Performance Evaluation of AODV, DSR and DSDV Routing Protocols in MANET Networks

Mohammed Abdullah Taha
Islamic University College, Department of Computer Techniques, Najaf, Iraq,
mhdabdtaha@yahoo.com
Aqeel Hamzah Al-fatlawi
Imam Kadhum University College, Department of computer Techniques,AL-diwanya ,
aqeelhamza88@yahoo.com.
Hussein Ali Rasool
Islamic University College,Department of Computer Techniques, Najaf, Iraq,
hussien_ie@yahoo.com

Abstract

MANET is a type of ad hoc netw rk that consists of wirel ss mobile node commun cates with each other without using a fixed infrastr cture or centr l administrat on and which establish s the route from sou ce to destin ation. In mobile ad-hoc netw ork (MANET), ea ch node can unr eservedly move in an y direction and every no de also a ct as router as it fo rward traffic for o ther nodes.Using vario us routin g protocols s uch as AODV, D SR and D SDV are desig ned for rout ing in ad h oc networks. In this paper, the execution examination is completed on Ad hoc On-request Distance Vector (AODV), Dynamic Source Routing (DSR), and Destination Sequenced Distance Vector (DSDV) conventions in view of measurements, for example, Throughput, Packet Delivery Ratio (PDR) and Average End-to-end Delay (AED) utilizing the Network Simulator (NS-2).

Keywords: – MAN ET, AO DV, DS R, DSDV.

الخلاصة

الشبكات المتنقلة المخصصة ال(MANET) هي شبكات لاسلكية متخصصة تتكون من عقد لاسلكية تتصل مع بعضها البعض لاسلكيا من دون استخدام بنية تحتية ثابتة او اي سيطرة مركزية تقوم بتحديد المسار بين العقدة المرسلة والمستلمة . في هذا النوع من الشبكات ، كل عقدة يمكن أن تتحرك دون تقييد او تحفظ في أي اتجاه وكل عقدة تعمل بمثابة الموجه لأنها تقوم بتوجيه حركة البيانات بين العقد أخرى. تم تصميم عدة انواع من بروتوكولات التوجيه مثل(AODV,DSR,DSDV) لغرض توجيه البيانات في هذا النوع من الشبكات. وفي هذه الورقة، تم تحليل الأداء للبروتوكولات التوجيه المختلفة مثل (AODV,DSR,DSDV) لغرض اختبارها وتقييمها بأستخدام مقاييس عدة مثل الإنتاجية، نسبة تسليم البيانات بين المرسل والمستلم ومتوسط التأخير في ارسال البيانات من طرف إلى طرف باستخدام محاكي الشبكة (NS-2).

1-Introduction

Ad hoc is a wireless netwrk wihout any access pont. The netwok is ad-hoc becaue it doen't rely on a pior base station, such as routers in wired networs or access ponts in wirelss networks. Ad-hoc is a decentralized wireless network. The need of specially appointed system setting up of altered access focuses and spine frame work is not generally viable. It means infrastructure may not be present in the disaster area or a war zone. "These systems presentd another specialty of system foundation and can be appropriate for a domin wher either the framework is lost or where send a base is not exceptionally financally savy. In mobile ad hoc networks, two nodes communicate directly or via a multi-jump route with the cooperation of other nodes" (YogitaKhasa, Pooja,2016). Remote systems give association adaptability between clients in various workplaces. What's more, the framework can be connected with wherever or working without the prerequisite for a wired affiliation. Remote systems are arranged into two classes; Infrastructure networks and Ad hoc organizes (Ammar Odeh, *et. al* ,2012).

A. Infrastrucure netwoks

An Access Point (AP) speaks to a central facilitator for all hubs. Any hub can join the system through AP. Likewise, AP deals with the relationship between the Basic Set Services (BSSs) so the course is prepared when it is required. Be that as it may, one downside of using a foundation organize is the expansive overhead of keeping up the directing tables. Figure 1 shows an infrastructure network.

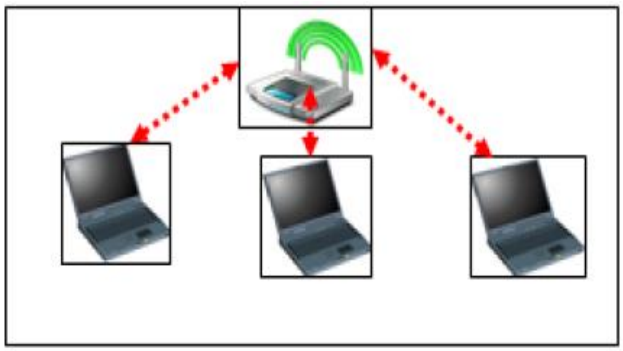
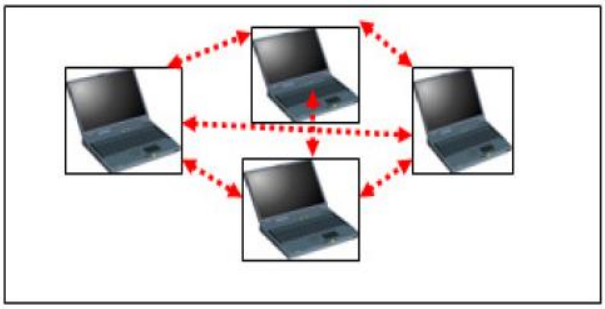


Fig (1): An Infrastructure Network

B. Ad Hoc Netwoks

Specially appointed systems don't have a "particular topology or a central coordination point. Along these lines, sending and accepting packets are more confounded than foundation systems Figure 2 illustrates an ad hoc network" (Rajesh Sharma, *et.al* ,2013).



Fig(2): An Ad Hoc Network

2-Literature Review

There have been indeed numerous attempts published in the literature that aimed to review the quantitative properties of MANET routing protocols.

In (Ahmed and Alam, 2006) "think about three directing conventions (DSR, AODV, and TORA) through reproductions led with a discrete-occasion test system (OPNET Modeller 10.5 version).Simulation comes about demonstrate that under particular re-enactment parameters TORA presents a higher execution than AODV and DSR".

In (Divecha, *et al.* 2007) "the impacts of different portability models on the execution of DSR and AODV are considered. For test purposes, four portability situations are introduced: Random Waypoint, Group Mobility, Freeway and Manhattan models. Execution correlation has additionally been directed crosswise over fluctuating hub densities and number of jumps. The exploratory outcomes

delineate that the execution of directing conventions fluctuates crosswise over various versatility models, hub densities and length of information ways".

In (Ammar Odeh, *et al,* 2 012) "the execution investigation of AODV and DSR steering convention are considered by utilizing system test system (NS-2) regarding bundles' size. The creators infer that the, DSR has indicated better execution as far as proficiency for a bundle measure under 700 bytes. Be that as it may, the two conventions have delineated practically identical outcomes for other execution measurements".

In (Yogita Khasa, *et al,* 2016) "introduces the execution of two steering conventions OLSR(Optimized link state routing protocol) and DSR(Dynamic Source Routing convention) utilizing measurements throughput, bundles conveyance proportion and End-to-end delay. The execution assessment of directing conventions is finished by utilizing two distinct traffics i.e TCP and UDP with the Simulation instrument will be NS-2".

3-Mobile Ad hoc Network Routin Protocos

One of the imperative research runs in Mobile Ad hoc Network (MANET) is the foundation and support of the ad hoc network using directing conventions. Execution of steering conventions is particular according to their working. To examine the execution of steering conventions reproduction is finished. Simulation helps in analysing the performance of routing protocols and networks befor being applied in real applications. Directing conventions experiencing various issues like portability, synchronization, limitation, long course and other while steering. Subsequently these conventions ought to be examined in points of interest, simulated in various conditions and arranged. This characterization and reenactment help in appreciation, contrasting exhibitions , help scientists with separate the qualities and characterize the proactive and responsive of directing conventions. "There are numerous approaches to arrange the MANET steering conventions upon how the conventions handle the bundle to be conveied from source to objective. Yet, steering conventions are comprehensively arranged into three sorts, for example, Proactive, Reactive and Hybrid conventions" (Patil ,2012). The hierarchy of these protocols is shown in the Figure below:

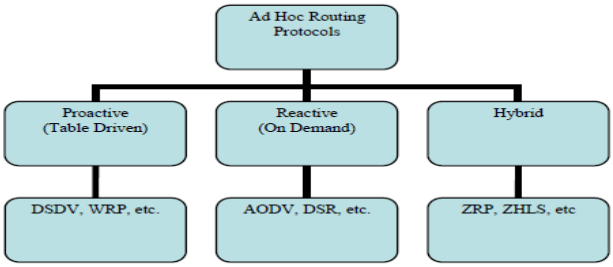


Fig (3): MANETs Routing Protocol

3-1- Proactive routing protocols

Proactive directing conventions are additionally called as a table driven steering conventions. "In this each hub keeps up a directing table which contains data about the system topology even without requiring it. The directing tables are refreshed infrequently whenever the system topology changes. Proactive conventions are not sensible for substantial systems as they need to keep up nod sections for every single node in the directing table of each node" (Dhenakaran, *et. al, 2013*). "In this class, every node in the network has one or more paths to any possible destination in its

routing table at any given time" (Patil, 2012) . These protocols maintain different number of routing tables varying from protocol to protocol. Proactive protocols exhibit low latency, yet medium to high directing overhead. This is because of the nodes intermittently trade control messages and directing table data with a specific end goal to keep refresh courses to any dynamic node in the system. Nonetheless, a node, squandering process assets and transmission capacity, may never utilize any of these courses. Proactive traditions can better address security vulnerabilities, because of the intermittent exchange of control messages and directing table information. Thus a misfortune or change of any course refresh can be overcomes by the following booked refresh. There are different understood proactive directing conventions. Example: DSDV, OLSR, WRP etc.

3-1-1- Destination Sequenced Distance-Vector Routing

DSDV is a proactve, "separation vector convention, which utilizes the Bellman-Ford calculation" (Guoyou, 2004) . DSDV is a bounce by-jump remove vector directing convention, where in every node keeps up a guiding table posting the accompanying bob and number of hops for each reachable objective. This tradition requires each flexible station to advance, to each of its, present neighbors, its own particular coordinating table for event, by conveying its passages. The sections in this rundown may change sensibly dynamically after some time, so the advertisements ought to be made frequently enough to ensure that each nodes can quite often find each different nodes of the accumulation. Likewise, every nodes consents to hand-off information parcels to different nodes upon ask. "This understanding detects a premium on the ability to choose the most brief number of bounces for a course to a goal we might want to stay away from superfluous exasperating versatile hosts in the event that they are in rest mode. Along these lines a node may trade information with whatever other nodes in the gathering regardless of the possibility that the objective of the information is not inside the scope of direct correspondence" (Ajay Kuma, *et.al,* 2011, Krunal , *et.al,* 2016) .

3-2- Reactie Protocol

These types of protocls are likewise called as On Demand Routing Protocols where the routes are not predefined for routing. "A source node requires for the route discovery phase to decide a new route at what ever point a transmission is required. This route discovery mechanism depends on a flooding calculation which utilizes the packet on the system that a node just sends to all of its neighbours and intermediate nodes just forward that packet to their neighbours. This is a redundant strategy until it achieves the goal. Reactive techniques have smaller routing overheads but higher latency" (Patil,2012; Dhenakaran ,2013) .Example Protocols: DSR, AODV.

3-2-1- Ad-Hoc on Demand Distance Vector (AODV)

The specially appointed On-interest Distance Vector steering convention enables multi-jump routing between the participating mobile nodes wishing to set up and keep up an ad-hoc network. "AODV is a reactive protocol based upon the distance vector algorithm. The algorithm uses different kinds of messages to discover and maintain links. At whatever point a node needs to endeavor and find a course to another node, it communicates a Route Request (RREQ) to every one of its neighbors. The RREQ parcel spread through the system until the point that it achieves the goal or the node with a sufficiently new course to the objective. At that point the course is

made accessible by unicasting a RREP parcel back to the source. The calculation utilizes Hello bundle that is communicated intermittently to the quick neighbors. "These Hello bundles are close-by promotions for the continued with closest of the nodes, and neighbors utilizing courses through the telecom node keeps on denoting the courses as substantial. In case Hello parcel quit starting from a particular node, the neighbor can acknowledge that the nodes has moved away and engraving that association with the node as broken and tell the affected arrangement of nodes by sending a Route Error Message (RERR) to other node so as to advise different nodes that the connection is down" (Perkin, 2003; Patil ,2012).

3-2-2- Dynamic Source Routing (DSR)

DSR is also an on-demand routing protocol. The DSR convention comprises of two systems that cooperate to allow the disclosure and continuation of source courses in specially appointed system. Course Discovery is the method by which a source node goals to forward a bundle to a goal node and discover an asset course from source node to goal node utilizing RREQ and RREP messages. "Route Continuance is the technique by which a source node is capable to discover while using resource routes to the destination node if the network topology has altered because a linkage alongside the route no longer works. When route continuance specifies a source route is destroyed, DSR forwards the RERR message to the source node for obtaining a new route" (Dhenakaran, *et. al* , 2013; Johnson, *et.al* , 2007; Rakesh Poonia,2011) .

3-3- Hybrid Protocols

"Hybrid protocols are the mixes of reactive and proactive protocols and takes advantages of these two protocols and therefore, routes are found rapidly in the routing zone" (Das, 2011). Example Protocol: ZRP (Zone Routing Protocol), GPSR (Greedy perimeter stateless routing).

4- Performance metrics

There are various performance metrics. Packet delivery ratio (PDR), average end to end delay (AED) and throughput is considered as three basic performance metrics.

4-1- Packet delivery Ratio (PDR)

The packet delivery ratio is characterized as the proportion of information bundles got by the goals to those created from the sources. It is figured by apportioning the quantity of bundles got by the goal through the quantity of packet made by the application layer of the source. It portrays both the accuracy and proficiency of impromptu directng conventions. A high packet delivery ratiois wanted in any system..

4-2- Average End-to-End Delay (AED)

AED is the average time of data packet to be effectively transmitted over a MANET from source to destination. It is the time taken for a whole message to totally arrive at the goal from the source. Evaluation of end-to-end delay for the most part relies on transmission time, queuing time and processing delay. For each received packet, the average of end-to-end delay is the time difference between every packet sent and received divided by the total number of received packets. The lower the average end-to-end delay is the better application execution.

4-3-Throughput

Throughput of the conventions, alludes to how much information can be exchanged starting with one area then onto the next in a given measure of time. It is the measure of information per time unit that is conveyed starting with one node then onto the next through a correspondence interface. The throughput is measured in bits every second. A Throughput with a higher esteem is all the more frequently a flat out decision in each system since it decides the capacity of nodes to convey the bundles from source to its proposed goal.

5- Simulation Scenarios and Performance Comparisons

System Simulator (Version 2.35), for the most part known as NS2, is basically an occasion driven reproduction device that has exhibited accommodating in concentrating the dynamic idea of correspondence systems. Re-enactment of wired and also remote system capacities and conventions should be possible utilizing NS2. A re-enactment contemplate was done to assess the execution of MANET steering conventions, for example, AODV, DSDV, and DSR in light of the measurements throughput, packet delivery ratio and normal end-to-end delay.

Next table summarizes the simulated network that are a topology, mobility parameters, and the data traffic scenario used in the simulation.

Table (1) Simulation Values

Parameters	Value
Radio model	Two Ray Ground
Protocols	DSDV, AODV, DSR
Traffic Source	Constant Bit Rate (CBR)
Packet size	512 bytes
Transmission range	250
Area	1500*1500 m
Number of nodes	10,20,30,40,50,60,70,80,90,100
Network Protocol	IP
Duration	200 seconds
Max speed	5 m/s
Pause Time	3 s

The reproduction is directed in various situations. In the main situation, the examination of the three directing conventions is contrasted and different quantities of nodes. The number of nodes is set to 10, 20, 30,… to 100 and the number of connections between nodes is fixed to 6 connections, while the simulation time and the area is fixed. In the second scenario, the comparison of three routing protocols is compared with various numbers of connection and the number of nodes is fixed to 60 nodes while the simulation time and the area is fixed. Random waypoint mobility

model in common to the scenarios considered below. In each of the scenarios, unless otherwise specified, simulation settings are same as shown in table (1).

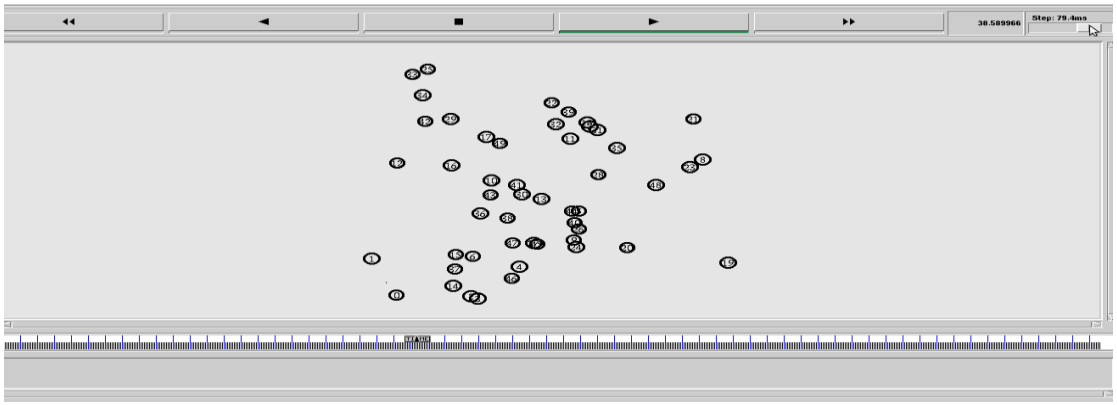
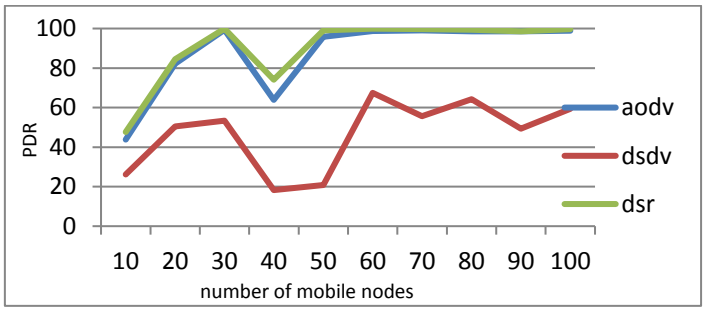


Fig (4) sample of simulation scenarios

5-1 Varying Number of Nodes

In this scenario, number mobile nodes have changed from 10 to 100, while the number of connections between nodes is fixed to 6 and simulation area and nodes speed and other parameter are fitted according to the table (1). In this situation, all the three directing convention is assessed in view of the three execution measurements which are packet delivery ratio, the average end-to-end delay and throughput.

5-1- 1 Packet Delivery Ratio (PDR):



Fig(5): Impact of mobile nodes on packet delivery ratio

Fig (5) shows the packet delivery ratio of the AODV, DSDV and DSR routing protocols. In this set of the simulation, the number of nodes is varied in the network. The objective of this is to investigate the impact of node density on the protocol performance. The same simulation setup is used as described in the Table 1.

5-1-2 Average End-to-End Delay (AED):

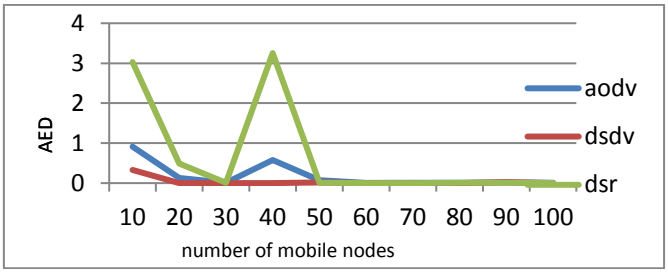
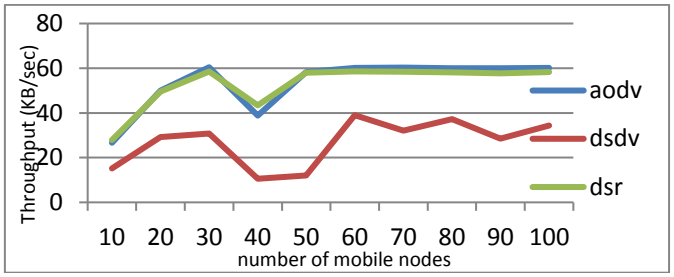


Fig (6) Impact of mobile nodes on Average end to end Delay (AED)

Fig (6) demonstrates the effect of changing number of portable nodes on the normal end-to-end delay (AED) of the AODV, DSDV and DSR steering conventions. In this arrangement of reenactment, DSR directing convention has a high normal end-to-end delay (AED) as contrasted and AODV and DSR steering conventions.

5-1-3Throughput



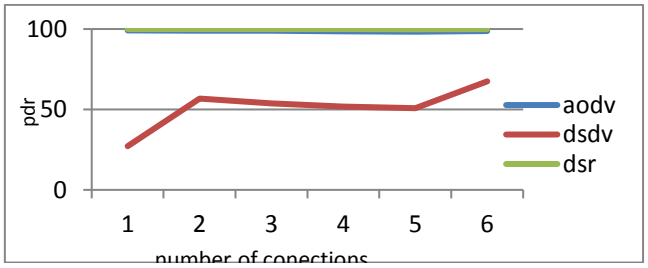
Fig(7) Impact of mobile nodes on Throughput

Fig (7) shows the impact of varying number of mobile nodes on the throughput of the AODV, DSDV and DSR routing protocols. From Fig(7), it is observed that DSDV routing protocol produces less throughputs when it's compared with AODV and DSR routing protocols when we change the number of mobile nodes. AODV and DSDV routing protocols show the similar performance in the same simulation scenario.

5-2 Varying number connections between Nodes

In this scenario, we change the number of connections between nodes from 1 to 6 while the number of mobile nodes is fixed to 60 nodes and simulation area and nodes speed and other parameter are fitted according to the table (1). All the three routing protocol is evaluated based on the three performance metrics which are Packet Delivery Ratio, End-to-End Delay and Throughput.

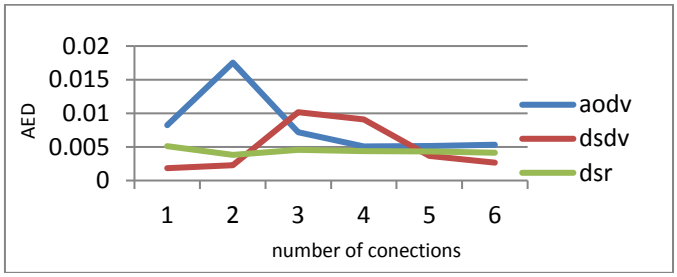
5-2-1-Packet Delivery Ratio (PDR):



Fig(8) Impact of number of connections on Packet Delivery Ratio

Fig(8) shows the impact of varying number of connections on PDR of the AODV, DSDV and DSR routing protocols. From Fig(8), it is clear that AODV and DSR routing protocol produces high PDR when it's compared with DSDV routing protocols when we change the number of connections.

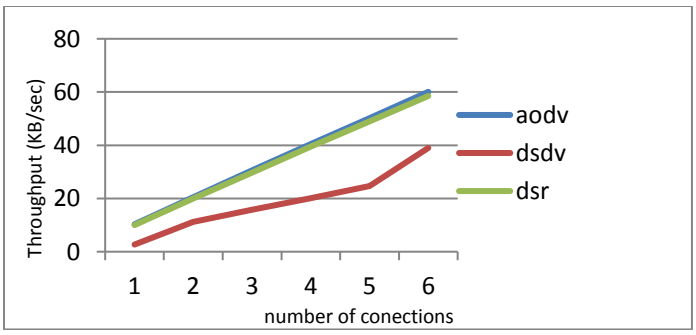
5-2-2- Average End-to-End Delay (AED):



Fig(9) Impact of number of connections on Average End-to-End Delay (AED)

Fig(8) shows the impact of varying number of connections on the average end-to-end delay (AED) of the AODV, DSDV and DSR routing protocols. In this set of the simulation, AODV routing protocol has a high average end-to-end delay (AED) as compared with DSR and DSDV routing protocols.

5-1-3-Throughput



Fig(10) Impact of number of connections on Throughput

Fig(10) shows the impact of number of connections on Throughput of the AODV, DSDV and DSR routing protocols. From Fig(10), it is observed that AODV

and DSDV routing protocol produces high throughputs when it's compared with DSR routing protocols when we change the number of connections.

6- Conclusion

In this paper, simlation of the AODV, DSR and DSDV directing conventions have done and assessed the execution under UDP and CBR traffics. Exhaustive reenactment consequences have done of the packet delivery ratio (PDR), Average End-to- Delay and throughput and over the routing protocols DSDV, DSR and AODV by varying the number of mobile nodes and number of connections between nodes. Performance analysis shows in the first scenario, when have changed the number of mobile nodes, that DSR and AODV perform better than DSDV in terms of packet delivery ratio and throughput while DSDV show the best execution in terms of average end-to-end delay becau˛se it's a proactive routing protocol, keeps up directing data about the system topology even without requiring it that prompt discover the way from source to destination faster than DSR and AODV routing protocols. When the number of mobile nodes is 40 packet delivery ratio (PDF) and throughput are decreased while the average end to end delay is increased that's done because of the source nodes and destination nodes are moved away out of the transmission range. While in˛ the second scenario when we changed the number of connections, performance analysis shows that DSR and AODV perform better than DSDV in terms of packet delivery ratio and throughput. AODV shows worst performance in terms of average end-to-end delay.

References

Ahmed S, Alam MS. "Performance evaluation of important ad hoc network protocols." EURASIP Journal on Wireless Communications and Networking; (2): 42–42, 2006.

Ajay Kumar, Ashwani Kumar Singla," PERFORMANCE EVALUATION OF MANET ROUTING PROTOCOLS ON THE BASIS OF TCP TRAFFIC PATTERN", International Journal of Information Technology Convergence and Services (IJITCS) Vol.1, No.5, October 2011.

Amit Kumar Chaturvedi, Jitendra Kumar Khemani," Analysis of Mobility Models in Mobile Ad-hoc Networks " International Journal of Computer Applications (0975 – 8887), National Seminar on Recent Advances in Wireless Networks and Communications (NWNC-2014).

AmmarOdeh, EmanAbdelFattah and MuneerAlshowkan, "PERFORMANCE EVALUATION OF AODV AND DSR ROUTING PROTOCOLS IN MANET NETWORKS" , International Journal of Distributed and Parallel Systems (IJDPS) Vol.3, No.4, July 2012.

Das, R. and others, " Security Measures for Black Hole Attack in MANET: An Approach ", International Journal of Engineering Science and Technology (IJEST), 2011.

Divecha A, Grosan AC, Sanya S." Impact of node mobility on MANET routing protocols models", Journal of Digital Information Management; ; 5: 19–23, 2007 .

Dr. S. Dhenakaran and A.Parvathavarthini ," An Overview of Routing Protocols in Mobile Ad-Hoc Network ",International Journal of Advanced Research in Computer Science and Software Engineering Volume 3, Issue 2, ISSN: 2277 128X,February 2013 .

Guoyou He, "Destination-Sequenced Distance Vector (DSDV) Protocol", Helsinki University of Technology, 2004.

Johnson, D. ; D. Maltz," The Dynamic Source Routing Protocol (DSR) for Mobile Ad Hoc Networks for IPv4", Network Working Group Request for Comments: 4728, Microsoft Research, February 2007.

Krunal S Bhavsar, Dr. Kamaljit I Lakhtaria," Comparison of DSDV and AODV Routing Protocol in Mobile Adhoc Network ", International Journal of Advanced Research in Computer Science and Software Engineering, ISSN: 2277 128X, Volume 6, Issue 3, March 2016.

Mihail L. Society Dept. of Electrical and Computer Eng., Campus Box 7911,"Mobility Models for Ad Hoc Networks", NC State University, Raleigh, NC, 27695,2012.

Patil V.P," Reactive and Proactive Routing Protocol Performance Evaluation for Qualitative and Quantitative Analysis in Mobile Ad Hoc Network", International Journal of Scientific and Research Publications, Volume 2, Issue 9, 1 ISSN 2250-3153, September 2012.

Perkins, C. and others,"Ad hoc On-Demand Distance Vector (AODV) Routing protocol " , http://www.faqs.org/rfcs/rfc3561.html, Copyright (C) The Internet Society (2003).

Rajesh Sharma, SeemaSabharwal," Dynamic Source Routing Protocol (DSR) ", International Journal of Advanced Research in Computer Science and Software Engineering, ISSN: 2277 128X, Volume 3, Issue 7, July 2013.

RakeshPoonia, Amit Kumar Sanghi, Dr. Dharm Singh,"DSR Routing Protocol in Wireless Ad-hoc Networks: Drop Analysis ", International Journal of Computer Applications (0975 – 8887) Volume 14– No.7, February 2011.

Upneet Singh, Mohinder Singh and ShanuMalhotra, "Performance evaluation of routing protocols under different mobility models over MANETs ",International Journal of Application or Innovation in Engineering & Management (IJAIEM),Volume 3, Issue 5, ISSN 2319 – 4847, May 2014.

YogitaKhasa, Pooja, "Performance Evaluation of Routing Protocols in MANET", IJCSET(www.ijcset.net) | Vol 6, Issue 3,109-112 l ISSN: 2231-0711, March 2016.