

Performance Analysis of Dynamic Source Routing Protocol

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Abstract

Routing protocol is the primary strategy to design any wireless network. In Mobile Ad Hoc Networks many routing protocols are present for sending packets from source to destination. Routing protocols in Mobile Ad Hoc Networks (MANETs) are reactive routing protocols, proactive routing protocols and hybrid routing protocols. Performance analysis of different routing protocols is the major step before selecting the routing protocol. Dynamic Source Routing (DSR) is an efficient reactive routing protocol for mobile ad-hoc networks (MANET).

In this paper, the TCP and UDP based on performance analysis was carried out in Dynamic Source Routing (DSR) protocol with different scenarios by varying the number and speed of mobile nodes and size of the network area using network simulator (ns.35) under different traffic conditions. The average end to end delay (AED), throughput and packet delivery ratio (PDR) are common measures parameters used for the comparison of performance metrics. Results of experimental show that the performance of TCP is better than UDP from throughput, but UDP is faster than TCP.

Keywords: MANET, FTP, DSR, NS2,

الخلاصة

بروتوكول التوجيه هو الاستراتيجية الأساسية لتصميم أي شبكة لاسلكية. توجد في الشبكات اللاسلكية العديد من بروتوكولات التوجيه لإرسال البيانات من المرسل إلى المستلم مثل بروتوكولات التوجيه التفاعلي و بروتوكولات التوجيه الاستباقية و بروتوكولات التوجيه المختلطة. تحليل أداء بروتوكولات التوجيه المختلفة هو الخطوة الرئيسية قبل اختيار بروتوكول التوجيه لأي شبكة لاسلكية. بروتوكول التوجيه الديناميكي هو بروتوكول توجيه تفاعلي فعال للشبكات اللاسلكية.

في هذا البحث، يتم تنفيذ تحليل الأداء لبروتوكول التوجيه الديناميكي مع سيناريوهات مختلفة باستخدام محاكي الشبكات (ns2) وتقييم أداء البروتوكول على أساس الانتاجية ومعدل تأخير البيانات بين المرسل والمستلم و النسبة المئوية للبيانات المرسله الى المستلمة . ومن خلال النتائج تبين ان TCP افضل من UDP في مجال الانتاجية ولكن بروتوكول UDP اسرع من بروتوكول TCP.

الكلمات المفتاحية: محاكي الشبكات , الشبكات اللاسلكية, بروتوكول التوجيه الديناميكي, بروتوكول نقل الملفات

Introduction

A Mobile Ad-hoc Network (MANET) is the active research subject in wireless communications. It is a collection of two or more nodes in which the communication links are wireless without the service of any fixed infrastructure or centralized administrator. MANETs is made up of three words i.e. Mobile which means changeable or portable, Ad Hoc which means Temporary or for specific purpose, Networks which means Flexible data applications which use networks to communicate. MANETs is a wireless ad hoc network which consists of self-governing nodes (Barinderpal Singh, *et. al*, 2015) The benefit of this type of network is that it does not require any kind of infrastructure, like a base station in cellular network, so the most important challenge in a mobile Ad-hoc network is to implement routing protocols that can deal with these system network topology changes to maintain and rebuild the

dependable routes in a timely approach. A few different routing algorithms for MANET networks, with their particular advantages and disadvantages have been proposed until now. Researchers traditionally classify these protocols as proactive protocols, reactive protocols, or hybrid of them, in light of the algorithms that find new routes or update existing ones. Proactive routing is implemented by exchanging routing tables, (such as SDV, WRP). Reactive routing is on demand routing, (such as DSR, AODV) (Amer O. Abu Salem, *et. al*, 2014). The primary objective of this paper is to analyze the performance of DSR routing protocols under different simulation scenarios. Through this paper it is find that how TCP and UDP will react under different network conditions. Traditional Transport Layer Protocol Transport Control Protocol (TCP) and User Datagram Protocol (UDP) which perform well on wired networks, but it corrupts its execution in case of Ad-hoc wireless networks due to the existing problems associated such as confusion of packet loss, frequent path breaks, effect of path length, This research work aims to evaluating the simulation based comparison of TCP and UDP. In order to achieve this, File Transfer Protocol (FTP) and Constant Bit Rate (CBR) traffic conditions is used. In this underlined on end to end delay, throughput and packet delivery ratio. The above parameters are validating with different network size, varying number of nodes and varying speed of nodes. This analysis is done to check the quality of service provided by DSR routing protocol.

Dynamic Source Routing Protocol (DSR):-

DSR is a reactive protocol designed to restrict the bandwidth consumed by control packets in ad hoc wireless networks by eliminating the periodic table-update messages required in the table-driven approach (Navreet Kaur, *et. al*, 2014).DSR uses source routing which means that the source must know the complete hop sequence to the destination (Suneel Kumar Duvvuri, *et. al*, 2016). DSR used to alter its route caches while discovering new routes. It updates its caches with new route discovered or when there exist a direct route between source and destination node. It is intended for use in multi-hop ad hoc networks of mobile nodes .DSR allows the network to be self-organized and self-configured without any central administration and network infrastructure (Amith Khandakar, 2012). When a node wants to transmit data, it characterizes a route for the transmission and then starts transmitting data through the defined route. In the DSR protocol, source node sends the routing request (RREQ) packets to its neighbors by means of flooding technology (Yu-chee Tseng, *et. al*, 2002).

On a node receiving this request, two things may happen. If the node does not know a route to the destination, it appends its own address to the packet and propagates the (RREQ) packet to its neighbors. Thus, paths leading to the destination can be tracked by (RREQ) packets. Loops can likewise be kept away from by looking at the packet content. When the destination receives a (RREQ), it returns to the source node a route reply (RREP) packet containing the route indicated in the (RREQ) (Manoj Barnela, *et. al*, 2016).The (RREP) then travels, through unicast, in the reverse direction of the discovered route or on a path already known by the destination, to the source. The source node, on receiving the RREP, will place the route in its route cache.

Each RREQ packet includes source node address (S-id), destination node address (D-id) and the unique request sequence-number (R-id). An advantage of DSR is that nodes can store various routes in their route cache, which means that the source node can check its route cache for a valid route before starting route discovery, and if a substantial route is found there is no need for route discovery (Bharath Chandra, *et. al*, 2015). This is very beneficial in network with low mobility. Since the routes stored in the route cache will be valid longer. Another advantage of DSR is that it does not require any trade of Hello messages, therefore nodes can enter sleep mode to conserve their power. This also saves a significant amount of bandwidth in the network and thus reduces cost.

Transmission Control Protocol (TCP):- TCP is a transport layer protocol used by applications that require guaranteed delivery (Behrouz A. Forouzan, 2007). It is a connection oriented byte stream protocol. TCP is a reliable stream transport protocol. The term stream, in this context, means connection. TCP is broadly utilized as a connection oriented transport layer protocol that provides reliable data packet delivery over unreliable links. TCP conveys roughly 90% of Internet activity in today's heterogeneous wireless and wired networks (Amer O. Abu Salem, *et. al*, 2014). TCP is utilized to control segment size, rate of data exchange, flow control and network congestion. Web browsing, email and file transfer are common applications that make use of TCP. It is preferred where error correction facilities are required at network interface level. TCP is reliable end to end protocol because TCP is trying to provide reliable data transmission between two entities (QasMarrogy *et. al*, 2014).

User Datagram Protocol (UDP):- User Datagram Protocol (UDP) is a more straightforward, connectionless Internet protocol (Gosai, *et. al*, 2013). Is one of the foundation protocol members of the Transmission Control Protocol & Internet Protocol (TCP/IP) Suite other than set of network protocols utilized for the internet. Packets are referred to as datagram in case of UDP. UDP sends Datagrams to different hosts on an Internet Protocol network without the need of prior interchanges to set up uncommon transmission channels or information ways. UDP utilizes a basic transmission demonstrate without comprehended handshaking dialogues without executing for providing reliability, ordering and data integrity. Time-sensitive applications often use UDP because when packet delivery time is the interest, dropping packets is ideal as opposed to waiting for delayed packets. Multimedia data transmission, UDP is largely used by time sensitive applications as well as by servers that answer small queries from huge number of clients. UDP is commonly used in Domain Name System (DNS), voice over IP (VOIP), trivial file transfer protocol and online games, news websites, etc.

Data Traffic:- Network layer and transport Layer have different kinds of Data and traffic agents respectively which is responsible to transport data in the network and provides different characteristics in the network (Bijan Paul, *et. al*, 2014). In this simulation scenario two types of traffic pattern are chosen. User Datagram

Protocol (UDP) and Constant Bit Rate (CBR). In such a traffic scenario, implies data of UDP type and application traffic is CBR. This scenario offers connectionless transmission environment, where communication occurs. It has more speed as compared to TCP. The second traffic pattern is Transmission Control Protocol (TCP) and File transfer Protocol (FTP) in such an activity situation, TCP represents the data type and FTP represents the application traffic of any application which transport TCP data. TCP is the Transport layer Protocol. In TCP Transmission is done using stream based. It has lower speed than the UDP.

Simulation Methodology:-In this paper TCP and UDP protocols are simulated and their performance is compared. To analyze the performance of routing protocols simulation is done. Simulation helps in analyzing the behavior of routing protocols and performance of complex networks before apply in real applications. To carry out the simulation several simulators are available which gives outputs according to the performance. In this work, the simulation done by using Network Simulator (NS-2.35) with different traffic models are presented and AWK script is conducted to analyze the performance.

Simulation Tools:-Network Simulator (Version 2.35), generally known as NS2, is simply an event driven simulation tool that has demonstrated helpful in concentrating the dynamic nature of communication networks. In this paper the operating system that is used to support the simulation described is Linux Mint10 Julia. The simulation parameters that have been used in the following experiments are summarized in Table-1

Table (1) - simulation values

Parameters	Value
Radio model	Two Ray Ground
Protocols	DSR
Traffic Source	CBR,FTP
Packet size	1000 bytes
Transmission range	250
Area	500, 1000, 1500, 2000 ,2500
Number of nodes	10,20,30,40,50
Network Protocol	IP
Duration	100 seconds
Speed	1,5,10, 15 m/s
Pause Time	5 s

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.

1- Packet delivery Ratio (PDR):-The packet delivery ratio is characterized as the ratio of data packets received by the destinations to those generated from the sources. It is computed by partitioning the number of packets received by the destination through the number of packets made by the application layer of the source. It characterizes both the correctness and efficiency of ad hoc directing protocols. A high packet delivery ratio is wanted in any network.

2- Average End-to-End delay (AED):-AED is the average time of data packet to be successfully transmitted across 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 upon transmission time, queuing time and processing delay. For each received packet, the average of end-to-end delay will be 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 performance.

3-Throughput:-Throughput of the protocols, refers to how much data can be transferred from one location to another in a given amount of time. It is the amount of data per time unit that is delivered from one node to another via a communication link. It is measured in bits per second. A Throughput with a higher value is more often an absolute choice in every network because it determines the ability of nodes to deliver the packets from source to its intended destination.

Performance Results:- In this section we analyze the performance of TCP and UDP over DSR based on three parameters such as number of nodes, mobility speed (m/s) and size of network area considering packet delivery ratio, throughput and average end to end delay for data packet delivery.

First scenario:-In first scenario, we have set all parameter same as table 1 except the Terrain area set to 500*500 m, speed of nodes =5m/s , packet size = 1000 mb /s and we change Number of nodes(10, 20,30,40,50) . In this scenario we have taken the following results shown in figures below:

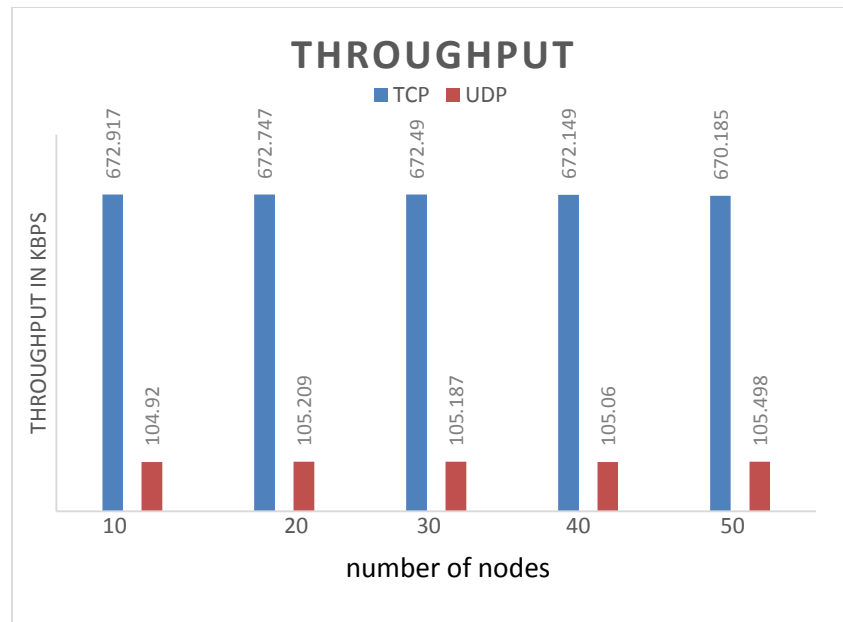


Figure (1) Throughput when varying number of mobile nodes

Figure (1) illustrates the impact of the number of nodes on Throughput for DSR under TCP and UDP . In terms of the Throughput we can see TCP has the best result when compared with UDP under DSR routing protocol.

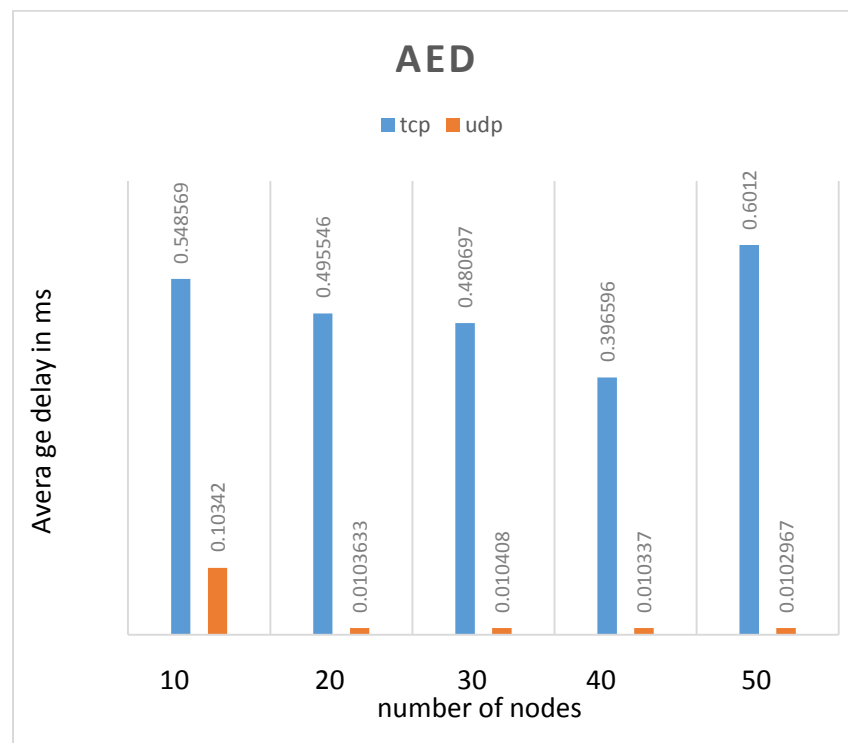


Figure (2) AED when varying number of mobile nodes

Figure (2) shows the impact of the number of nodes on the average end-to-end delay (AED). TCP protocol has little bit of more end to- end delay than UDP protocol since it takes more time to find out a secure and reliable route.

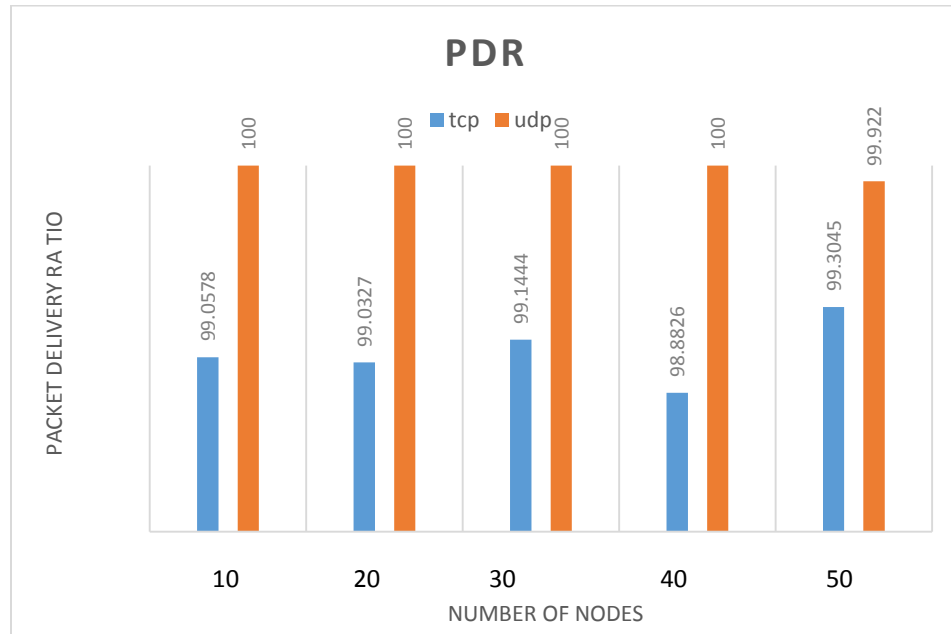


Figure (3) PDR when varying number of mobile nodes

From Figure (3), it is seen that, UDP has a little higher packet delivery ratio than TCP with DSR protocol even number of mobile nodes is changed.

Second scenario:-In second scenario, we have set the number of mobile nodes to 50 nodes and all parameter same as in previous scenario except the speed of nodes changed from (1, 5, 10, 15 m/s). In this scenario we have taken the following results shown in figures below:

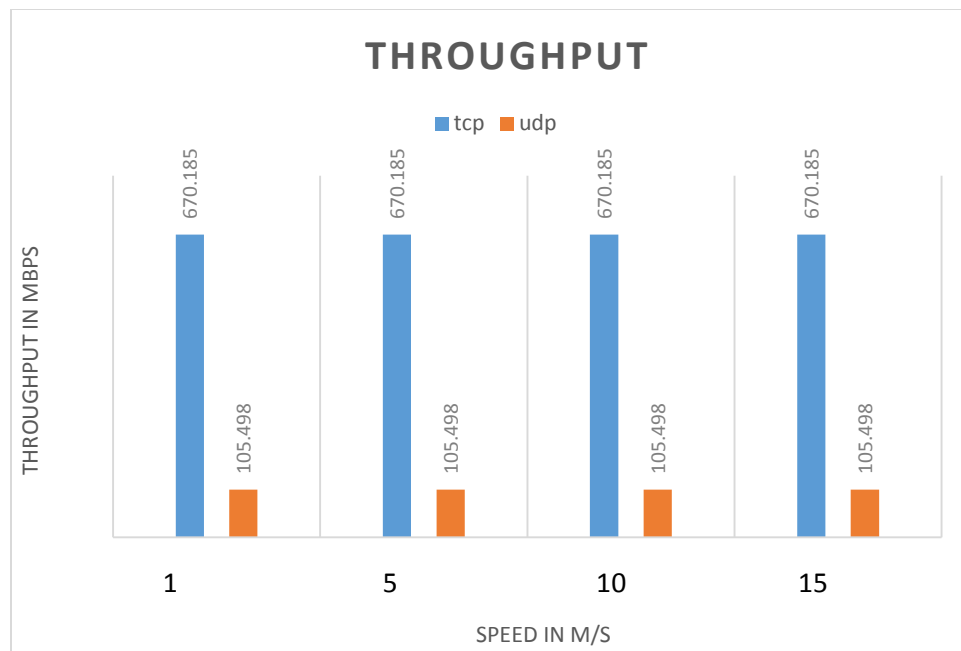


Figure (4) Throughput when varying speed of mobile nodes

As it can be seen from figure (4) , TCP has a higher throughput than the UDP .Throughput remains the same in all the scenario despite the increase speed the mobile nodes which could be due to the multihop characteristics of the DSR routing protocol.

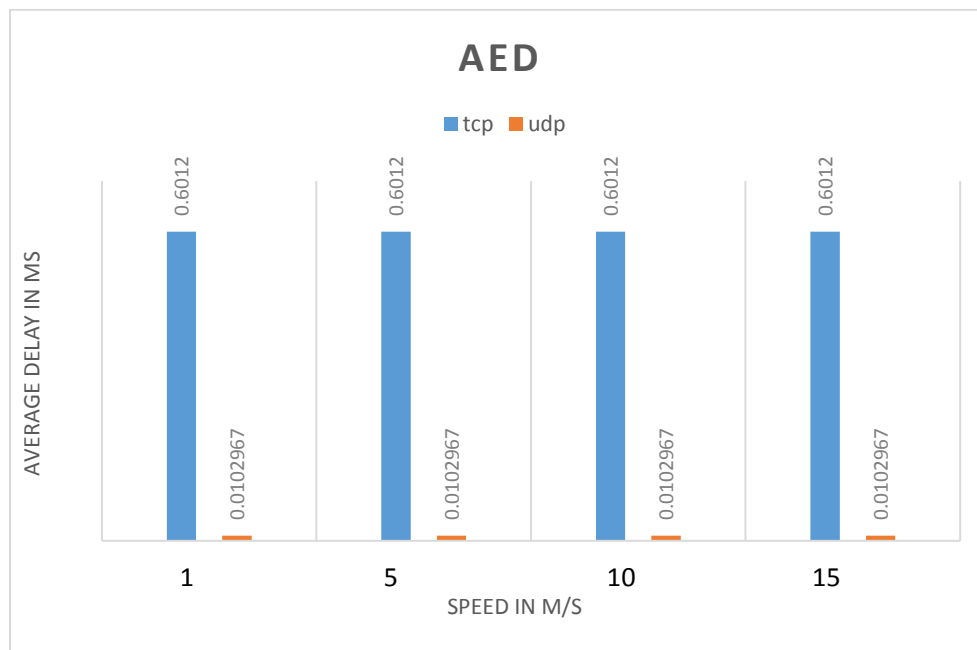


Figure (5) AED when varying speed of mobile nodes

As it can be seen from the figure (5) Average end to end delay (AED) of TCP is higher than UDP in DSR because of UDP is connectionless routing .

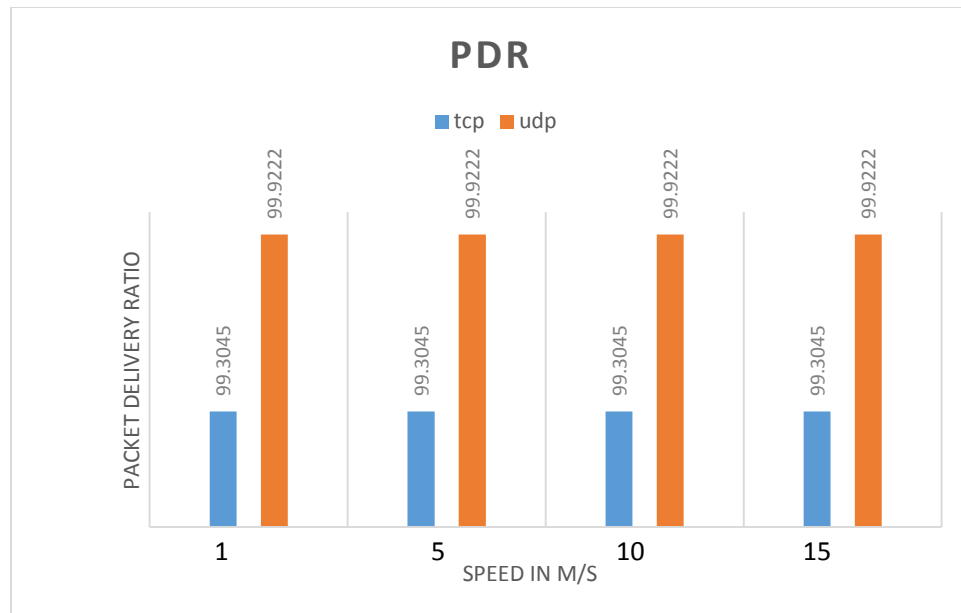


Figure (6) PDR when varying speed of mobile nodes

From Figure (6), it is seen that, UDP has a little higher packet delivery ratio than TCP with DSR protocol when the speed of mobile nodes was increased.

Third scenario:-In the third scenario, we have set all parameter same as in previous scenario except the size of network changed from (500, 1000, 1500, 2000, 2500 square meter) and number of mobile node stay the same in the second scenario (50) nodes. In this scenario we have taken the following results shown in figures below:

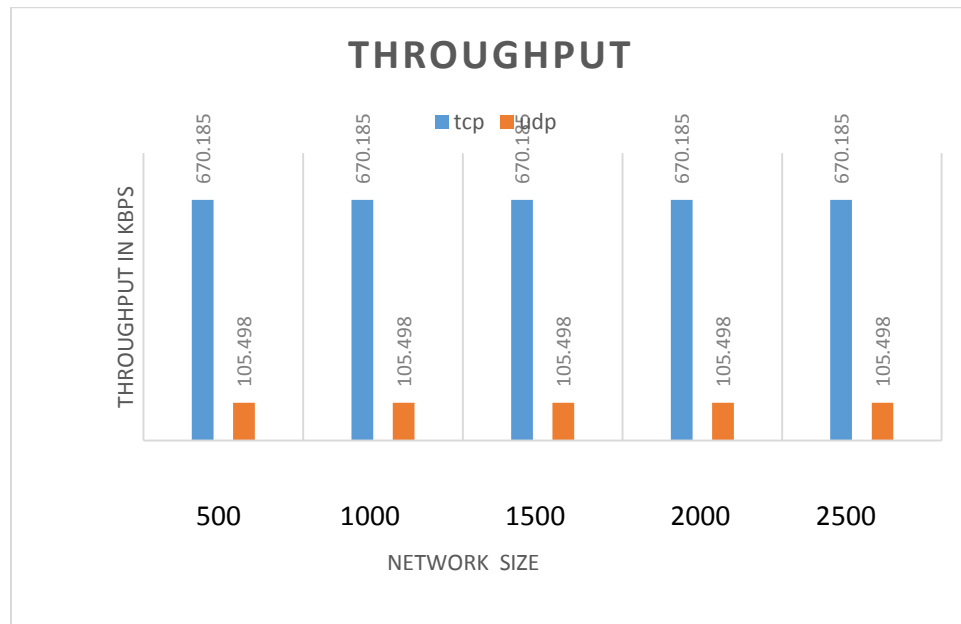


Figure (7) Throughput when varying network area

In the figure (7) shows the comparison of TCP and UDP with DSR protocol. It clearly that TCP has higher Throughput than UDP even the network area was changed.

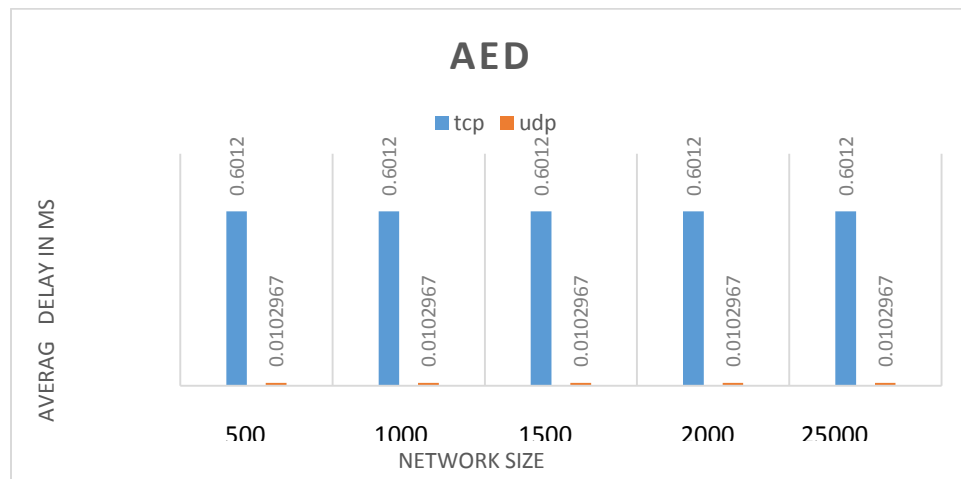


Fig (8) AED when varying network area

From Figure (8), it is seen that, TCP has a higher AED than UDP with DSR routing protocol in this simulation scenario because TCP a connection oriented byte stream protocol a connection must be set up between both ends of a transmission before transmit data



Figure (9) PDR when varying network area

From Figure (9), it is seen that, UDP has a little higher packet delivery ratio than TCP with DSR protocol despite of the area of network was increased.

Conclusion

This study was conducted to analyze the performance DSR routing Protocol in cases TCP/FTP and UDP/CBR with performance metrics over several simulation scenarios over different network topologies were carried out. From the simulation results, the performance analysis of TCP and UDP show that TCP is better than UDP in term of throughput in the three simulation scenario despite of varying number and speed of mobile nodes in the network and change the size of the simulation area, but in Packet Delivery Ratio (PDR) and Average End to End Delay (AED) of UDP is better than TCP because there is no form of flow control or error correction and TCP suffers on multihop wireless routes because its packets sent acknowledgement is time consuming as compared to that of UDP.

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