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Simulation Study of Efficiency for Implementation of Routing Protocols in MANET

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Abstract: Mobile ad-hoc networks are described by absence of base, and irregular and rapidly changing network topology, for instance, there are no base stations; consequently the requirement for a robust dynamic routing protocol that can fulfill such a network system. Every node in the network additionally goes as a router, sending information for other nodes[1]. The dynamic way of these networks requests new arrangement of network routing methodology protocols to be actualized with a specific end goal to give productive end-to-end correspondence. Due to the various applications that use MANETs, such as battlefield, emergency services, mobile communication and disaster discovery, MANETs offer many merits to many organizations that need wireless roaming. Subsequently, numerous routing algorithms have come into presence to fulfill the necessities of communication in such networks. This paper presents a simulation study and correlation the execution between two classes of routing protocols, table-driven (Proactive) and on-interest (Reactive) routing protocols, this two classifications will be outlined by utilizing two distinct case of routing protocols, first illustration is DSDV (Destination Sequenced Distance-Vector) belongs to Proactive family and the second case is AODV (Ad Hoc On-Demand Distance Vector) and DSR (Dynamic Source Routing Protocol) belongs to Reactive family. Both protocols are simulated by utilizing NS-2 (Network Simulator 2.35) package. Both routing protocols are compared as far as normal throughput (packets delivery ration), % Packets lost and Jitter while varying Packets Size, TCP types ,maximum packets in queue and number of packets drop while changing packers size by utilizing the Trace file (.tr file). Besides, an performance comparison of examined routing protocol methodologies is given and suggestions are made to accomplish change in execution of these protocols. This study is followed by showing further analysis that will be sought after to characterize a fundamentally most ideal arrangement of procedures to fulfill distinctive sorts of utilization spaces.

Keywords: ***Mobile Ad Hoc Network; MANETs; routing; routing protocols; proactive; reactive etc.***

I. INTRODUCTION

Mobile phones have been around for almost 15 years and are presently all over the place you look and the numbers have been expanding exponentially. With the proceeding with expansion in innovation mobile phone have gotten smaller size, less expensive, and because of the move from simple to advanced the calls are much clearer. So that specifically, countless studies concentrated on Mobile Ad Hoc Networks (MANETs)[6]. A mobile Ad-hoc network (MANET) is a sort of remote ad-hoc network, and is a self configuring network of mobile routers (and related hosts) associated by wireless connections the union of which frame a discretionary topology. Ad-hoc network is an interconnected gathering of remote nodes autonomous of any focal organization. At a few spots when wired network is unyielding to set up, the remote Ad-hoc network is supportive in such cases[6]. The routers are allowed to move haphazardly and compose themselves subjectively; in this manner, the network's wireless topology may change quickly and capriciously. Such a network may work in a standalone mold, or might be associated with the bigger Internet. A large number of the scholastic papers assess protocols and capacities expecting changing degrees of versatility inside a limited space, ordinarily with all nodes inside a couple hops of each other, and generally with nodes sending information at a steady rate. Distinctive protocols are then assessed taking into account the packet drop rate, the overhead presented by the routing protocol, and different measures.

The Children's Machine One Laptop for every Child program has built up a shoddy mobile PC for mass circulation (>1 million at once) to creating nations for training. The mobile workstations will utilize IEEE 802.11 based Ad-hoc remote cross section networks administration to build up their own interchanges network out of the crate. Vehicular Ad Hoc Networks (VANET) are a type of MANETs utilized for correspondence among vehicles and amongst vehicles and roadside hardware.

II. MOBILE AD HOC NETWORK

Mobile Ad-hoc network, one of the quick developing innovations in the field of telecom. An Ad-hoc network is a gathering of wireless mobile hosts framing an interim network without the help of any stand-alone base or concentrated administration[2]. Mobile Ad-hoc networks (MANETs) permit quick organization

since they don't rely on upon an altered framework. Manet nodes can take part as the source, the destination, or a halfway router. This adaptability is alluring for military applications, disaster-response situations, and academic environments where altered networks administration frameworks won't not be accessible. Recreation has ended up being a significant instrument in numerous regions where diagnostic techniques aren't pertinent and experimentation isn't feasible[3]. Versatile Ad-hoc networks are self-sorting out and self-arranging multi-jump remote networks where, the structure of the network changes progressively. This is for the most part because of the portability of the nodes[5]. Nodes in these networks use the same arbitrary access remote channel, participating in a neighborly way to connecting with themselves in multi-jump sending. The nodes in the network go about as hosts as well as router that Route information to/from different nodes in network[4]. Beneath figure speaks to a MANET of 3 nodes. Node 2 can specifically speak with node 1 and node 3, however any correspondence between Nodes 1 and 3 must be directed through node 2. There are some limitations of MANETs such Higher error rate (more packets are dropped as compared to wired), Lower data rate (data rate is lower as compared to wired network), Dynamic topology (as MANET has no infrastructure and its topology changes from time to time) and scalability (not much scalable and reliable sometimes signals data losses because of signal weakness etc.), Security (Data passes through wireless chances of hacking is more as compared to wired) and Energy limitation (As the wireless device operates on batteries and batteries has limited power).

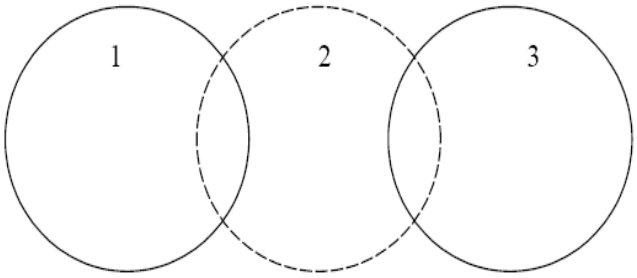


Figure 1: Example of simple MANET of 3-nodes

Applications of MANET:

With the expansion of compact gadgets and in addition progress in remote correspondence, Ad-hoc networks administration is picking up significance with the expanding number of across the board applications. Ad-hoc networks administration can be connected anyplace where there is practically zero correspondence foundation or the current framework is costly or badly arranged to utilize. Ad-hoc networks administration permits the gadgets to keep up associations with the network and also effortlessly adding and expelling gadgets to and from the network. The arrangement of uses for MANETs is assorted, going from extensive scale, versatile, profoundly dynamic networks, to little, static networks that are obliged by force sources. Other than the legacy applications that move from protocol framework environment into the Ad-hoc setting, a lot of new administrations can and will be created for the new environment[8]. Run of the mill applications include:

Military Sector: Military hardware now routinely contains some kind of PC gear. Ad-hoc networks administration would permit the military to exploit ordinary network innovation to keep up a data network between the fighters, vehicles, and military data base camp. The essential methods of Ad-hoc network originated from this field

Commercial Sector: Ad hoc can be utilized as a part of crisis/salvage operations for fiasco alleviation endeavours, e.g. in flame, surge, or tremor. This might be on account of the majority of the gear was annihilated, or maybe in light of the fact that the area is excessively remote. Rescuers must have the capacity to impart with a specific end goal to make the best utilization of their vitality, additionally to look after security. Via consequently building up an information network with the correspondences hardware that the rescuers are as of now conveying, their employment made less demanding. Other business situations incorporate e.g. boat to-boat Ad-hoc mobile correspondence, law authorization, and so forth.

Low Level: Suitable low level application may be in home networks where gadgets can convey specifically to trade data. So also in other regular citizen situations like taxicab, games stadium, vessel and little flying machine, mobile Ad-hoc correspondences will have numerous applications.

Data Networks: A business application for MANETs incorporates pervasive registering. By permitting PCs to forward information for others, information networks might be stretched out a long ways past the standard scope of introduced base. Networks might be made all the more broadly accessible and less demanding to utilize.

Sensor Networks: This innovation is a network made out of countless sensors. These can be utilized to distinguish any number of properties of a territory. Cases incorporate temperature, weight, poisons, contaminations, and so on. The capacities of every sensor are exceptionally constrained, and each must depend on others keeping in mind the end goal to forward information to a focal PC. Singular sensors are restricted in their figuring capacity and are inclined to disappointment and misfortune. Versatile Ad-hoc sensor networks could be the way to future country security[8].

III. INTRODUCTION TO NS2

The usage part is an essential time of the task. We have worked with NS2. NS2 is accessible under Linux, with a GPL license. Some standard algorithms are as of now executed in this simulator, and DSR, AODV and DSDV is one of these. NS2 is a

network simulator; worked with C++ and TCL. As each simulator, the fundamental design is to reproduce distinctive networks, to test diverse protocols, and to discover the confinements of each. It has been created in the California University, by LBL, Xerox PARC, UCB, and USC/ISI through the VINT venture upheld by DARPA.

To begin with, this simulator was work for fixed network: all connections among nodes were wired. That implies that the neighbor had no immediate neighbor: if two nodes were close, they don't convey each other in the event that they don't have a link between each other. Along these lines, later, an augmentation for remote network was produced by UCB Daedelus, CMU Monarch undertakings and Sun Micronetworks. These days, this simulator is utilized the world over, as a result of the GPL permit, and in light of the fact that it is a capable simulator.

It can be download form Internet, at this URL: Network Simulator 2 . There are some tutorials to help beginners, and there is a lot of documentation and videos are available on YouTube. The simulator is composed of two parts:

- ***The TCL code: it is used to communicate with the simulator, and permits to define different simulation parameters.***
- ***The C++/Java code: it is the main part of the project, because it defines how the simulator has to behave***

IV. DESCRIPTION OF ROUTING PROTOCOLS

Distance sequenced distance vector (DSDV)

DSDV is a distance vector routing protocol and is a proactive routing protocol which is a change of ordinary Bellman-Ford routing calculation. In this protocol every node keeps up routing algorithm. This routing data must be intermittently redesigned. With the assistance of routing data nodes can transmit information to other hub in a network. The fields of routing table are as taking after: destination, next, metric, sequence number, installs time, stable data and etc. Sequence numbers are fundamentally started from destination itself which guarantees circle freeness. Install time are utilized to erase fake entries from table. Stable data is fundamentally a pointer to a table holding data on how stable a Route is furthermore used to sodden changes in network[12]. Every node has a routing table that demonstrates for every destination, which is the following jump and number of hops to the destination. Every node intermittently shows routing overhauls. A succession number is utilized to tag every Route. It demonstrates the freshness of the highway, a Route with higher succession number is more ideal. Likewise, among two Routes with the same grouping number, the one with less jumps is more positive. In the event that a hub recognizes that a Route to a destination has broken, then its jump number is set to interminability and its grouping number upgraded (expanded) however allotted an odd number, even numbers correspond to sequence numbers of connected paths.

Ad-hoc On-Demand Distance Vector (AODV)

AODV is a distance vector type routing. It doesn't require nodes to keep up routes to destinations that are not effectively utilized. For whatever length of time that the endpoints of a communication connection have legitimate route to each other, AODV does not assume a part. The protocol utilizes distinctive to find and look after connections, Route Replies (RREPs), Route Requests (RREQs) and Route Errors (RERRs). These message sorts are received by means of TCP, UDP, and ordinary IP header preparing applies[13]. AODV utilizes a destination sequence number for every route section. The destination sequence number is made by the destination for any route data, it sends to asking for nodes. Utilizing destination sequence numbers guarantees loop opportunity and permits which of a few routes is all the more "new". Given the decision between two routes to a destination, an asking for node dependably chooses the one with the best sequence number.

At the point when a node needs to discover a Route to another, it telecasts a RREQ to all the network till either the destination is come to or another node is found with a "new enough" route to the destination (a "new enough" route is a substantial route entry for the destination whose related sequence number is at any rate as extraordinary as that contained in the RREG). At that point a RREP is sent back to the source and the found route is made accessible. Nodes that are a piece of a dynamic route may offer network data by broadcasting intermittently nearby Hello messages (unique RREP message) to its quick neighbors. In the event that Hello messages quit touching base from a neighbor past some given time edge, the association is thought to be lost.

At the point when a node identifies that a route to a neighbor hub is not legitimate it evacuates the routing entry and sends a RERR message to neighbors that are dynamic and utilize the route, this is conceivable by keeping up dynamic neighbor records. This methodology is rehashed at nodes that get RERR messages. A source that gets a RERR can reinitiate a RREQ message; AODV does not permit taking care of unidirectional connections.

Dynamic Source Routing Protocol (DSR)

The Dynamic Source Routing Protocol (DSR) was particularly intended for use in multi-jump wireless mobile Ad-hoc networks[14]. The DSR protocol does not have need of any current network base or focal organization and is totally self arranging and self-designing. This protocol essentially comprises of two components: Route Discovery and Route Maintenance, where the route disclosure instrument handles the foundations of routes and the route support network keeps overhaul the Route data. DSR is

an on interest routing protocol, which implies that no information is sent intermittently and hence it scales routing movement and maintain a strategic distance from the overhead package. The whole route in this routing protocol is known before the start of packet transmission; and it stores the route data in a Route Cache.

V. SIMULATION RESULTS OF THE PERFORMANCE ANALYSIS

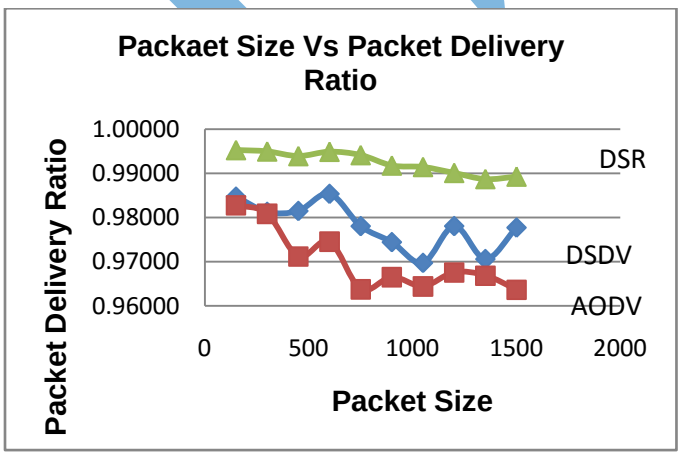
The performance measures which have been used for evaluating the performance of the three routing protocols DSR, DSDV and AODV by using the Trace file and compare the results with different nodes number.

In our work, we have done the evaluation through three different ad-hoc wireless networks just to confirm our results. The ad-hoc wireless network contains 20-nodes.

Table5.1 shows the packet delivery ratio for each (DSDV, AODV and DSR) protocol versus packet size using the following calculation: **Packet Delivery Ratio = packets Received / packets sent**

Packets Delivery Ratio			
Packet Size	DSDV	AODV	DSR
150	0.98472	0.98276	0.99528
300	0.98128	0.98086	0.99497
450	0.98148	0.97116	0.99392
600	0.98536	0.97455	0.99490
750	0.97805	0.96375	0.99414
900	0.97442	0.96649	0.99179
1050	0.96972	0.96440	0.99145
1200	0.97806	0.96756	0.99012
1350	0.97058	0.96684	0.98872
1500	0.97771	0.96365	0.98929

Table 5.1: Packet Delivery Ratio versus Packets sizes for different Protocols

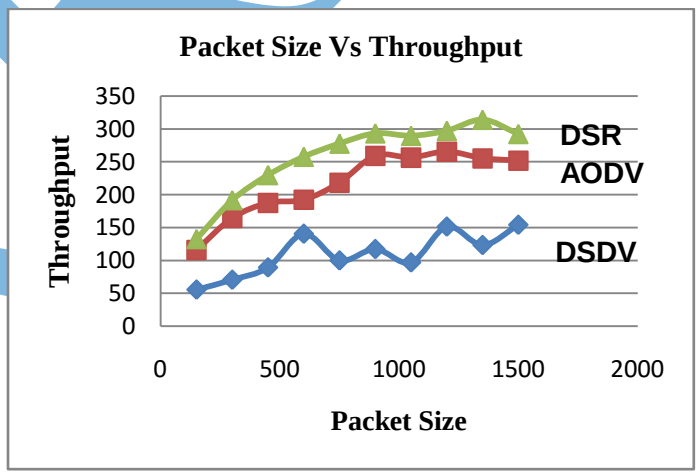


Graph 5.1: Packet Delivery Ratio versus Packets sizes for different Protocols

Table5.2 shows the throughput for each protocol versus packets sizes using the following calculation: (**Total bytes/ (Stop time-Start time))*(8/1024)**

Throughput			
Packets Size	**DSDV**	**AODV**	**DSR**
150	55.84156	116.1495	132.5278
300	70.8171	164.6323	191.6878
450	89.53238	187.5857	229.9153
600	140.7058	192.5084	257.7429
750	100.1467	218.4232	277.7764
900	117.4332	259.2482	293.3409
1050	97.11427	256.5611	289.6412
1200	151.5389	265.4335	297.2842
1350	123.5218	255.4061	314.0255
1500	154.3228	251.7669	292.4003

Table5.2: shows the throughput for each protocol versus packets sizes



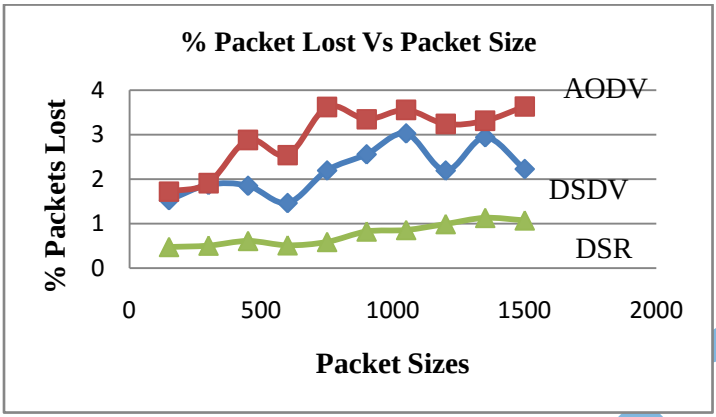
Graph 5.2: Throughput versus Packets sizes for different Protocols

Table 5.3 shows the packets lost % by each protocol versus different sizes of packets sizes for each of the DSDV, AODV and DSR protocols versus packets sizes by using the equation: **Packets Lost % = (Packets Lost/(Sent Packets/100)**

Packets Lost %			
Packet Sizes	DSDV	AODV	DSR
150	1.528056	1.724137	0.472319
300	1.872027	1.913875	0.50306
450	1.851852	2.884195	0.608324
600	1.464129	2.545388	0.51031
750	2.195416	3.624963	0.585617
900	2.558348	3.351141	0.821319
1050	3.028391	3.560459	0.854527

1200	2.194074	3.243512	0.988431
1350	2.942078	3.315957	1.127596
1500	2.228867	3.635482	1.071328

Table5.3 shows the % packets Lost for each protocol versus packets sizes.



Graph 5.3: % Packets lost versus Packets sizes for different Protocols

Table5.4 shows the packet delivery ratio for each protocol versus different types of TCP using the following calculation: **Packet Delivery Ratio = packets Received / packets sent**

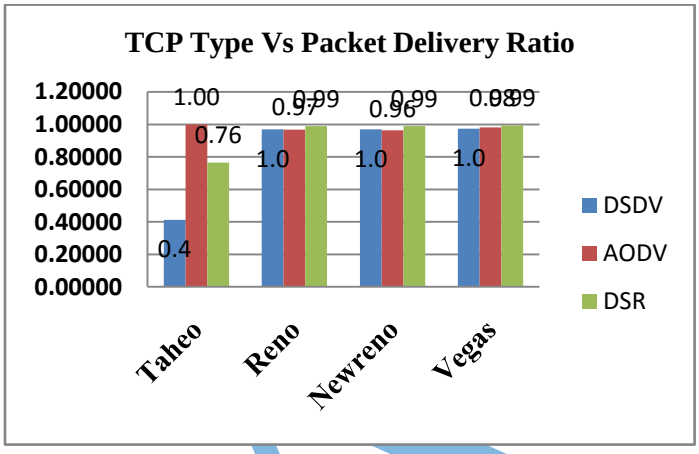
TCP Type	DSDV	AODV	DSR
Taheo	0.41176	1.00000	0.76471
Reno	0.96952	0.96666	0.98931
Newreno	0.96927	0.96418	0.98880
Vegas	0.97250	0.98057	0.99359

Table 5.4: Packet Delivery Ratio Vs Packets sizes for different types of TCP

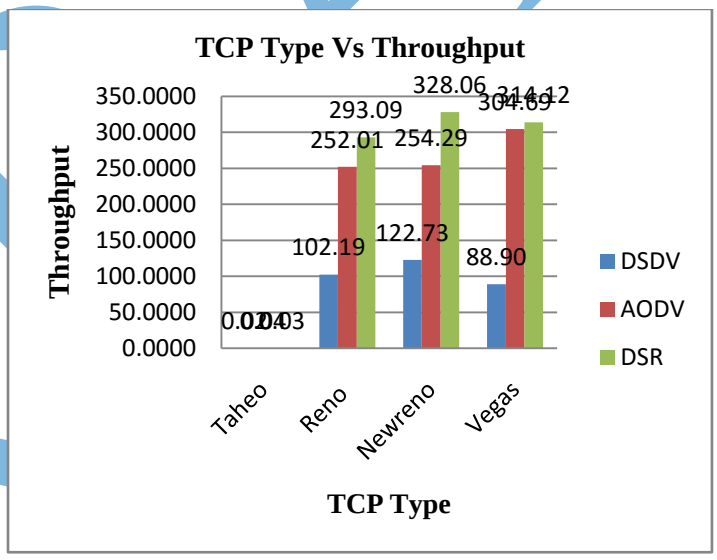
Table 5.5 shows the throughput for each protocol versus different TCP types using the following calculation: **(Total bytes/ (Stop time-Start time))*(8/1024)**

TCP Type	DSDV	AODV	DSR
Taheo	0.0237	0.0366	0.0287
Reno	102.1922	252.0146	293.0898
Newreno	122.7346	254.2900	328.0633
Vegas	88.9027	304.6906	314.1164

Table 5.5: shows the throughput for each protocol Vs different TCP types



Graph 5.4: Packet Delivery Ratio versus different types of TCP

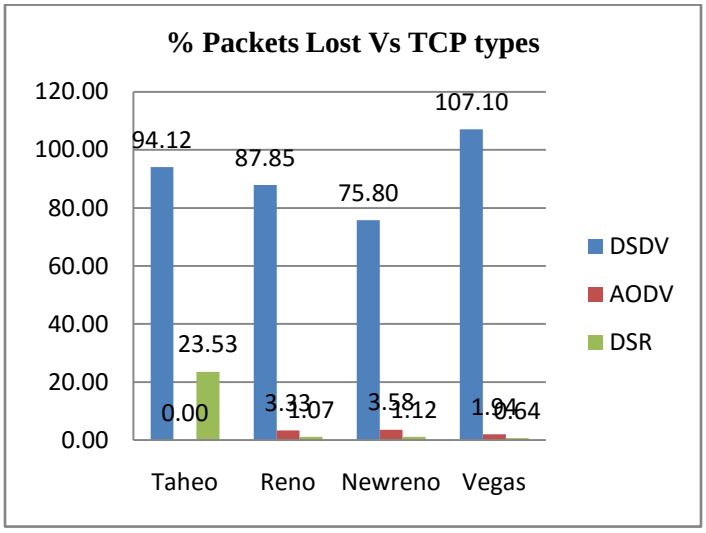


Graph 5.5: Throughput versus TCP types for different Protocols

Table 5.6 shows the packets lost % by each protocol versus different types of TCP for each of the DSDV, AODV and DSR protocols using the equation: **Packets Lost % = (Packets Lost/(Sent Packets/100)**

TCP Type	DSDV	AODV	AODV
Taheo	94.11765	0	23.52941
Reno	87.85259	3.333873	1.068917
Newreno	75.80026	3.581708	1.119779
Vegas	107.1036	1.942767	0.640779

Table 5.6 shows the % packets Lost for each protocol versus TCP types.



Graph 5.6: % Packets lost versus Packets sizes for different Protocols

VI. CONCLUSION AND FUTURE SCOPE

In this project we study performance analysis of AODV, DSDV and DSR routing protocols in Mobile Networks (MANETs). We evaluated the effect of speed, Packet size, TCP types, Packet rate and maximum packets in queue on throughput, packet ratio, jitter and the effect of speed on number of packet drops.

1. **Packet size**: by examining Graph 5.1 We observed that from packet size 150-750 there was good packet delivery ratio. When we compare to 1500 bytes packet size in all the protocol, (DSR, AODV and DSDV) DSR reflects better results. In graph 5.2 We noticed that the throughput increases as the packet size increases as compare to throughput in the beginning from 150 byte packet size to 1500 byte. As in Graph 5.3 as the packet size increases above 800 byte, there is an increase in the packet lost % in numbers mostly in AODV protocol but in other two protocol there is no much difference in increase of packet lost %. Although DSR shows improved performance than AODV and DSDV in the case of packet size analysis.
2. **TCP Types**: In our study we analysed four types of TCP protocols; Taheo, Reno, Newreno and Vegas. By examining Graph 5.4 we evaluate that DSR has performed better in Reno, Newreno, and Vegas whereas AODV performs better in Taheo type TCP protocol. In Graph 5.8 we observed that AODV lost minimum packets in all the four types of TCP protocol when compared to DSR and AODV. DSR has performed better than AODV except in the case of Taheo.
3. **Maximum number of packets in queue:** By analyzing we observed that in DSR there is no difference in the packet delivery ratio, throughput, packet lost and jitter during analyzing the different maximum packets in queue like 10, 20, 30, 40 and 50 whereas in the other two routing protocol (DSDV and AODV) performs better when the packet in queue increases upto 20 and after 20 we do not observe any difference in any matrices of these protocols.
4. **Packet drop:** By examining Graph 5.3 all the protocols AODV, DSDV and DSR the % of numbers of lost packets increased by increasing size of the packets in bytes from (150 bytes to 1500 bytes) the performance of DSR protocol was better than other two (AODV and DSDV) protocols. In case of AODV and DSDV there was inconsistent change in both dimensions whereas in case of DSR there was minor change (0.5 % to 1%) we can say that in this matrices DSR performs better than AODV and DSDV.

We measured the performance of DSR (Dynamic Source Routing), DSDV (Destination Sequenced Distance- Vector) belongs to Proactive family with the second type is AODV (Ad-hoc On-Demand Distance Vector) belongs to Reactive family. We used a detailed simulation model using NS2 on ubuntu 12.04 to demonstrate the performance distinctiveness of these protocols.

By simulating we recommend that when packet delivery ratio, throughput, packet lost and jitter is the main criteria than DSR should be the best choice for the case of different sizes of packets (bytes) and number of maximum packets in queue. In the same criteria AODV is the good choice if we choose TCP Taheo type protocol for Mobile Networking in all the above factors.

In spite of the fact that there are numerous different issues that should be considered in breaking down the execution of Mobile networks, we trust that our work can give instinct to future protocol choice and investigation in Mobile Networks. While concentrating just on the network throughput it is intriguing to consider different measurements like force utilization and vitality utilization, the quantity of jumps to Route the bundle, mistake resilience, minimizing the measure of control parcels and so forth. In the fates, expansive multifaceted reproductions could be done to pick up a more inside and out execution investigation of the Mobile Wireless networks and improving the execution and diminishing the vitality utilization furthermore to propose new protocols and new algorithms to explain some of versatile network routing protocol issues.

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