Volume 5, Issue 8, August 2015 ISSN: 2277 128X
International Journal of Advanced Research in Computer Science and Software Engineering
Research Paper
Available online at: www.ijarcsse.com

# Review of Routing Protocols in MANET by Evaluating Energy Consumption

**Kanika Garg***
Computer Science & Engineering
Dr. K. N. Modi University, Newai, India

**Vineet Kumar Sharma**
Computer Science & Engineering
Krishna Institute of Engineering & Technology, Ghaziabad, India

***Abstract*—The speedy development of wireless networks has simulated countless applications of wireless that have been used in vast areas. MANET is one of that wireless networks. A mobile Adhoc network (MANET) is a type of wireless communication network, where nodes that are not within the direct transmission range of each other require other intermediate nodes between sender and receiver to progress data. The main characteristic of MANET is that its topology is dynamic in nature. This dynamic nature of MANETs raises significant challenges to the design and routing of MANET protocols. Conservation of energy is one of the design constraints for mobile Adhoc networks (MANETs) since mobile nodes are powered by limited battery power and mobile nodes are dynamic in nature. As a result nodes will consume their batteries very soon once routing starts in the network.. So this paper is review of MANET routing protocols based on evaluation of energy consumption In this paper we will consider two network scenario one of 6 nodes and other comprises of 10 nodes. Simulation results indicate that the disadvantage of DSDV (flooding of data) can be used as an advantage to control energy consumption. In this paper we consider three routing protocols AODV, DSDV and DSR for simulation.***

***Keywords*— Mobile Adhoc Network, AODV, DSDV, DSR, Energy Consumption.***

## I. INTRODUCTION

The rapid evolution of wireless network has become increasingly popular in the computing industry. The field of mobile computing is driving a new alternative way for mobile communication in which [1] the mobile devices form a self-creating, self-organizing and self-administering wireless network called mobile Adhoc network (MANET). A mobile Adhoc network (MANET) is a collection of mobile nodes that are dynamically located in a manner that can communicate with each other using multihop wireless links. In MANET interconnections between nodes can be changed on continual basis means there is no stationary infrastructure; for instance there are no base stations. MANETs do not use any centralized administration. Each node in the network also acts as a router forwarding data packets for other nodes [2] means all nodes work independent of any common centralized administrator. Example application of Adhoc networks are emergency search and rescue operations, meetings or conventions in which persons wish to quickly share information.

**1.1 Problem Definition-** As nodes in mobile Adhoc networks work independently means if their connection topology changes, their routing tables should reflect the change. Also since they are mobile, they largely run on finite batteries. One of the main design constraints in mobile Adhoc networks is that they are power constrained. In MANETs the nodes are constrained by the battery power for their operation. To route a packet from source to destination [3] involves a sufficient number of intermediate nodes. Hence the battery power of a node is a precious resource that must be used efficiently in order to avoid early termination of a node or a network. The prime concern of this paper is to make a comparative and statistical study among routing protocols Adhoc On-Demand Distance Vector Routing (AODV), Dynamic Source Routing (DSR), Destination Sequenced Distance Vector (DSDV) by calculating their energy throughput or efficiency. The main objective of this paper is to find out which MANET routing protocol will achieve optimal energy efficient routing. Based on the observations we make recommendations about efficient performance of routing protocols.

**1.2 Description of Routing Protocols-** MANET routing protocols are categorized in 2 types

- Table – Driven (Proactive)
- Source – Driven (Reactive)

**1.2.1 Table Driven (Proactive) Routing Protocols-** In table driven routing protocol the main attempt is to maintain up-to-date information from each node to every other node in the network. In proactive routing each node consists of one or more tables that contain the latest information of the routes to any other node in the network. The nodes of this routing protocol [4] respond to changes in network topology by propagating updates or latest information throughout the network in order to maintain a consistent network view.

**1.2.2 Source Driven (Reactive) Routing Protocols-** Reactive routing protocol is also known as on demand routing protocol. Source driven routing protocol has different approach from table driven routing protocol. This type of routing creates routes only when desired by the source node. They do not maintain or constantly update their

 

route tables with the latest route topology. When a node requires a route to a destination, it initiates a route discovery process within the network. This process is completed once a route is found or all possible routes have been examined. Once a route has been established, it is maintained by a route maintenance procedure.

## II. EXISTING ROUTING PROTOCOLS

We explained three routing protocols of MANET - AODV, DSDV and DSR. We performed our simulation work for calculating energy consumption to evaluate the above mentioned protocols.

**2.1 Adhoc On-Demand Routing Protocol-** AODV is on demand routing protocol. It is a source driven routing protocol in which it does not maintain routes for every node to other node in the network. Whenever a route to the destination is needed, it initiates a route discovery process and the routes remains as long as they are necessary. It broadcasts a route request (RREQ) packet to its neighbors which then forward the request to their neighbors and so on until destination node is located. Once the RREQ reaches the destination, the [5] destination node responds by unicasting a route reply (RREP) packet back to neighbor from which it first received the RREQ. Another feature of this protocol is the use of hello messages, periodic local broadcasts by a node to inform each mobile of other nodes is neighborhood. These messages can be used to maintain the local connectivity of a node. Route maintenance phase is responsible for maintaining the routes. If the route is not available, then error message (RERR) will be sent, and all nodes will be notified.

**2.2 Destination Sequenced Distance Vector Routing-** Destination Sequence Distance Vector (DSDV) is a proactive routing protocol and is based on the distance vector algorithm. In DSDV each routing table will comprise all available destinations, associated with next hop. A sequence number and associated metric are created by a destination node. The routing tables are renewed in the topology after exchange between nodes. All the nodes can broadcast to its neighbor's entries in their table. This swap of entries can be done by dumping the whole routing table, or by presenting an [6] incremental update, which means exchanging just newly updated routes. Nodes which obtain this data can then renew their tables if they received a better route, or a latest one. Updates are implemented regularly, and are immediately scheduled if a new event is found in the topology. If there are repeated changes in topology, complete table exchange will be favored whereas in a fixed topology, incremental updates will produce less traffic. The route selection is done on the metric and sequence number standards. The sequence number is a time signal sent by the destination node. It permits the table to update process, as if similar routes are known, the one with the best sequence number is kept and used, while the other is abolished and, which is considered as the stale entries. The structure of the routing table for this protocol is simple. Each table entry has a sequence number that is incremented every time a node sends an updated message. Routing tables are periodically updated when the topology of the network changes and are propagated throughout the network to keep consistent information throughout the network. Each DSDV node maintains two routing tables: one for forwarding packets and one for advertising incremental routing packets. The routing information sent periodically by a node contains a new sequence number, the destination address, the number of hops to the destination node, and the sequence number of the destination. When the topology of a network changes, a detecting node sends an update packet to its neighboring nodes. On receipt of an update packet from a neighboring node, a node extracts the information from the packet and updates its routing table as follows.

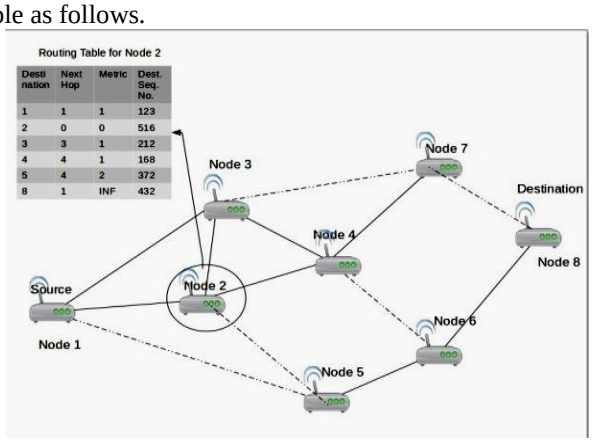


Fig. 1. Shows a routing table for node 2, whose neighbors are nodes 1, 3, 4, and 8. The dashed lines indicate no communications between any corresponding pair of nodes. Therefore, node 2 has no information about node 8.

Figure 1 shows a routing table for node 2, whose neighbors are nodes 1, 3, 4, and 8. The dashed lines indicate no communications between any corresponding pair of nodes. Therefore, node 2 has no information about node 8. The packet overhead of the DSDV protocol increases the total number of nodes in the ad-hoc network. This fact makes DSDV suitable for small networks.

**2.3 Dynamic Source Routing (DSR)-** The key distinguish feature of DSR is the use of source routing. That is sender knows the complete hop by hop route to destination. These routes are stored in route cache. The data packets carry the source route in the packet header. When a node in the Adhoc network attempts to send a data packet to a destination for which it does not already know the route, it uses a route discovery process to dynamically determine such a route. Route discovery works by [7] flooding the network with route request (RREQ) packets. Each node receiving an RREQ [4] rebroadcasts it, unless it is destination or it has a route to the destination in its route cache. Such a node replies to the

 

RREQ with a route reply (RREP) packet that is routed back to the original source. RREQ and RREP packets are also source routed. The RREQ builds up the path traversed across the [5] network. The RREP routes itself back to the source by traversing this path backward. If any link on a source route is broken, the source node is notified using a route error (RERR) packet. The source removes any route using this link from its cache.

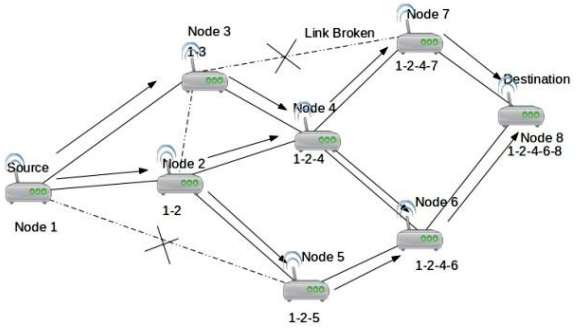


Fig. 2. Shows that in DSR protocol route discovery takes place by flooding the route request packet (RREQ) in the network. This packet is transferred to every node until and unless captured by destination node.

Above figure shows an ad-hoc network with eight mobile nodes and a broken link (3-7). Node 1 wants to send a message to the destination, node 8. Node 1 looks at its routing table, finds an expired route to node 8, and then propagates route-request packets to nodes 3 and 2. Node 3 finds no route to the destination and so appends the route record 1-3 to the route-request packet and forwards it to node 4. On receiving this packet, node 7 finds a route to the destination and so stops propagating any route-request packet and instead sends a route-reply packet to the source. The same happens when a route-request packet reaches the destination node 8 with a route record 1-2-4-6. When the source, node 1, compares all the route-reply packets, it concludes that the best route is 1-2-4-6-8 and establishes this path.

## III. SIMULATION AND RESULTS

In this work we designed a network scenario in which we consider 6 nodes (Node0 – Node5) for the communication between sender (Node0) and Receiver (Node5) shown in the figure no. We mainly elaborate on three different routing protocols (AODV, DSDV and DSR) on Mobile Adhoc Network scenario to analyze the energy consumption throughout the communication process.

**3.1 Scenario Environment—** For our simulation work we have created two types of scenario environment by considering different number of nodes. In first scenario we assumed 06 nodes and in second scenario we assumed 10 nodes. We consider the following parameters for our simulation work. While we consider the antenna length 1.1 in our first scenario (6 nodes) the communication path is 1, 3, 5 (1 and 5 are sender and receiver respectively) and in second scenario (10 nodes) the communication path is 1,2,4,5 (1 and 5 are sender and receiver respectively) [8].

$P_t$ = .28183815

$R_x$Thresh = 3.652e-10

Antenna Length =1.1

Where $P_t$ = Transmitted Signal Power

$R_x$Thresh= Signal Reception

On the basis of above mentioned data we calculate transmission range for our scenarios.

$(\text{Transmission Range})^4 = (\text{Antenna Length})^4 * P_t / (R_x\text{Thresh})$ (1)

By using above equation the transmission range of nodes is 183.33. Based on these values we performed our simulation for two scenarios.

**TABLE 1**

Simulation Parameters. Adapted from: "*The ns Manual*", The VINT Project A Collaboration between researchers at UC Berkeley, LBL, USC/ISI, and Xerox PARC. 4 November,2011. http://www.isi.edu/nsnam/ns/doc/ ns_doc.pdf

| | |
|---|---|
| Channel Frequency | 2.4 GHz |
| No. of Nodes | 06/10 |
| Antenna Length | 1.1 |
| Simulation Time Period | 150 |
| Node Max Energy | 10 |
| Transmission Range | 183.33 |

 

According to the data mentioned in table 1, as we assumed two scenarios and based on that, we examined the behavior of routing protocols with respect to energy consumption. Figure no.3 is depicting that AODV and DSR are utilizing maximum energy at Node3 only because of shortest path criteria for routing. As a result Node3 will die out soon, if this situation persists.

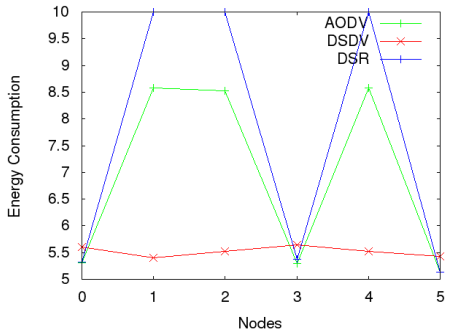


Figure 3: shows node wise energy consumption for first scenario (6 nodes).

While in DSDV energy consumption is different because load is distributed among all nodes in the network.

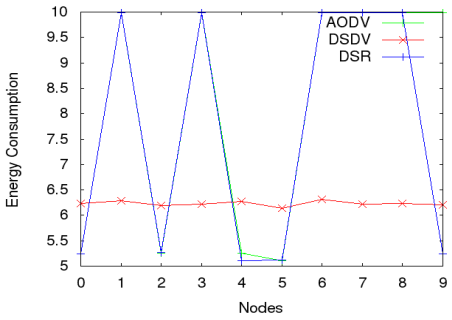


Figure 4: shows node wise energy consumption for second scenario (10 nodes).

The same scenario happened in figure no. 4 in which there are total 10 nodes in network. Figure is showing that AODV and DSR are utilizing maximum energy at Node2 and Node4 because of shortest path criteria. As a result these two nodes will die out soon, if this situation persists. While in DSDV energy consumption is different because of load distribution behavior.

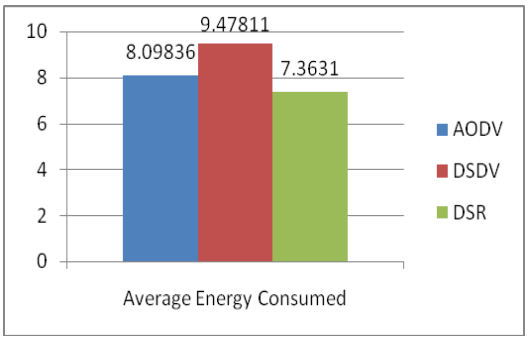


Figure 5: shows average energy consumption for first scenario (6 nodes)

In figure 5, it is clearly shown that DSDV has maximum average energy consumption because of its load distribution method as RREQ packet is flooded to all nodes in the network. As DSDV includes all its nodes while transmitting data from sender to destination hence it is having higher average energy consumption in comparison with AODV and DSR. Same result can also be seen in figure 6.

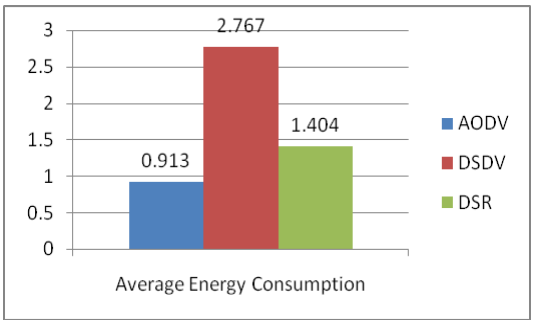


Figure 6: shows average Energy Consumption for second scenario (10 nodes)

 

## IV. CONCLUSION

In this paper we elaborate on maximum energy consumption of various routing protocols in mobile Adhoc networks. We presented the results of energy consumption behaviour of three routing protocols Ad hoc on demand routing protocol (AODV), Destination Sequenced Distance vector (DSDV) and Dynamic Source Routing (DSR). The results obtained from simulation allowed us to conclude that in AODV and in DSR, routing is followed by only shortest path criteria. In this paper we consider two network scenarios of 6 nodes and 10 nodes respectively. Simulation results of both scenarios are indicating that the disadvantage of DSDV (load distribution behaviour or flooding) can be used as an advantage in future. As a result node along shortest path (3) is used more often and exhausts its battery faster. But in DSDV scenario is somewhat different, it is using all possible routes in which all nodes are taking part in routing equally. Due to load distribution nature of DSDV its disadvantage (flooding) can be consider as an advantage in future scope to control the energy consumption.

## REFERENCES

[1] Shiva Shankar, Golla Varaprasad, Hosahalli Narayanagowda Suresh: *Importance of on-demand modified power aware dynamic source routing protocol in mobile ad-hoc networks*, IET Micro Antennas Propagation, Vol.8, Issue 7, 459-464.(2014)

[2] Shilpa Mehta, Tamanna, Mukesh Kumar: *A Comparitive Study of Power Aware Routing Protocols of Ad Hoc Network*, National Workshop Cum-Conference on Recent Trends in Mathematics and computing (RTMC), International Journal of computer applications.(2011)

[3] P.S. Karadge, Dr. S.V. Sankpal: *A Performance Comparison of Energy Efficient AODV Protocols in Mobile Adhoc Networks*, International Journal of Advanced Research in Computer and Communication Engineering, Vol.2, Issue 1, 1000-1004.( January 2013)

[4] Elizabeth M. Royer, Chai-Keong Toh: *A Review of Current Routing Protocols for Ad Hoc mobile Wireless Networks*, IEEE Personal Communications, 46-55.( April 1999)

[5] Charles E. Perkins, Elizabeth M. Royer, Samir R. DAS and Mahesh K. Marina: *Performance Comparison of Two On- Demand Routing Protocols for Ad Hoc Networks*, IEEE Personal Communications, 16-28.( February 2001)

[6] D. Loganathan, P. Ramamoorthy: *Performance Analysis of Enhanced DSDV Protocol for efficient Routing in Wireless Ad-Hoc Networks*, International Journal of Engineering and Science, Vol.2, Issue 10, 01-08.(April 2013)

[7] Morteza Maleki, Karthik Dantu and Massoud Pedram: *Lifetime Prediction Routing in Mobile Ad Hoc Networks*.

[8] ns-2 Manual. [online]. Available http:// www.isi.edu /nsnam/ns /doc/index.html.

 