SOCIETY FOR SCIENCE AND EDUCATION
UNITED KINGDOM

TNC TRANSACTIONS ON
NETWORKS AND COMMUNICATIONS

VOLUME 4, ISSUE 6
ISSN: 2054 -7420

Estimating an Efficient Routing in MANET for UDP and TCP Traffic

[1]Md. Repon Hossen, [2]Khandaker Takdir Ahmed, [3]Sonali Saha and [4]Zakir Hossain
[1,2]Department of Computer Science and Engineering, First Capital University of Bangladesh, Chuadanga-Bangladesh;
[3]Instructor (Computer Technology) Magura Polytechnic Institute Magura-7610, Bangladesh;
[4]Instructor (Computer Technology)Gopalganj Polytechnic Institute,Goplaganj-8103,Bangladesh
reponice08@gmail.com; takdir.iu0607@gmail.com; sonalius1@gmail.com;zakir.ict.iu@gmail.com

ABSTRACT

Mobile computing applications have enjoyed a tremendous improvement and enhancement due to recent technological advances in computers and wireless communication devices. The enormous use of information technology and the demand for mobile communication ‘anywhere, anytime' has fueled the need for dynamically reconfigurable networks. Mobile ad hoc networks (MANETs) provide continuous network connectivity to mobile computing devices. Performance analysis of routing protocols used for MANETs under varying conditions and constraints is a full of zipping area of research at present. In this paper, we compare UDP and TCP traffic in respect to three MANETs protocols namely AODV, DSR and DSDV. Here we consider a network scenario of fixed nodes and fixed pause time, these nodes are varying with respect to different mobility speed to check the difference between UDP and TCP traffic.

Keywords: MANET, UDP, TCP, AODV, DSR, DSDV, PDF and E2E Delay.

1 Introduction

Mobile ad- hoc networking (MANET) is a telecommunication technology that uses radio wave to make the dedicated connection between two or more wireless devices. MANET provides traffic is 27 MHz and 400-500 MHz area of the UHF spectrum and covers an omnidirectional area of about 1km -2km [1].

MANET is now becoming an emerging technology that provides us an on-demand service through a finger click .It is now used in handled computer, PDAs and cell phones surfing the internet from the railway station, airport, cafes, public locations anytime we need. We use MANET in a war zone because MANET devices run limited power source without interruption [2][3][4].

The installation and architecture of Mobile Ad hoc Networks (MANETs) make them highly usable for recent data and multimedia communications [5]. Different types of network are necessary to transmit and exchange multimedia information across a network [6]. Performance and limitations are concerned while making ad-hoc network that the physical layer of OSI model imposes on the network performance. The communication media in the wireless network is unreliable because it is expected to come up with an integrated design of physical layer, MAC layer and network layer [7]. Dynamic and reliable protocols

DOI: 10.14738/tnc.46.2443
Publication Date: 25th December 2016
URL: http://dx.doi.org/10.14738/tnc.46.2443

are usually necessary for MANETs, when they make no infrastructure and their own network topology changes usually [8].

The transport layer of OSI model, which is responsible for end-to-end communication and flow control functionalities. The TCP/IP protocol suite consists of TCP and UDP as the transport protocols. UDP is a difficulties transport layer protocol solution that provides the functionalities for applications. The functionalities such as reliability, flow control etc is pushed up into the applications. On the other hand, TCP provides applications with reliable, end-to-end, connection-oriented services. It also performs both flow control and congestion control, recovers from packet losses in the network [9].

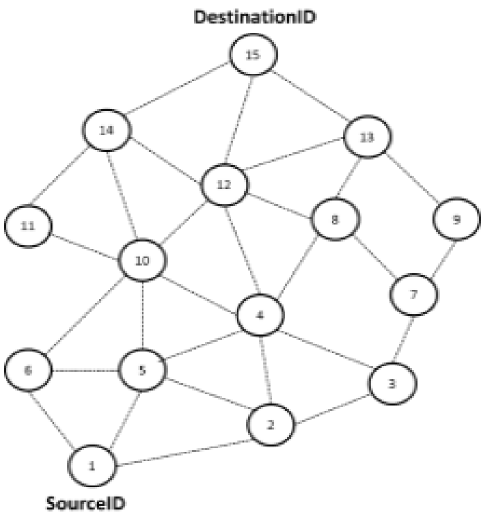
The rest of this paper is organized as follows. Protocols under consideration assumed in this paper are described in Section 2. The simulation and performance Evaluation technique is described in Section 3. Finally, conclusions are given in Section 4.

2 Protocols under Consideration

In this paper, we observed the performance of UDP and TCP over the routing protocols such as DSDV, AODV, and DSR. This section describes the protocols shortly.

2.1 Destination-Sequenced Distance-Vector Routing Protocol (DSDV)

The DSDV [10] is one of the important protocols used for MANET. It is an advanced form of Bellman-Ford algorithm that each node contains a predefined route that provides the shortest way to reach the destination node in the network. DSDV updates its routing table that prevents increasing sequence number, count-to-infinity problem and for faster convergence.



(a): Topology graph of the network

Dest	NextNode	Dist	SeqNo
2	2	1	22
3	2	2	26
4	5	2	32
5	5	1	134
6	6	1	144
7	2	3	162
8	5	3	170
9	2	4	186
10	6	2	142
11	6	3	176
12	5	3	190
13	5	4	198
14	6	3	214
15	5	4	256

(b): Routing Table of Node 1

Figure 1: Route establishment in DSDV

In Figure 1 (a) we describe the route calculating process of DSDV protocol, where node 1 is the starting node and node 15 is the ending node. As we know from Bellman-Ford algorithm nodes maintain global topology information for finding routes , the route is available as shown in figure 1 (b).The source node 1 reach the destination node 15 through its nearest node 5 and distance of 4 hops as shown in figure 1(a).

2.2 Dynamic Source Routing (DSR)

DSR is an on-demand protocol designed to restrict the bandwidth consumed by control packet transfer rate in ad hoc wireless networks by removing table update messages required in static approach [11]. The major advantage of using DSR or on-demand routing protocols, that does not require sending any hello packet transmissions to inform its neighbor's nodes that are live.

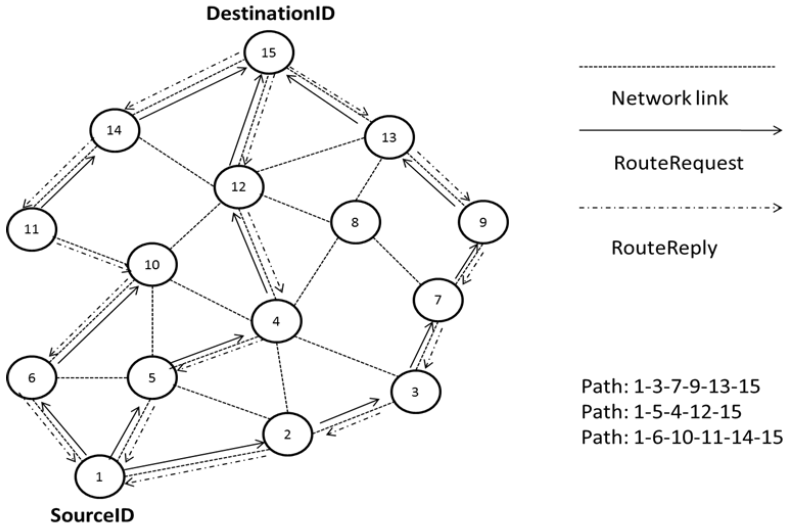


Figure 2: Route maintenance in DSR

In Figure 2. Starting node 1 send a route request packet to the ending node 15 to find a path. This protocol uses a route cache that stores all potential data extracted from the supply route contained in an exceeding knowledge packet. Nodes also can study the neighboring routes traversed by knowledge packets if operated within the promiscuous mode (the mode of operation during which a node can receive the packets that are neither broadcast nor addressed to itself). This route cache is additionally used throughout the route construction part. If AN intermediate node receiving a Route Request incorporates a route to the destination node on its route cache, then it replies to the supply node by causing a Route Reply with the complete route info from the supply node to the destination node.

2.3 Ad-Hoc ON-Demand Distance Vector (AODV)

Ad-hoc on-demand distance vector (AODV) [12] routing protocol uses associate on-demand approach for locating routes, that is, a route is established only if it's needed by a supply node for transmission information packets. It employs destination sequence numbers to spot the foremost recent path. The major distinction between AODV And alternative on-demand routing protocols is that it uses a destination sequence range (DestSeqNum) to work out an up-to-date path to the destination.

Consider the instance delineated in Figure 3. During this figure, supply node 1 indicates a path-finding method by originating a Route Request to be flooded within the network for destination node 15, assumptive that the Route Request contains the destination sequence variety as 3 and also the supply sequence variety as 1. When nodes 5 and 6 receive the Route Request packet, they check their routes to the destination. Just in case a route to the destination isn't found, they additional forward it to their neighbors. Here nodes 3, 4, and 10 are the neighbors of nodes 5, and 6. This can be with the idea that intermediate nodes 3 and 10 have already got routes to the destination node, that is, node 15 through methods 10-14-15 and 3-7-9-13-15, severally.

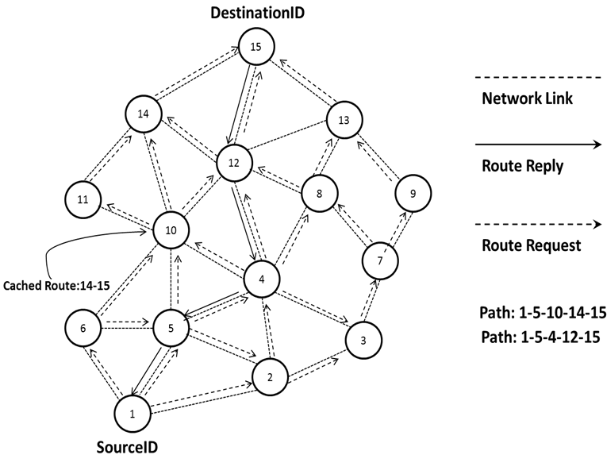


Figure 3: Route establishment in AODV

If the destination sequence range at intermediate node 10 is 4 and is 1 at intermediate node 3, then solely node 10 is allowed to reply on the cached route to the supply. This is as a result of node 3 has route to node 15 compared to the route obtainable at the supply node (the destination sequence range at node 3 is 1, however, the destination sequence range is 3 at the supply node), whereas node 10 includes a more modern route (the destination sequence range is 4) to the destination. If the Route Request reaches the destination (node 15) through path 4-12-15 or the other various routes, the destination conjointly sends a Route Reply to the supply.

3 Simulation and Performance Evaluation

3.1 Simulation Parameters

We have considered three routing protocols for our simulations which are DSDV, AODV, and DSR as explained in chapter four. For analyzing the performance of TCP and UDP traffic over considered protocols we used NS-2(Network Simulator2) with CMU wireless extension. The MAC protocol and Physical layer radio type used are respectively IEEE802.11 and IEEE802.11b. The network simulations carried out for the study are based on 1000 x 1000 meter flat grid topography. The square topography seemed to a right choice for simulations which provides a more rigorous environment for performance comparison.

Table 1: Simulation parameters

Routing Protocols	AODV,DSR, and DSDV
Network Simulator	NS2
Trace File Analyzer	AWAK Script
Area	1000*1000 Square meters
Number of Node	30
Mobility Speed	5,10,15,20,25 and 30 meters per second
Simulation Time	200s
Pause Time	50s
Data Packet Size	512 Bytes
Packet Transmission Rate	4 packets per second
Traffic Source	Constant Bit Rate(CBR) File Transfer Protocol(FTP)

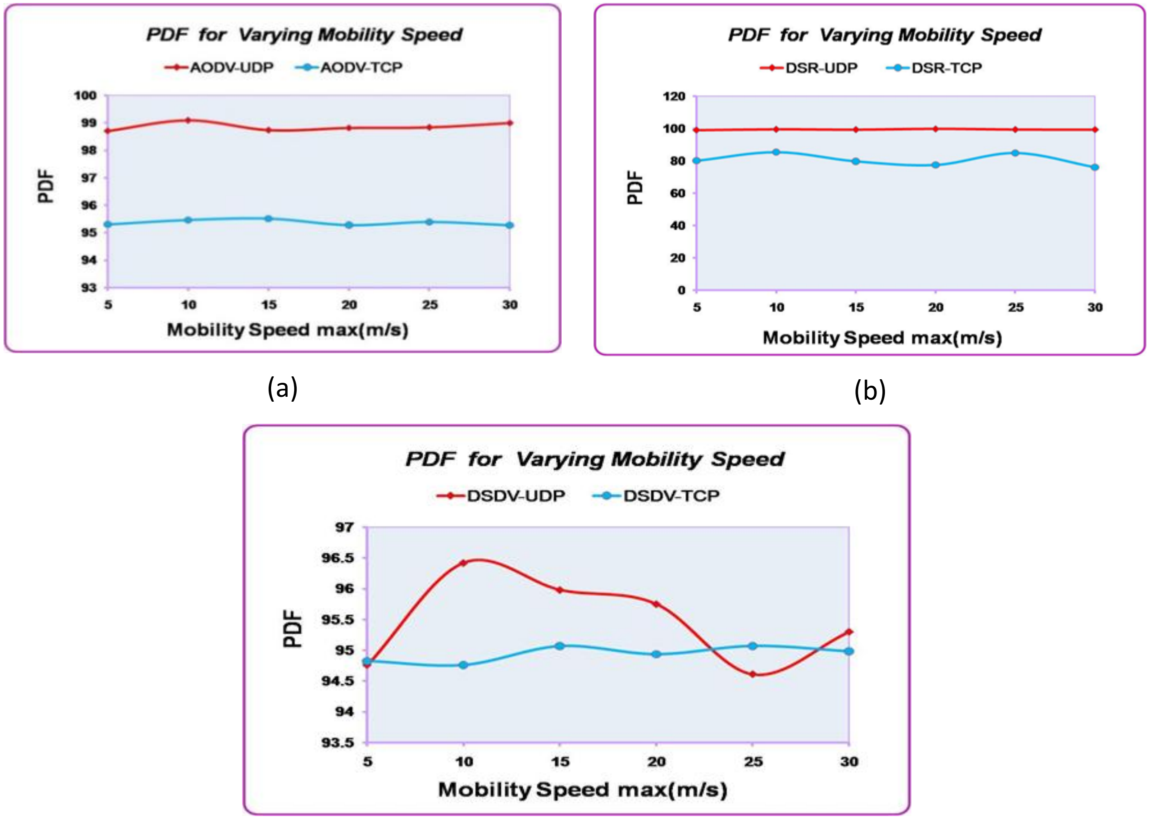
3.2 Performance Evaluation

In this section, simulation results are presented for the performance comparison between AODV, DSDV and DSR using the transport layer protocols TCP and UDP. As described earlier, for all the simulations the traffic pattern, the number of mobile nodes, the duration of simulation, the data packet size, the transmission range of the nodes and the link capacity are kept uniform. The variable parameters for every simulation are node speed for varying mobility speed.

3.2.1 PDF Performance for Varying Mobility Speed

While defining the simulation metrics, packet delivery fraction is calculated by dividing the total number of data packets delivered to all the nodes, by the total number of data packets generated by the sources getting a result by percentage. The number of data packets successfully delivered at the destination depends mainly on path availability, which in turn depends on how effective the underlying routing algorithm is in a mobile scenario. In figure 5.6, the packet delivery fractions are plotted at different speeds to see how the throughput varies for different network scenarios as shown figure 4.

Figure 4(a) shows that AODV offers more PDF when UDP traffic is transmitted. This is because no flow control is used in UDP and no need to wait for an acknowledgement. The increase in mobility speed does not affect the packet delivery fraction of UDP traffic that much because of its unidirectional feature. But TCP traffic experiences rise and fall over AODV protocol. The congestion control mechanism might be the cause for this because at a certain time several nodes gather at a certain area. PDF of UDP is almost about 98.5% for AODV and PDF of TCP is about 95.5% for AODV



(a) (b)

(c)

Figure 4: PDF comparison for variable speed

Figure 4(b) shows that DSR offers higher PDF when UDP traffic is transmitted. PDF of TCP traffic is much less over DSR. This is due to the flow control and congestion control mechanism of TCP. The increment in node mobility speed does not affect the UDP traffic over DSR. This is because DSR include the feature of route caching which saves packet dropping at the time of route discovery. But when mobility speed increases, PDF of TCP traffic fluctuates a little over DSR again suffering from congestion control mechanism.PDF of UDP is almost about 100% for DSR and PDF of TCP is about 80% for DSR.

Figure 4(c) shows that DSDV offers more PDF when UDP traffic is transmitted. This may be because, in proactive protocols, routes are available at the moment they are needed. The increase in mobility speed does not reduce the packet delivery fraction over DSDV. Because of being proactive protocol, DSDV does not drop packets during the route discovery. PDF of UDP is almost about 96% for DSDV and PDF of TCP is about 94.5% for AODV.

It can be concluded for TCP traffic that, AODV has the higher PDF over DSDV and DSR. When mobility increases AODV offers almost constant and best PDF for TCP traffic. This is because AODV puts reduced overhead on the network keeping the network free for data packets. Although few data packets are dropped over AODV while route discovery phase. Over DSDV, a slightly reduced but constant PDF for TCP is observed. The PDF for TCP traffic is the least and suffers a nonlinear variation over DSR. This is because DSR drops a few data packets while route discovery.

We can also conclude for UDP traffic that, DSR has the highest PDF over AODV and DSDV. This is because AODV uses route expiry, dropping some packets when a route expires and in proactive routing protocol like DSDV, stale routing table entry directed the packets to be forwarded over broken links dropping many packets. The simulated results of different scenarios for PDF are summarized in the table below.

Table 2: Simulated Result for PDF for variable speed

Node	Speed	AODV		DSR		DSDV	
		TCP	UDP	TCP	UDP	TCP	UDP
30	5	95.3017	98.70	80.0971	99.05	94.8248	94.76
	10	95.4621	99.09	85.3928	99.48	94.7581	96.42
	15	95.5108	98.73	79.7269	99.31	95.0695	95.98
	20	95.2779	98.81	77.5054	99.71	94.9348	95.75
	25	95.3907	98.83	84.8966	99.36	95.0723	94.61
	30	95.2739	98.99	76.057	99.32	94.9831	95.30

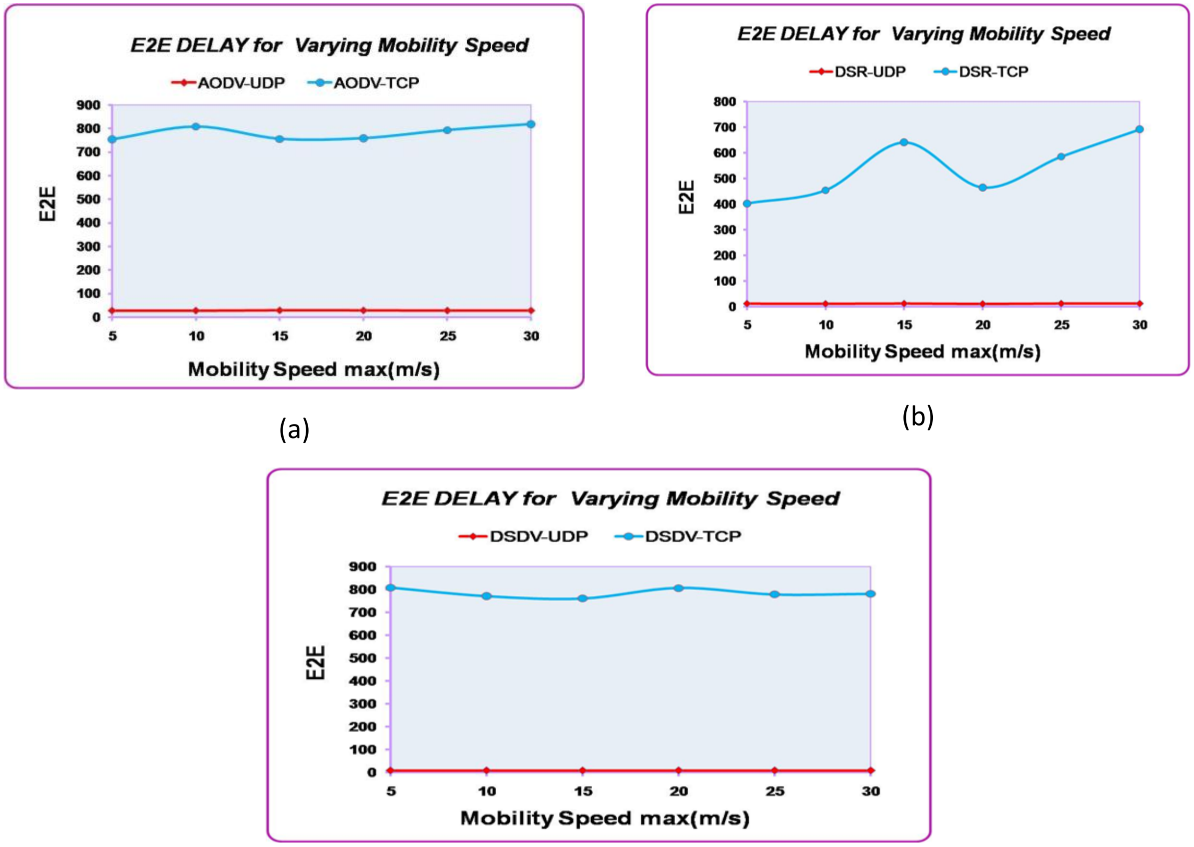
3.2.2 End-to-End Delay Performance for Varying Mobility Speed

End-to-end delay performance is a measure of how efficient following routing algorithm is because primarily the delay depends on upon a maximum of the path chosen, the delay experienced at the interface queues and delay caused by the retransmission at the physical layer due to collisions. The following figures show that the End-to-End delay measured in second for transferring TCP packets from source to destination over three routing protocols.

Figure 1.5(a) shows that in the case of AODV protocol, end-to-delay for UDP packets suffers much less than TCP packets. This is because UDP packets do not need to wait for acknowledgment but for TCP traffic; delay suffers more rise and fall with increasing mobility speed because when the nodes move speedily the routes between the source and destinations become shorter and longer more frequently.

It can be observed from figure 1.5(b) that, end-to-end delay of UDP packets is much lesser than TCP over DSR protocol. This is because of the same reason stated before. End-to-End delay of UDP traffic over DSR does not suffer much as the node mobility is increased. But for TCP traffic; delay suffers more rise and fall with increasing velocity.

It can be observed from figure 1.5(c) that, UDP packets experiences better and constant end-to-end delay performance than TCP over DSDV protocol. With the increase in mobility the delay experiences non-linear variation for TCP traffic. This is because when the nodes move speedily the routes between the source and destinations become shorter and longer more frequently.



(a)

(b)

(c)

Figure 5: End-to-End Delay comparison for variable speed

In all the cases TCP traffic experiences the least delay over DSR. This is due to the source routing used by DSR, which implies that a destination node does not need to discover a new route to the source node in order to send the acknowledgment. Among the other two protocols, TCP traffic suffers more delay over DSDV than AODV. This is because TCP's congestion control and flow control mechanism restricts the source from sending packets over the network when it is already overloaded with the control overhead of DSDV. All the protocols experience ups and downs with variation in mobility Speed. This is because on mobile condition the sources and destinations sometimes come closer and sometimes go further away.

End-to-End delay of UDP traffic experiences least and constant delay over DSDV. This is due to the fact that, in the case of proactive protocol like DSDV routes are available the moment they are needed. UDP traffic suffers more delay over AODV and DSR. This is because in reactive protocols there is some finite latency while the route is discovered. Among these two reactive protocols DSR has less delay because of its route caching feature. The simulated results of different scenarios for End-to-End are summarized in the table below.

Table 3: Simulated Result for End-to-End Delay for variable speed

Node	Speed	AODV		DSR		DSDV	
		TCP	UDP	TCP	UDP	TCP	UDP
30	5	754.134	27.91	401.78	11.16	807.857	9.15
	10	808.672	27.70	453.85	10.72	771.291	9.30
	15	756.237	28.81	640.32	11.47	761.265	9.16
	20	759.141	28.57	464.15	10.26	806.395	9.36
	25	794.002	27.95	584.89	11.52	778.324	9.23
	30	819.513	28.10	691.37	11.41	781.104	9.21

4 Conclusion

In this paper, after detailed analysis, we get the comparison between the three routing protocols namely DSDV, AODV and DSR is depicted in table 4. In short, for UDP traffic, DSR is better considering these two metrics since offering the highest PDF and moderate end-to-end delay. For TCP traffic, AODV is better because it offers the highest PDF and moderate delay.

Table 4: Comparison of performance analysis for variable speed

TCP Traffic			
Metrics	**AODV**	**DSR**	**DSDV**
PDF	Highest	Average	Higher
Delay	Lower	Lowest	Average
UDP Traffic			
Metrics	**AODV**	**DSR**	**DSDV**
PDF	Higher	Highest	Average
Delay	Average	Lower	Lowest

REFERENCES

[1] https://en.wikipedia.org/wiki/Walkie-talkie

[2] C.-K Toh; “Ad Hoc Mobile Wireless Networks”; Prentice Hall PTR 2002;ISBN 0-130078174.

[3] C. E. Perkins, “Ad Hoc Networking”, Addison-Wesley 2001,ISBN 0-20130976-9.

[4] H. Zhou, “A Survey on Routing Protocols in MANETs”, Technical Report: MSU-CSE-03- 08, Mar. 2003.

[5] E. Ganicand A. M. Eskicioglu, "Robust DWT-SVD Domain Image Watermarking: Embedding Data in All Frequencies",Proceedings of the ACM Multimedia and Security Workshop 2004, pp. 166-174, Magdeburg, Germany, September 20-21, 2004.

[6] R. Desai and B. P. Patil, “Analysis of routing protocols for Ad Hoc Networks”, IEEE, Communication and Information Technology Applications (CSCITA), (2014).

[7] S. Mohapatra and P. Kanungo, “Performance analysis of AODV, DSR, OLSR and DSDV Routing Protocols using NS2 Simulator”, International Conference on Communication Technology and System Design, (2011)

[8] N Sharma, S Rana and R.M. Sharma, “Provisioning of Quality of Service in MANETs performance analysis & comparison (AODV and DSR)” IEEE 2nd International Conference on Computer Engineering and Technology (ICCET), (2010).

[9] P. Mohapatra and S.V.Krishnamurty,"Ad Hoc Networks Technologies and Protocols",Springer Science and Business Media,Inc. (2005).

[10] C. E. Perkins and P. Bhagwat, "Highly Dynamic Destination-Sequenced Distance-Vector Routing (DSDV) for Mobile Computers," Computer Communications Review, 234-244, October 1994.

[11] D. B. Johnson and D. A. Maltz, "Dynamic Source Routing in Ad-Hoc Wireless Networks", Mobile Computing, edited by T. Imielinski and H. Korth, Kluwer Academic Publishers, pp. 153-181, 1996.

[12] C. E. Perkins, E. M. Royer, and S. R. Das, "Ad-hoc on-demand distance vector (AODV) routing," IETF Internet draft, draft-ietf-manet-aodv-11.txt, June 2002.

[13] F. Wang and Y. Zhang, "Improving TCP Performance over Mobile Ad-Hoc Networks with Out-of-Order Detection and Response".

[14] Md. Abdullah-Al-Mamun, M. MahbuburRahman, Hwee-Pink Tan, "Performance Evaluation of TCP over Routing protocols for Mobile Ad Hoc Networks", 1-4244-0463-0/06/$20.00 ©2006 IEEE (In Press), First International Conference on Communications and Networking in China (CHINACOM 2006), Beijing, China, October-2006.

[15] Bikash Chandra Singh, Tapan Kumar Godder, Md. SiponMiah, H. M. Abdul Awal, "Experimental Analysis of UDP Performance in Mobile Ad Hoc Networks with Different Routing Protocols and Varying Payload", International Journal of Distributed and Parallel Systems (IJDPS) Vol.2, No. 6, November 2011.

[16] Gundalwar P. R. and Chavan V. N., "Empirical Evaluation of TCP and UDP Based Fundamental Ad Hoc Network Routing Protocols", International Journal of Applied Engineering and Technology ISSN: 2277-212X (Online) 2013 Vol. 3(3) July-September, pp. 24-28/Gundalwar and Chavan.