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COMPARISON SIMULATION STUDY FOR TCP AND UDP TRAFFICS IN DSR MOBILE AD-HOC ROUTING PROTOCOL USING NS2

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ABSTRACT

Mobile Ad Hoc Networks (MANETs) is a collection of wireless mobile nodes forming a temporary network without using any established infrastructure or centralized administration. Generally, with high mobility environment and high load network traffic, network performance may be degraded causing packet loss or increase overhead. Of the Dynamic Source Routing (DSR) protocol for the MANETs. Average throughput, average end-to-end delay, and routing overhead, by increasing the time and number of the node. In this paper, we study the performance of DSR average throughput, average end-to-end delay, and routing overhead. Simulator (NS) version 2.35 used to study the performance of in both DSR-TCP and DSR-UDP. The simulation result shows that when the time is increased affected the average throughput, average end-to-end delay, and routing overhead, and routing overhead, and when to increase the number of nodes by increasing the average throughput, average end-to-end delay, and routing overhead, by decreasing path.

Keywords: MANET, simulation, DSR, TCP, UDP, NS2.

1. INTRODUCTION

The growing interest in MANETs brought its impact towards academic research due to its importance in critical applications such as battlefield communication, disaster relief without requiring a fixed or static setting[1, 2].

MANETs can be characterized as a wireless network, in which its topology changes rapidly[3]. Furthermore, MANETs can be run alone. It can be connected to a bigger Internet sector. The use of MANETs became well-known among researchers in the 90*s* due to the growing fame and importance of laptops and Wi-Fi. A simple clarification of MANET'S operation is illustrated in Figure-1.

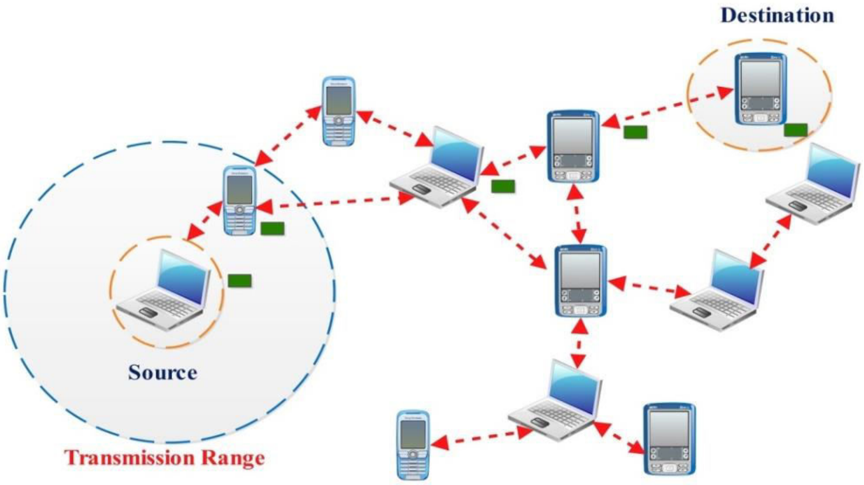

Figure-1. MANET.

In the MANETs, each node has two functions; it can act as a router for other nodes, and another node can rout it. Different routing protocols have been developed, including DSR, Destination-Sequenced Distance-Vector Routing (DSDV)[4], and Ad hoc On-Demand Distance Vector (AODV)[2, 5]. As shown in Figure-2. The network can be classified as Table Driven or On-Demand. In Table Driven, the node set the path with the source from the establishing of the network, where the routes are pre-set and current activities of the node is to just maintain the paths, whereas On-Demand, the paths are established just before sending the packet to the node from the source[5].

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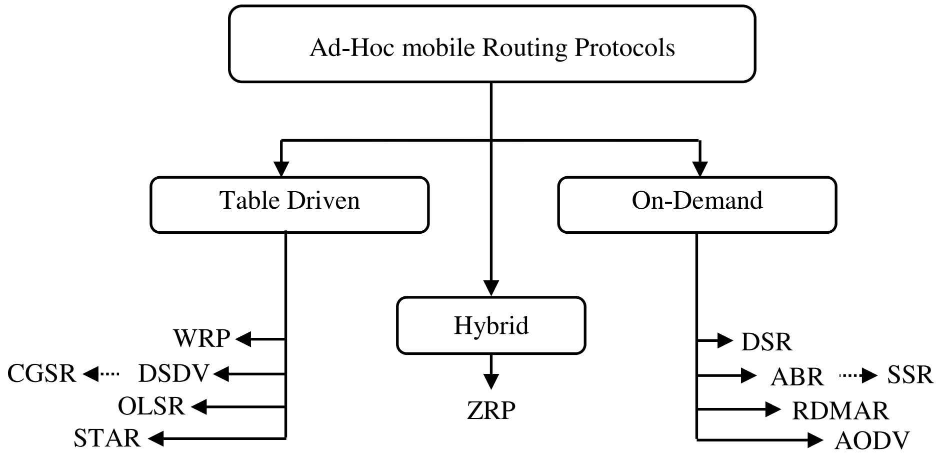

Figure-2. MANET routing protocols.

2. ROUTING PROTOCOLS OF MANET

Routing is the task of changing information among the nodes (devices) within the network. Since these devices have restricted range, the routing is being conducted in MANET throughout multiple hops. The routing protocols in MANET aim to identify the route between the main source and the destination in terms of delivering the packets [6-8].Have listed multiple criteria should be existed in any proposed routing protocols.

Moreover,[9].Have also classified the routing protocols in MANET into three main classes as Proactive, Reactive, and Hybrid. Figure-3 depicts such classes and their sub-instances.

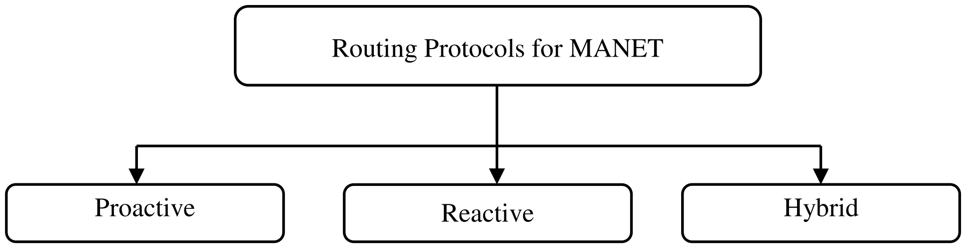

Figure-3. Taxonomies of routing protocols for MANET.

As shown in Figure-3. Proactive protocols aim to accommodate exchanging process for the information between the nodes within the network. This process is being performed in order to provide the information about the route to deliver packets from source to the target. Since, the topology of MANET is frequently changing from time to time thus, maintaining the network would be cost consuming.

On the other hand, Reactive protocols tend to be kind of query-reply dialog. The key characteristic behind Reactive protocols lies on its mechanism of establishing the route to a particular target only when there is a demand. Therefore, it does not require periodic transmission of the network topology's information.

Finally, Hybrid protocols aim to combine both mechanisms of proactive and reactive when one of them appears to be insufficient. Obviously, combining the two mechanisms would bring a better solution. Therefore, most recent protocols are mainly depending on the hybrid.

2.1 Proactive routing protocols

As mentioned earlier, this kind of protocols aims to deliver topological information between the nodes within the network. Figure-4depicts the sub-instances protocols inside the proactive category.

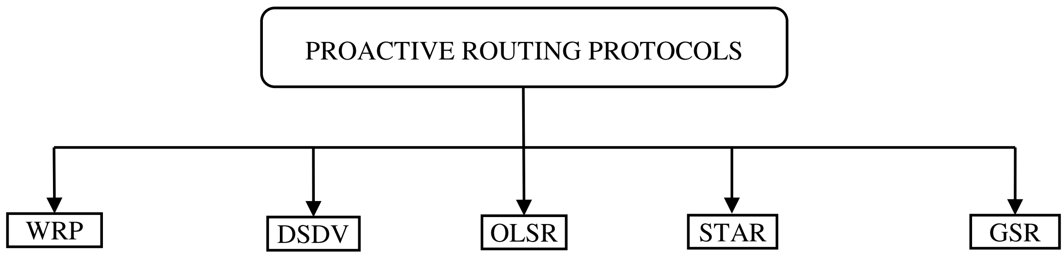

Figure-4. Proactive routing protocols.

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2.2 Reactive routing protocols

As mentioned earlier, the key characteristic behind Reactive protocols lies on its mechanism of establishing the route to a particular target only when there is a demand. Therefore, it does not require continuous transmission of the network topology's information Figure-5.Depicts the sub-instances protocols inside the reactive category.

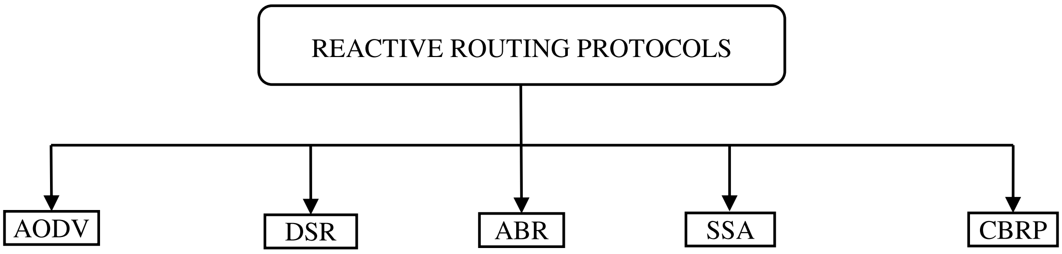

Figure-5. Reactive routing protocols.

2.3 Hybrid routing protocols

As mentioned earlier, hybrid protocols aim to combine both mechanisms of proactive and reactive when one of them appears to be insufficient. Obviously, combining the two mechanisms would bring a better solution. Therefore, most recent protocols are mainly depending on the hybrid. Figure-6 depicts the sub-instances protocols inside the hybrid category.

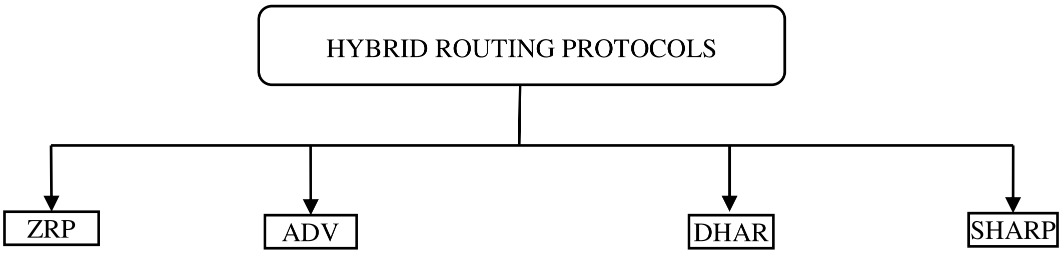

Figure-6. Hybrid routing protocols.

3. DYNAMIC SOURCE ROUTING (DSR) PROTOCOL

DSR, as a protocol, is composed of two major tasks; Route Discovery and Rout Maintenance. When a source in the network tries to send a packet to a destination and it has not had a route towards the destination in its cache, it starts a route searching process by broadcasting this request as a packet to the network. The request packet contains source node address, destination node address, a unique sequence number and an empty route record. The other nodes, after receiving route request, will verify its cache. If the cache does not have the destination, the particular node will add its address in the record and rebroadcast the request. If it has the route to the destination, the particular node will append its data to the original packet data and send a reply to the source. A simple of DSR operation is illustrated in Figure-7.

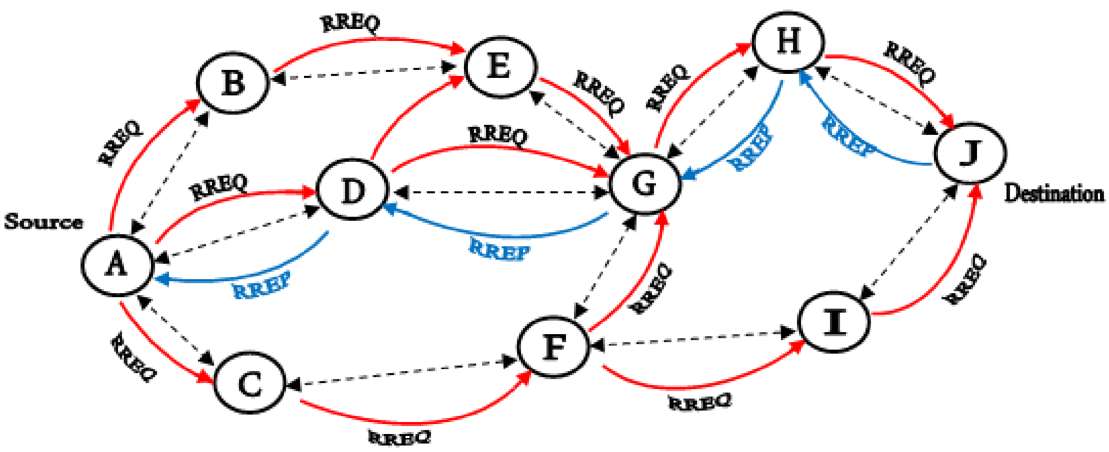

Figure-7. DSR routing protocols.

The sequence number will help in assisting the node to cancel or ignore the same request in case of a repeated request [10]. However, as the size of network increased, the size of the route cache in DSR protocol increases too, making the searching of the best possible route to the destination a slow process. Besides cache size, the broken route can hamper the search process by registering a route in the cache that may get broken in later event (route changes). Several researches addressed the problem of route changes. In the work of[11], a caching strategy had been developed that allows nodes to efficiently adapt their cache network changes. It implies introducing a new packet to the DSR cache and involves visiting each node in the network twice by the new packet. In the first visit, topology data is collected and neighbor discovery mechanism starts. After saving this information into a compressed matrix, the new packet resumes its visit to another node. In the second visit of this packet, the node updates and validates the link caches of the nodes.[5] established a semi-proactive protocol based on the Active Packets and Route Error (RERR) flooding, both are two improved strategies of route cache in DSR integrated to what is called a Tiding Active Packets (TAP). Although TAP is different from DSR, but it could be a good solution to overcome DSR mentioned problems.

3.1 Overview of DSR mechanism

Generally the procedure to discover a destination starts when the node fail to find a direct route to that destination when the request RREQ had been triggered. The receiver neglects the message whenever it had been repeated (message that holds the same identification header).If the message had not been repeated, it replied by triggering an RREP to the sender.

When the mentioned procedure is not fulfilled, the receiving node put its address to the record of routes of RREQ. RREP passes in the route pointed by the route record. The propagation of RREQ and RREP packets in DSR are illustrated in Figure-8.[12].

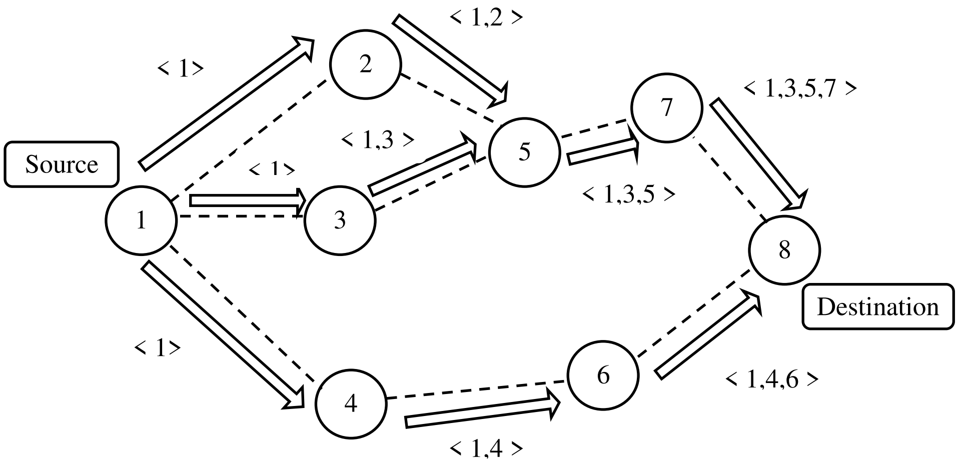

Figure-8. Propagation of RREQ in DSR.

4. SIMULATION RESULT AND DISCUSSIONS

The main network parameters used in this study wee throughput, end-to-end delay, and route overhead in two different scenarios. The first scenario consists on examining the DSR for MANETs with regards to the number of nodes and time. The simulation tool that has been used in this study is NS2. As shown in Table-1.

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Table-1. Simulation parameter.

Description	Value	Unit
No. of node	10,20,30,40,50	node
Network area size	750×750	m²
Simulation time	100, 200, 300, 400, 500	S
Node transmission rang	30	M
Data Packet Size	512	bytes
Examiner Protocol	DSR protocol	-
Performance metric	Average throughput, average end-to-end delay, and routing overhead.	-
Type of node	Mobile	-
Mobility model	Randomly moving away	-
MANET Gateway	wlan_ethernet_slip4 Operate on IEEE802.11b Standard	-

The process for calculating the mentioned parameters were as follow[13].

- **Average throughput (T):** refers to the total number of the received bytes multiplied by the simulation time, is represented by (T) and obtained as (1).

$$T = \frac{1}{n}\sum_{i=1}^{n}\frac{bi}{ti} \quad (1)$$

- **Average end-to-end delay (E delay):** refers to the average of transmitted data packet within a network. This include estimating the potential delays during the route discovery latency, queuing, retransmission delay, the propagation, and the transfer time, is represented by $(E2E)$and obtained as (2).

$$E2E = \frac{1}{n}\sum_{i=1}^{n}\frac{di}{pktdi} \quad (2)$$

- **Routing overhead (RO):** refers to the measure of the total number of thecontrol packets that are originally produced from the routing protocol during the simulation, is represented by $(RO)$and obtained as (3).

$$RO = \frac{1}{n}\sum_{i=1}^{n}\frac{cpki}{pki} \times 100\% (3)$$

4.1 Effect of number of nodes

For the first scenario, the average throughput value was examined for DSR with regards to the number of nodes as shown in Figure-9.WhereasDSR-TCP and DSR-UDP starting with 10 nodes and ending with 50 nodes. Based on the result, it can be noted that DSR was found to perform better in TCPas compared to the UDP. In addition, one can summate that an increase in the number of nodes can results in slight change in the average throughput in both TCP and UDP. This can be reasoned to that a potential throughput penalty is resulted due to the transfer time in UDP for each data block which is seems to be significantly larger than TCP.

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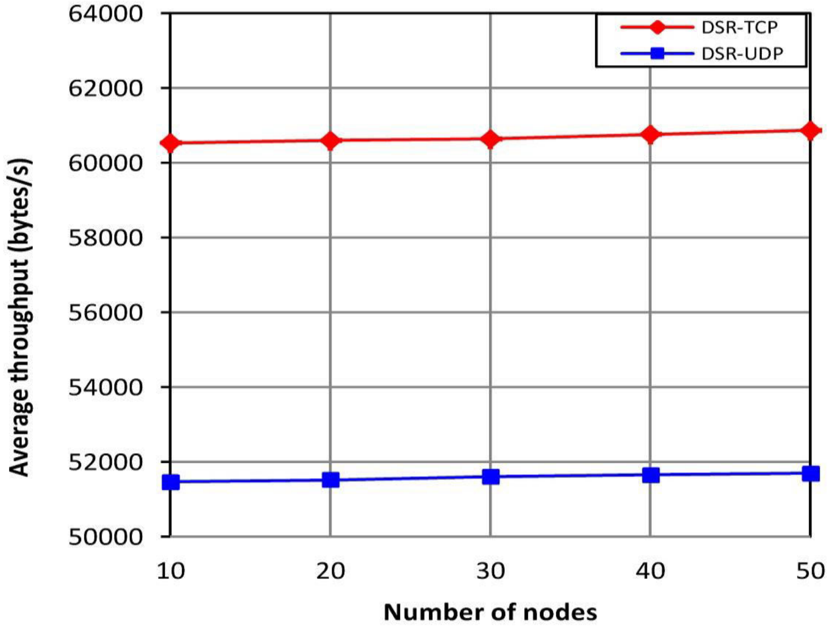

Figure-9. Average throughput versus no of nodes.

The e2e delay was also examined in both protocols with regards to the number of nodes Figure-10. The result showed that DSR-UDP offered better packet transfer rate with minimal delay as compared to the DSR-TCP. From this, it can be concluded that an increase in the number of node can progressively lead to additional delay in TCP. Such delay is believed to be urticated to that DSR-TCP deals with packet loss information in order to indicate the window size along with the queueing, which as a result consumes more time to process and transfer nodes between source and destination.

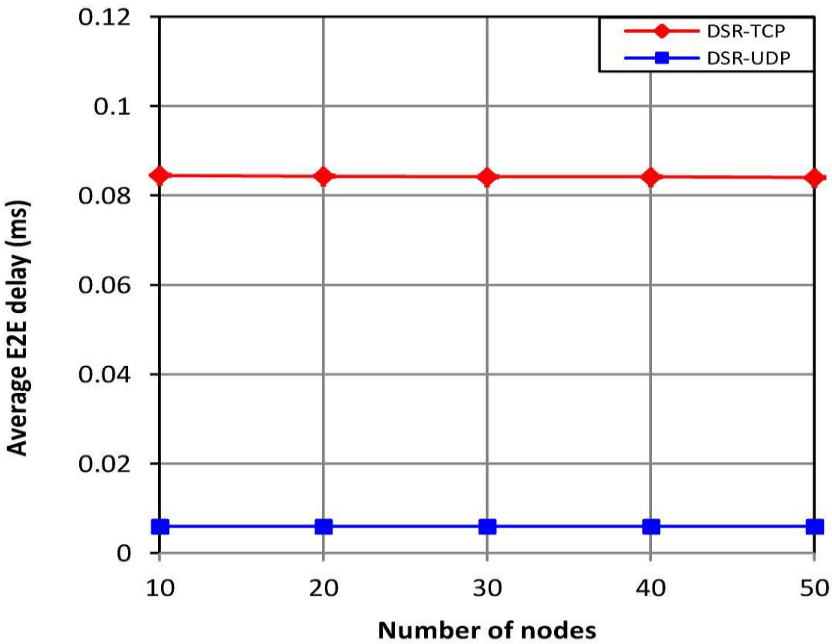

Figure-10. Average end-to-end delay versus no of nodes.

Figure-11shows the route overhead comparison result for DSR with TCP and UDP based on the progressive increase in the number of nodes. From the result, it can be concluded that the route overhead of DSR-UDP and DSR-TCP increases significantly when the number of nodes is increased. However, it can be said that DSR-TCP offer better alternate for DSR with regards to the number of nods transmitted in the network. This can be attributed to that DSR-TCP offer route cache the information at each node records routes in which the

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resulted overheard over time is accordingly reducedwhen it's generated by a route discovery phase.

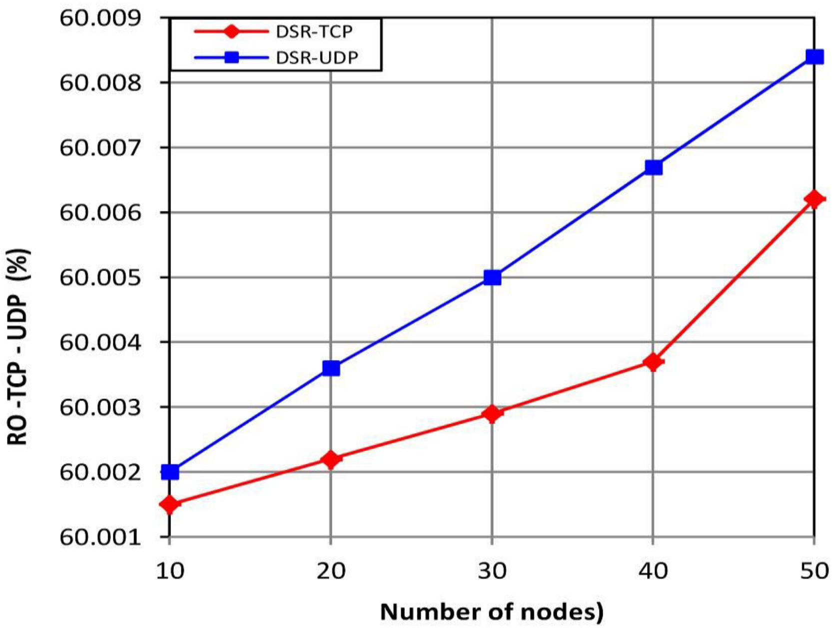

Figure-11. Route overhead versus no of nodes.

4.2 Effect of time

In the second scenario, the effect of time on the DSR-TCP and DSR-UDP was examined based on the average throughput, e2e delay, and route overhead. The time for examining these metrics was set to start at 100 sec and ends at 500 sec. Figure-12 shows the average throughput result for DSR-TCP and DSR-UDP with regards to the time. From the Figure, it can be noted that DSR-TCP offered better throughput value as compared to the UDP. This value was also found to be stable when the time is increased. This can be contributed to that DSR-UDP will not have enough time to probe available bandwidth especially when the streaming is continuous and the allowed period is too long.

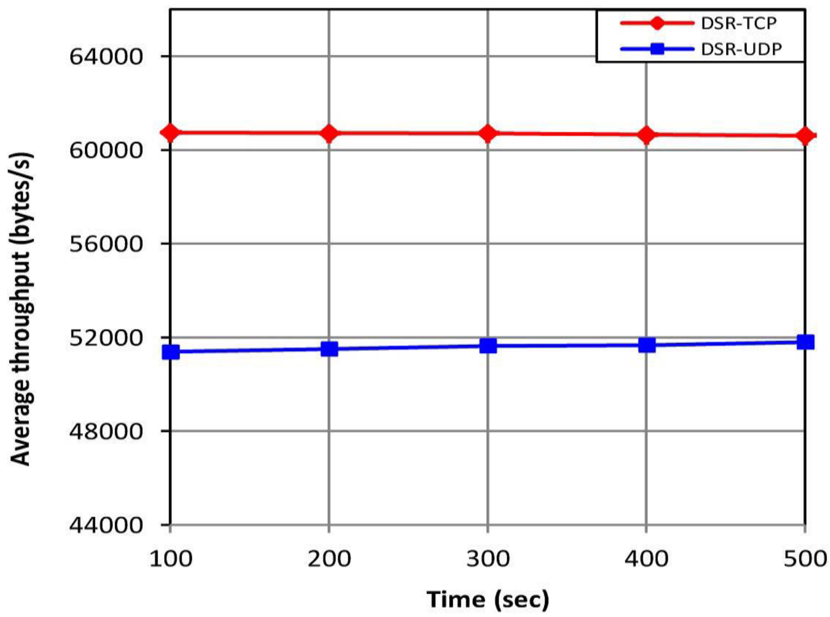

Figure-12. Average throughput versus Time.

On the other hand, the average e2e delay was also examined with regards to the time in both DSR-TCP and DSR-UDP Figure-13. The simulation result showed that DSR-UDP offered a significantly stable performance with minimal delay as compared to the performance of DSR-TCP. This can be reasoned to that TCP required additional time to transmit the nodes successfully due to both propagation delays and router processing delays that are separately configured across network.

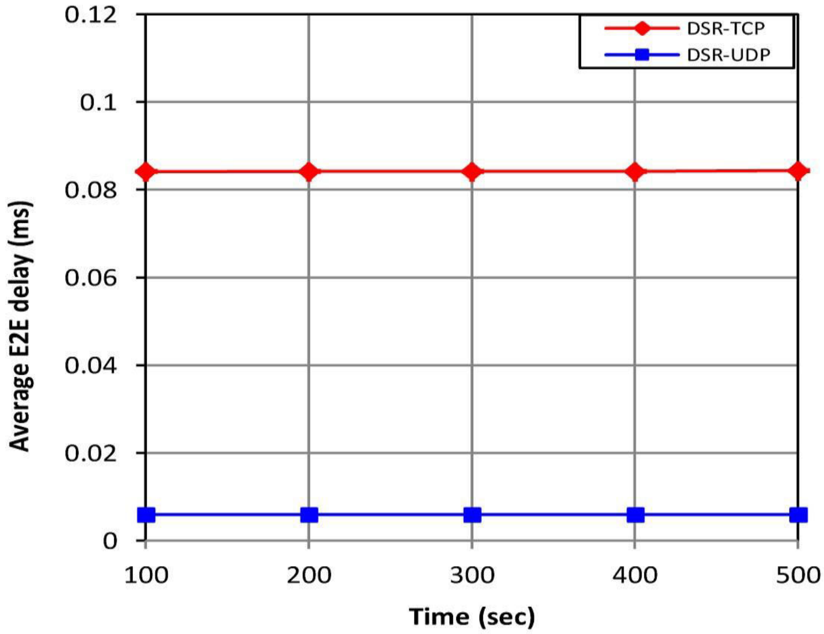

Figure-13. Average end to end delay Time.

Figure-14 shows the route overhead for the DSR-TCP and DSR-UDP with regards to the time. The result showed that an increase in the time led to a slight increase in the route overhead for the DSR-TCP at the 100 sec till it starts to drop after the 200 sec. Such result can be associated with the feasibility of DSR-TCP in effectively processing the node in the network functions as a router that discovers and maintains routes for other nodes.

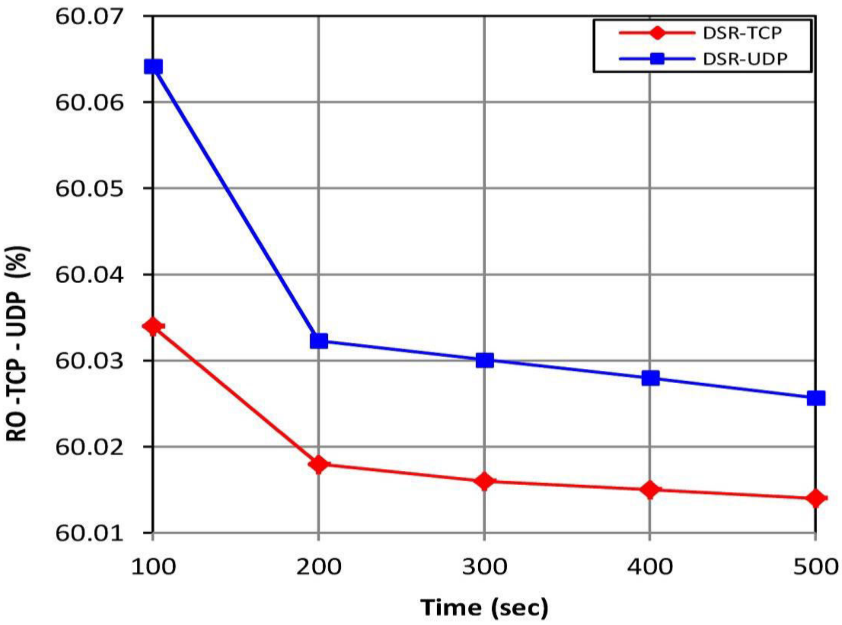

Figure-14. Route overhead versus Time.

4. CONCLUSION AND FUTURE WORKS

The simulation result in this study revealed that an increase in the number of nodes and time can regulate the network performance with regards to the average throughput, e2e delay, and route overhead. In DSR-TCP, the result showed a promising performance when a node it transmitted from source to destination with better throughput but with larger e2e delay and lower route overhead as compared to the DSR-UDP which has only found to offer less e2e delay performance. In addition, the result also showed that an increase in time can significantly affect the DSR-UDP based on the low throughput value and large route overhead. Despite these findings, it is still believed that further efforts should be carried out in order to examine other network metrics with regards to other network characteristics in both DSR-TCP and DSR-UDP. This includes assessing the average packet delivery ration and packet loses which can be used as an indication of protocol stability when transmitting nodes from the source to destination.

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