Influence of Routing Protocols through the Interpretation of TCP Variants in Mobile Ad Hoc Network.

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Abstract— MANET is a combination of uphold connected portable nodes. Nodes may have different processing capacity. For achieving reliable communication Transmission Control Protocol (TCP) is commonly used in MANET. In this research effect of two MANET routing protocols Destination-Sequenced Distance Vector Routing (DSDV) and DSR (Dynamic Source Routing Protocol) examine over the performance of three TCP Variants (TCP Vegas, TCP Veno and TCP High-Speed). We considered (Packet Loss Ratio, one end to the other -delay, Data Delivery Ratio and Throughput) as performance metrics and on mobility model named Random Waypoint with different density of nodes like 10, 20, 50, 75, and 100. NS2 simulation tool used to create scenario and get results. In conclusion, results suggest that which performance of routing protocol of DSR and DSDV under any TCP variant in case of packet loss and data delivery ratio. So DSR is an optimal choice for such applications that seek to enhance data delivery ratio and minimize packet loss ratio. On the other hand, overall performance of DSDV remained good for the measurement from one end to the other delay time and throughput under any TCP variant. Therefore such applications, that require minimum end-to-end-delay and high throughput, should employ DSDV routing protocol. The result of our current work included to be used as a guideline for the design of specific TCP enhancements for ad hoc networks.

Index Terms— DSR, DSDV, Performance Parameters, Network Simulator (NS-2), Mobile Ad hoc Network

1 Introduction

A Mobile Ad hoc Network (MANET) is autonomous, self-configuring network of mobile nodes that can be set up randomly and formed without the need of any existing network infrastructure or centralized administration. All nodes can be mobile resulting in a possibly dynamic network topology which is a real challenging issue in mobile ad hoc networks. The dynamic nature of MANET topology imposes the use of efficient routing protocols that ensure the delivery of packets safely to their destinations with acceptable delays. Simulation studies of MANET routing protocols have mostly considered Random Waypoint as a reference mobility model. In order to examine many different MANET applications, there is a need to provide additional mobility models. There is various mobility models such as Random Way Point, Many researches have been focused on the evaluation of routing protools according to nodes mobility: a performance comparison of DSR protocols based on Manhattan Grid (MG) model has been published by [5]. A performance study of DSR considering probabilistic random walk and boundless simulation area has been presented in R. Al-Ani research 2011. A performance evaluation of DSDV using scenario based mobility models has been presented in. A comparative analysis of DSR and DSDV protocols, considering Random Waypoint, Group Mobility, Freeway and MG models can be found in various papers, Per-

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ISSN 2229-5518

formance Analysis and Comparison of MANET Routing Protocols vs. Mobility Models is presented in last two year but didn't evaluate the positive results by [6].

The rest of this paper is organized as follows Quantitative approach is use to carried out this research. NS2 simulation tool was used to acquire the results. First of all the required software are installed and simulation environment is created. NS2 simulation tool is installed in windows operating system by using CYGWIN. Third party software bonnmotion 2.1 is installed and movement of nodes is created using Random Waypoint mobility model reffered by [4]. In first scenario 10 nodes are use and placed randomly on 1000m x 1000m area. After that each TCP variant is examined using DSR routing protocol. In next scenario only changing DSR with DSDV routing protocol same simulation run with all proposed variants and results collected. After that all size of network like 20, 50, 75 and 100 mobile nodes were inputted in simulation and simulation run on both routing protocols. Total 30 different scenarios were created and simulation runs.

2 Review of Literature

TCP is the Internet's mostly common protocol being used transport control protocol. TCP's strength deceits in the control algorithm, adaptive nature of its overcrowding prevention and its mechanism of retransmission, it was first projected as a part of TCP Tahoe. Reno and New Reno versions of TCP contained it. TCP Vegas suggests primarily altered overcrowding prevention arrangement from that of TCP Tahoe [1]. Key control tools of TCP are mechanisms for avoiding controlling and congestion. Routing protocols are usually engaged to determine the routes following a set of rules that enables two or more devices to communicate with each other. In an ad hoc network routes are enabled in between the nodes using multi-hop, as the propagation range of the wireless radio is limited. The nodes engaged in traversing the packets over MANET are not aware of the topology of the network [2].

2.1 Routing Protocols Description

Two routing protocols are considered in this paper, namely; DSR and DSDV. Below is a brief description of each protocol: Dynamic Source Routing (DSR) and Destination Sequenced Distance Vector (DSDV) Protocol.

2.2 Dynamic Source Routing (DSR)

The Dynamic Source Routing (DSR) is a reactive routing protocol designed specifically for use in multi-hop wireless ad hoc networks of mobile nodes. In this protocol each source determines the route to be used in transmitting its packets to selected destinations [4]. There are two main components, called Route Discovery and Route Maintenance. Route Discovery is the mechanism by which a node wishing to send a packet to a destination obtains a path to the destination. Route Maintenance is the mechanism by which a node detects a break in its source route and obtains a corrected route. The sender knows the complete hop by hop route to the destination. These routes are stored in a route cache [3]. The protocol allows multiple routes to any destination and allows each sender to select and control the routes used in routing its packets, for example for use in load balancing or for increased robustness. The DSR protocol is designed mainly for mobile ad hoc networks of up to about two hundred nodes, and is designed to work well with even very high rates of mobility [7].

2.3 Destination Sequenced Distance Vector (DSDV) Protocol

The Destination Sequenced Distance Vector routing protocol is a proactive routing protocol based on the Bellman-Ford routing algorithm. It was developed by [9]. This protocol adds a new attribute, sequence number, to each route table entry at each node. Each node in the mobile network maintains a routing table in which all of the possible destinations within the non-partitioned network and the number of routing hops to each destination are recorded by [8]. In this protocol, packets are routed between nodes of an ad hoc network using routing tables stored at each node. Each routing table, at each node, contains a list of the addresses of every other node in the network. Along with each node's address, the table contains the address of the next hop for a packet to take in order to reach the node. This protocol was motivated for the use of data exchange along changing and arbitrary paths of interconnection which may not be close to any base station [10].

3 Simulation Environments

NS2 simulation tool was used to acquire the results. First of all the required software are installed and simulation environment is created. NS2 simulation tool is installed in windows operating system by using CYGWIN. Third party software bonnmotion 2.1 is installed and movement of nodes is created using Random Waypoint mobility model. In first scenario 10 nodes are use and placed randomly on 1000m x 1000m area. After that each TCP variant is examined using DSR routing protocol. In next scenario only changing DSR with DSDV routing protocol same simulation run with all proposed variants and results collected. After that all size of network like 20, 50, 75 and 100 mobile nodes were inputted in simulation and

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ISSN 2229-5518

simulation run on both routing protocols. Total 30 different scenarios were created and simulation runs.

3.1 Simulation Parameters

The simulation parameters are listed in Table.

Table: Simulation Parameters

Environment Attributes	Attribute Values
Simulator	NS-2 (Version 2.34)
Protocols	DSR and DSDV
Performance Metrics	End-to-end-delay,Throughput,Data Delivery Ratio, Packet Loss Ratio
Simulation Time in Each Scenarios	500 Seconds
Number of nodes	10, 20, 50, 75 and 100
Maximum Speed of Mobile Nodes	10 Meter / Second
Simulation Area	1000m x 1000m
Packet Size	512 Bytes

3.2 Performance Parameters

This paper analyzed the following important performance parameters for compared the DSR and DSDV routing protocols:

➢ Data Delivery Ratio

It is the ratio of all received data packets successfully at destinations and all data packets sent by sources.

➢ Average end-to-end Delay

It represents the delay encountered between the sending and receiving of the packets. It is the time from the transmission of data packet at a source node until packet delivery to a destination which includes all possible delays caused by:

- Buffering during route discovery process
- Retransmissions delays
- Queuing at Interface Queue
- Propagation and transfer times of data packet.

➢ Throughput

It is the average number of messages successfully delivered per unit time.

➢ Packet Loss Ratio

It defines the Packet loss ratio in between the range of lost from the quantity of packets originated by the sources to sink (destination node) at the ultimate destination.

4 Simulation Results and Analysis

4.1 Simulation Results:

		Throughput Bits/seconds		Packet Loss Ratio %		End to End Delay Milli-seconds		Data Delivery Ratio %	
Nodes		DSR	DSDV	DSR	DSDV	DSR	DSDV	DSR	DSDV
10	Vegas	547	541.58	0.02	0.14	819.72	798.84	99.98	99.86
20	Vegas	540.91	524.893	0.11	0.29	1564.82	1401.73	99.89	99.71
50	Vegas	453.92	441.13	0.22	0.61	3043.24	1940.66	99.78	99.39
75	Vegas	400.39	412.99	0.06	0.97	3594.95	2155.87	99.94	99.03
100	Vegas	227.97	365.67	0.06	1.52	5454.59	2276.65	99.94	98.48
10	Veno	546.8	531.2	0.01	0.14	821.54	776.71	99.99	99.86
20	Veno	538.65	519.933	0.16	0.27	1537.67	1363.99	99.84	99.73
50	Veno	454.94	438.22	0.09	0.69	3197.93	2149.61	99.91	99.31
75	Veno	385.12	417.77	0.09	1.03	3958.03	2146	99.91	98.97
100	Veno	546.8	531.2	0.06	0.14	4854.02	776.71	99.94	99.86
10	High speed	542.48	531.66	0.03	0.17	805.59	792..40	99.97	99.83
20	High speed	536.39	514.973	0.13	0.23	1564.72	1469.74	99.87	99.77
50	High speed	456.44	450.36	0.14	0.86	3211.68	1942.49	99.86	99.14
75	High speed	386.25	411.77	0.11	1.15	3862.27	2122.18	99.89	98.85
100	High speed	230.87	367.05	0.06	1.32	5337.04	2353.74	99.94	98.68

Simulation Results

4.2 Performance Analysis on 10 Numbers of Mobile Nodes

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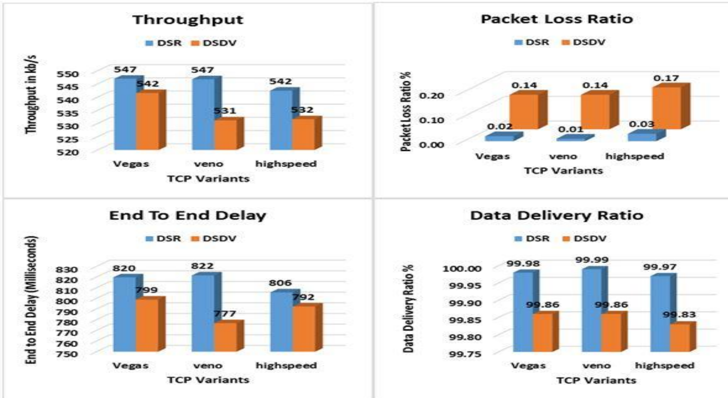
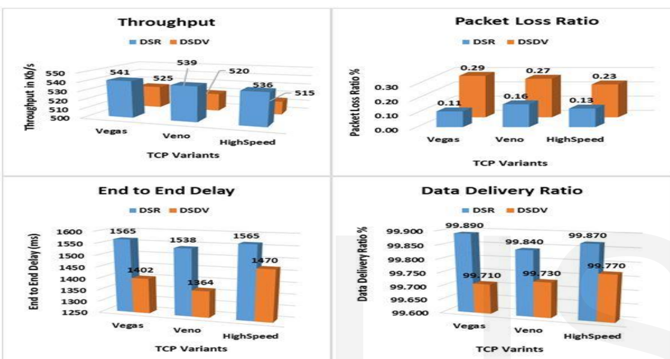
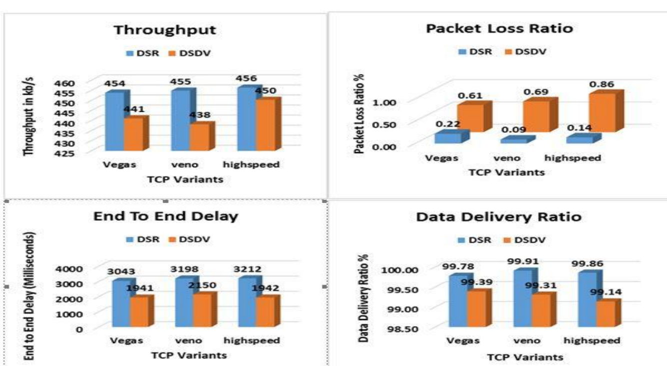
ISSN 2229-5518



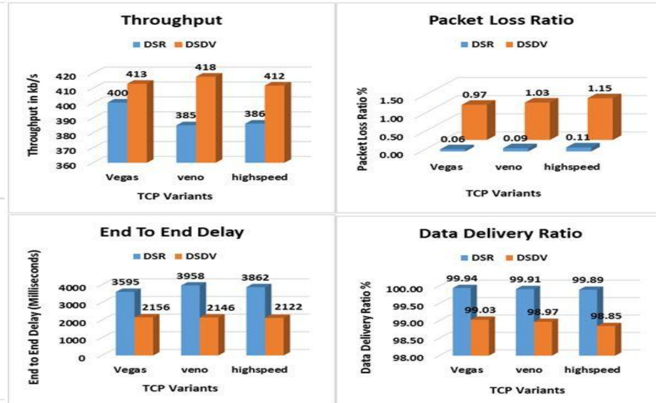
4.3 Performance Analysis on 20 Numbers of Mobile Nodes:



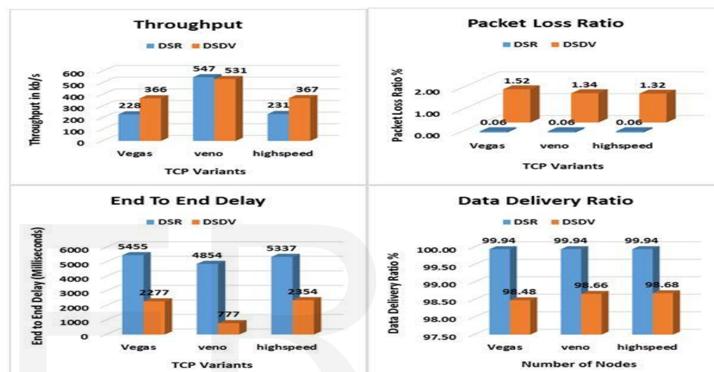
4.4 Performance Analysis on 50 Numbers of Mobile Nodes:



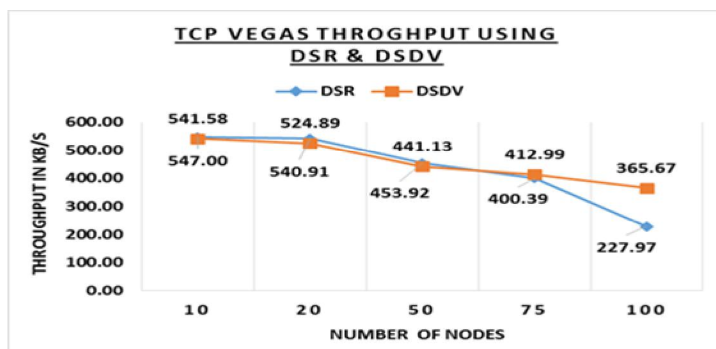
4.5 Performance Analysis on 75 Numbers of Mobile Nodes:



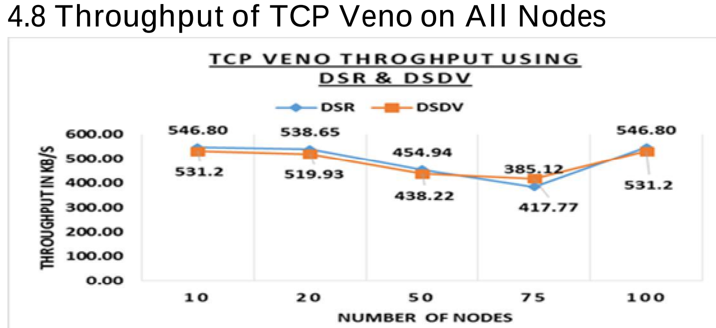
4.6 Performance Analysis on 100 Numbers of Mobile Nodes



4.7 Throughput of TCP Vegas on All Nodes:



4.8 Throughput of TCP Veno on All Nodes



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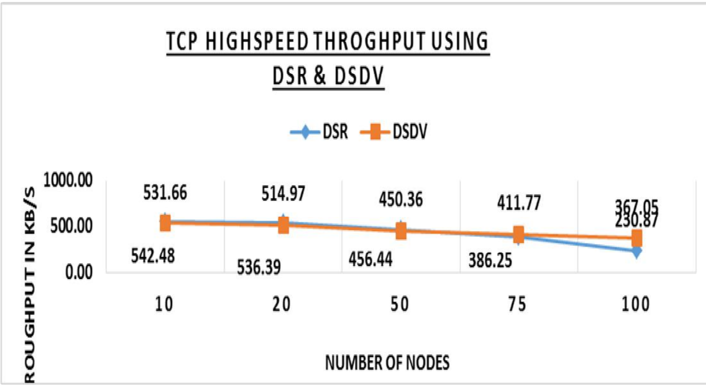
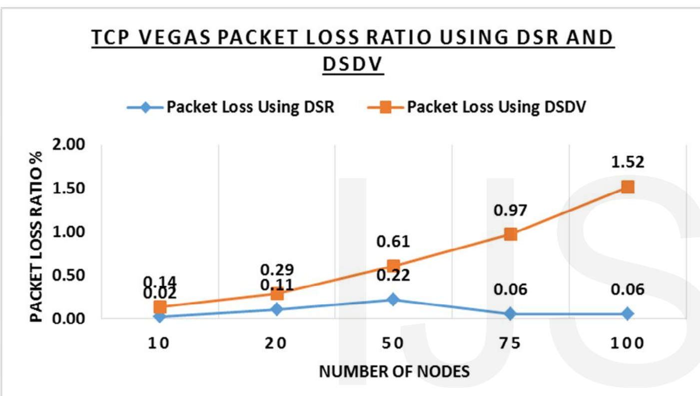
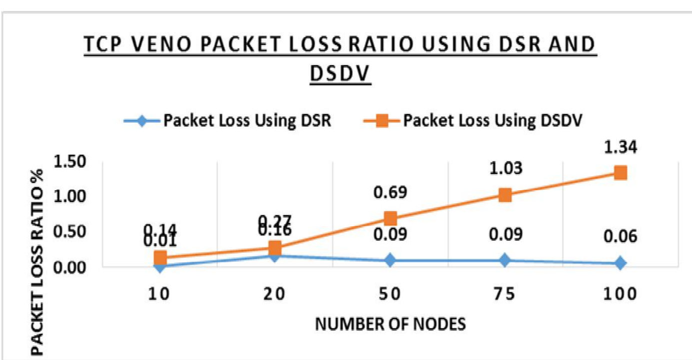
4.9 Throughput of TCP High-Speed on All Nodes



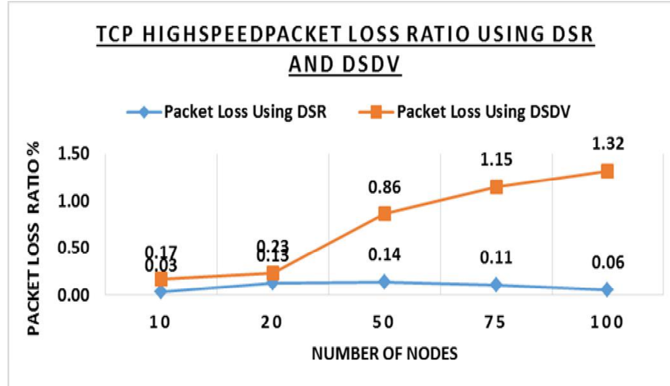
4.10 Packet Loss Ratio of TCP Vegas on All Nodes:



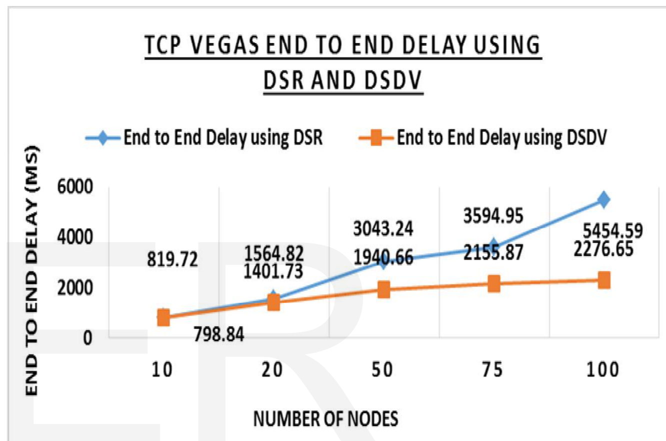
4.11 Packet Loss Ratio of TCP Veno on All Nodes



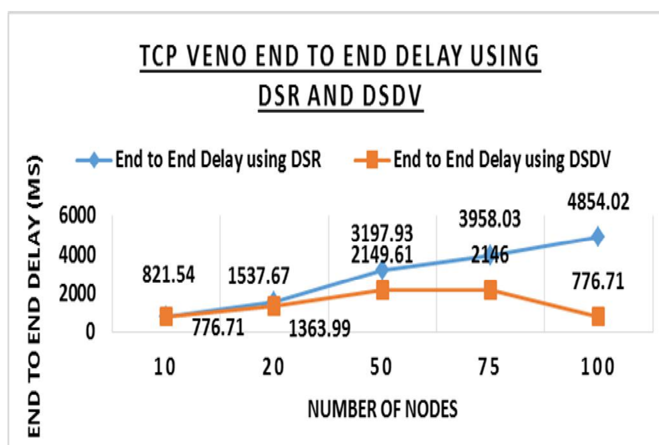
4.12 Packet Loss Ratio of TCP High-Speed on All Nodes:



4.13 End-to-End Delay of TCP Vegas on All Nodes:



4.14 End-to-end-delay of TCP Veno on All Nodes:



4.15 End-to-end-delay of TCP High-Speed on All Nodes:

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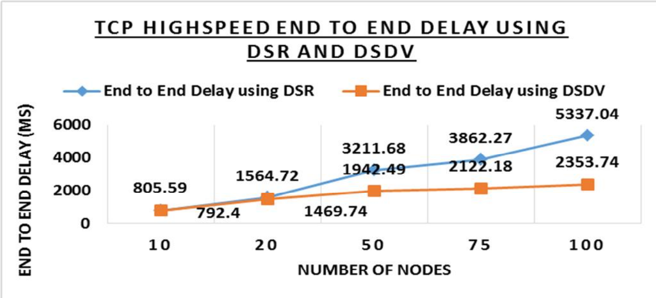
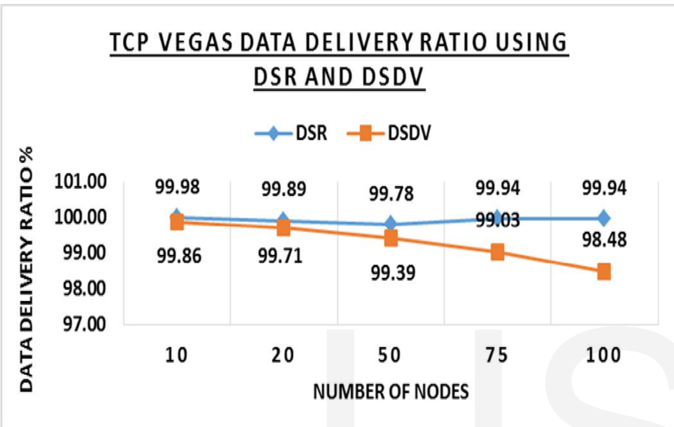
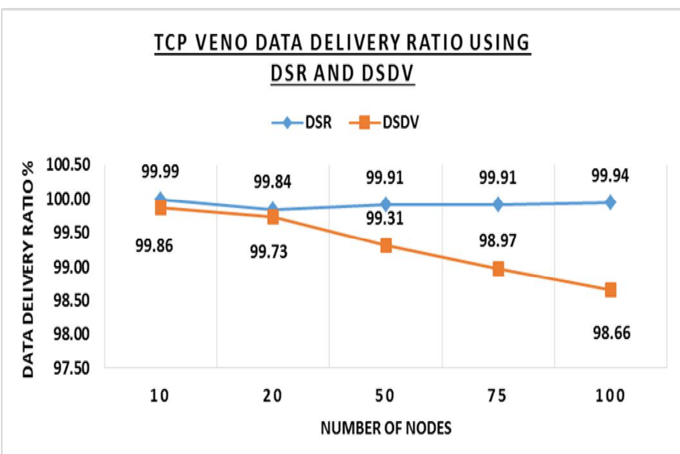


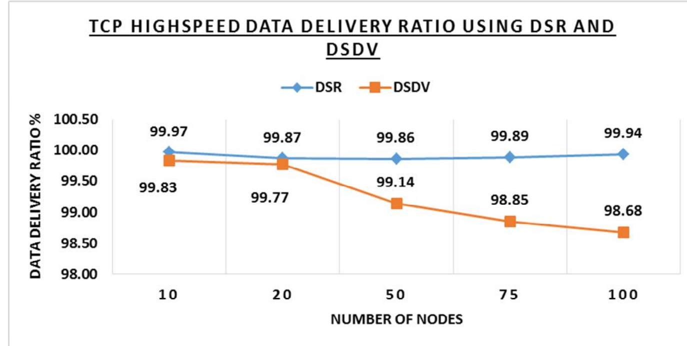
4.16 Data Delivery Ratio of TCP Vegas on All Nodes:



4.17 Data Delivery Ratio of TCP Veno on All Nodes:



4.18 Data Delivery Ratio of TCP High-Speed on All Nodes:



Conclusion

Performance results revealed during this research shown that selection of any proposed TCP variant for any MANET routing protocol heavily depend on the choice of application to be used. Because some applications can be delay sensitive and some can require high throughput with minimum packet loss ratio during data transmission. For this research work, the main focus is to measure the performance of two routing protocols DSDV and DSR using TCP variants of vegas, veno and high-speed over the metrics of end-to-end-delay, data delivery ratio throughput and packet loss ratio. DSR protocol provides efficient performance while using any variant of TCP in small to medium sized network up to 50 nodes in three performance metrics throughput, packet loss ratio and data delivery ratio. Conversely, performs of DSDV is stable and superior to DSR in large networks under parameters of end-to-end-delay and throughput with tradeoff data delivery ratio and packet loss. Comparison suggests that performance of DSR under packet loss and data delivery ratio in all sizes of network remains dominated using any TCP variant. To conclude, results suggest that performance of DSR is much better than DSDV under any TCP version in case there is packet damage and data delivery ratio. So DSR should be an optimum choice for such applications that seek to improve data delivery ratio and decrease packet loss ratio. Alternatively, efficiency of DSDV remains good for the metrics of throughput and end-to-end-delay under any TCP version. Therefore such applications, that require minimum end-to-end-delay and high throughput, should employ DSDV routing protocol.

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