PERFORMANCE COMPARISON OF TCP VARIANTS FOR WIRELESS SENSOR NETWORKS

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Abstract: Mobile Ad hoc Networks (MANETs) are a collection of mobile nodes forming a dynamic autonomous network.Wireless-capable devices may operate as autonomous entities, communicating via multiple wireless hops without a pre-established fixed infrastructure. Nodes can also join or leave the network freely and arbitrarily without any restriction. Routing in WSN is becoming more complex compared to in a typical wired LAN or ad-hoc network. Therefore, a detailed analysis is required in order to gain an insight of these factors that determine the performance of the routing protocol. More specifically, it would be important to study how the different network parameters and protocols interact, and to what extent each of the individual factors affects the routing performance observed from the transport layer, i.e., the TCP. It is observed that Vegas gives better performance as compared to other variants of TCP.

***Index Terms*⁚** WSN, AODV, DSR, DSDV, MANET, RENO, TCP, SACK, VEGAS

I. INTRODUCTION:

Wireless access points, representing a fixed infrastructure, allow devices equipped with wireless adapters to be linked together in a Local Area Network (LAN) and to get access to the Internet. Wireless-capable devices may operate as autonomous entities, communicating via multiple wireless hops without a pre-established fixed infrastructure. Such a network is called a Mobile Ad-hoc Network (MANET) where the nodes employed in the network can change their location from time to time.

Because of the lack of centralized control and frequent changes of network topology, routing becomes a vital issue and a major challenge in wireless networks. Transmission Control Protocol (TCP) is also needed to establish a reliable end-to-end connection in the network. the TCP also facilitates in managing the flow and congestion control in the data communication mechanism. Due to congestion problem, the network performance can go down by several orders of magnitude. As a consequence of that, the TCP executes four intertwined algorithms, which prevent senders from overwhelming the TCP receiver. The algorithms are defined as slow-start, congestion-avoidance, fast-retransmit and fast-recovery [3]. By implementing these mechanisms, the TCP can realize the throughput maximization so as to maintain a high performance of the network.

Manuscript received Oct 2014.

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II. EXISTING ARCHITECTURE:

The idea of mobile ad-hoc networking is sometimes also known as infrastructure-less networking as it does not require any servers, routers, access-points or cables. Instead, a MANET is comprised of a set of autonomous mobile nodes where the nodes must work together in a distributed manner to enable routing among them. Consequently, a variety of MANET routing protocols has evolved over recent time. Examples of such routing protocols are, among others Optimized Link State Routing (OLSR) protocol Wireless Routing Protocol (WRP) Ad-hoc On-Demand Distance Vector (AODV) routing protocol [39], Dynamic Source Routing (DSR) protocol . Among several TCP variants, five types are considered important for our investigation namely TCP Reno, TCP New Reno, TCP Tahoe, TCP Vegas and TCP Selective Acknowledgment (SACK). These five variants are reckoned as the most prominent transport layer mechanisms.

ANALYSIS OF EXISTING ARCHITECTURE:

For our work to be done successfully we have used MANET scenario with varying node density which are 30, 40 and 50 nodes and constant 100 sec under dynamic scenario using various routing protocols. We have reached to the results with the help of various performance matrices for now we have used following performance matrices.

1. End to End Delay
2. Packet Delivery Ratio
3. Residual Energy

III. A DETAILED ANALYSIS OF ABOVE MENTIONED MATRICES ARE AS FOLLOWS.

3.1 End to End Delay

(A) End to End Delay for AODV nodes:- Figure shows the End to End Delay under various node density i.e. 30, 40 and 50 nodes for AODV routing protocol.

III.I(a) End To End Delay for AODV

End to End Delay for AODV					
No. of Nodes	NewReno	RENO	TCP	SACK	Vegas
30 node	157.506	161.805	146.735	154.786	35.7482
40 node	332.825	507.088	339.32	496.123	54.8288
50 node	234.306	350.673	234.306	390.48	234.306

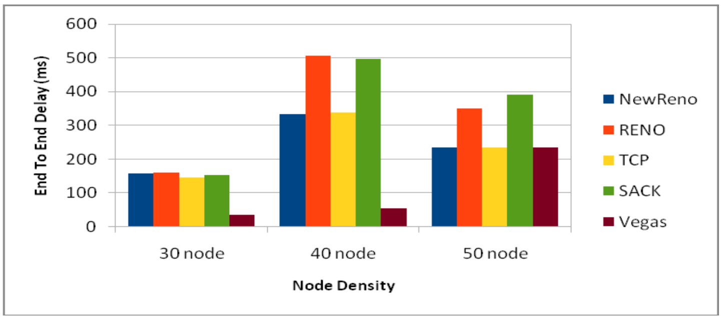

Fig: 3.1(a) End To End Delay for AODV

(B) End to End Delay for DSDV nodes:- Figure shows the End to End Delay under various node density i.e. 30, 40 and 50 nodes for DSDV routing protocol.

III.I(b) End To End Delay for DSDV

End to End Delay for DSDV					
No. Of Nodes	NewReno	RENO	TCP	SACK	Vegas
30 nodes	139.4	137.7	138.3	139.4	23.9
40 nodes	131.1	131.5	131.1	131.1	22.6
50 nodes	146.4	142.7	145.1	142.8	146.4

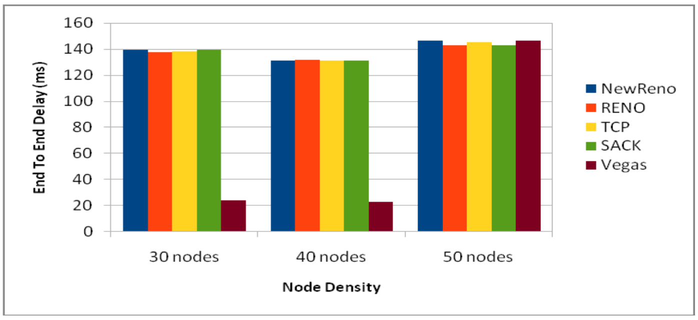

Fig: 3.1(b) End To End Delay for DSDV

(C) End to End Delay for DSR nodes:- Figure shows the End to End Delay under various node density i.e. 30, 40 and 50 nodes for DSR routing protocol.

III.I(c) End To End Delay for DSR

End to End Delay for DSR					
No. Of Nodes	NewReno	RENO	TCP	SACK	Vegas
30 nodes	182.58	191.75	182.68	189.27	137.99
40 nodes	200.24	213.41	429.395	449.7	56.119
50 nodes	461.32	253.66	461.32	502.58	461.32

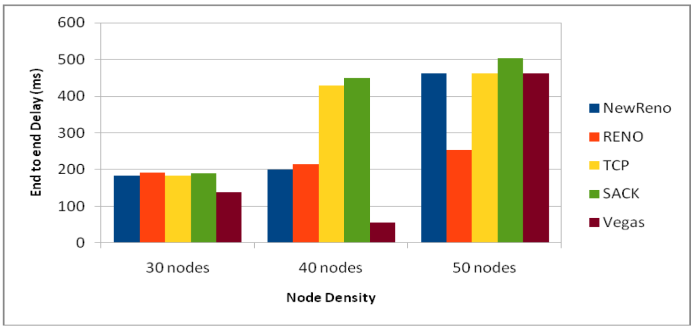

Fig: 3.1(c) End To End Delay for DSR

3.2 Packet Delivery Ratio

(A) Packet Delivery Ratio for AODV:- Figure shows the PDR under various node density i.e. 30, 40 and 50 nodes for AODV routing protocol.

III.II (a) Packet Delivery Ratio for AODV

Packet Delivery Ratio for AODV					
No. of Nodes	NewReno	RENO	TCP	SACK	Vegas
30 node	96.98	96.23	96.19	96.68	97.27
40 node	93.98	94.15	94.98	92.89	97.56
50 node	91.08	94.31	91.08	87.78	91.08

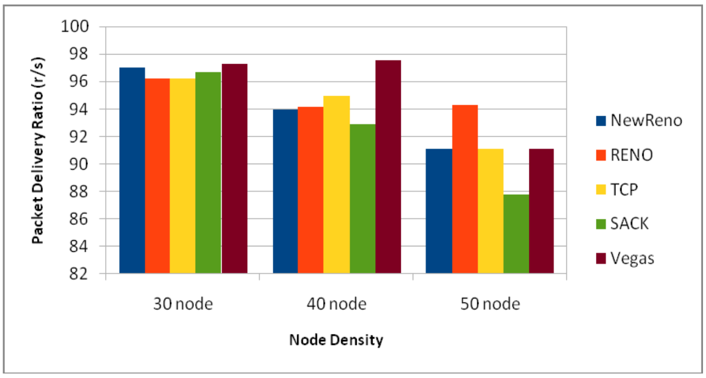

Fig: 3.2(a) Packet Delivery Ratio for AODV

(B) Packet Delivery Ratio for DSDV:- Figure shows the PDR under various node density i.e. 30, 40 and 50 nodes for DSDV routing protocol.

III.II (b) Packet Delivery Ratio for DSDV

Packet Delivery Ratio for DSDV					
No. of Nodes	NewReno	RENO	TCP	SACK	Vegas
30 nodes	93.6	92	92.8	92.9	93.1
40 nodes	90.5	90.5	90.5	90.5	26.1
50 nodes	85.5	85.3	85.1	85.4	85.5

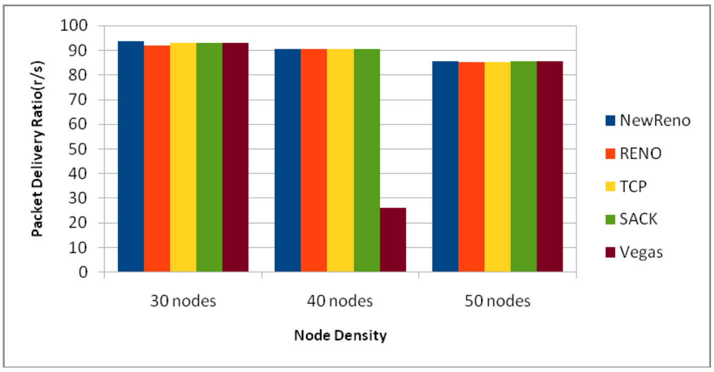

Fig: 3.2(b) Packet Delivery Ratio for DSDV

(C) Packet Delivery Ratio for DSR:- Figure shows the PDR under various node density i.e. 30, 40 and 50 nodes for DSR routing protocol.

III.II (c) Packet Delivery Ratio for DSR

Packet Delivery Ratio for DSR					
No. of Nodes	New Reno	RENO	TCP	SACK	Vegas
30 nodes	96.49	96.79	96.16	97.51	92.11
40 nodes	81.17	97.06	96.22	96.9	97.05
50 nodes	94.54	95.41	94.54	93.39	94.54

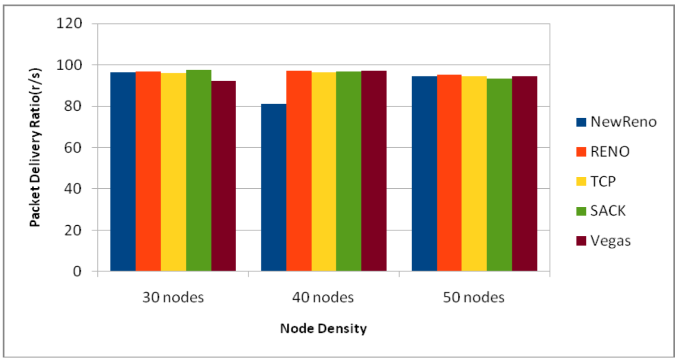

Fig: 3.2(c) Packet Delivery Ratio for DSR

3.3 Residual ENERGY

(A) Residual Energy for AODV:- Figure shows the Residual Energy under various node density i.e. 30, 40 and 50 nodes for AODV routing protocol.

III.III (c) Residual Energy for AODV

Energy for AODV					
No. of Nodes	NewReno	RENO	TCP	SACK	Vegas
30 node	31.952	32.89	29.569	30.819	44.89
40 node	26.45	29.13	28.74	29.701	27.72
50 node	26.66	27.43	26.66	28.05	26.66

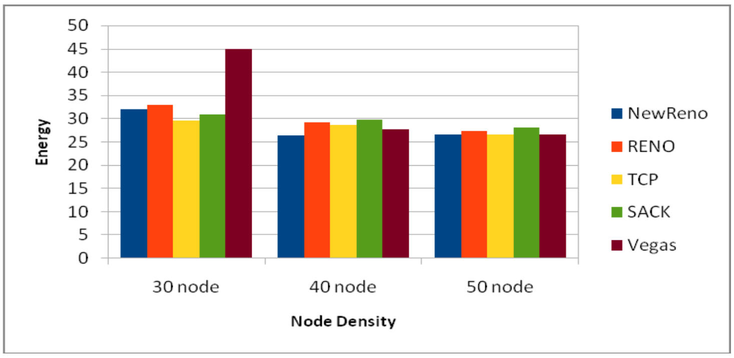

Fig: 3.2(a) Residual Energy for AODV

(B) Residual Energy for DSDV:- Figure shows the Residual Energy under various node density i.e. 30, 40 and 50 nodes for DSDV routing protocol.

III.III (b) Residual Energy for DSDV

Energy for DSDV					
No. of Nodes	NewReno	RENO	TCP	SACK	Vegas
30 nodes	60.81	62.37	63.94	61.59	60.88
40 nodes	51.34	52.91	51.34	52.13	97.81
50 nodes	60.74	62.27	63.83	61.5	60.74

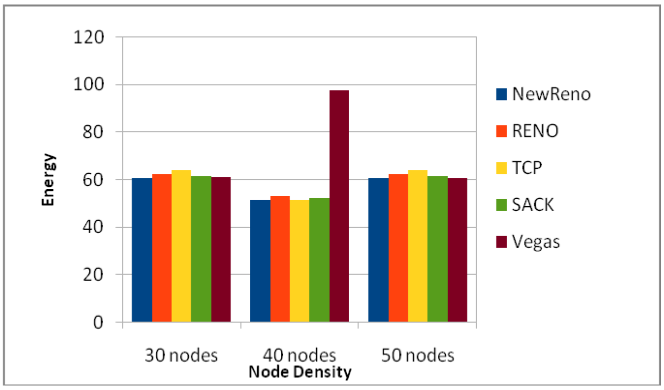

Fig: 3.3(b) Residual Energy for DSDV

(C) Residual Energy for DSR:- Figure shows the Residual Energy under various node density i.e. 30, 40 and 50 nodes for DSR routing protocol.

III.III (c) Residual Energy for DSR

Energy for DSR					
No.of Nodes	NewReno	RENO	TCP	SACK	Vegas
30nodes	36.45	28.94	47.71	28.13	80.89
40nodes	26.55	26.8	28.76	27.82	26.64
50nodes	28.81	28.88	28.81	28.3	28.81

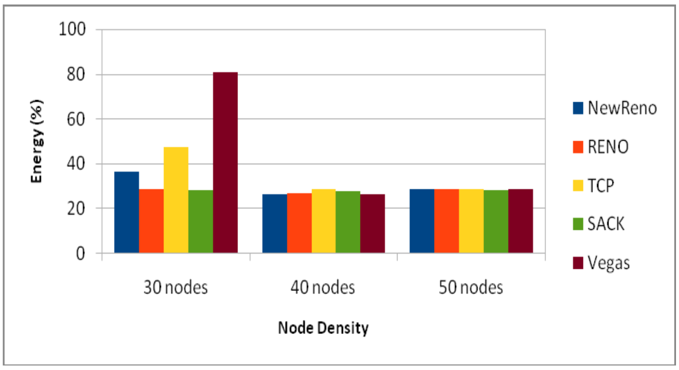

Fig: 3.3(c) Residual Energy for DSR

IV. Conclusions:

The detailed study in MANET over five main variants which are Reno, NewRENO, TCP, SACK and Vegas concluded that DSR and DSDV protocols performs better with PDR for all variants. Also Packet Delivery Ratio for SACK is better as compared to other variant. But TCP variant Vegas is giving good result with End to End Delay and energy.

V. Future Enhancement:

Current research work has focused on few parameters like End-to-end, Packet Delivery Ratio, and Residual Energy. But there are also other efficiency parameters of TCP like packet drops, Flow control , Error control and connection control and throughput which can be studied in future.

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