing information. Routing information is generally flooded in the network. Whenever a node requires a path to destination it runs an appropriate path-finding algorithm on the topology information it maintains.

Reactive or on-demand routing protocols:

Protocols that fall under this category do not maintain the network topology information. They obtain the necessary path when it is required by using a connection establishment process. Hence these protocols do not exchange information periodically.

Hybrid routing protocols:

Protocols belonging to this category combine the best features of the above two categories. Nodes within a certain distance from the node concerned or within a particular geographical region, are said to be within the routing zone of the given node. For routing within zone a table driven approach is used. For nodes that are located beyond this zone on-demand approach is used [7].

V. OVERVEIW OF AODV, DSR ROUTING PROTOCOL

Every routing protocol has its own merits and demerits, none of them can be claimed as absolutely better than others. In this paper the two reactive routing protocols – AODV, DSR has been selected for evaluation.

Ad-hoc On-Demand Distance Vector (AODV)

AODV [6] is a purely reactive routing protocol. In this protocol, each terminal does not need to keep a view of the whole network or a route to every other terminal. Nor does it need to periodically exchange route information with the neighbor terminals. Furthermore, only when a mobile terminal has packets to send to a destination does it need to discover and maintain a route to that destination terminal. In AODV, each terminal contains a route table for a destination. A route table stores the following information: destination address and its sequence number, active neighbors for the route, hop count to the destination, and expiration time for the table. The expiration time is updated each time the route is used. If this route has not been used for a specified period of time, it is discarded. ***Dynamic Source Routing (DSR)***

The Dynamic Source routing algorithm is an innovative approach to routing in a MANET in which nodes communicate along paths stored in source routes carried by the data packets. It is referred as one of the purest examples of an on demand protocol. In DSR, mobile nodes are required to maintain route caches that contain the source routes. Entries in the route cache are continually updated as new routes are learned [4].

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The DSR protocol is composed of two mechanisms that work together to allow the discovery and maintenance of source routes in the ad hoc network:
Route Discovery: is the mechanism by which a node S wishing to send a packet to a destination node D obtains a source route to D. Route Discovery is used only when S attempts to send a packet to D and does not already know a route to D [6].
Route Maintenance: is the mechanism by which node S is able to detect, while using a source route to D, if the network topology has changed such that it can no longer use its route to D because a link along the route no longer works. When Route Maintenance indicates a source route is broken, S can attempt to use any other route it happens to know to D, or can invoke Route Discovery again to a new route. Route Maintenance is used only when S is actually sending packets to D [6].

VI. PROPOSED METHODOLOGY AND PERFORMANCE METRICS

Problem formulation: Understanding the performance of routing protocols in ad hoc networks is a key feature to determine which routing protocol is best suited for which type of network scenario. From the literature survey it was found that there is a lot of work done on evaluating the performance [7] of various MANET routing protocols for CBR traffic but there is very little work done for variable bit rate like FTP, TELNET type of traffic. In this paper, evaluation has been done for the performance of Reactive protocols i.e. Ad hoc on demand distance vector routing (AODV) and dynamic source routing (DSR) of mobile ad-hoc network routing protocols for FTP, FTP/Generic, TELNET traffic patterns. The performance of these routing protocols is evaluated with respect to effect on packet delivery ratio and average throughput due to variation in no. of nodes, and node speed.
Performance metrics: Design and performance analysis of routing protocols used for mobile ad hoc network (MANET) is currently an active area of research. To judge the merit of a routing protocol, one needs metrics both-qualitative and quantitative- with which to measure its suitability and performance. Specifically, this paper evaluates the performance comparison of AODV and DSR reactive routing protocols .The **Packet Delivery Ratio (PDR)** and **Average Throughput** performance metrics is used to compare the performance of these routing protocols in the simulation by varying **no. of node** and **node speed** and for these traffic patterns **FTP, FTP/Generic and TELNET**.
Packet delivery ratio is calculated by dividing the number of packets received by the destination through the number of packets originated by the application layer of the source. It specifies the Packet loss rate, which limits the maximum throughput of the network. The better the delivery ratio, the more complete and correct is the routing protocol.
Average Throughput (packet/second) It is the rate at which network send or receive data. It rated in term of bits or packets per seconds. It is the sum of data rates that are delivered to all nodes in MANET. Throughput = Pr/Pf Where Pr is the total number of Received Packets and Pf is the total number of Forwarded Packets.

VII. SIMULATION

Simulation Model: Simulation is a fundamental tool in the development of MANET protocols, because the difficulty to deploy and debug them in real networks. The simulation software used the GloMoSim (Global Mobile information systems Simulation). Global Mobile Information System Simulator is a popular network simulation tool, which is frequently used in the study of the behavior of large-scale hybrid networks that include wireless, wired, and satellite based communications are becoming common in both in military and commercial situations.
Simulation Parameter: The parameters used for carrying out simulation are summarized bellows tables.
(a) Table 1, For no. of nodes, where pause time-30s(fix) and Speed-30 m/s (fix).

Table 1: Simulation Parameter for no. of nodes

Parameters	Values
Simulation Time(sec)	400s
Area	1000*1000
MAC Protocol	802.11
Routing Protocol	AODV,DSR
Mobility Model	Random-Way Point
Propagation Model	Two-Ray
No. of Nodes	30,60,90,120,150,180

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Traffic Source	FTP, FTP/Generic, TELNET
Seed[st. pt.]	1
Node Placement	Random

(b) Table 2, For node speed, where no. of nodes-30 (fix) and pause time-30s (fix).

Table 2: Simulation Parameter for node speed

Parameters	Values
Simulation Time(sec)	400s
Area	1000*1000
MAC Protocol	802.11
Routing Protocol	AODV,DSR
Mobility Model	Random-Way Point
Propagation Model	Two-Ray
Node Speed	30,60,90,120,150,180
Traffic Source	FTP, FTP/Generic, TELNET
Seed [st. pt.]	1
Node Placement	Random

Mobility Model: The mobility model plays a very important role in determining the protocol performance in mobile Ad-Hoc Network. To evaluate the performance of protocol in MANET, the protocol should be tested under realistic conditions such as – transmission range, data traffic, movement of mobile users (nodes) etc. There have been a wide variety of mobility models (MM) proposed and it is expected the MM should attempt to mimic the movement of real mobile nodes, the changes in speed and direction must occur in reasonable time slots [5].

(a)Random Waypoint Mobility Model: We used the Random Waypoint Mobility Model for our examinations, which is by far the most often used model. It was first used by Johnson and Maltz in the evaluation of Dynamic Source Routing , and was later refined by the same research group .In this model, a mobile node moves from its current location to a randomly chosen new location. Within the simulation area, using a random speed uniformly distributed between [vmin, vmax]. vmin refers to the minimum speed of the simulation, vmax to the maximum speed[5].

VIII. RESULT AND ANALYSIS

Here we present a comparative analysis of the performance metrics of both the on-demand routing protocols AODV and DSR with FTP and FTP Generic and TELNET traffic sources for different no. of nodes (30,60 and 90,120,150,180),node speed(30,60 and 90,120,180).

A. Results for FTP Traffic Generators:

1) PDR and Average throughput with Varying No of Nodes: The performance of the routing protocols in terms of packet delivery ratio and average throughput is examined with respect to No. of Nodes. The simulation results are shown in figure 8.1 and 8.2 respectively.

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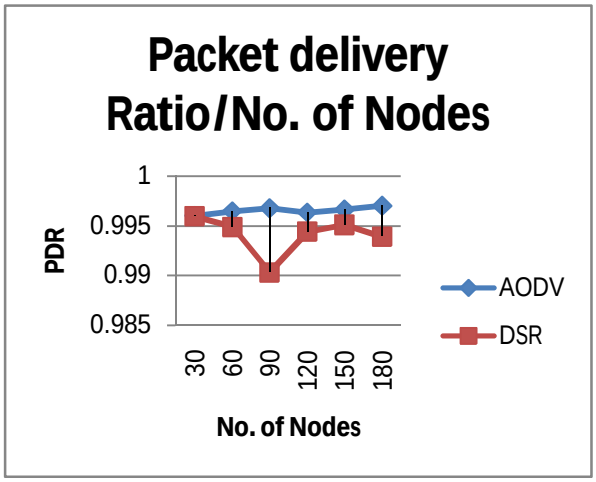

Fig 8.1 PDR with Varying No. of Nodes

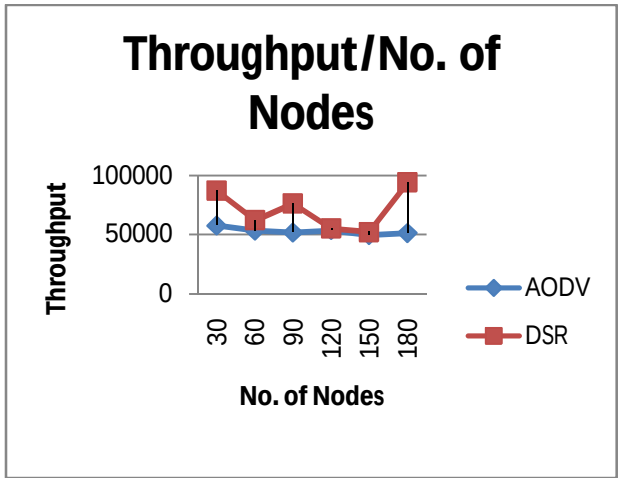

Fig 8.2: Average Throughput with Varying No. of Nodes

PDR AODV gives constant delivery ratio when node density is increased while DSR is changed in delivery ratio when No. of Nodes increased. When the No. of Nodes is increased and then there is peak fall in DSR Delivery Ratio 60 to 90 and then there is sudden increase from 90 to 120 after 120 there is almost constant delivery ratio as shown in figure 8.1
Average Throughput Shown in Figure 8.2 there is random change in Average Throughput in DSR when No. Of Nodes is changed. Throughput remains constant through away in case of AODV. Highest value is gain at node 180 in DSR.
2) PDR and Average Throughput with varying Node Speed: The performance of the routing protocols in terms of packet delivery ratio and Average Throughput is examined with respect to Node Speed. The simulation results are shown in the figure 8.3 and 8.4 respectively.

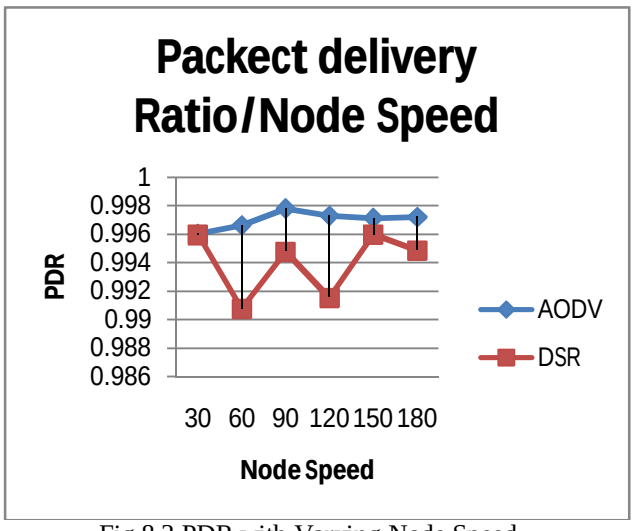

Fig 8.3 PDR with Varying Node Speed

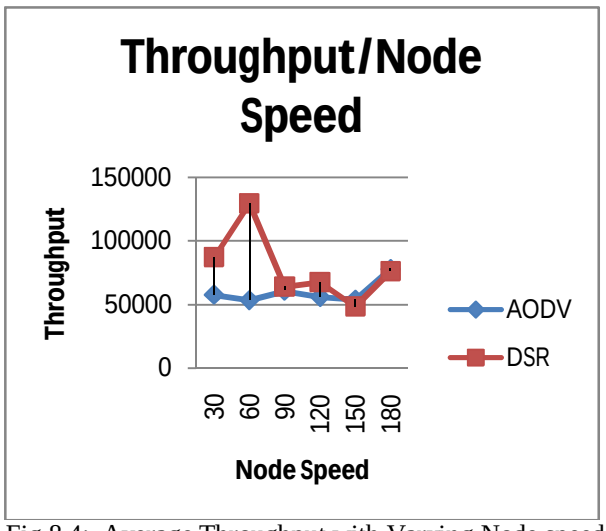

Fig 8.4: Average Throughput with Varying Node speed

PDR Shown in figure 8.3 AODV gives constant delivery ratio and DSR gives random changes in delivery ratio. There are sudden falls and raises in DSR delivery ratio. Highest delivery ratio is gain in case of Node Speed 30, where Nodes 30(fix) and pause time 30s (fix).
Average Throughput Shown in figure 8.4 There are constant changes in AODV and DSR gain a high value at node speed 60 after that there is constantly changes in throughput. At node speed 180 AODV and DSR both attains almost same value in throughput.

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B. Results for FTP/Generic Traffic Generators:

1) PDR and Average Throughput with varying No. of Nodes: The performance of the routing protocols in terms of packet delivery ratio and Average Throughput is examined with respect to No. of Nodes. The simulation results are shown in fig 8.5 and fig 8.6 respectively.

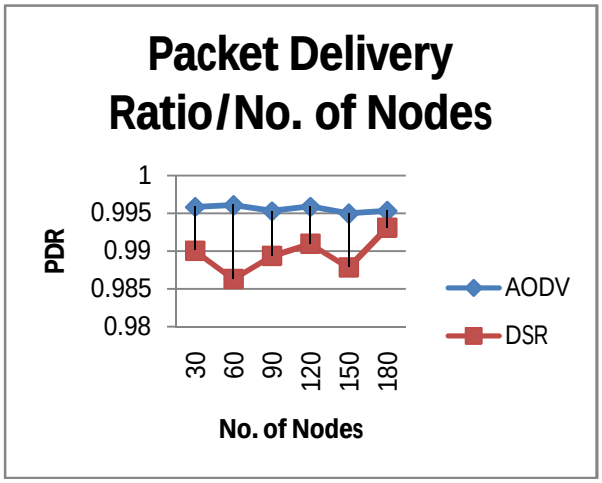

Figure 8.5: PDR with varying No of Nodes

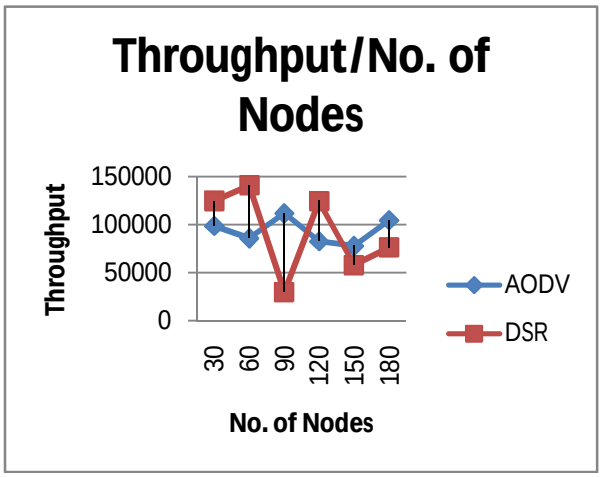

Fig 8.6: Average Throughput with varying No. of Nodes

PDR Shown in figure 8.5, Delivery Ratio of AODV remains almost constant as No. of Nodes is changing. There is randomly changes occurs in DSR Delivery Ratio, highest Delivery Ratio is attains at 180 and lowest at 60.
Average Throughput Shown in figure 8.6, AODV and DSR randomly changes, lager changes are shown in the values of DSR. It attains highest value at 60 and lowest value at 90, there is a peek fall at 90. AODV gives small changes in to values as compare to DSR.

2) PDR and Average Throughput with varying Node Speed: The performance of the routing protocols in terms of Packet Delivery Ratio and Average Throughput is examined with respect to Node Speed. The simulation results are shown in figure 8.7 and figure 8.8 respectively.

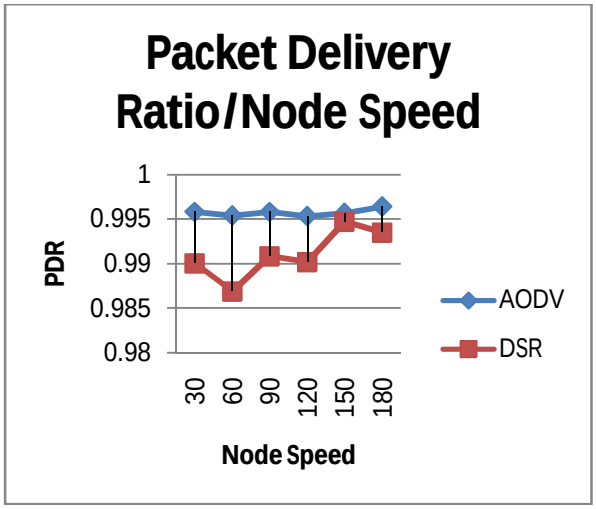

Fig 8.7: PDR with varying Node Speed

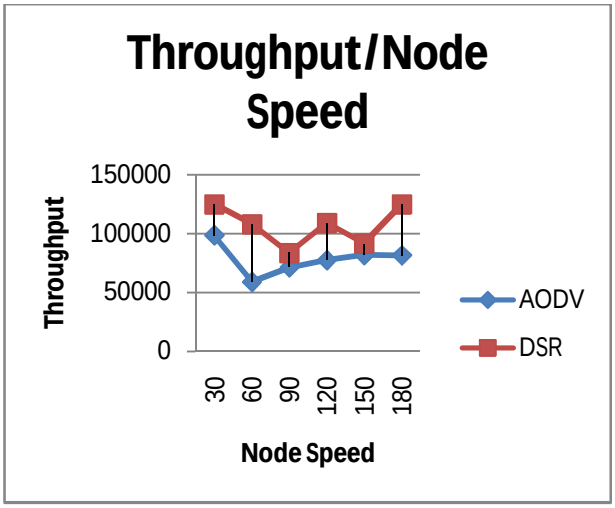

Fig 8.8: Average Throughput with varying Node Speed

PDR Shown in figure 7.7, AODV remains almost same whatever the node values and DSR randomly changes as the values of nodes are changing. It attains lowest Delivery Ratio at node 60 and highest Delivery Ratio at 150.

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Average Throughput Shown in figure7.8, DSR have randomly changes, AODV's Throughput peek fall at Node Speed 60. Then there is constantly increment in Throughput of AODV up to Node Speed 180.

C. Results for TELNET Traffic Generators:

1) PDR and Average Throughput with varying No. of Nodes: The performance of the routing protocols in terms of packet delivery ratio and Average Throughput are examined with respect to No. of Nodes. The simulation results are shown in figure 8.9 and figure 8.10 respectively.

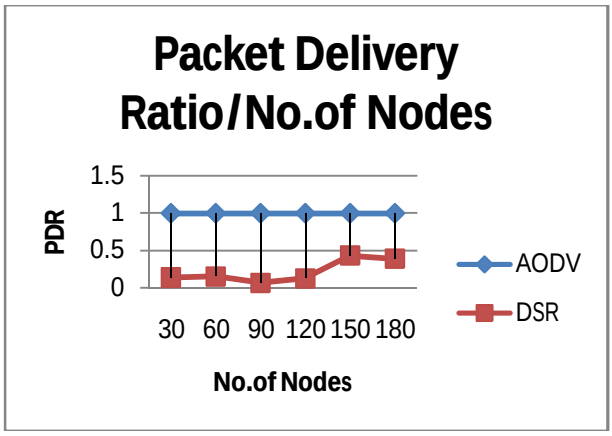

Fig 8.9: PDR with varying No. of Nodes

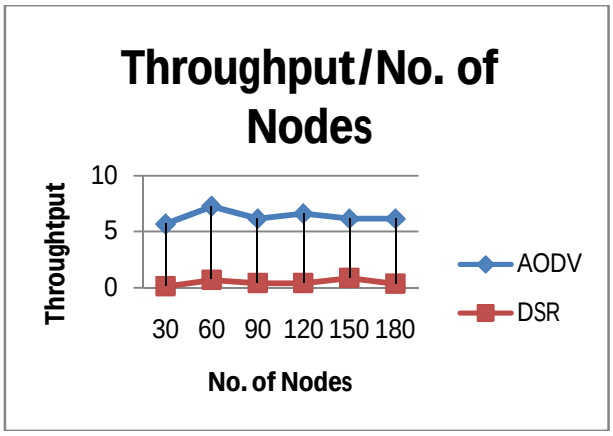

Fig 8.10: Average Throughput with varying No. of Nodes

PDR Shown In figure 8.9, Deliver Ratio of AODV attains constant value as No. of Nodes is changing. There is constant changes occurs in Delivery Ratio of DSR, highest Delivery Ratio is attains at node 150.

Average Throughput Shown in figure 8.10, there is larger difference in Throughput of AODV and DSR, AODV gives higher Throughput and DSR gives lower Throughput. Both are constantly changes.

2) PDR and Average Throughput with varying Node Speed: The performance of the routing protocols in terms of packet delivery ratio and Average Throughput are examined with respect to Node Speed. The simulation results are shown in figure 8.11 and figure 8.12 respectively.

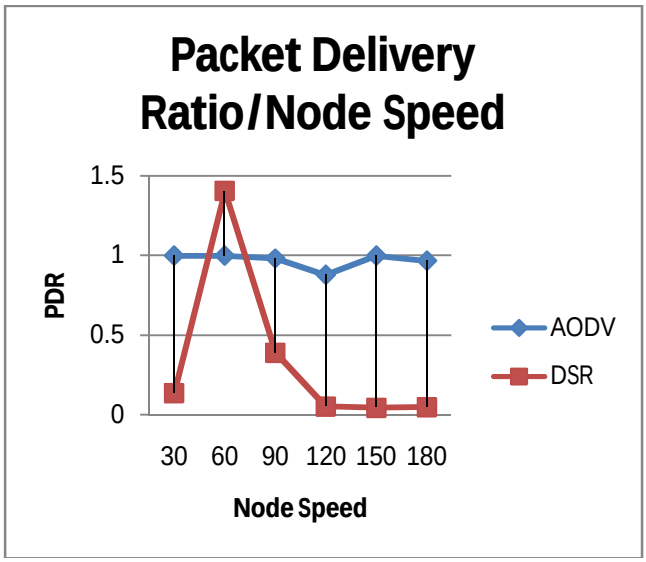

Fig 8.11: PDR with varying Node Speed

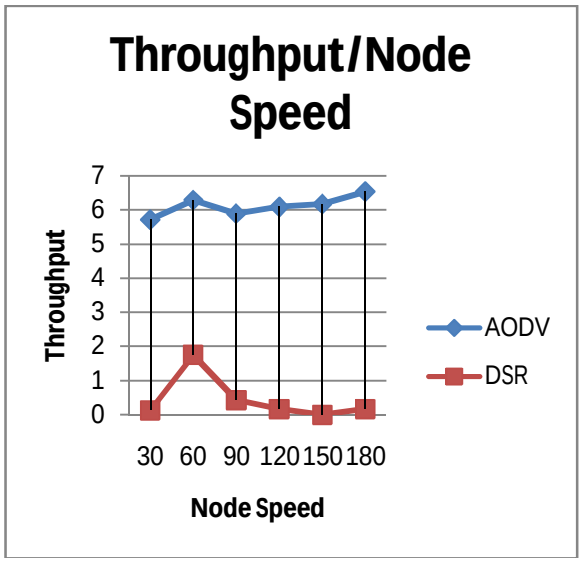

Fig 8.12: Average Throughput with varying Node Speed

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PDR Shown in figure 8.11, AODV remains almost constant throughout the simulation but DSR shows larger variations in Delivery Ratio, it attains highest value at Node Speed 60. After that it falls down instantly and goes on decreasing.
Average Throughput Shown in figure 8.12, as PDR not match with each other of AODV and DSR, similarly Throughput AODV and DSR not meet each other at only single point. AODV remains constantly changing and DSR attains highest value at 60 Node Speed.

IX. CONCLUSION

Here AODV, DSR routing protocols are studied .The performance evaluation parameter for these protocols are PDR and Throughput.
A. Conclusion for FTP Traffic Generator: Various numbers of nodes and node speed, it is observed that Packet Delivery Ratio of AODV is very high and it's constant up to end of simulation. DSR perform good at starting but its performance remains changing as no. of nodes and node speed change. Average Throughput of DSR is better than AODV in both scenarios.
B. Conclusion for FTP/Generic Traffic Generator: Various numbers of nodes, it is observed that Packet Delivery Ratio of AODV is very high and it's constant up to end of simulation. PDR of AODV is approximately 100 %. DSR perform good at starting but its performance goes down and up as values increases. Average Throughput of DSR is better than AODV.
C. Conclusion for TELNET Traffic Generator: various number of nodes and node speed, it is observed that PDR of AODV is very high and it's constant up to end of simulation. DSR has very low Delivery Ratio at staring and remains decreasing up to end of simulation, its attains highest value at node speed 60 and then it goes on decreasing in PDR. Average Throughput of AODV is much better than DSR.
So, conclusion is that if the MANET has to be setup for a large network then AODV should be prefer due to high Packet Delivery Ratio and high Throughput with TELNET traffic pattern.

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