An Inspection of MANET'S Scenario using AODV, DSDV and DSR Routing Protocols

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***Abstract*- In this paper the Mobile Ad Hoc Network (MANET) was considered for analyzing the performance of Destination Sequenced Distance Vector (DSDV) of Proactive class and Ad Hoc On-Demand Distance Vector (AODV) and Dynamic Source Routing Protocol (DSR) of Reactive class. The protocols were simulated using the NS-2 (Network Simulator 2.35) package on Linux 12.04. The paper focuses on performance parameters e.g. Packet size, Speed, Packet rate, Transmission Control Protocol (TCP) types and Number of Packets and energy in the network. Simulation results shows that DSR gives better performance as compared to AODV and DSDV. The results were compared for inspection of packet delivery rate, % Lost packets, throughput and Jitter on varying Packet size, TCP types, and the number of packets in queue by changing packet size. The implementation study can further extend by applying artificial algorithms in MANET for enhancing the better results in presence of any type of attacks too.**

Keywords: MANETs; Mobile Ad-Hoc Network; Artificial Intelligence; Routing protocols

I. INTRODUCTION

Mobile devices are connected wirelessly in a temporary fashion for communication. With the extension of the renaming mobile phones, devices become smaller in size, less expensive, and user friendly and are much clearer. Mobile Ad Hoc Network is a collection of mobile nodes to set up a wireless network without using any infrastructure. The devices in MANET join the network freely and randomly, themselves organizes their network communication. Therefore, countless studies are focused on MANETs [1]. The variety of applications that are being used in MANET are Emergency, Disaster Management, Battlefield Mobile Services and Communications, MANET also offers many benefits to many organizations that require wireless navigation [12]. Later, there are many algorithms for routing to meet the communication needs of these networks. The analysis is also required to be done on the needs of artificial intelligence in MANET and distinctiveness of the two types classes of routing protocols proactive and Reactive, [12]. The analysis the performance of DSDV with Optimized Link State Routing i.e. OLSR and Wireless Routing Protocol i.e. WRP on the parameters of packet delivery ratio, throughput, overhead and Media Access Control i.e. MAC collision using MATLAB has done in [2]. The performance analysis shows that DSDV was better than WRP and the performance of the OLSR protocol which shows much better results as compared to other agreements. There are problems associated with MANET in design and implementation. As MANET uses a multi-hop route protocol due to restriction of network area radios and security from attacks nodes can break or disturb the communication. Protocol may prevent the selection of the appropriate and more efficient route than others. Several protocols have been suggested by researchers in the recent studies on the basis of various parameters movement limit, power consumption, bandwidth, and accuracy in MANET.

II. BACKGROUND

The Ad-hoc network is a group of wireless mobile hosting providers that install a router / temporary network without the help of any independent domain or root management.

MANETs allow faster editing as they do not depend on a modified framework. The MANET nodes play a role as a source, destination, or central router. Recreation has become an important tool in many regions where diagnostic methods are not appropriate and testing is not possible. Various Ad-hoc networks set up for themselves and set up multiple remote network networks where, the network structure changes continuously [3]. The figure 1 refers MANET of the source point and destination.

Figure 1: Example of MANET Communication

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Lots of research work have done on detailed comparisons between the DSDV of Proactive class and the AODV & DSR where DSR is considered an effective protocol on the basis of Packet size, Speed, Packet rate, TCP types and Number of Packets in line [16]. However, real-world use of mobile ad networks is necessary to analyze real-world features such as node or radio features. As well as information about topology formation plays an important role in the wireless sensor network such as parameters: power consumption, network lifetime, data delivery delays in real-life use. In the study [4] [17] the researchers compared the performance between DSR, AODV, advanced AODV [15] and DSDV routing protocol to effectively determine which routing protocol is more effective for the performance parameters of average end-to-end delay, packet delivery ratio, packet loss ratio and average throughput with respect to the variable number of nodes. In other paper [5] researcher evaluated and compared the performance of two protocols AODV and OLSR in MANET. The study included implementation of simulation to analyze the performance of the routing protocols based on the terms of the number of nodes and network size. The evaluation study shows that the AODV performs better than OLSR in most of the simulation results. The results declares that the nodes and network size has huge impact on services.

1. Distance sequenced distance vector

DSDV, which is a distance vector routing protocol and is an active route protocol that changes the standard Bellman-Ford route number. DSDV protocol the whole node maintains a route algorithm. This route data must be redesigned from time to time. With the help of route data nodes can transfer information to another hub on the network. Route table fields are as follows: location, next, metric, tracking number, installation time, static data and more. Installation process/time is used to clear incorrect entries in database. Stable data is basically an index of the table that contains details of the routes that were used and the changes done in the network [6]. In the event that the hub detects that the Route connectivity is lost, its jump to the number that is fixed to interminability and its grouping number is updated (extended) assigned to an even number, odd number corresponding to serial numbers of connected routes [13].

2. Ad-hoc On-Demand Distance Vector (AODV)

AODV is a vector type of route. It does not need nodes to maintain routes to areas that can be used effectively. In any length of time when the conclusions of the connection have a legal path to another, AODV does not take part. The protocol uses alternatives for finding and maintaining communications, Routing Responses (RREPs), Route Errors (RERRs) and Route Requests (RREQs). These types of messages are received via TCP, User Datagram Protocol (UDP), and standard Internet Protocol (IP) header configuration [7]. AODV uses the destination tracking number for each section of the route. The tracking number is made to the destination of any route data, sending to query notices. Using destination sequence numbers ensures a loop chance and allows for a few more "new" routes. When considering a selection between two routes to a destination location, the request site selects the one that has the best tracking number [8].

When the location indicates that the route to the neighboring hub is invalid it removes the incoming route and sends a RERR message to the changing and using the router neighbors, this is possible by keeping a record of the changing neighbors. This method is rewritten in the notes that receive RERR messages. The source receiving the RERR can re-run the RREQ message; AODV does not allow for the maintenance of a single connection. Further research can be done with security issues implementation with secure AODV [14].

3. Dynamic Source Routing Protocol (DSR)

DSR Protocol was primarily used in various multilevel jump mobile networks. This protocol basically contains two parameters: Route Detection and Route Care, in which the Route disclosure tool manages the basics of the routes and the Route Support network eventually corrects Route data. The DSR is an interesting route protocol, no information is sent periodically and that is why it measures the movement of the route and maintains a significant route for the package. Every route with protocol is well defined initially for the start of transferring packets and stores the details regarding route in Route Archive [9].

4. Artificial Intelligence in MANET

Many security problems arise against threats in MANET. Another way to protect and secure nodes in MANET is to create a smart network. Artificial intelligence (AI) can be a good way to turn nodes in a network into intelligent, self-learning and smart. The embedded intelligence on the nodes allows them to make an intelligent and independent human-like decision. In different scenarios the impact of routing protocols reflects different behaviour so there is need to analyze the network with artificial intelligence technique. Researchers have started working on the impact of node behaviour issue with AI technique in MANET, sensor networks together with IoT services [18] [19].

Artificial intelligence is widely used in games, thinking, natural language processing, etc. [10]. Performance intelligence is based on mathematical thinking, biological sensors, mathematical technology, language, machine learning and engineering. To upgrade to new security features, AI can also be deployed on wireless networks to enhance other features such as performance and speed. Route performance on a wireless network is enhanced through Q-learning and Ant Learning.

Artificial Intelligence can be used in MANET to enhance performance and security for the following reasons:

i. Managing large data volumes
ii. Successful disclosure of threats
iii. Increasing response time

III. METHODOLOGY AND SIMULATION SETUP

The work has started with the certain assumptions as given in Table I in MANET scenario. The dynamic nature of nodes depicts the different behaviour in the network while transferring the data from one node to other nodes in the network. Since the different types of routing protocols behave differently in every next milli /micro/nano sec. strategically the nodes were deployed in the Manet area as taken in assumption and then the various traffics were introduced in the network for checking the performance of DSDV, AODV and DSR routing protocols behaviors in terms of various parameters. This approach of implantation scenario was introduced in methodology steps and further iterations were done by varying number of nodes in the network. The tools and other required essential parameters for simulation is given in Table 1.

TABLE I. SIMULATION PARAMETERS

Parameters	Values
Channel Type	Wireless Channel
Simulator	NS 2.35
Number of Nodes	20 nodes
Interface queue type	Drop Tail/PriQueue
Dimensions X x Y	1859 x 550
Node Speed	5ms
Simulation Time	150 Sec
Transmission Range	2.0m
Routing Protocols	DSR, AODV and DSDV
Antenna Model	Omni Antenna
Traffic Model	TCP (Newreno, Reno, Vegas, Taheo)
Packet Size	150 to 1500 bytes
MAC Type	802.11
Performance Measures	Packet delivery rate, packets lost, throughput and Jitter

- *Brief of Simulation Tool NS 2.35*

The implementation phase of simulator is an important part of this work. NS2 is available under Linux, with a General Public License (GPL) license. Some common algorithms are already in use in this simulation: DSR, AODV and DSDV [11].

Process to Install - Install NS2 on Ubuntu 12.04 LTE →Untar ns-allinone-2.35 by command: tar –xvzf ns-allinone-2.35.tar.gz → Install ns2 : sudo apt-get install ns2 → Install nam : sudo apt-get install nam → Install xgraph : sudo apt-get install xgraph → Now type ns , a % sign and ns2 is installed → Exit and then check nam -> nam window.

Creating mobile node for simulation using TCL Code, Tracing the data from simulation using NAMtrace file format.

The proposed simulator NS2 is basically designed in two parts:

1. The TCL code: This is implemented in communication for the simulator, it allows to ascertain different simulation parameters. It describes the initial conditions and also in case of some activities such as when we want to accelerate or deaccelerate.

2. The C++/Java code: the main part of the project, the program of routine protocol, simulator depends on this code. C++ code provides us as result some of the output files, which consist of unique outcomes from the results of the simulation. Such as, it can be used for having a graphical representation of simulation Network Animator (NAM), every other one carries a hint of all the packets and for evaluation with different equipment to have records about the simulation.

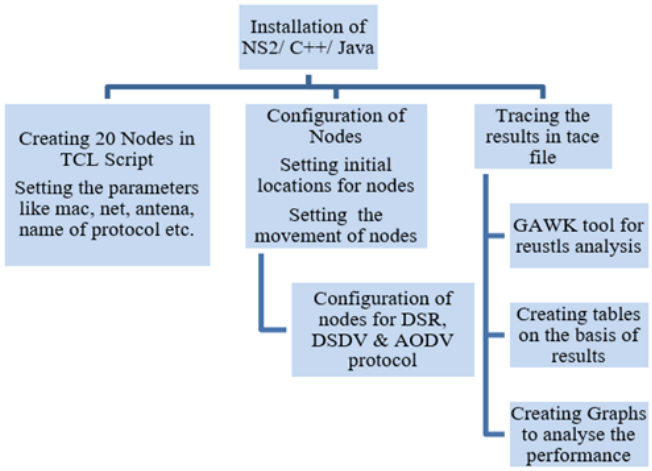

Figure 2: Stepwise Methodology implementation and Simulation process

The MANET simulation environment creation process is referred in figure 2, the NS2 simulation using the C++/ Java, the configuration of 20 nodes in different protocols, tracing the trace file and finally analyzing the results has presented.

An example of one record in the wireless trace file is listed as follows:

```
r 55.032257812 _1_ AGT --- 25 tcp 1060 [13a 1 2 800] ------ [0:0 1:0 31 1] [1 0] 2 0
r 55.056807709 _1_ AGT --- 27 tcp 1060 [13a 1 2 800] ------ [0:0 1:0 31 1] [2 0] 2 0
r 55.091395573 _1_ AGT --- 28 tcp 1060 [13a 1 2 800] ------ [0:0 1:0 31 1] [3 0] 2 0
r 55.103810505 _1_ AGT --- 30 tcp 1060 [13a 1 2 800] ------ [0:0 1:0 31 1] [4 0] 2 0
r 55.130038361 _1_ AGT --- 33 tcp 1060 [13a 1 2 800] ------ [0:0 1:0 31 1] [5 0] 2 0
r 55.164636110 _1_ AGT --- 34 tcp 1060 [13a 1 2 800] ------ [0:0 1:0 31 1] [6 0] 2 0
r 55.187018902 _1_ AGT --- 35 tcp 1060 [13a 1 2 800] ------ [0:0 1:0 31 1] [7 0] 2 0
r 55.198894818 _1_ AGT --- 37 tcp 1060 [13a 1 2 800] ------ [0:0 1:0 31 1] [8 0] 2 0
r 55.233752555 _1_ AGT --- 40 tcp 1060 [13a 1 2 800] ------ [0:0 1:0 31 1] [9 0] 2 0
```

IV. Results And Discussion

The performance of AODV, DSDV and DSR protocols in MANETs using NS tool 2.35 has done. This paper presents the outcome on the basis of Packet size, speed, Packet rate, TCP types and number of packets in line on Jitter, Packets Delivery Rate, throughput and the consequences of tempo on number of packets drops. The PDR is defined as total no. of packets received over the packets transferred in the network**.**

TABLE II. The Packet Delivery Ratio Vs Packet Sizes

Packets Delivery Ratio (%)			
Packet Size (Bytes)	AODV	DSDV	DSR
1500	96.4	97.8	98.9
1350	96.7	97.1	98.9
1200	96.8	97.8	99
1050	96.4	97	99.1
900	96.6	97.4	99.2
750	96.4	97.8	99.4
600	97.5	98.5	99.5
450	97.1	98.1	99.4
300	98.1	98.1	99.5
150	98.3	98.5	99.5
Average	97	97.8	99

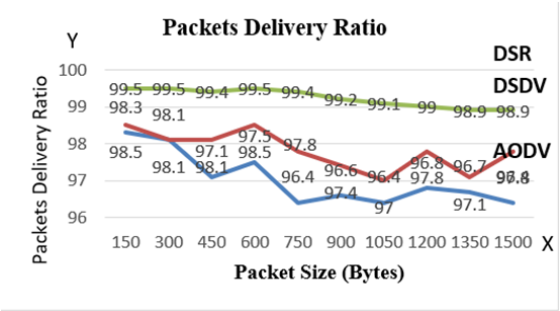

Figure 3: Packets sizes Vs Packet Delivery Rate

Size of Packets: By analyzing the Table II and figure 3, we found that in the packet size from 150 to 750 there was good packet delivery ratio by DSR, AODV and DSDV, however when inspected for the performance in the size of packet 1500 bytes the DSR gives better outcomes. The throughput is defined as Total bytes received over the time to Stop-time to Start multiplied by (8/1024) value.

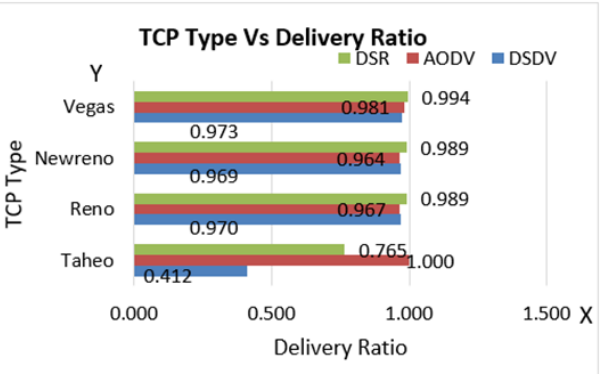

Figure 4: Packets Vs Throughput

TABLE III. Throughput Vs Packet Sizes

Throughput (bytes/sec)			
Packets Size (Bytes)	**AODV**	**DSDV**	**DSR**
1500	251.77	154.32	292.4
1350	255.41	123.52	314.03
1200	265.43	151.54	297.28
1050	256.56	97.11	289.64
900	259.25	117.43	293.34
750	218.42	100.15	277.78
600	192.51	140.71	257.74
450	187.59	89.53	229.92
300	164.63	70.82	191.69
150	116.15	55.84	132.53

In the analysis of Table III and Figure 4, it is observed that the output increases as packet size increases, compared to initially from packet size of 150 bytes to 1500 bytes in all stated protocols.

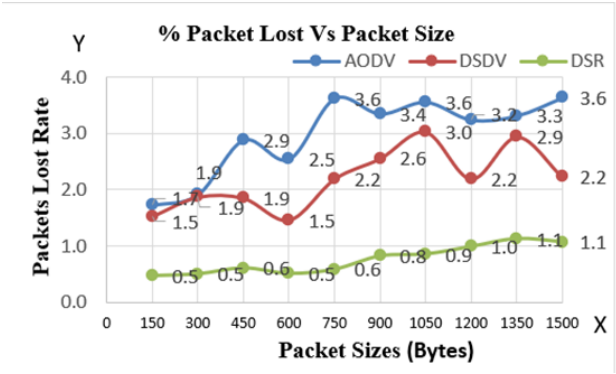

Figure 5: Packet Size Vs Packets Lost Rate

TABLE IV. Presents The Packet Lost % Vs Different Packets Sizes

Packets Lost Ratio (%)			
Packet Sizes (Bytes)	AODV	DSDV	DSR
1500	3.6	2.2	1.1
1350	3.3	2.9	1.1
1200	3.2	2.2	1.0
1050	3.6	3.0	0.9
900	3.4	2.6	0.8
750	3.6	2.2	0.6
600	2.5	1.5	0.5
450	2.9	1.9	0.6
300	1.9	1.9	0.5
150	1.7	1.5	0.5
Average	**2.2**	**3.0**	**0.8**

In the Figure 5 and table IV, the DSR shows lost minimum packet from 0.5- 1.1%, DSDV lost packets from 1.5-3.0%, however AODV lost maximum packets 1.7- 3.6% in during our simulation study. The DSR has given the best performance (0.99 average delivery ratio) on the parameter of packet size.

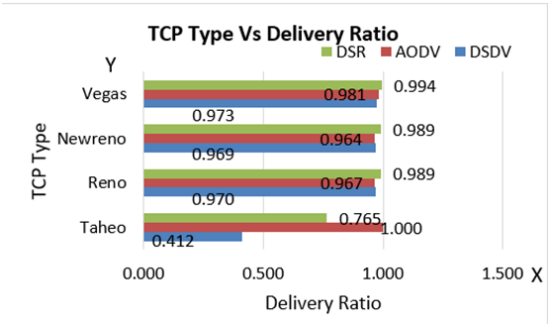

Figure 6: Packet Delivery Ratio Vs different types of TCP

The simulation deals with four types of Transmission Control Protocol (TCP); Taheo, Reno, Newreno and Vegas in DSR, DSDV and AODV protocols. Analyzing the Figure 6 and Figure 7, it has found that DSR has given the best outcome in Reno, Vegas and Newreno, whereas in Taheo TCP protocol AODV shows the satisfactory outcome. DSR's outcome is better than AODV in all TCP protocols except Taheo. However, if comparing the average of packet delivery ratio than AODV is best in inspection of behaviour of packets and routing protocols.

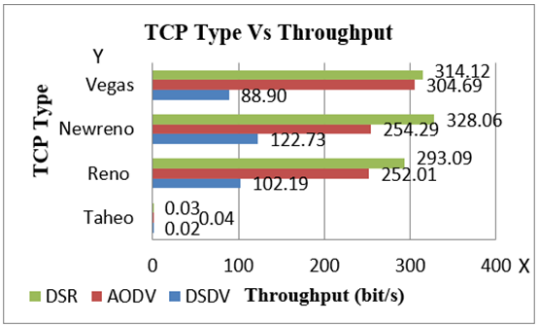

Figure 7: TCP Types Vs Throughput

TABLE V. THE PACKET DELIVERY VS MAXIMUM NUMBER OF PACKETS IN QUEUE

Packets in Queue	DSDV	AODV	DSR
10	0.97	0.95	0.99
20	0.98	0.96	0.99
30	0.98	0.96	0.99
40	0.98	0.96	0.99
50	0.98	0.96	0.99

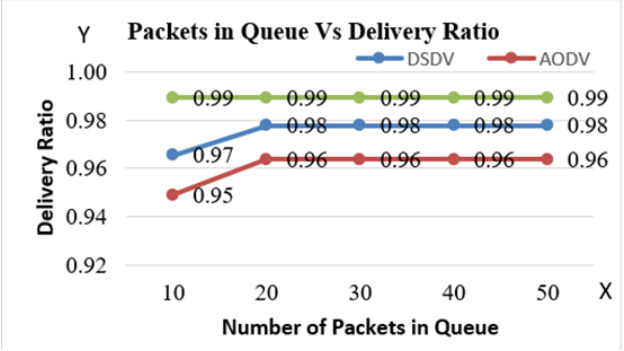

Figure 8: Packets in Queue Vs Delivery Ratio

Analyzing the Table V and figure 8, The output of DSR on the parameter of packets in queue the delivery ratio is constant, and also there is ignorable difference in the throughput, jitter and packet lost when the packets in queue were 10, 20, 30, 40 and 50, however the DSDV and AODV at 10 packets in queue the delivery ratio were less as compared to packet in queue more than 20 packets.

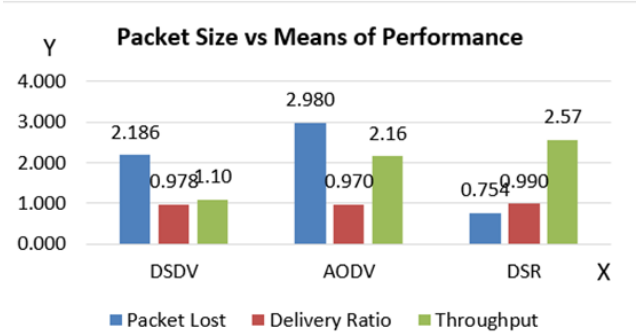

Figure 9: Packet Size vs Means of Performance for Protocols

In the analysis as per the Figure 9 and table VI, suggestion are made that on distinctiveness and outcome of Packet Lost, Jitter Rate of Packets Delivery and Throughput the DSR is the best choice in the parameters of distinct packet sizes in bytes and packets in queue in numbers. AODV is also good choice to select if the TCP protocol is selected as Taheo type protocol.

TABLE VI. PACKETS SIZES VS MEANS OF PERFORMANCES FOR DIFFERENT PROTOCOLS

Packet Size vs Means of Executions			
Performance	DSDV	AODV	DSR
Packet Lost Ratio	0.02	0.03	0.01
Delivery Ratio	0.98	0.97	0.99
Throughput(bps*100)	1.10	2.16	2.57

V. CONCLUSION AND FUTURE SCOPE

In presented work the performance of DSDV, AODV and DSR routing protocols have been presented for the different parameters in MANETS scenario. However, there are still many issues that need to be considered in differentiating the use of Mobile networks. The work provides basic research for future protocol selection in Mobile ad hoc Networks for analyzing the behaviour of routing protocols.

The further work can be focused with Artificial Intelligence for research in Mobile ad hoc networks for the metric energy consumption. The new principles and new methods can be proposed for taken scenario by having extension of assumptions. Future Research work may focus on the representation and development of a smart and intelligent framework that should be modeled using AI and Machine Learning algorithms to enhance the security and performance of MANET routing protocols.

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