PERFORMANCE ANALYSIS BETWEEN OLSR AND DSR ROUTING PROTOCOLS USING NS3

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Abstract: This study has been undertaken to identify which protocols amongst the Proactive and Reactive Routing Protocols of Mobile Ad Hoc Networks (MANET) serve their best purposes in communicating through a wireless network. This is being comparedby analysing Optimized Link State Routing (OLSR) which is a proactive routing protocol and Dynamic Source Routing (DSR) which is a reactive routing protocol. These two protocols are being analysed by specifying a set of parameters such as the packets received, end to end delay, throughput and the number of sinks, number of nodes and simulation time. These measurements bring an analysis to decide which protocols amongst both work better in wireless communication system.

Key Terms: MANET, DSR, OLSR, Wireless Communication

I. INTRODUCTION

The wireless communication system plays a major role in enabling high end facilities to the customers and many other global organizations. This can be brought into existence using different Ad Hoc Routing Protocols which are termed as Mobile Ad Hoc Networks (MANET). The MANET protocols are also termed as wireless ad hoc networks which have a routable networking environment setup on top of the link layer ad hoc network. [1] MANET is set up by connecting a set of mobile nodes connected wirelessly in a configured healing network without any fixed infrastructure. The MANET nodes are also free to move randomly as topology of the network changes. MANET has a set of routing protocols which are categorized as proactive and reactive routing protocols.

Proactive Routing Protocols: In networking terminology a proactive protocol is utilized when each node maintains one or more routing tables representing the entire topology of the network. [1] The updates of these routing tables are performed on a regular basis for storing the routing information of each node to every other node. Examples of Proactive Routing Protocols are Optimized Link State Routing Protocol (OLSR), Distance vector (DV) protocol, Destination Sequenced Distance Vector (DSDV) protocol, Wireless Routing protocol Fisheye State Routing (FSR).

Reactive Routing Protocols: These protocols are used in networking to set up the routes on demand. If a node wants to initiate a communication with the neighboring nodes without any proper route, then these protocols try to establish such a route. Examples of Reactive Routing Protocols are Ad-Hoc On-Demand Distance Vector (AODV), [2] Dynamic Source Routing (DSR), Temporarily Ordered Routing Algorithm (TORA), etc.

This paper thereby gives a brief summary of the literature survey of the existing systems using MANET protocols in the section 2 and then detailed explanation of the implementation of OLSR and DSR routing protocols and about the parameters used for testing their performance in the consecutive 3 and 4 sections. Then this paper explains [3]about the different test results obtained using the two protocols in different conditions in the section 5 and their outcome and future scope in the section 6 accordingly.

II. LITERATURE REVIEW

The research for analysing different wireless communication technologies has brought up the development of different routing protocols which help in the proper establishment of routes and the transmission of message flow system from the desired source to destination. This has reduced the wired setup communication system and also the setup cost. This type of wireless communications is been enabled using the Mobile Ad Hoc Networks (MANET) which work on top of a link layer routing network.[1]

The past developments in this area include the performance analysis of MANET routing protocols for UAV communications (Unnamed Aerial Vehicle) technology which are used in the military base camps for transferring message from one base station to another and also used in other civilian application such as in Amazon for delivering couriers from the desired package centre to the resident location. [2] This type of communication system requires a low setup cost and also can travel at a faster rate across larger bandwidths.

The MANET routing protocols were also analysed by considering a set of parameters such as the Quality of Service (QOS) for analysing which protocol could obtain the best route amongst Ad Hoc On Demand Distance Vector (AODV) Routing Protocol and Dynamic Source Routing (DSR) Protocols. This analysis helped in finding the better node density which enables to obtain the higher performance [3] among the protocols by parallelly estimating the factors such as throughput and average end delay.

The Optimized Link State Routing (OLSR) Protocol is used in eliminating long delays in transmitting data packets, helps in establishing communication very frequently for dense set of nodes, enables route requests for new destinations very frequently and also allows higher broadcast ratio. This protocol has guided for large range of communication system and also has an improved capacity for storing the routing table information that is updated on a periodic basis. These different methodologies for analysing the wireless sensor networks has improved the efficiency for wireless communications and increased rates of data transfer between the routers. [4] Finally, different conclusions have been obtained based on research done for analysing the efficient protocols that can be used in different situations as necessary.

III.METHODOLOGY FOR IMPLEMENTING THE ROUTING PROTOCOLS

Optimized Link State Routing Protocol (OLSR): It is one of the table-driven or proactive routing protocol which is an IP routing protocol that is used for functioning in MANET's which can also be used on other wireless networks. It discovers the routes using the hello and topology control (TC) messages and then builds the link state information throughout the MANET. Each node uses this topology [5] information for measuring next hop destinations for all nodes within the network using shortest hop transmitting paths.

Using Hello messages, the OLSR protocol at each node discovers 2-hopneighbor information and performs a distributed election of multipoint relays (MPR)**.** These are selected by each node such that there exists a path to each of its 2-hop neighbours via a node selected as an MPR.These MPR nodes then source and forward the TC messages that contain MPR selectors. Depending on the source the forwarding path for TC messages take place but it is not shared randomly, not all links of a node are advertised but only those that represent MPR selections.[7] OLSR does not bother with reliability, it simply floods the topology data often enough to ensure that the database does not remain unsynchronized for extended periods of time. The MPR's play a main role in routing and selecting proper route from any source to desired destination by calculating the route. Every node broadcasts a Hello Message for link sensing, neighbor detection and selection process.

Dynamic Source Routing Protocol: It is one of the Reactive Routing Protocol used for wireless mesh networks. It forms a route on-demand when a transmitting node request one. DSR relies on source routing instead of using routing table at each intermediate router. For determining the route between source and [6] destination the source router needs to accumulate the address. The accumulated path information is cached by the routers which process route discovery packets and the learned paths are used to route packets. In order to accomplish source routing, the routed packets contain the address of each device the packet will traverse. Due to this factor the packets may result in high overhead for large addresses, like IPv6. To avoid such situations, DSR provides a flow ID option that allows packets to be forwarded [7] on a hop-by-hop basis.

This routing information is truly based on source routing and also continuously updates the routes it traverses. The DSR protocol has 2 major phases, which are Route Discovery and Route Maintenance. The message flow traverses from the route record which is initially contained in the Route Request would be inserted into the route reply and then the route reply would be initiated if the message has reached intended destination router. To return the Route Reply, the destination node must have a route to the source node. The route and message flow depend on the [5] route cache that is being used and this requires that all links are symmetric. In the event of fatal transmission, the maintenance phase is initiated and the route error packets are being generated at respective nodes. Once the error packets are being captured, they are removed from the node's route cache and all the routes containing the path are truncated at that point. Again, the process of route discovery takes place for obtaining a viable communication path.

IV. ARCHITECTURE

The system architecture of this paper can be visualized as a 3-tier architecture where the initial phase which is the data tier consists of the OLSR and DSR protocols as input which needs to be simulated. The business tier is the application logic where the protocols are simulated and evaluated using the NS3 Simulator and then gets simulated using the Python Visualizer. Once the protocols are being simulated the CSV files are being generated in the background for both the protocols and are thereby analysed based on the parameters generated. Once all the parameters are being analysed the effective protocol among the both is being concluded as the output for utilizing [8] them in the process of wireless communications in presentation tier.

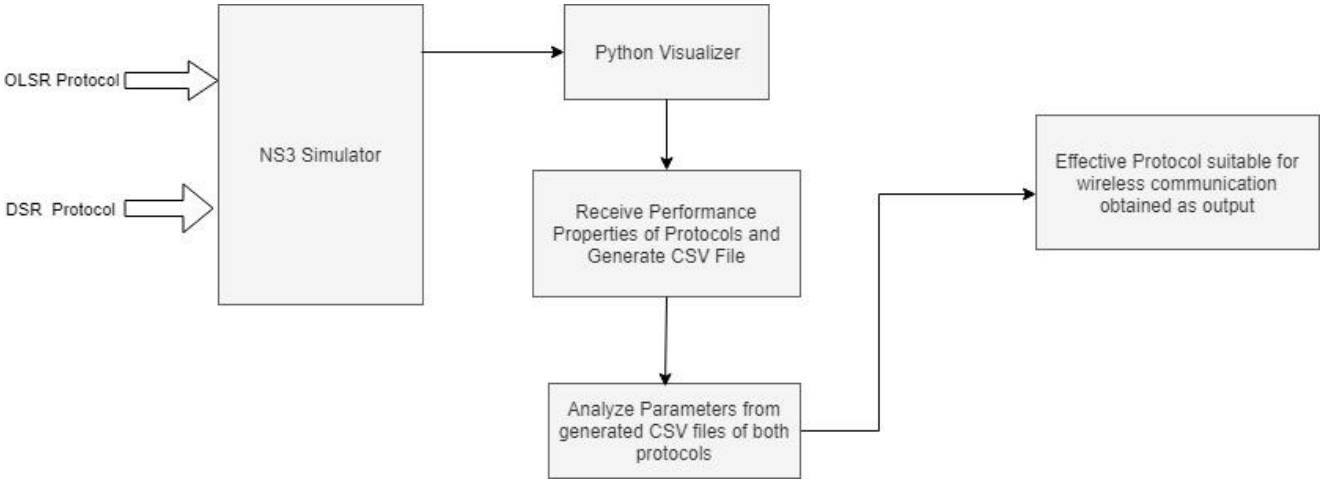

Fig.1 System Architecture of the application

In Figure 1, the system architecture of this paper is being explained using a 3-tier architecture model where the flow explains how the protocols help in analysing the better Performance of the entire system by processing through several phases.

V. EXPERIMENTAL RESULT

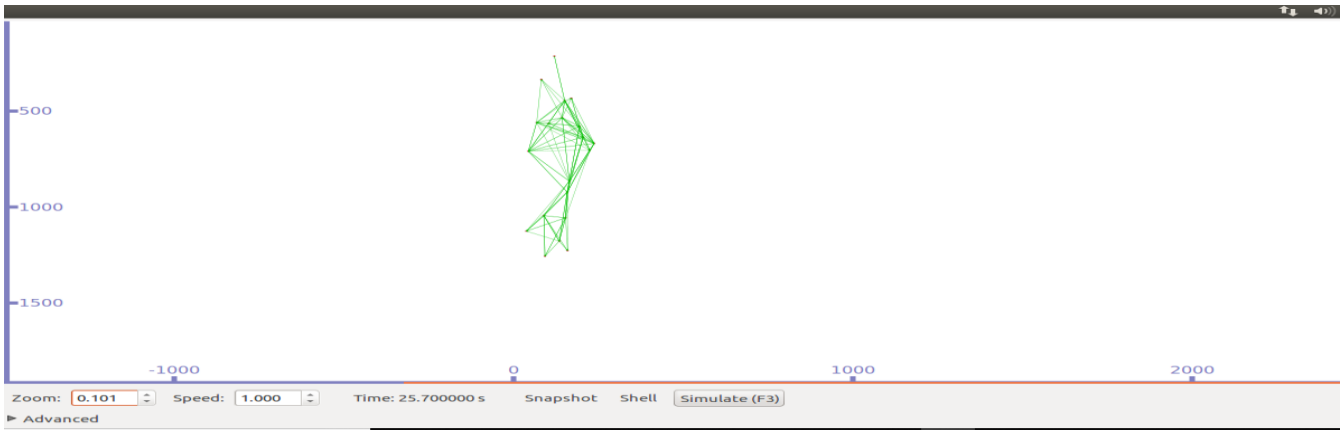

Fig.2 Simulation of OLSR Protocol with 20 nodes

In Figure 2 it resonates the simulation of OLSR routing protocol [7] with 20 number of nodes with a transmission power of 7.5W and number of sinks as 10 which shows the communication path from the source to destination needed for wireless communication.

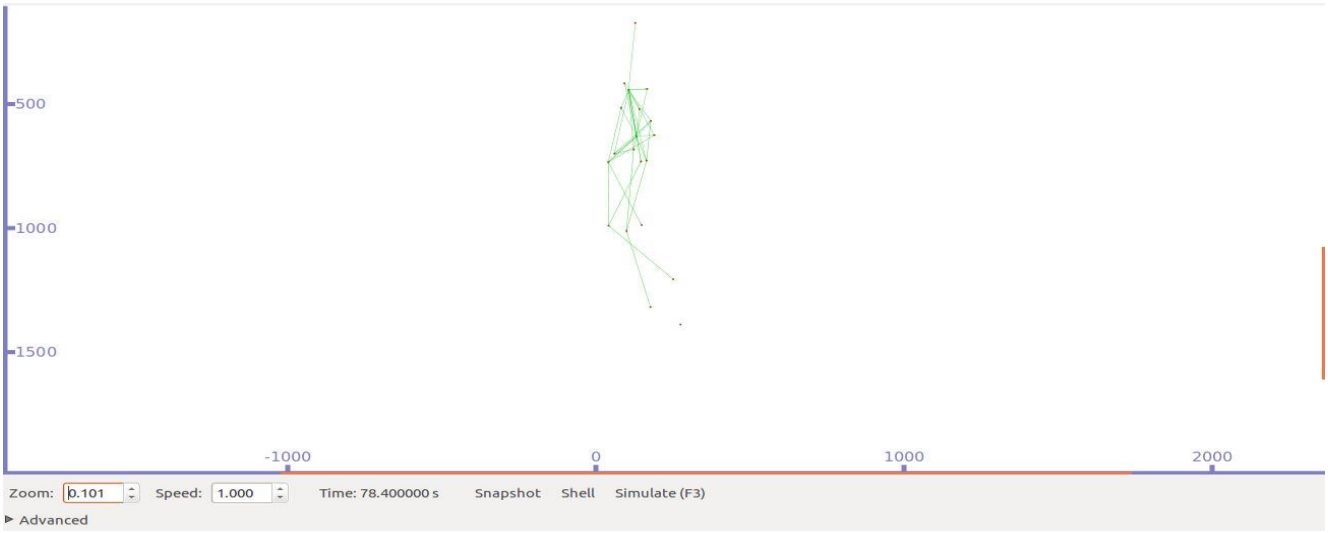

Fig.3 Simulation of DSR Protocol with 20 nodes

In Figure 3, it resonates the simulation of DSR routing protocol with 20 number of nodes with a transmission power of 7.5W and number of sinks as 10, which shows the communication path from the source to destination needed for wireless communication.

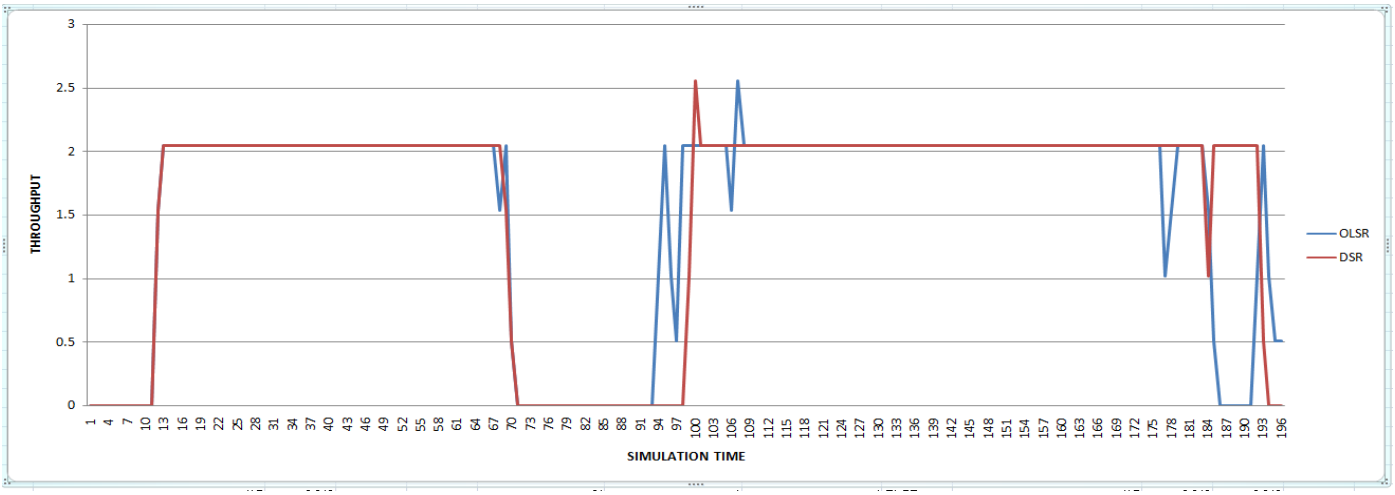

Fig.4 Simulation Time v/s Throughput with number of sinks as 1

In Figure 4, it shows the graph plotted between the simulation time and [6] throughput with number of sinks as 1. In this case OLSR performs better with a good overall throughput and produces the best result case.

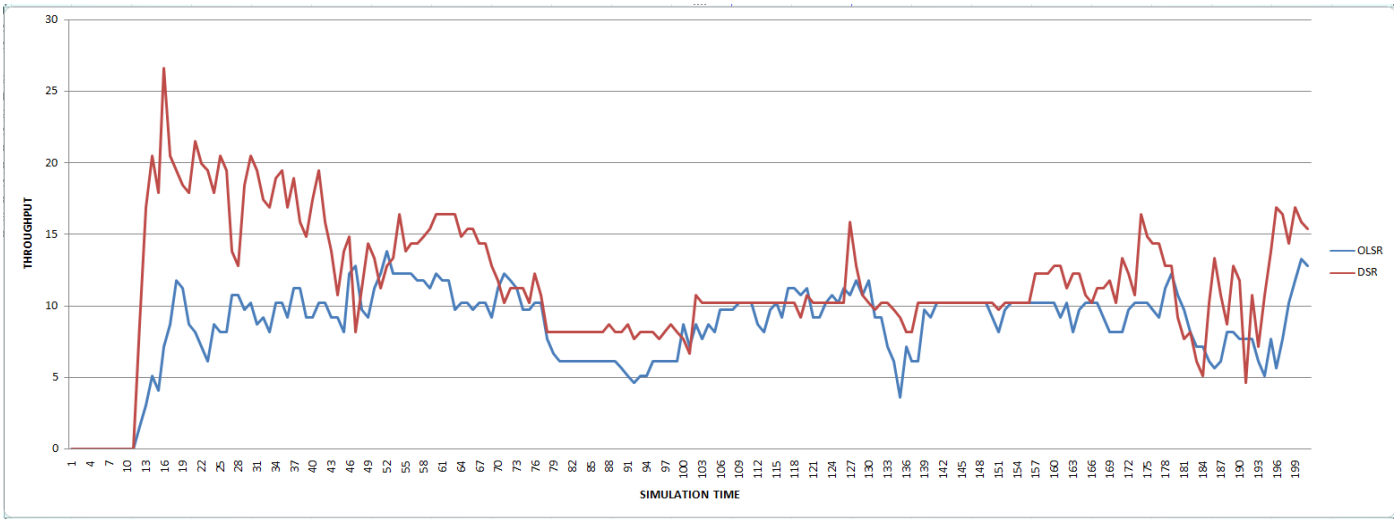

Fig.5 Simulation Time v/s Throughput with number of sinks as 10

In Figure 5, it shows the graph plotted between the simulation time and throughput with number of sinks as 10. In this case both the protocols function with the same and also show the same throughput rate by the end of total simulation time.

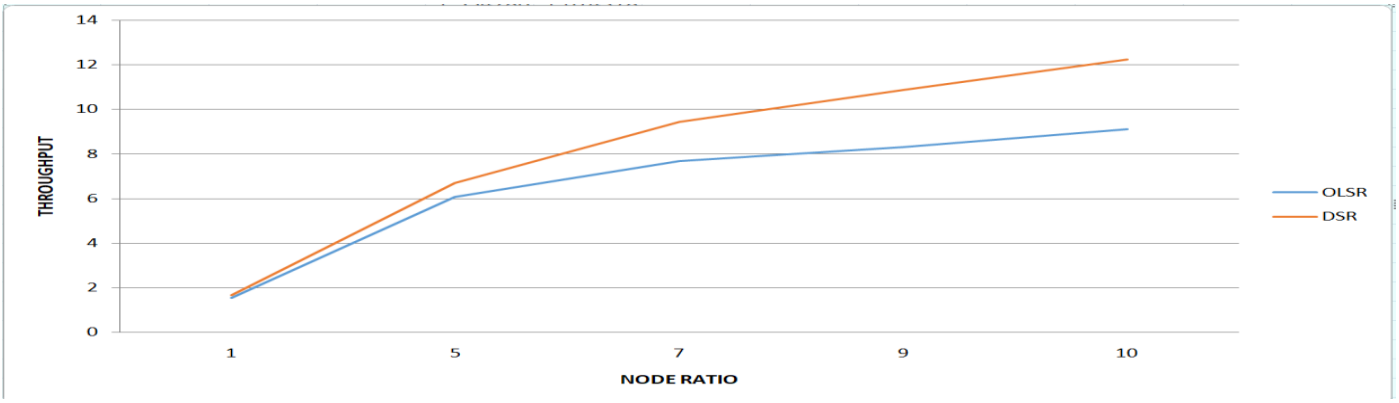

Fig.6 Node Ratio v/s Throughput

In Figure 6, it shows the graph plotted between node ratio and throughput which explains the scenario where when the ratio of number of nodes and nodes of sinks increases the throughput of the DSR protocol is high and the number of packets received in that particular unit time is higher.

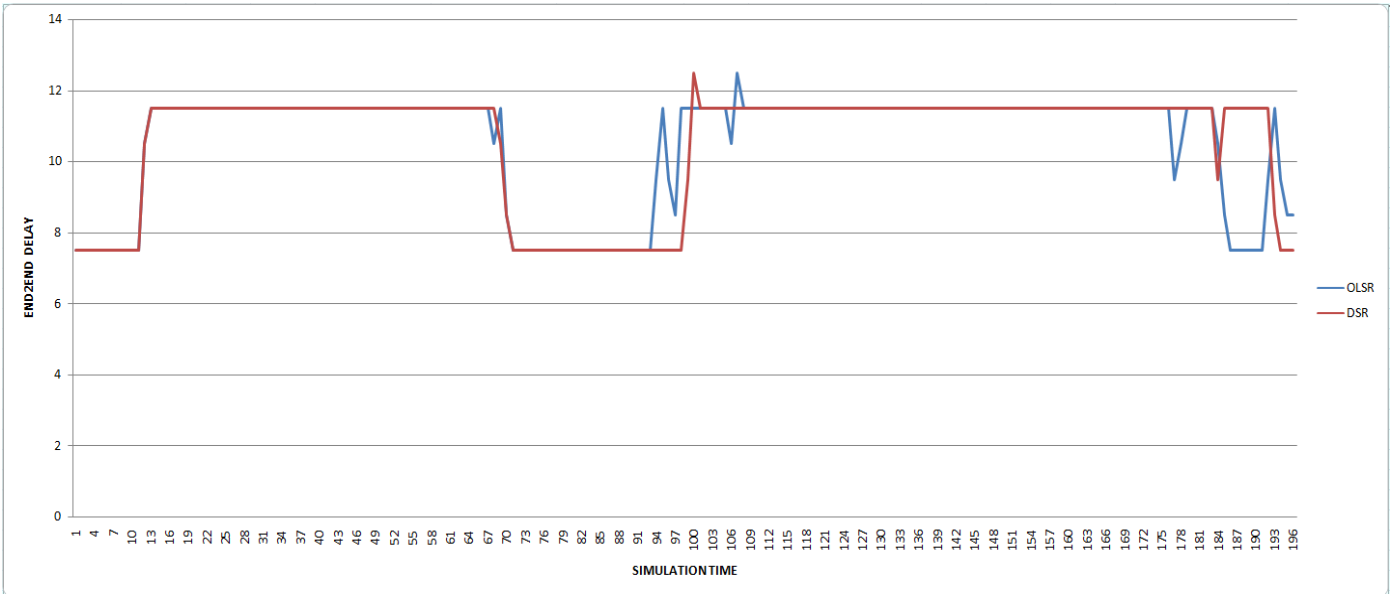

Fig.7 Simulation Time v/s End to End Delay with number of sinks as 1

In Figure 7, it shows the graph between simulation time and end to end delay with number of sinks as 1. This resultant output explains that the end to end delay is reduced between source and destination using OLSR protocol.

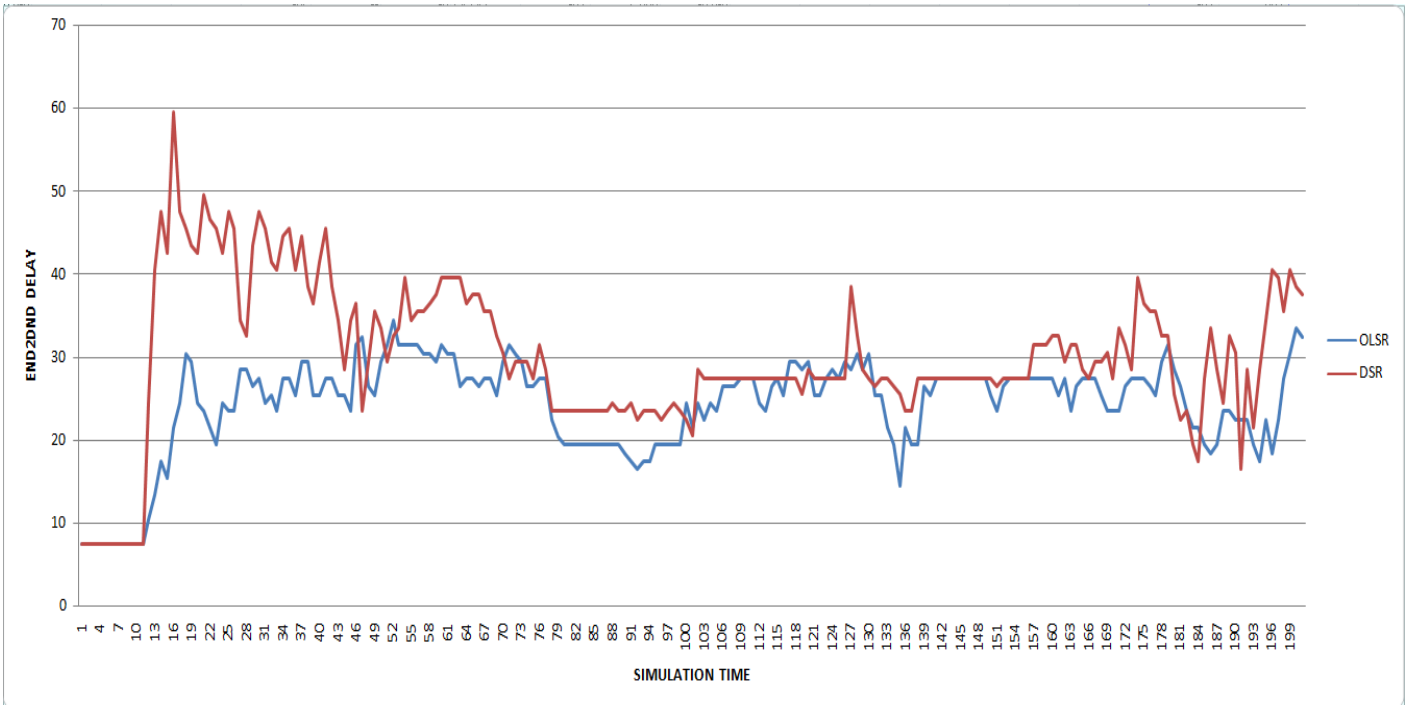

Fig.8 Simulation Time v/s End to End Delay with number of sinks as 10

In Figure 8, it shows the graph between simulation time and end to end delay with number of sinks as 10. This resultant output explains that the end to end delay is reduced between source and destination using OLSR protocol.

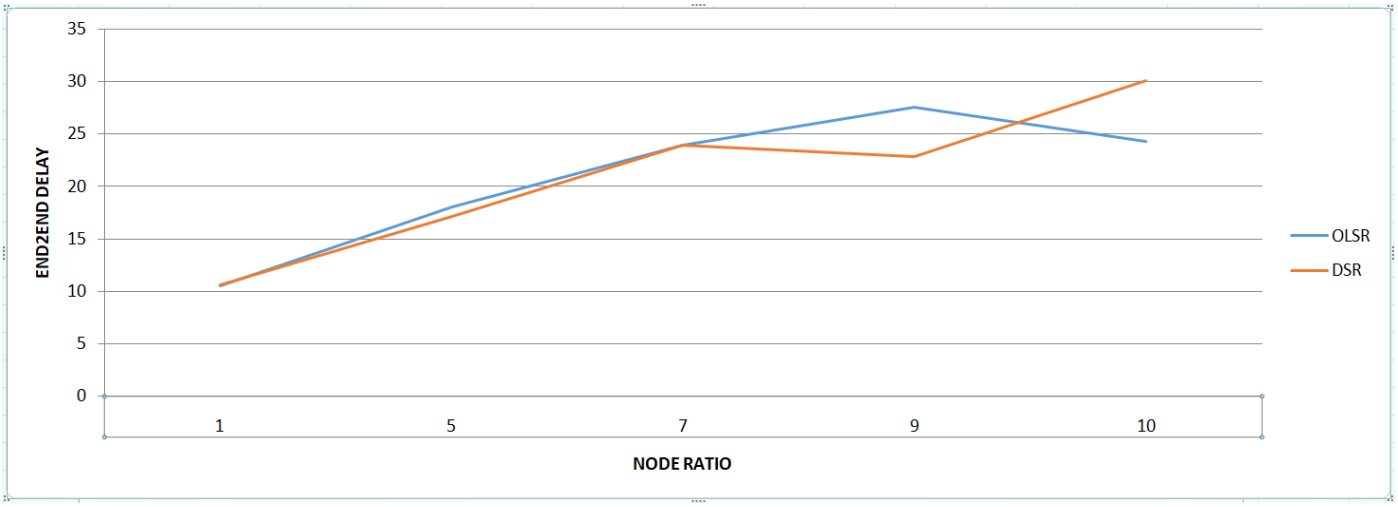

Fig.9 Node Ratio v/s End to End Delay

In Figure 9, it shows the graph plotted between node ratio and end to end delay which explains the scenario where when the ratio of number of nodes and nodes of sinks increases the end to end delay for OLSR [7] protocol decreases and due to this the protocol exhibits only a minute delay rate with the other neighbouring nodes.

VI. Conclusion and Future Scope

This paper intends to depict the results obtained in measuring the performance between the OLSR and DSR routing protocols which helps in analysing whether proactive or reactive protocols which is the most suitable depending on the different parameters considered. On considering different set of parameters generated using the CSV files this paper visualizes a set of resultant graphs. Based on the graphs obtained the concluded output [7] is that the OLSR (proactive) protocol works with a better efficiency for enabling wireless communication where as the number of sinks increases based on the simulation time, the end to end delay between the system decreases and also a minute delay rate would exist between nodes. In the other case using DSR (reactive) protocol as the node ratio increases the throughput generated within the unit of time also increases. On considering different scenarios in this paper an analysis is obtained for opting which protocol on what parameter basis for obtaining effective wireless communication paths.

In the future go there can be analysis of different such protocols that can be used for measuring performance of different wireless communication systems and increased ability for using them [8] in real time applications also increases. The different parameters such as jitter, area coverage, maximum and minimum node movement speeds, packet size, delay can be used to find out the performances of individual protocols accordingly and help in increasing the efficiency of real time systems.

VII. Bibliography

[1] Hassen Redwan Hussen, Sung-Chan Choi, Jaeho Kim, Jong-Hong Park, 2018, Performance Analysis of MANET Routing Protocols for UAV Communications, IOT Platform Research Centre, Korea Electronics Technology Institute (KETI), ICUFN, IEEE.

[2] Prabhat Kumar Sahu, Biswamohan Acharya, Niranjana Panda, QOS based Performance Analysis of AODV and DSR Routing Protocols in MANET, 2018 2nd International Conference on Data Science and Business Analytics, IEEE, Siksha 'O' Anusandhan Deemed to be University, Bhubaneshwar, India.

[3] P.Jacquet, P. Muhlethaler, T.Clausen, A. Laouiti, A. Qayyum, L. Viennot, 2016, Optimized Link State Routing Protocol for Ad Hoc Networks, Hipercom Project, IEEE, INRIA Rocquencourt, France.

[4] Shivani Attri, 2015 Performance Analysis of OLSR and DSR Routing Protocols for Static Wireless Sensor Networks (WSN), IJARCET, Maharshi Dayanand University, Delhi, India.

[5] Sudha Singh, S C Dutta, Dharmendra K Singh, 2013 A study on Recent Research Trends in MANET, IJRRCS, National Institute of Technology, Patna, India.

[6] Alex Hinds, Michael Ngulube, Shaoying Zhu, 2013 A Review of Routing Protocols for Mobile Ad-Hoc Networks (MANET), IJIET

[7] C Siva Ram Murthy, Ad Hoc Wireless Networks: Architectures and Protocols.

[8] Singh Sankalp Bahadur, Optimization of Routing Protocols in MANET using GA.