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Performance Metrics of AODV, DSDV and DSR Protocols in Wireless Sensors Network

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Abstract: The wireless sensors network (WSN) consists of various nodes having capabilities of sensing, computing and communicating data. Thus for communications, various routing protocols came into existence which includes AODV, DSDV and DSR etc. These routing protocols consume energy while routing but provides the best delivery in packets among source an destinations. Each of these routing protocols has its various properties on the basis it can send data to the destination. Thus in this paper, various pursuance investigation is done on these routing protocols i.e. AODV, DSDV, DSR and are compared by taking in to consideration various simulation scenarios i.e. 30, 35, 40, 50 and 100. These results are simulated and compared using NS2 simulator.

Keywords: AODV; DSDV; DSR; Throughput; WSN; Packet Delivery; Energy Consumption and Routing Overhead.

I. INTRODUCTION

The wireless sensor networks (WSN) is comprised of individualistic sensor nodes that are deployed in area engaged in conjointly for monitoring different environments using radio signals. The WSN's advancement in research has proved beneficial for military applications and is extended to other areas like monitoring of industries, traffic controlling and health surveillance. The advancements in WSNs deployment at large scale is taken for revelation process because of easy deployment of sensor nodes. However, the sensors have various constraints like power depletion, limited memory, low bandwidth and lack of processing power giving rise to decrease the network's lifetime. This is due to the reason that the networks once deployed are left unattended at remote places, yet energy constraint routing should be formulated to increase the lifetime of network. Various researchers have tried to remove the energy constraint by proposing various routing protocols that can be taken as optimal solution for the network. Even the existing routing techniques were deployed for testing purposes and finding the gaps among the research. Thus, researchers modified the existing techniques in order to decrease or almost removing the constraints related to WSN. During the deployment of routing it has been assumed that routing, source and destination will be in stationary mode which is quite not possible in real environment..Thus, in order to increase the lifetime, routing is considered in which the sensor will consume very less power at the time when not in process of revelation. In hierarchical routing various researchers have tried to send data to destination in an easy way but due to large number of sensors deployed, the energy is dissipated in sending data as sensors send the data in omnidirectional and its sending is blocked due to the others sensors request of acknowledgements and traffic of signals within range. Thus in order to remove this constraint, it is taken into consideration that few number of nodes will be added to the network as the distance among source and destination increases. This research proved better and provides a good routing technique for sending data to destination but is not taken at far level. The routing protocols such as AODV, DSDV and DSR came into existence for sending data. Each of this protocol has their advantages and constraints if taken independently and is made for very small networks. AODV is used for routing on demand protocol. It helps in creating a route only if the connection by network is requested and at each level it stores the routing information at the source in finding the exact path of route by taking into consideration of routing tables. Destination Sequenced Distance Vector is a loop free routing protocol in which the shortest-path calculation is based on the Bellman-Ford algorithm. Data packets are transmitted between the nodes using routing tables stored at each node. DSR is a reactive routing protocol for ad hoc wireless networks. It also has on-demand features like AODV but it is not table-driven.

The rest of the paper is organised as following. The section II discusses the related work. The various WSN routing protocols are discussed in Section III. Simulation tool and performance metrics are presented in Section IV. Section V is comprised of Simulation Results drawn. Finally, the main conclusion is drawn in Section VI.

II. RELATED WORK

The recent interest of researchers for exploration of oceans had brought a revolution among the field of research in order to generate various revelation techniques for WSN. The researcher have proposed Dynamic Source based routing (DSR) which helped in getting information of routing from traffic due to the reason that DSR stores complete information of routing. Thus, DSR helped for generating and analyzing routing by sending multiple routing acknowledgements with route requests called as RREQs. It was also presented that DSR helped to sustain and overhead controlled packets during the routing for longer time. Some worked on DSDV which is a protocol for finding shortest distance among various sensor nodes by using multi-hop revelation process. DSDV proves to be loop free routing as compared to traditional routing but is failed to update its routing information because of high overhead. AODV is introduced to combine the advantageous applications based on DSDV and DSR with keeping in view the information of sensor nodes and following single path to reach to destination. It helps in minimizing energy consumption by not broadcasting extra signals to the nodes which are actually not in range and also thus not storing those nodes' information in routing table. This helps in saving memory also. AODV has loop free routing and disseminates the information of breaking of links from nearby nodes. The intermediate nodes among source and destination gives reply only if they are in process of routing information related to RREQs. AODV proves to be better routing than existed protocols. Thus, it is extended further to AODV-I by storing information for processed congestion. This helps in reducing packet loss rate and end to end latency by enhancing the utilization rate of resources available. The authors have tried to minimize delay and improving ration of packet delivery by combining multi-hop accumulation with AODV routing. It helps in reducing frequency of revelation. An improved protocol is introduced based on AODV for checking the nodes' capability of retaining information, battery status and its link state with different selection procedures. This has proved to be a better approach for high delivery of packets and lowering node to node delay. AODV-ES is an extension to AODV which uses third party model for replying to the acknowledgements sent through intermediate nodes by source to destination. The intermediate nodes which stores same routing information for destination need not to forward messages to destination. The authors even try to combine various modifications on AODV to improve the scalability of the networks. It is done so in order to take the benefits of all the local nodes information and it seems to reduce overhead but the nodes are limited in this scenario. Thus, local ring based n-hop routing is done using AODV-ES in order to know that which nodes are near to the centred node. The third party reply of AODV-ES proves to be good strategy for n-hop count but the nodes here are limited and the concentration is filled on the centred node only. Some researchers try to combine various routing protocols with TTL-based recovery method for reducing the use of unnecessary bandwidth. Here the author presented that if the link breakage is near to source or destination then tries for local repairing. The AODV's mobility is checked at different parameters such as PDR, delay and throughput in order to study its simulation scenario for random deployment of mobile nodes. Some even try to design protocol similar to AODV to adhere the conditions of hostile environment in order to extend the sensors lifetime by introducing forwarder nodes. As a whole the various parameters are proved to be working efficiently but not possible for larger environments where sensors are deployed enormously. At this point without hierarchical routing, the information cannot be send to longer distances taking in view various energy constraints of sensors network. Thus, in this paper, we tried to control the overhead and end-to-end delay with improving the packet delivery ratio in hierarchical routing using AODV protocol.

III. WSN Routing Protocols

There are various routing protocols for WSN. The AODV, DSDV and DSR are reactive routing protocols. These protocols basically overcome the common limitations of the networks such as lower bandwidth, higher power consumption or high rate of errors.

A Ad-hoc On Demand Distance Vector (AODV)

AODV is reactive routing protocol which does not find or keep up a course until or unless asked for by nodes. AODV utilizes destination arrangement number to guarantee the circle opportunity and freshness of course [4]. AODV is fit for both unicast and multicast directing. Then the operation of protocols is divided into two functions: route discovery and route maintenance. When a node requests to communicate with another node it starts route discovery mechanism. A route request message RREQ gets a source node to their neighbors and On the off chance that every one of those neighbor nodes do have any data about the destination nodes then they will further send the message to its neighbors thus on until the destination node is node is found. The node which has information of the destination node sends a route reply message RREP to the initiator of the RREQ message. The path is recorded in the intermediate nodes in the routing table and this path identifies the route. When the initiator receives the route reply message the route is ready and the initiator can start sending the packets. The route error RRER is reported when the link with the next hop breaks.

B. *Destination Sequenced Distance Vector (DSDV)*

Destination Sequenced Distance Vector is a loop free routing protocol in which the shortest-path calculation is based on the Bellman-Ford algorithm. DSDV routing-table construction starts with the condition that every node in the network periodically exchange control messages with its neighbours to set up multi hop paths to any other node in the network. Data packets are transmitted between the nodes using routing tables stored at each node. Each routing table contains all the possible destinations from a node to any other node in the network and also the number of hops to each destination. The protocol has three main attributes: to avoid loops, to resolve the count to infinity problem, and to reduce high routing overhead. Each node issues a sequence number that is attached to every new routing-table update message and uses two different types of routing-table updates to minimize the number of control messages disseminated in the network.

C Dynamic Source Routing (DSR)

DSR is additionally a reactive routing protocol which utilizes the idea of source routing. In source routing the sender knows complete hop-by-hop route to the destination. All the routes are stored in the route cache. When a node attempts to send a data packet to a destination for which it does not know the route [6]. In DSR every node keeps up a course reserve with course passages which are ceaselessly overhauled as and when course adapts new courses. The greatest point of preference of DSR is that no intermittent steering parcels are needed.DSR has also the capability to handle unidirectional links. Unlike other protocols DSR requires no periodic packets of any kind at any layer within the network. The sender of the packets selects and controls the route used for its own packets, which also supports features such as load balancing. All routes used are guaranteed to be free of loops as the sender can avoid duplicate hops in the selected routes.

IV. SIMULATION TOOL AND PERFORMANCE METRICS

The simulator tool used for the pursuance investigation of AODV, DSDV and DSR protocols in NS-2. The simulators based on network proves to be an efficient tool for analyzing various constraints like routing, protocols in network whether it is wired or wireless. Table 1 shows the simulation parameters.

TABLE I. Simulation Parameters

Attributes	*Value*
Simulator	NETWORK SIMULATOR
Simulation time	100 ms
No. of nodes	30,35,40,50,100
Routing Protocols	AODV, DSDV, DSR
Traffic type	UDP

The performance of the simulated results is analyzed according to different performance metrics. Such quantitative measurement is useful as a prerequisite for assessing or evaluating the performance of network or even to compare the performance using different routing protocols. The following performance metrics are employed in this study:

a. Energy Consumption - The energy model speaks to the energy level of hubs in the system. The energy model characterized in a node has an introductory worth that is the level of energy the node has toward the recreation's start. The energy level of a network can be determined by summing the entire node's energy level in the network.

b. Packet Delivery Ratio – The packet delivery ratio is total percentage of totals packets sent in unit time.

c. Throughput- Throughput is total packets successfully delivered to individual destination over total time divided by total time.

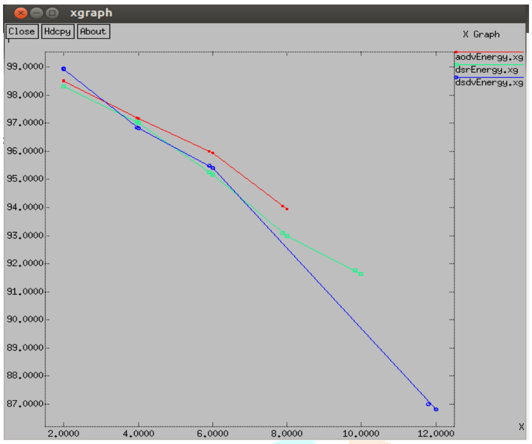
d. Routing Overhead - Routing overhead is the aggregate number of steering bundles transmitted over the system and it is communicated in bits every second or parcels every second.

V. SIMULATION RESULTS

In this section we analyze the performance of routing protocol based on the results obtained after simulation experiments are conducted on routing protocols. The main target of this paper is to evaluate the performance and behaviour of each routing protocol with respect to the effect of varying the number of nodes for two different applications i.e. video conferencing and e-mail. The results are based on evaluation metrics of delay, load, media access delay, throughput and retransmission attempts. We have divided our study into five sets of experiments: the first set studies the performance of three protocols over a small number of nodes (30 nodes) while the other sets consists of 35, 40, 50 and 100 nodes. The main results are discussed at the end of the results metrics.

A. Energy Consumption

The Figure shows the results for five different sets. These results provide the simulation scenarios for 30, 35, 40, 50 and 100 nodes and thus giving the results of energy consumption with the addition of nodes at different scenarios.



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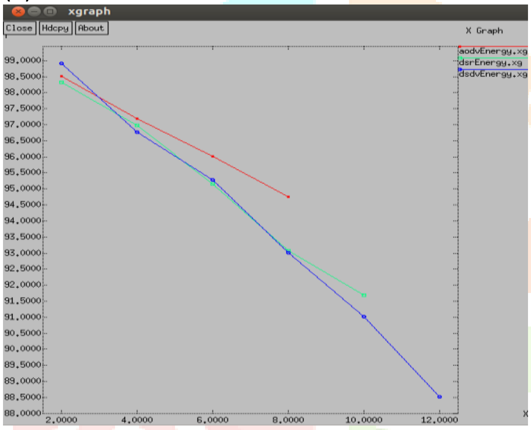

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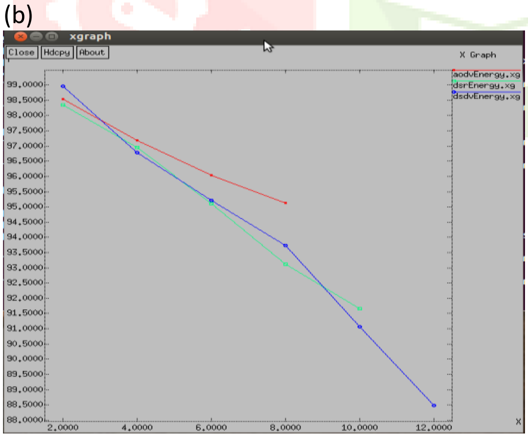

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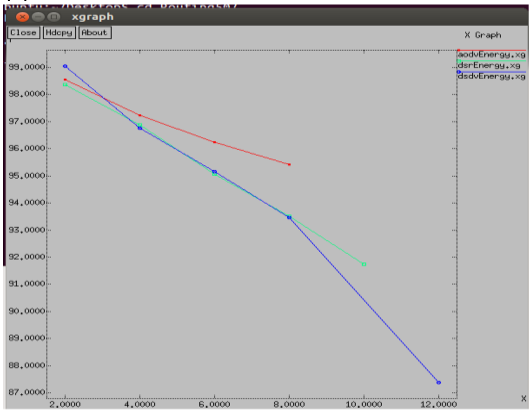

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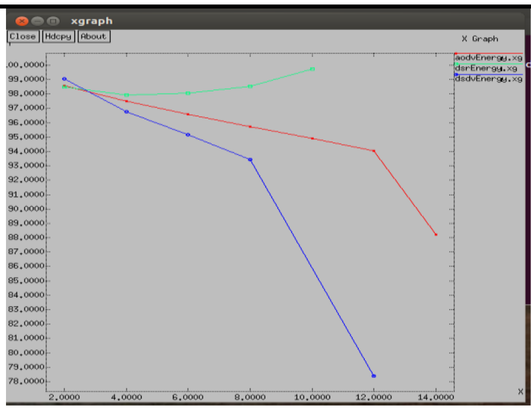
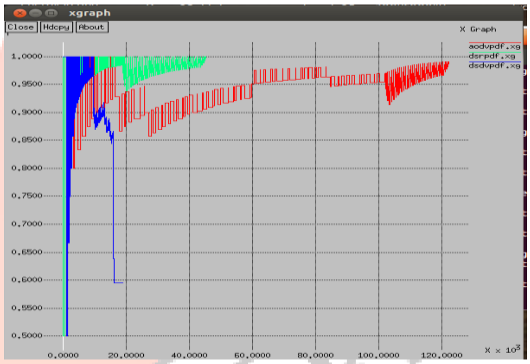


(e)

Fig. 1. Energy Consumption in five different Experimental Sets (a) 30 nodes (b) 35 nodes (c) 40 nodes (d) 50 nodes (e) 100 nodes

B. Packet Delivery

The Figure shows the results for five different sets. These results provide the simulation scenarios for 30, 35, 40, 50 and 100 nodes and thus giving the results of Packet Delivery with the addition of nodes at different scenarios.



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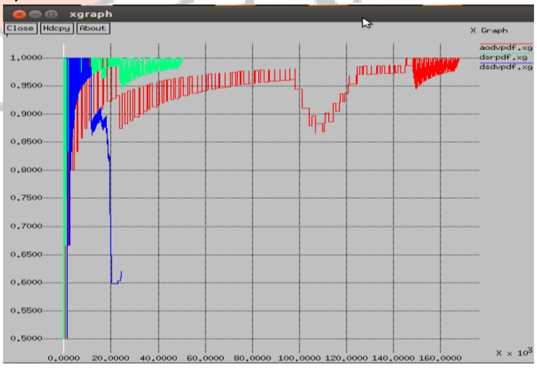

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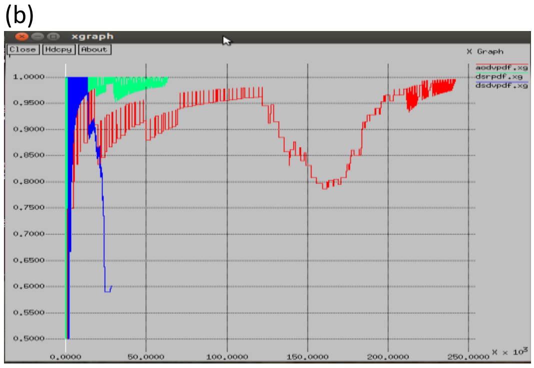

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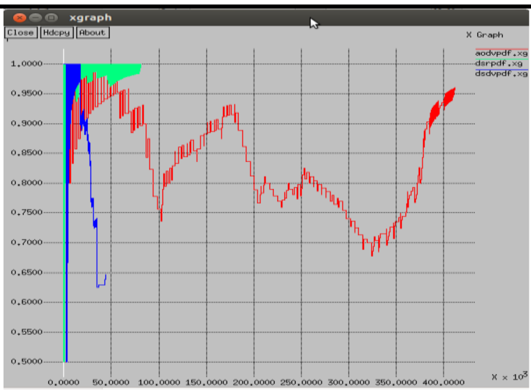

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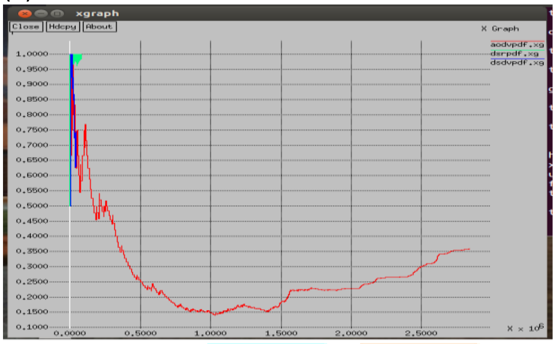

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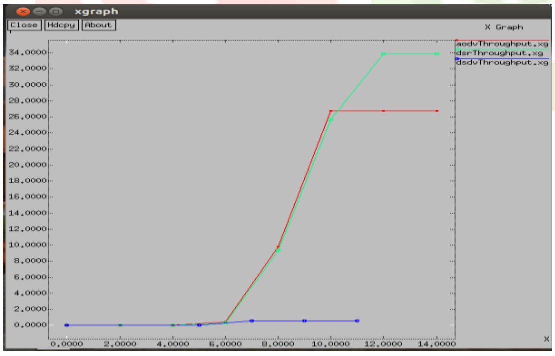
Fig. 2. Packet Delivery in five different Experimental Sets (a) 30 nodes (b) 35 nodes (c) 40 nodes (d) 50 nodes (e) 100 nodes

C. Throughput

The Figure shows the results for five different sets. These results provide the simulation scenarios for 30, 35, 40, 50 and 100 nodes and thus giving the results of Throughput with the addition of nodes at different scenarios.



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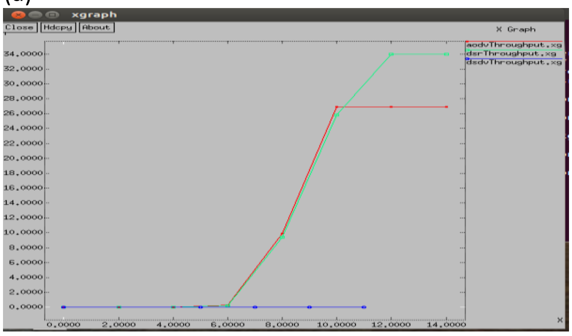

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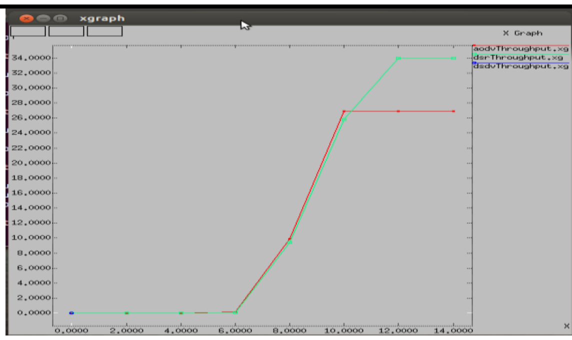

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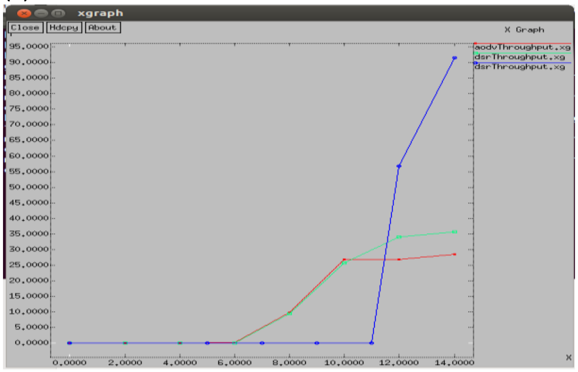

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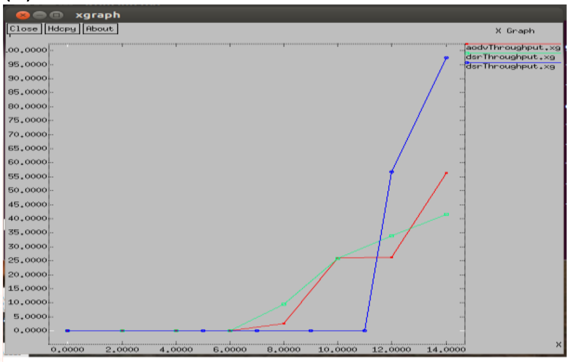
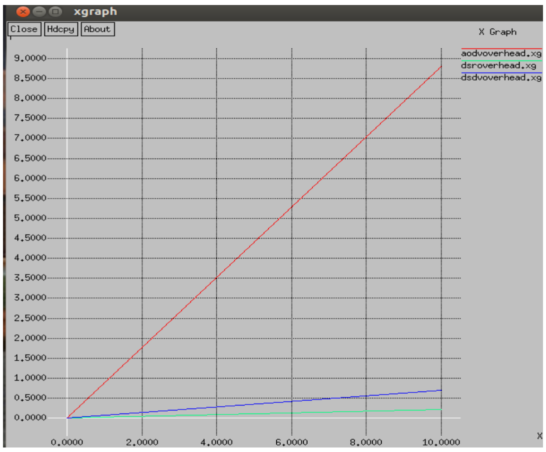


(e)

Fig. 3. Throughput in five different Experimental Sets (a) 30 nodes (b) 35 nodes (c) 40 nodes (d) 50 nodes (e) 100 nodes

C. Overhead

The Figure shows the results for five different sets. These results provide the simulation scenarios for 30, 35, 40, 50 and 100 nodes and thus giving the results of Throughput with the addition of nodes at different scenarios.



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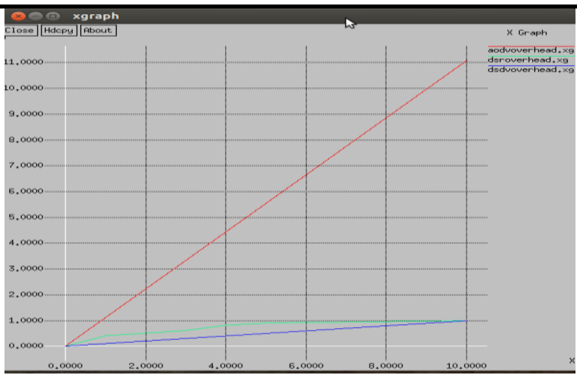

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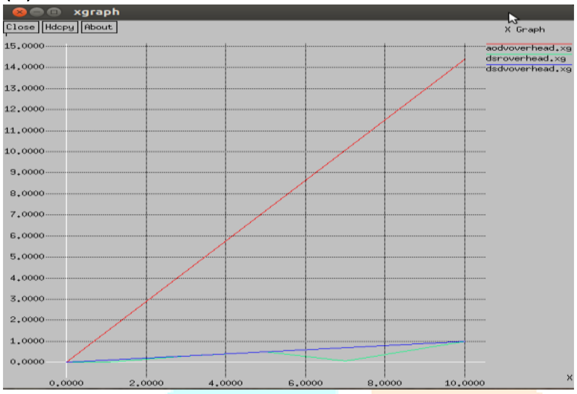

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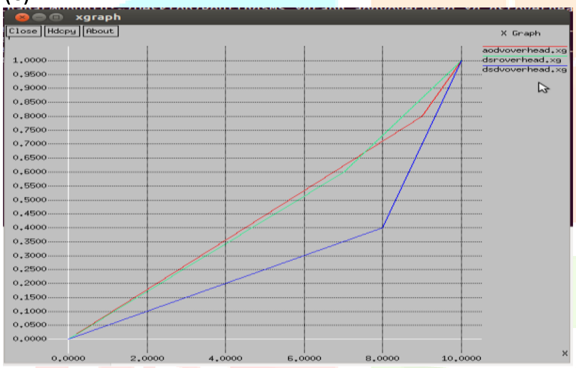

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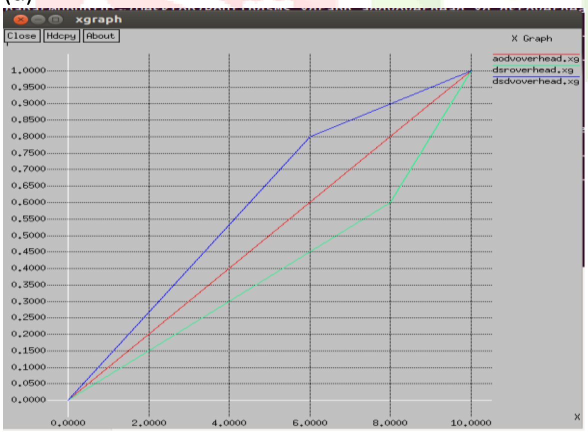

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Fig. 4. Overhead in five different Experimental Sets (a) 30 nodes (b) 35 nodes (c) 40 nodes (d) 50 nodes (e) 100 nodes

Thus, the comparative analysis of AODV, DSDV and DSR from the above results drawn is discussed in Table as given below:

Table II. Simulation Result

Scenario	*AODV*	*DSDV*	*DSR*
Scenario 1 (30 nodes)	Higher Energy Consumed (93% aprx), Average packet delivery Ratio (99% aprx), Average Throughput (26% aprx), Higher Routing Overhead (9% aprx)	Lower Energy Consumed (86% aprx), Lower packet delivery Ratio (59% aprx), Lower Throughput (0.7% aprx), Lower Routing Overhead (0.6 % aprx)	Average Energy Consumed (91% aprx), Higher packet delivery Ratio(100% aprx), Higher Throughput (33% aprx) , Lower Routing Overhead (0.2 % aprx)
Scenario 2 (35 nodes)	Higher Energy Consumed (94% aprx), Higher packet delivery Ratio (100% aprx), Average Throughput (27% aprx) , Higher Routing Overhead (12% aprx)	Lower Energy Consumed (88% aprx), Lower packet delivery Ratio (62% aprx), Lower Throughput (0.8% aprx) , Lower Routing Overhead (1% aprx)	Average Energy Consumed (91% aprx), Higher packet delivery Ratio (100% aprx), Higher Throughput(34 % aprx) , Lower Routing Overhead (1% aprx)
Scenario 3 (40 nodes)	Higher Energy Consumed (95% aprx), Average packet delivery Ratio(99% aprx), Average Throughput(27 % aprx), Higher Routing Overhead (15% aprx)	Lower Energy Consumed (88% aprx), Lower packet delivery Ratio(60% aprx), Lower Throughput (0.9% aprx) , Lower Routing Overhead(1 % aprx)	Average Energy Consumed (91% aprx), Higher packet delivery Ratio (100% aprx), Higher Throughput (34% aprx) , Lower Routing Overhead (1% aprx)
Scenario 4 (50 nodes)	Higher Energy Consumed (95% aprx), Lower packet delivery Ratio (96% aprx), Average Throughput (28% aprx) , Higher Routing Overhead (1% aprx)	Lower Energy Consumed (87% aprx), Average packet delivery Ratio (64% aprx), Higher Throughput (91% aprx) , Lower Routing Overhead (1% aprx)	Average Energy Consumed (91% aprx), Higher packet delivery Ratio (100% aprx), Higher Throughput (35% aprx) , Lower Routing Overhead (1% aprx)
Scenario 5 (100 nodes)	Average Energy Consumed (88% aprx), Lower packet delivery Ratio(35% aprx), Average Throughput(56 % aprx) , Lower Routing Overhead (1% aprx)	Lower Energy Consumed (78% aprx), Average packet delivery Ratio (74% aprx), Higher Throughput (97% aprx) , Lower Routing Overhead(1 % aprx)	Higher Energy Consumed (99% aprx), Higher packet delivery Ratio (100% aprx), Higher Throughput (41% aprx) , Lower Routing Overhead(1% aprx)

In the scenario 1, AODV with 30 nodes showed to an High Energy Consumed, Average packet delivery ratio, average Throughput and High routing Overhead, where DSDV with 30 nodes showed an High Energy Consumed, Average packet delivery ratio, average Throughput and High routing Overhead and also DSR with 30 nodes showed an High Energy Consumed, Average packet delivery ratio, average Throughput and High routing Overhead.

In the scenario 2, AODV with 35 nodes showed an High Energy Consumed, Average packet delivery ratio, average Throughput and High routing Overhead, where DSDV with 35 nodes showed an High Energy Consumed, Average packet delivery ratio, average Throughput and High routing Overhead and also DSR with 35 nodes showed an High Energy Consumed, Average packet delivery ratio, average Throughput and High routing Overhead.

In the scenario 3, AODV with 40 nodes showed an High Energy Consumed, Average packet delivery ratio, average Throughput and High routing Overhead, where DSDV with 40 nodes showed an High Energy Consumed, Average packet delivery ratio, average Throughput and High routing Overhead and also DSR with 40 nodes showed an High Energy Consumed, Average packet delivery ratio, average Throughput and High routing Overhead.

In the scenario 4, AODV with 50 nodes performs the higher energy and higher packet delivery ratio where as DSR has average comparative to AODV where as DSDV has an average energy and higher throughput and also where as DSDV have average energy consumed and packet delivery ratio.

In the scenario 5,AODV with 100 nodes performs the average energy and lower packet delivery ratio where as DSR has average comparative to AODV where as DSDV has an average energy and higher throughput and also where as DSDV have average energy consumed and packet delivery ratio.

VI. CONCLUSION

This paper presented pursuance investigation of three routing protocols is described with respect to their energy consumption, packet delivery ratio, and throughput and routing overhead. All these metrics addresses the reliability of protocols.

Reactive routing protocol DSR execution is the best considering its capacity to keep up association by occasional trade of data, which is needed for DSDV, based movement. As far as packet delivery fraction and routing overhead are concerned, DSR performs better than DSDV and AODV with varied number of nodes. Hence for real time traffic DSR is preferred over DSDV. Also, AODV works on the principle of shortest and fastest path to be chosen and as such considering the packet delivery fraction AODV and DSR can work well in certain scenarios where routing overhead is not a priority criteria. DSR is the best protocol in low capacity links. DSR is an exact opposite of AODV because of its performance is best in situation where DSDV does not perform well. One similarity in both protocols is that both had the same performance in routing overhead. DSR outperforms DSDV at high speed mobility under medium and heavy network conditions. DSDV gives low performance at packet delivery ratio and routing overhead metrics.

References

[1] Bin Y., Yang, Bin H., Cen, “An improved AODV routing protocol for MANETs”, Proceedings of International Conference on Wireless communications, Networking and Mobile Computing, pp 2918-2921, 2009.

[2] Downard I., "Simulating Sensor Networks in ns-2"

[3] Flyd S., Jacobon V., Li C.G., McCane S., Zhag L., “A Reliable Multicast Framework For Light-Weight Sessions And Application Level Framing”, IEEE Transactions on Networking, 1997.

[4] Johnson D.B. and Maltz D.A., “Dynamic Source Routing In Ad Hoc Wireless Networks”, International Journal on Mobile Computing, Vol. 353, Kluwer Academic, 1996.

[5] Johnson D.B., Maltz D.A., Hu Y.-C., “The Dynamic Source Routing Protocol For Mobile Ad Hoc Networks (DSR)”, Internet Draft, Draft-Ietf-Manet-Dsr-09.Txt, 2003.

[6] Jutao H., Jingjing Z., Minglu L., “Energy level and link state aware AODV route request forwarding mechanism research”, Transactions on Communications, pp 292-299, 2009.

[7] Le S.J., Royr E.M., Perkns C.E., “Scalability study of the Ad Hoc On-Demand Distance Vector Routing Protocol”, ACM Wiley International Journal of Network Management, Vol. 13, Issue 2, pp 97-114, 2003.

[8] Li Z., and Gupta B., “A Modified Shared-tree Multicast Routing Protocol in Ad Hoc Network”, Journal of Computing and Information Technology, Vol. 13, Issue 3, pp 177–193, 2005.

[9] Manjla S.H., Abhilsh C.N., Shila K., Vengopal K.R., and Patnak L.M., “Performance Of Aodv Routing Protocol Using Group And Entity Mobility Models In Wireless Sensor Networks”, Proceedings of International Multiconference of Engineers and Computer Scientists, Vol. 2, Hong Kong, 2008.

[10] Meng L., “A Novel Ad Hoc Routing Protocol Based On Mobility Prediction”, International Conference on Information Technology, Vol. 7, Issue 3, pp 537-540, 2008.

[11] Naito K., Mori K., and Kobayashi H., “Evaluation of Power-aware Routing for Sensor Networks with Forwarder Nodes”.