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Differentiative Comparison Study of Routing Protocols and Maintaining Energy Management in MANETS

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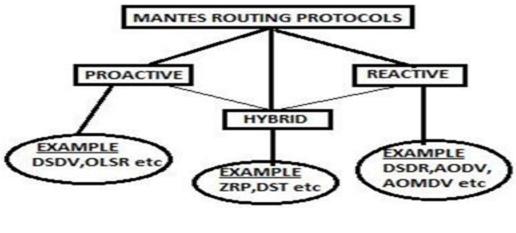
Abstract: *A Mobile Ad-hoc Network (MANET) is a dynamic Wireless network that can be formed without the need for any pre-existing infrastructure in which each node can act as a router. Mobile ad hoc network (MANET) is an autonomous system of mobile nodes connected by wireless links. Each node operates as a router to forward packets and also acts as an end system. The nodes are free to move about and organize themselves into a network. The position of the nodes will be changed frequently. The main classes of routing protocols are Proactive, Reactive and Hybrid. A Reactive (on-demand) routing strategy is a popular routing category for wireless ad hoc routing. The design follows the idea that each node tries to reduce routing overhead by sending routing packets whenever a communication is requested. In this work an attempt has been made to compare the performance of three routing protocols for MANETs: Dynamic Source Routing (DSR) protocols, Ad-hoc on-demand Multipath Distance Vector Routing (AOMDV) and Zone Routing Protocol (ZRP). DSR is reactive gateway discovery algorithms where a mobile device of MANET connects by gateway only when it is needed. AOMDV was designed primarily for highly dynamic ad hoc networks where link failures and route breaks occur frequently. It maintains routes for destinations in active communication and uses sequence numbers to determine the freshness of routing information to prevent routing loops. It is a timer-based protocol and provides a way for mobile nodes to respond to link breaks and topology changes. ZRP is hybrid protocol. It is the combination of both proactive and reactive protocols. The performance differentials are analyzed using varying number of nodes. These simulations are carried out using the ns-2 network simulator. The results presented in this work illustrate the importance in carefully evaluating and implementing routing protocols in an ad-hoc environment.*
Keywords: *MANETS, PROTOCOLS, DSR, AOMDV, ZRP*

I. Introduction

A mobile ad-hoc network or MANET is a collection of mobile nodes sharing a wireless channel without any centralized control or established communication backbone. They have no fixed routers with all nodes capable of movement and arbitrarily dynamic. These nodes can act as both end systems and routers at the same time. When acting as routers, they discover and maintain routes to other nodes in the network. The topology of the ad-hoc network depends on the transmission power of the nodes and the location of the mobile nodes, which may change from time to time [1]. One of the main problems in ad-hoc networking is the efficient delivery of data packets to the mobile nodes where the topology is not pre-determined nor does the network have centralized control. Hence, due to the frequently changing topology, routing in ad-hoc networks can be viewed as a challenge.

II. Classification of Routing Protocols

Classification of routing protocols in mobile ad hoc network can be done in many ways; the routing protocols can be categorized as Proactive (Table Driven), Reactive (on-demand) and Hybrid depending on the network structure.



A. Proactive Routing Protocols or Table Driven

Proactive routing is also often termed as table- driven routing. In this type of routing protocols, fresh lists of destinations and their routes are maintained by periodic distribution of routing tables throughout the network and this category of protocol always strives to maintain consistent and updated routing information at each node. The proactive routing protocols use link-state routing algorithms which frequently flood the link information about its neighbors and the main drawback of proactive routing protocol is that all the nodes in the network always maintain an updated table. Destination-Sequenced Distance-Vector Routing Protocol (DSDV) [2] and Optimized Link-State Routing (OLSR) are the two common proactive routing protocols.

B. Reactive Routing Protocols or On-Demand

This type of routing is often known as on- demand routing or source-initiated routing protocol. The main advantage of reactive protocols is that it imposes less overhead due to route messages on the network but at the same time, it is also facing high latency time in route finding process and sometimes excessive flooding of the communication packets may lead to network blockage.

Unlike table driven protocols, all nodes need not maintain up-to- date routing information here. Ad-hoc On- Demand Multipath Distance Vector Routing (AOMDV) [3], Dynamic Source Routing (DSR) [4] and Temporally Ordered Routing Algorithm (TORA), are some of the examples of reactive routing protocol.

C. Hybrid Routing Protocol

Hybrid routing protocol combines the advantages of both proactive and reactive routing protocols. The routing is initially established with some proactively prospected routes and then serves the demand from additionally activated nodes through reactive flooding. Example-ZRP [5], DST etc

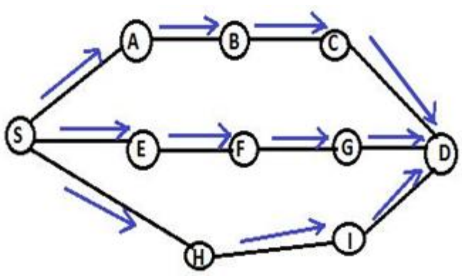
III. Proposed Protocols

A. Dynamic Source Routing (DSR)

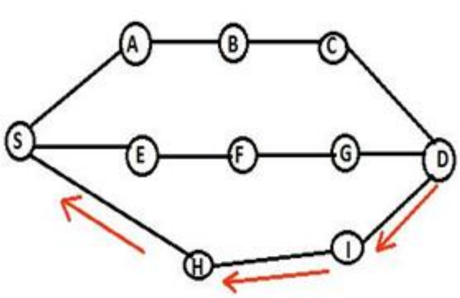
DSR is a reactive routing protocol i.e. determines the
Proper route only when packet needs to be forwarded. For restricting the bandwidth, the process to find a path is only executed when a path is required by a node (On-Demand Routing). In DSR the sender (source, initiator) determines the whole path from the source to the destination node (Source-Routing) and deposits the addresses of the intermediate nodes of the route in the packets. DSR is beacon-less which means that there are no hello-messages used between the nodes to notify their neighbors about their presence. DSR is based on the Link-State Algorithms which mean that each node is capable to save the best way to a destination. Also if a change appears in the network topology, then the whole network will get this information by flooding. The DSR protocol is composed of two main mechanisms that work together to allow discovery and maintenance of source routes in MANET

***Mechanism*:**

1. Route Discovery
2. Route Maintenance



(a) Propagation of request (RREQ) packet



***(*b)** Path taken by the Route Reply (RREP) packet

Advantages: Routes maintained only between nodes who need to communicate. Route caching can further

reduce route discovery overhead.
Disadvantages: Packet size increases and Degrade performance.

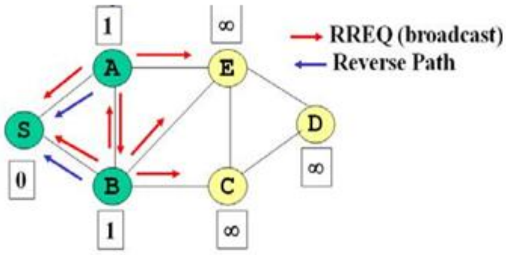
B. Ad-hoc On demand Multipath Distance Vector(AOMDV)

Ad-hoc On-demand Multipath Distance Vector Routing (AOMDV) protocol is an extension to the AODV protocol for computing multiple loop-free and link disjoint paths. The routing entries for each destination contain a list of the next-hops along with the corresponding hop counts. All the next hops have the same sequence number. This helps in keeping track of a route. For each destination, a node maintains the advertised hop count, which is defined as the maximum hop count for all the paths, which is used for sending route advertisements of the destination. AOMDV can be used to find node-disjoint or link-disjoint routes.

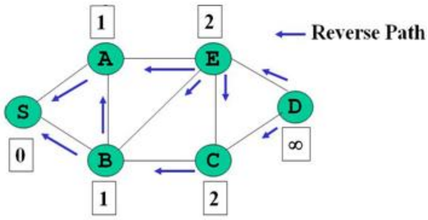
Mechanism:

1. Route Discovery
2. Route Reply
3. Route maintenance

1. Route Discover



2. Route Reply



Advantages: AOMDV is Loop free, loops are overcome by using sequence number and AOMDV is Disjoint.
Disadvantages: AOMDV has more message overheads during route discovery due to increased flooding and since it is a multipath routing protocol, the destination replies to the multiple RREQs those results are in longer overhead. If network increases then Congestion may occur.

C. Zone Routing Protocol

The Zone Routing Protocol (ZRP)[6] combines the advantages of proactive and reactive protocols in a hybrid scheme. It acts as a proactive protocol in the neighborhood of a node (Intra-zone Routing Protocol, IARP) locally and a reactive protocol for routing between neighborhoods (Inter-zone Routing Protocol, IERP) globally. The local neighborhoods are called zones, which are different for each node. Each node may be within multiple overlapping zones and each zone may be of a different size. The "size" of a zone is not determined by the geographical measurement but is determined by a radius of length *p*,
Where *p* is the number of hops to the perimeter of the zone.

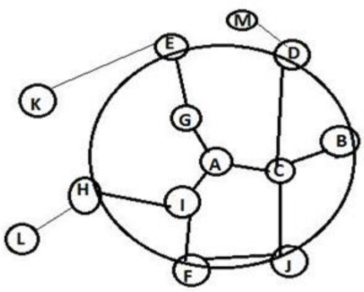


Figure2. Routing Zone of node A with p = 2.

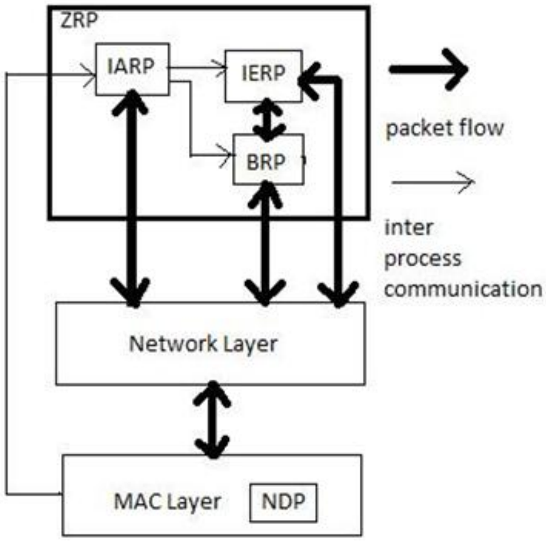


Figure3. ZRP Architecture

The nodes of a zone are divided into the nodes whose minimum distance to the central node is exactly equal to the zone radius r called peripheral nodes and the nodes whose minimum distance is less than r are interior nodes called interior nodes. In Fig. 2, the nodes A–F are interior nodes; the nodes G–J are peripheral nodes and the nodes K and L are outside the routing zone. Note that the node H can be reached by two paths, one with length 2 and one with length 3 hops. The shortest path is less than or equal to the zone radius if the node is within the zone. From Fig. 2, the IARP provides the topology information in the form of direct query request to the border of the zone is called as *border casting.* The Border cast Resolution Protocol (BRP) provides the delivery of border cast packet.

The route requests can be directed away from areas of the network which have been already covered through query control mechanisms. In ZRP, a Neighbor Discovery Protocol (NDP) provided by the Media Access Control (MAC) layer is used to detect new neighbor nodes and link failures. The "HELLO" beacons are transmitted by NDP at regular intervals. The neighbor table is updated upon receiving a beacon. The neighbors which has not been received beacon within a specified time, are removed from the table. The functionality of NDP must be provided by IARP if the MAC layer does not include a NDP. The two phases of reactive routing process are (1) the route request phase in which the source sends a route request packet to its peripheral nodes using BRP and (2) the route reply phase in which the receiver of a route request packet responds by sending a route reply back to the source if it knows the destination. Otherwise, it continues the process of border casting the packet. In this way, the route request is distributed throughout the network. When a node receives several copies of the same route request are considered as redundant and they are discarded

Advantages: Speed up Delivery and Reduce processing power.

Disadvantages: Each node required Network information and Memory Requirement.

IV. Metrics for Performance Comparison

MANET has number of qualitative and quantitative metrics that can be used to compare ad hoc routing protocols. This paper has been considered the following metrics to evaluate the performance of ad hoc network routing protocols.

A. End-to-end Delay

The average time taken by a data packet to arrive in the destination. It also includes the delay caused by route discovery process and the queue in the data packet transmission. Only the data packets that successfully delivered to destinations that counted.

B. Packet Delivery Ratio

The ratio of the number of delivered data packets to the destination. This illustrates the level of delivered data to the destination.

C. Throughput

It is the measure of the number of packets successfully transmitted to their final destination per unit time. It is the ratio between the numbers of received packets vs sent packets.

V. Simulation Result And Analysis

As already outlined we have taken two On-demand (Reactive) routing protocols, namely Dynamic Source Routing (DSR) and Ad-hoc On-demand Multipath Distance Vector Routing (AOMDV) and one hybrid protocol, namely Zone Routing Protocol. Packet delivery fraction, end to end delay and throughput are calculated for DSR, AOMDV and ZRP. The results are analyzed below with their corresponding graphs.

A. End to End Delay Vs No of Nodes

NO OF NODES	DSR (SEC)	AOMDV (SEC)	ZRP (SEC)
25	134.634	126.309	111.878
50	124.421	110.334	146.79
75	99.6119	112.332	223.56
125	118.98	126.949	307.895
150	96.419	119.952	358.712

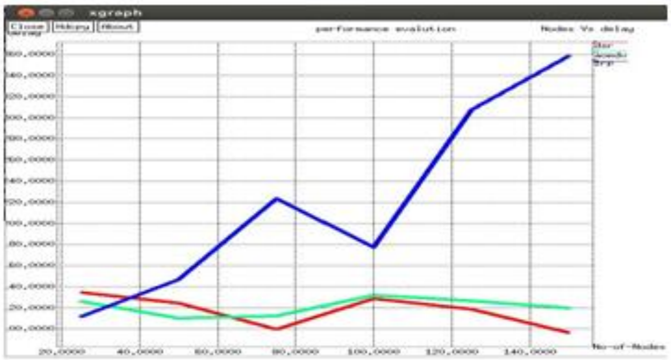


Fig1 Comparison of DSR, AOMDV and ZRP on basis of end to end delay

B. Packet Delivery Fraction Vs No of Nodes

Number of Nodes	DSR	AOMDV	ZRP
25	61.1288	98.8124	77.7751
50	85.7142	98.3397	40.8359
75	85.4167	98.1014	25.6929
100	84.3659	98.3297	11.5752
125	86.2944	98.1663	5.9147
150	86.0	97.6135	3.6619

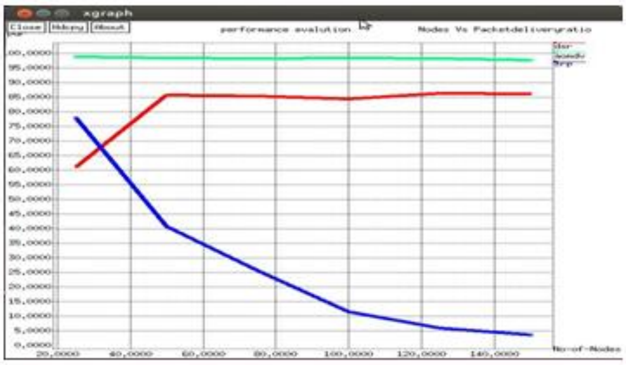


Fig2 Comparison of DSR, AOMDV and ZRP on basis of PDF

C. Throughput Vs No of Nodes

Number of Nodes	DSR	AOMDV	ZRP
25	660.06	653.22	615.15
50	653.10	538.80	482.99
75	678.88	551.70	386.77
100	681.19	535.52	236.32
125	664.93	600.77	163.31
150	699.36	464.36	122.75

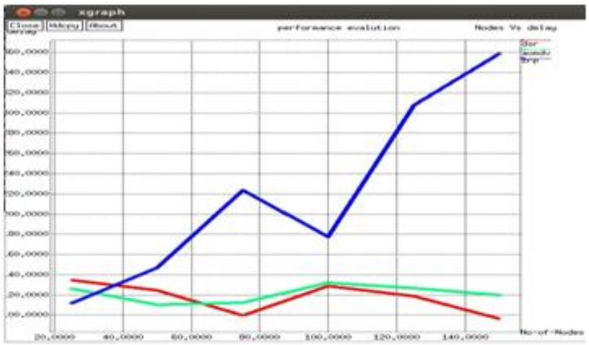


Fig 3 Comparison of DSR, AOMDV and ZRP on the basis of Throughput

VI. Conclusion

This paper evaluated the performance of DSR, AOMDV and ZRP using ns-2. Comparison was based on the packet delivery fraction, throughput and end-to-end delay. When nodes are less ZRP has less delay, if the no of nodes increases ZRP has high delay compared to DSR, AOMDV.AOMDV has average delay. AOMDV has high packet delivery ratio compared to DSR, ZRP at any no of nodes. AOMDV has average through put compared to DSR, ZRP. The performance of AOMDV is remarkably good while comparing its performance with DSR, ZRP. AOMDV being a well known and widely used on demand routing protocol, its performance will be improved in future by reducing delay in communications.

References

[1]. Ruchi gupta, 'A Survey of Energy Efficient Location Based Multipath Routing in MANETs', International Journal of Computer Applications, vol.59, no.11, pp.42-46, 2012.

[2]. Mallikarjun B. Channappagoudar & Pallapa Venkataram, 'Mobile Agent Based Node Monitoring Protocol for MANETs', IEEE National Conference on Mobile Computing, pp.1-5, 2013.

[3]. Karim El Defrawy, & Gene Tsudik, 'ALARM: Anonymous Location Aided Routing in suspicious MANETs', IEEE Transaction on Mobile Computing, vol.10, Issue.9, pp.1345-1358, 2011.

[4]. Elhadi M. Shakshuki, Nan Kang, & Terek R. Sheltami, 'EAACK-A Secure intrusion-Detection System for MANETs', IEEE Transaction Industrial Electronics,vol.60,Issue.3,pp.1089-1098, 2013.

[5]. Hung-Min Suna, Chiung-Hsun Chena, Ling-Chun Hsua & Yao-Hsin Chen, 'Reliable data transmission against packet dropping misbehavior in wireless ad hoc networks', IEEE International Conference on Wireless Mobile and Computing, pp.419-424, 2011.

[6]. Jiajia Lui, Xiaohong Jiang, Hiroki Nishiyama & Nei kato, 'Throughput Capacity of MANETs with Power Control and Packet Redundancy', vol.12, Issue.6, pp.3035-3047, 2013.

[7]. Hanan Saleet, Rami Langar, Kshirasagar Naik, Raouf Boutaba, Amiya Nayak & Nishith Goel, 'Intersection-Based Geographical Routing Protocol for VANETs: A Proposal and Analysis',IEEE TransactionsonVehicularTechnology,vol.60,Issue.9,pp.4560-4574, 2011.

[8]. Marcin Poturalski, Panos Papadimitratos & Jean-Pierre Hubaux, 'Formal Analysis of Secure Neighbor Discovery in Wireless Networks', IEEE Transactions on Dependable and Secure Computing,vol.10, Issue.6, pp.355-367, 2013.

[9]. Seon Yeong Han & Dongman Lee, 'An Adaptive Hello Messaging Scheme for Neighbor Discovery in On-Demand MANET Routing Protocols', vol.17, Issue.5, pp.1040-1043, 2013.

[10]. Adnan Abu-Mahfouz & Gerhard P. Hancke, 'Distance Bounding: A Practical Security Solution for Real-Time Location Systems', IEEE Transactions on Industrial Informatics, vol.9, Issue.1, pp.16-27, 2013.

[11]. Jie Yang, Yingying (Jennifer) Chen, Wade Trappe & Jerry Cheng, 'Detection and Localization of Multiple Spoofing Attackers in Wireless Networks', IEEE Transactions on Parallel and Distributed System, vol.24, Issue1, pp.44-58, 2013.

[12]. Raquel Lacuesta, Jaime Lloret, Miguel Garcia & Lourdes Pen alver, 'A Secure Protocol for Spontaneous Wireless Ad Hoc Networks Creation', IEEE Transactions on Parallel and Distributed Systems, vol.24, Issue.4, pp.629-641, 2013.

[13]. Mohammed Erritali, Oussam a Mohamed Reda & Bouabid El Ouahidi, 'IJARCSSE: UML Modelling of Geographic Routing Protocol 'GPSR' for its integration into the Java Network Simulator', 2012.

[14]. Chia-Mu Yu, Yao-Tung Tsou, Chun-Shien Lu & Sy-Yen Kuo, 'Localized Algorithms for Detection of Node Replication Attacks in Mobile Sensor Networks', IEEE Transactions on Information Forensics and Security, vol.8, Issue.5, pp.754-768, 2013.

[15]. Daojing He, Chun Chen, Sammy Chan, Jiajun Bu & Laurence T. Yang, 'Security Analysis and Improvement of a Secure and Distributed Reprogramming Protocol for Wireless Sensor Networks', IEEE Transaction on Industrial Electronics, vol.60, Issue.11, pp.5348-5354, 2013.

[16]. Shirina Samreen & G. Narasimha, 'An Efficient Approach for the Detection of Node Misbehaviour in a MANETs based on Link Misbehaviour', IEEE 3rd International Advanced Computing Conference, pp.588-592, 2012.

[17]. Jiajia Liu, Xiaohong Jiang, Hiroki Nishiyama & Nei Kato, 'On the Delivery Probability of Two-Hop Relay MANETs with Erasure Coding', IEEE TransactiononCommunications,vol.61,Issue.4, pp.1314-1326, 2013.

[18]. Kassem Fawaz & Hassan Artail, 'DCIM: Distributed Cache Invalidation Method for Maintaining Cache Consistency in Wireless Mobile Networks', IEEE Transaction on Mobile Computing, vol.12, Issue.4, pp.1314-1326, 2013.

[19]. Peng Zhao, Xinyu Yang, Wei Yu & Xinwen Fu, 'A Loose Virtual Clustering based Routing for Power Heterogeneous MANETs', IEEE Transaction on Vehicular Technology,vol.62, Issue.5, pp.2290-2302, 2011.

[20]. Kannan Govindan & Prasant Mohapatra, 'Trust Computations and Trust Dynamics in Mobile AdhocNetworks: A Survey', vol.14, Issue.2, pp.279-298, 2012.

[21]. Janusz Kusyk, Jianmin Zou, Stephen Gundry, Cem Safak Sahin & M. mit Uyar, 'Metrics for performance evaluation of self-positioning autonomous MANET nodes', IEEE Sarnoff Symposium, pp.1-5, 2012.

[22]. Quansheng Guan, F. Richard Yu, Shengming Jiang & Victor C. M. Leung, 'Joint Topology Control and Authentication Design in Mobile Ad Hoc Networks with Cooperative Communications', IEEETransactiononVehicularTechnology,vol.61, Issue.6, pp.2674-2685, 2012.

[23]. Aldar C-F. Chan, 'Distributed Private Key Generation for Identity Based Cryptosystems in Ad Hoc Networks', IEEE Transactions on Wireless Communication,vol.1,Issue.1,pp.46-48,2012. 2012.

[24]. Yingbin Liang, H. Vincent Poor & Lei Ying, 'Secrecy Throughput of MANETs Under Passive and Active Attacks', IEEE transactions on Information Theory, vol.57, Issue.10, pp.6692-6702, 2011.