ISSN(Online): 2320-9801
ISSN (Print): 2320-9798

International Journal of Innovative Research in Computer and Communication Engineering

*(An ISO 3297: 2007 Certified Organization)*

**Vol. 2, Issue 9, September 2014**

# A Compact AODV-based approach for MANET Routing

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**ABSTRACT:** In the present research we have implemented and carried out comprehensive analysis and comparison of unipath on-demand routing protocol (AODV), multipath on-demand routing protocol (AOMDV) using NS-2 simulator. We have then proposed S-AODV, a simple algorithm based on AODV which has performance nearly same as that of AODV but its main advantages are its simplicity, light weight and no routing overheads. The protocol was further implemented in NS-2 and its performance was compared with that of AODV and AOMDV. Performance of all protocols was carried out under identical traffic load and mobility patterns condition.

**KEYWORDS:** AODV, AOMDV, MANET, Performance, Routing.

## I. INTRODUCTION

Mobile Ad hoc networks consist of a group of wireless mobile nodes which exchange data dynamically among themselves without the dependence on a fixed base station or a wired backbone network [1,2]. These nodes generally have a limited transmission range and so, each node needs the support of its neighbouring nodes in forwarding packets as shown in Fig 1 and hence the nodes in an Ad hoc network can act as both routers and hosts. Thus a node is used to forward packets between other nodes as well as runs the user applications . Nowadays, a lot of effort is being put to develop Ad hoc networks. One of the important and famous groups developing Ad hoc networks is Mobile Ad hoc network Group (MANET) [3]. With the popularity of Ad hoc networks, many routing protocols have been designed for route discovery and route maintenance. Some of the most famous routing protocols are Dynamic Source Routing (DSR), Ad hoc On-demand Vector (AODV), Optimized Link State Routing protocol (OLSR), Zone Routing Protocol (ZRP) etc [4].

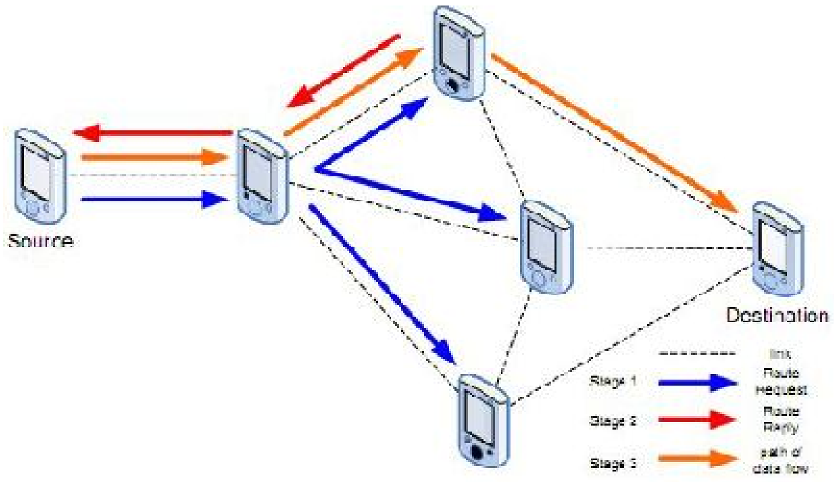


Fig 1 A Mobile Ad hoc Network (MANET)

Routing is the process of finding optimal path between source and destination. Routing in wireless Ad hoc networks is nontrivial due to highly dynamic environment. In recent years, on-demand routing protocols have attained more attention in mobile Ad hoc networks as compared to other routing schemes due to their abilities and efficiency. There exist many on-demand routing protocols for mobile Ad hoc networks (MANETS) [5,6].

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Design of routing protocols is a big challenge in Wireless Ad-hoc Networks due to multi hop mobility [7] and large network size and constraints like bandwidth and battery power limitations. The main problems about the routing protocols are as following:

- In wireless ad hoc networks the passing pattern of the nodes is very rapid due to which the topology of the network changes very rapidly leading to the loss of packets. Also, the routing table of every is required to be modified within the communication distance of the rapid passing node to improved the consumption the bandwidth and overhead of the networks.
- The transmission between two hosts over wireless ad hoc networks sometime works well only in one direction.
- Due to redundant routes, many protocols increase the network overhead. Periodic updation of routing tables leads to wastage of bandwidth.
- Periodic updation of routing table also leads to high consumption of battery power.

## II. RELATED WORK

Most of the protocols, however, use a single route and do not utilize multiple alternate paths. Multipath routing allows the establishment of multiple paths between a single source and single destination node and when a path breaks an alternate path is used instead of initiating a new route discovery, hence multipath routing represents a promising routing method for wireless mobile Ad hoc networks. Multipath routing protocols achieve lower routing overhead, lower end-to-end delay, more resilient to route failures and alleviate congestion in comparison with single path routing protocols. The performance comparison of these protocols considering all the characteristics that should be possessed by routing protocols is the fundamental step towards the invention of new routing protocol. Therefore, a lot of research is being carried out in this direction to achieve performance and optimize various issues in routing [8,9,10]. New protocols are being explored and tested for low-power, compact systems for various types of applications [11].
Efficient routing in an Ad hoc network requires that the routing protocol operate in an on-demand fashion, and requires that the routing protocol limit the number of nodes that must be informed of topology changes. Ad hoc networks running such a protocol can be designed and implemented, and they perform well enough to support useful applications. In the present research work we argue that there are three key objectives to designing a routing protocol that operates successfully on given the challenges of an Ad hoc network.

1. The protocol must be fundamentally on-demand, meaning that it has to react to changes in the environment only when necessary.
2. The protocol must involve multiple paths between source and destination because when a path breaks an alternate path can be used instead of initiating a new route discovery. Multipath routing should also achieve load balancing and must be more resilient to route failures.
3. The protocol must limit the number of nodes that are required to share consistent state information, since it is extremely expensive or impossible to maintain a distributed data structure in a consistent state across all the nodes in a rapidly changing Ad hoc network.

The aim of present research work is to provide a detailed comprehensive analysis of various on-demand routing protocols. We have implemented and compared several on-demand routing protocols. The present research work emphasizes the detailed comprehensive analysis and comparison of various on-demand routing protocols like AODV [12] and AOMDV. We have further proposed S-AODV, a simpler version of AODV, which can be deployed for small-size and low power applications. All protocols were subjected to identical traffic load and mobility patterns.

## III. PROPOSED ALGORITHM

AODV is an ad-hoc routing protocol. It is able to discover a route through a network of computers.
•Creates routes on-demand
•Built for mobile networks
•Loop free with quick convergence
•Can scale to handle a few hundred nodes
•Can be integrated into the existing protocol stack

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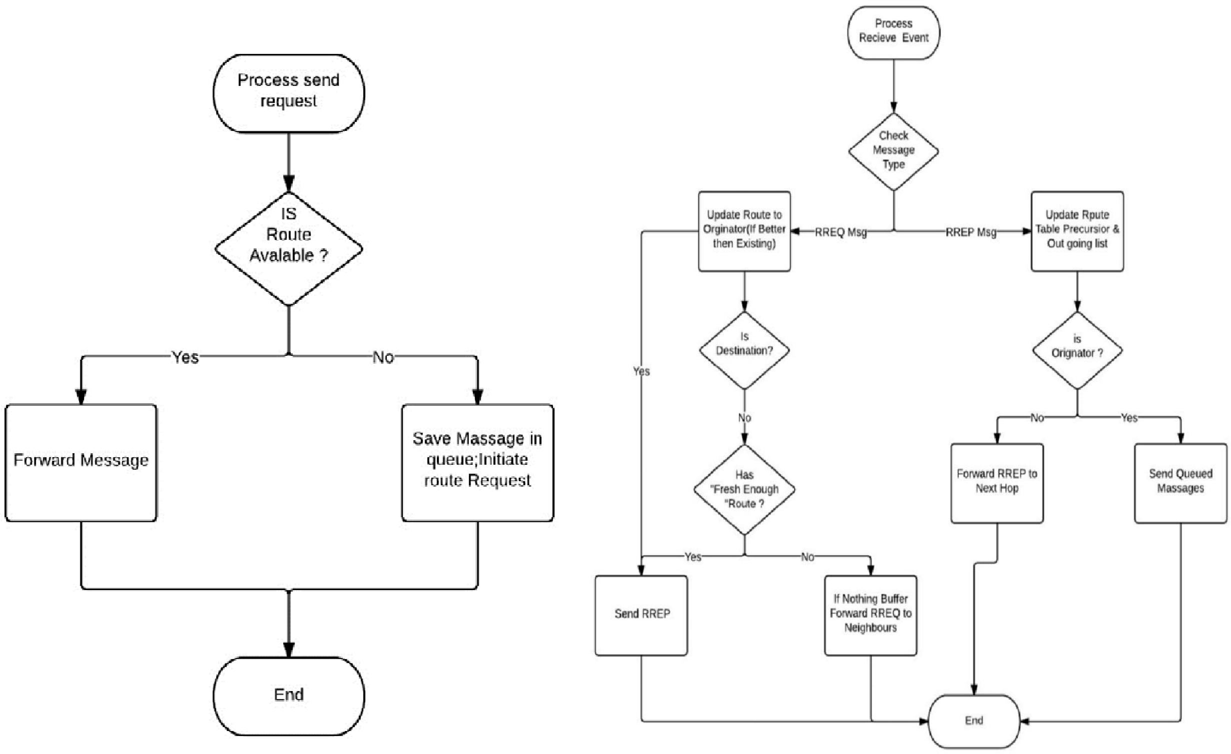
When AODV was designed it incorporated many features designed to maximize performance at the cost of added complexity [13]. The features of Link layer detection of AODV are as following:-

- Link layer detection allows a sending node to detect if a unicast packet is successfully received.
- In simulations, AODV using link layer detection provides amazing performance.
- Currently it is impossible to access link layer feedback information in off the shelf hardware.
- Current implementations use periodic hello messages to detect local link connectivity.
- Hello messages cause a large amount of control overhead. Each node must periodically send broadcast packets. Each receiving node must also process them.

Simple - Ad hoc On-Demand Distance Vector (S-AODV) is a simple algorithm based on AODV which has performance nearly same as that of AODV but its main advantages are its simplicity, light weight and no routing overheads. AODV and AOMDV specification contains many sections prone to erroneous programming. S-AODV is a simplified variant of AODV specification which removes all but the essential elements of AODV.
S-AODV removes the following items from the AODV specification.
• Sequence Numbers
• Gratuitous RREP
• Hop Count
• Hello Messages
• RERR
• Precursor lists

*A. S-AODV Operation*

Whenever an S-AODV router receives a request to send a message, it checks its *routing table* to see if a route exists. If a route exists, the router simply forwards the message to the next hop. Otherwise, it saves the message in a *message queue*, and then it initiates a route request to determine a route. The following flow chart illustrates this process:




(a) (b)

Fig. 2 (a) Send message process (b) Incoming message process

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To accomplish this S-AODV requires slightly different operation when compared to AODV. It is able to do this by requiring only destinations to reply to RREQ and uses end-to-end hello messages to maintain routes. Removing sequence numbers requires the destination to respond to RREQ (Fig 3 (a)); no intermediate nodes may respond. This also eliminates the need for Gratuitous RREP since all routes will be bidirectional. Since the destination will only respond to the first RREQ it receives the "best" (fastest) route is always chosen regardless of the number of hops. To perform route maintenance route lifetimes are only updated by the reception of packets and not the sending of packets. This requires the destination to occasionally send a packet to the source. If data traffic is unidirectional periodic messages (*connect*) are sent to maintain the route (Fig 4 (b)). If data communications are bidirectional, no additional overhead is needed. Using this end-to-end strategy, hello messages, RERR and precursor lists are not needed.

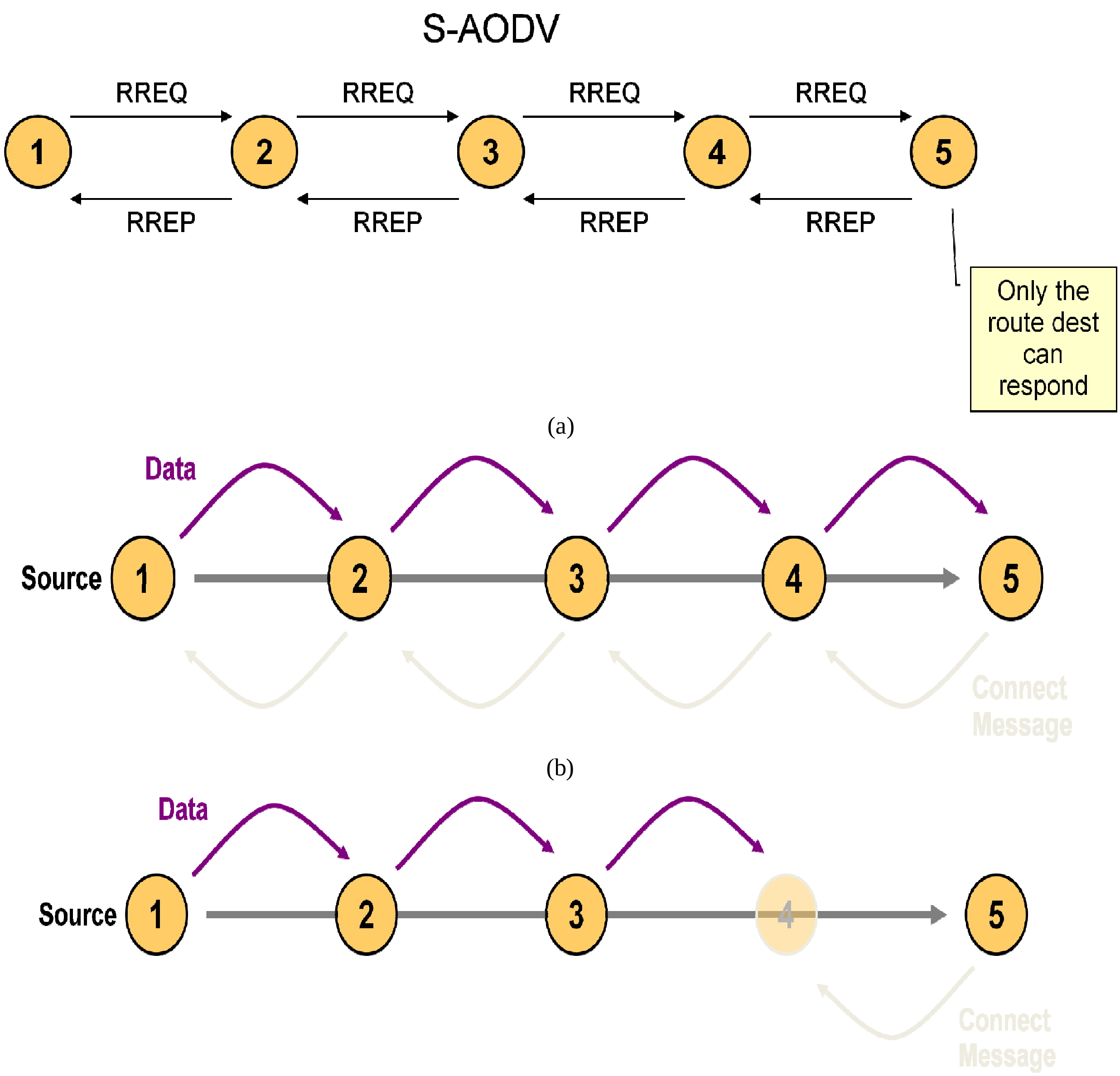


Fig. 3 S-AODV Operations

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International Journal of Innovative Research in Computer and Communication Engineering

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When a break in the route occurs, the source will stop receiving messages from the destination. In Fig 3 (c) , node 4 leaves the route. After a period of time node 1 detect the route is broken because it has not received a message from the destination and will reinitiate route discovery if the route is still needed.

## IV. SIMULATION RESULTS

The simulations were carried out using NS-2 network simulator which is a discrete event driven simulator developed at UC Berkeley [14,15] as a part of the VINT project. The goal of NS-2 is to support research and education in networking. It is suitable for designing new protocols, comparing different protocols and traffic evaluations. The performance of Ad hoc network is studied under varying condition of the traffic load and mobility of nodes. Two models used in the simulation study of evaluation of on demand and table driven protocols for Ad hoc networks are as follows-

1. **Mobility Generation Model.** It is used to study the effect of mobility of nodes on overall performance of the network.
2. **Traffic Generation Model.** It is used to study the effect of traffic load on the network.

Implementation study begins with simulation of Network Environment. This requires setting of simulation network parameters. These parameters are depicted in the Table 1.

**Table 1: Simulation Parameters**

| Serial No. | Parameters | Value |
|---|---|---|
| 1 | Number of nodes | 50 |
| 2 | Simulation Time | 200sec. |
| 3 | Area | 500*500$m^2$ |
| 4 | Max Speed | 20 m/s |
| 5 | Traffic Source | CBR |
| 6 | Pause Time (sec) | 0,20,30,40,100 |
| 7 | Packet Size | 512 Bytes |
| 8 | Packets Rate | 4 Packets/s |
| 9 | Max. Number of connections | 10,20,30,40 |
| 10 | Bandwidth | 10Mbps |
| 11 | Delay | 10 ms |
| 12 | Mobility model used | Random way point |

### *A. Traffic Generation Models*

Traffic-scenario generator script ‘cbrgen.tcl’ is used to create CBR traffic connections between wireless mobile nodes. To study the effect of traffic load on the network, various numbers of maximum connections were setup between the nodes with the traffic rate of 4 packets per second, where each packet size was 512 bytes. A set of traffic generation files created corresponds to different traffic to be generated.

To study the effect of traffic load on the network, the maximum numbers of connections were varied as 10, 20, 30 and 40 connections. The network was simulated for high mobility scenario keeping the pause time 0 seconds.

### *B. Mobility Generation Models*

The movement scenario files used for each simulation are characterized by a pause time. To study the effect of mobility, the simulation is carried out with movement patterns generated for different pause times. Pause time of 0 seconds corresponding to continuous motion, and a pause time of 100 corresponds to almost no motion. A set of movement scenario files corresponds to different mobility is created by varying pause time. The ‘setdest’ program of NS-2 simulators is used to generate node-movement files using the ‘Random Waypoint Algorithm’.

To study the effect of mobility, pause time can be varied from 0 seconds (high mobility) to 100 seconds (low mobility). However in simulation study sample pause time of 0, 10, 20, 30, 40 and 100 sec were considered.

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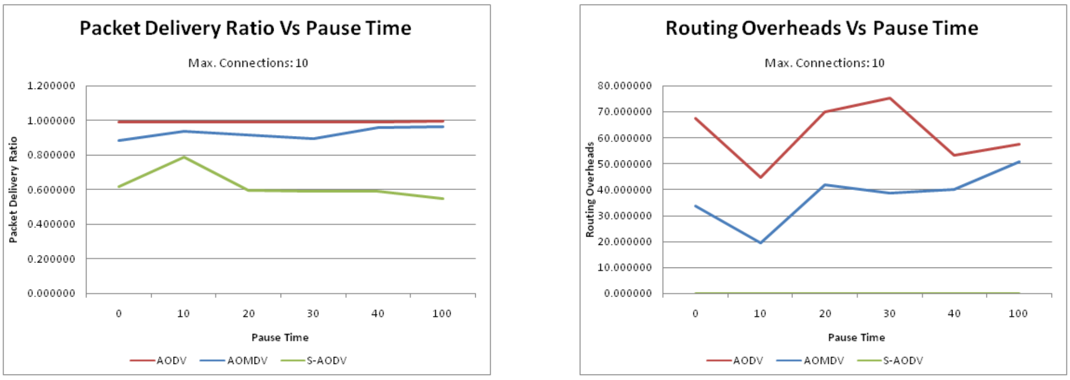
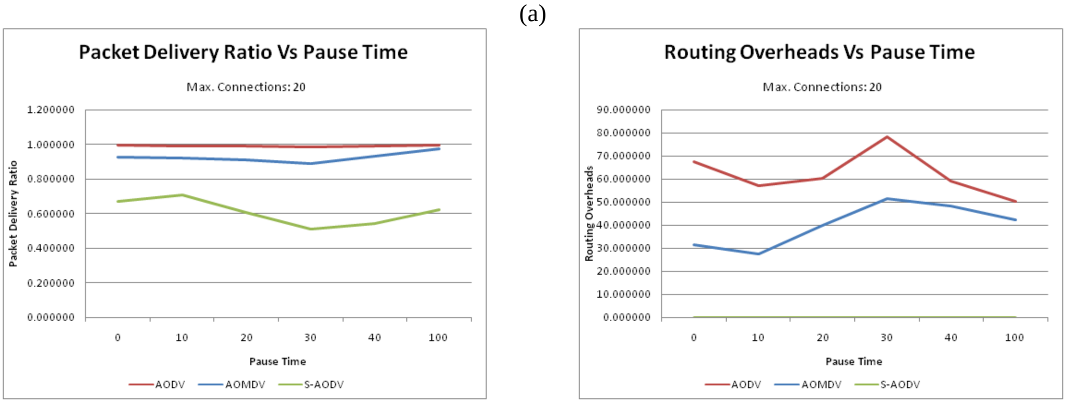
*A. Simulation Results: Effect of mobility*

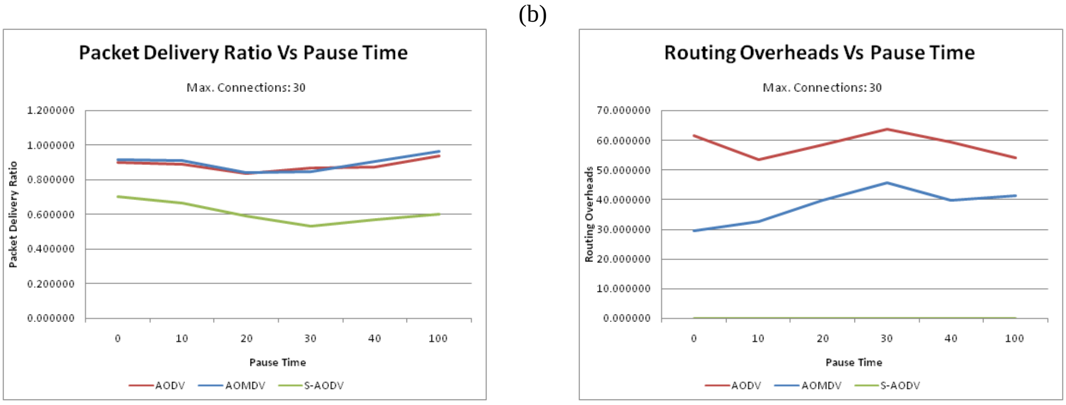
To analyze the effect of mobility, pause time was varied from 0 seconds (high mobility) to 100 seconds (no mobility). The numbers of nodes are taken as 50 and the maximum number of connection as 10, 20, 30 and 40.




(a)




(b)




(c)

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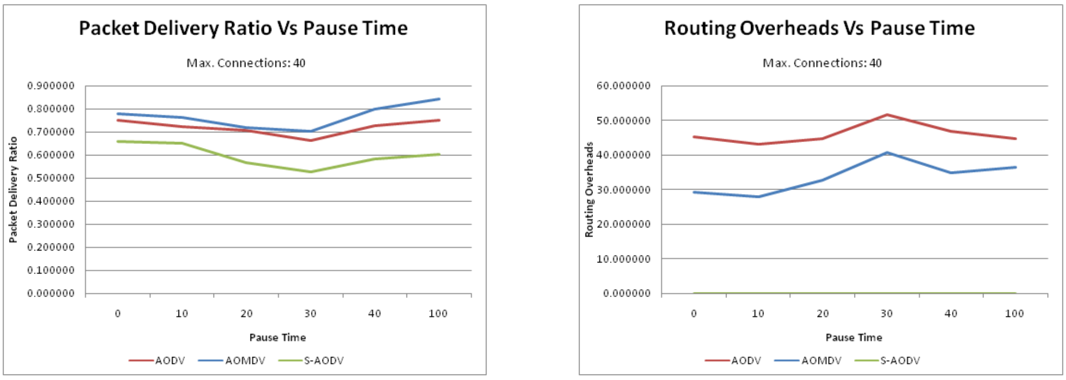


(d)

Fig 4 Pause Time Vs Various Parameters for Max. Connections = (a) 10 (b) 20 (c) 30 (d) 40

Due to several inherent properties of AOMDV like Load Balancing and Bandwidth Aggregation, AOMDV always outperforms AODV. When a link becomes over utilized and causes congestion, AOMDV can choose to divert traffic through alternate paths and hence throughput increases. However in case of less number of maximum connections i.e. 10, AODV performs better than AOMDV or S-AODV because congestion chances are less. The packet dropped varies with mobility. Number of packets dropped in AOMDV is always less compared to AODV. Multipath nature of AOMDV attributes to less packet drop. Similarly, packet delivery ratio in AOMDV is always more, due to availability of multiple paths as compared to AODV irrespective of variation in mobility.

When a link becomes over utilized resulting into congestion or failures, multipath routing protocols can divert traffic through alternate paths. However in case of less number of maximum connections i.e. 10, AODV performs better than AOMDV or S-AODV because of less congestion. Routing overhead in AOMDV is less compared to AODV, because the frequency of route discovery is less in AOMDV as multiple routes are always available. New route discovery is needed only when the entire link-disjoint paths fails. The probability such situation is very less. The optimal path length in terms of number of hops present across the optimal path is less in AOMDV irrespective of variations in mobility (pause time). Because of existence of multiple paths, option remains open for selecting a best optimal path. As far as packet delivery ratio is concerned, AODV and AOMDV proved to be much better than S-AODV. However, S-AODV has its own advantages. It has lowest routing overheads and average path length. Moreover, it is simpler to implement.

## V. CONCLUSION AND FUTURE WORK

The simulation results have demonstrated some important characteristic differences among the various routing protocols. The presence of high mobility implies frequent link failures and each routing protocol reacts differently during link failures. The different basic working mechanism of these protocols leads to the differences in the performance.

For robust scenario where mobility is high, nodes are dense, area is large, the amount of traffic is more, network pattern sustains for longer period and number of maximum connections is small, AODV performs better. To achieve lower routing overhead, better throughput, lower end-to-end delay, to be more resilient to route failures and alleviate congestion for robust scenario where mobility is high, nodes are dense and traffic is more and number of maximum connections is large, AOMDV is a better choice.

Therefore, AODV and AOMDV are currently amongst the easiest and most widely implemented MANET protocol. However, their specification still contains many sections prone to erroneous programming. S-AODV is a simplified variant of AODV specification which removes all but the essential elements of AODV. From the results, it can be seen that S-AODV has the same performance as AODV with minimum routing overheads and average path length in comparison to both AODV and AOMDV. The present research work can be extended to design and develop new routing protocols to meet the following additional desirable features.

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Robust Scenario, Probabilistic Route Maintenance, Quality of service (QoS) ,Security-Routing Overhead, Energy Aware Routing

## REFERENCES

[1] Ramjee Prasad, editor, "Universal wireless personal communications", Artech House, Norwood, MA, pp. 355-362, 1998.
[2] Seiichi Sampei, editor, "Applications of Digital Wireless Technologies to global Wireless Communications", Prentice Hall PTR, Upper Saddle River, NJ, ISBN: 0-13-214272-4, 1997.
[3] IEEE 802.11e Working Group, Specific Requirements Part 11: Wireless LAN Medium Access Control (MAC) and Physical Layer (PHY) Specifications, Amendment 8: Medium Access Control (MAC) Quality of Service Enhancements, IEEE Standard, 2005.
[4] J. Broch, D.A. Maltz, D. B. Johnson, Y.C. Hu and J. Jetcheva, "A performance comparison of multi hop wireless ad hoc network routing protocol", MobiCom'98, Proceedings of Annual ACM/IEEE Inter. Conf. on Mobile Computing and Networking, pp. 85–97, 1998.
[5] Acharya. A, A. Misra, and S. Bensal, "A label switching packet forwarding architecture for multihop wireless LANs", Proceedings of the ACM Workshop on Mobile Multimedia (WoWMoM -2002), Atlanta, GA, pp. 33-40,2002.
[6] Y. B. Lin and I. Chaamtac, "Wireless and Mobile Network Architecture", John Willey &sons, 2000.
[7] J. Broch, D. A. Maltz, D. B. Johnson, Y.-C. Hu, andJ. Jetcheva. "A performance comparison of multihop wireless ad hoc network routing protocol," MobiCom'98, Proceedings of Annual ACM/IEEE Inter. Conf. on Mobile Computing and Networking, pp. 85–97, 1998.
[8] B. P Crow, L.G kim and P. T Sakai, "IEEE 802.11 Wireless Local area Netwoks (LAN)", IEEE communication Magazine, vol. 35, no.9, pp. 116- 126, 1997.
[9] Ram Ramanathan and Jason Redi, "A brief over view of Ad hoc network: Challenges and direction", IEEE Communication Magazine, pp. 20-22, 2002.
[10] S. Ramanathan and Martha Steenstrup, "A Survey of Routing Techniques for Mobile Communications Networks", ACM/Baltzer Mobile Networks and Applications, 1(2): pp. 89–103, 1996.
[11] E. M. Royer and C.K. Toh, "A review of current routing protocols for ad hoc mobile wireless networks", IEEE Personal Communications, 6(2): pp. 46– 55, 1999.
[12] M.K. Marina and S.R. Das, "On-demand multipath distance vector routing in ad hoc networks," Proceedings of the International Conference for Network Procotols (ICNP), pp. 14–23, 2001.
[13] Charles E. Perkins, Elizabeth M. Royer, Samir R. Das, "Ad-hoc On-demand Distance Vector Routing", IETF Draft,(NMCSA), pp. 90-100 ,1999.
[14] 5th VNIT/NS Simulator Tutorial/Workshop slides and the NS Manual [2009].
[15] A tutorial named NS by example: http://nile.wpi.edu/NS/, visited 2006-07-22.