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Research Paper

Scheme to Make DSR and AODV Energy Efficient

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Abstract —Mobile Adhoc networks is the latest trend in networking arena and in research criterion. Many issues exist. Most important being routing, security and power issues. This paper is an effort to improve power functions of protocols. Two Algorithms have been proposed. This work has been done on two most popular routing protocols AODV and DSR used in on demand routing. The concept has been implemented and simulated. The results have been verified by simulating the protocols on NS2. Various metrics used are total energy consumed and packets exhausted.

Keywords — AODV, DSR, energy, NS2, Simulator

1. Introduction

Electronic scientists are moving from a processor–centric to a network-centric world with ability to process and share vast amount of distributed data. Efforts are showing their rewards with development of fast, reliable, secured and wide-ranging projects in terms of both software and hardware. These experiments will not only benefit the scientists but everyone else in the field of commerce, communications, health care and entertainment. The trend is bound to go on and on and more new things are still to knock our horizon. The important phenomenon is that the changes are occurring in all the major areas. Financial sector , Education system, Daily transactions, Mailing system , data transfers , Researches , e-commerce , conferencing and an unending list of areas.

An ad hoc wireless network is a collection of mobile devices. It is equipped with interfaces and networking capability. Ad hoc [1] networks can be mobile, standalone or networked. Communication is possible using their radio range for nodes nearby or by multihop for one that is outside their range. An Ad hoc network is adaptive in nature and is self organizing. Topology changes are very frequent and unpredictable in adhoc networks. A mobile ad hoc network is denoted as MANET [2]. The major characteristic of MANET is dealing with wireless link nature and node mobility.

Basically this includes dynamic topology, bandwidth. Other major issues are energy constraints, security limitations and lack of infrastructure. Among applications of MANET, most common are virtual classrooms, military communications, emergency search and rescue operations, data acquisition in hostile environments, communications set up in Exhibitions, conferences and meetings, in battle field among soldiers to coordinate defense or attack, at airport terminals for workers to share files etc.

Several routing protocols [1, 2] for ad hoc networks have been proposed as DSR, DDR, TORA, AODV and RDMAR. Major emphasis has been on shortest routes in all these protocols in response whenever break occurs. In this paper a new scheme the stable routing embedded with power factor has been suggested. This scheme will react to link breakages and changes in network topology in a much quicker fashion.
According to RFC 2386[18], quality of service has been defined as providing a set of service requirements to the flows while routing them through the network. In this paper A new scheme has been suggested which combines two basic features to achieve Qos. These are stable routing and concept of battery power. The scheme uses extra nodes for stable routes and uses power factor to determine active nodes to participate in routing.

The rest of the paper is organized as follows: Section 2 takes a look at the proposed plan along with algorithms. Section 3 analyzes Results and Last Section 4 summarizes the study and the status of the work.

2. Related Work

Author [25] described the concept of MANET, its characteristics and various attacks and challenges in an efficient manner.

In this paper author [23] compares the routing protocols AODV, DSDV and DSR performance in the cluster base

MANET environment with increases the mobile node in the cluster for making high traffic scenario. Author also suggested that for wireless networks, energy is forever fundamental resource, so there is need to prepare a mechanism to minimize the energy consumption.

In this paper [24] author emphasized that to attain high QoS in MANET, the energy, the location, and mobility of nodes are one the important factors that need to be taken into consideration. Therefore author designed a new algorithm (QAC) and compares the results with existing QOS, AODV, BMR and MSR

Author [26] depicted that Dynamic Source Routing(DSR) is one of the main widespread method used for source routing and continuously updating of information is not required to make and maintenance of route . In this when a request is given by network then route discovery and maintenance of route service is invoked.

Hubs might go up or nod off independent of the courses they are right now adjusting. This basic political race process, which as of now runs regardless of courses, would cause many broken source courses and make pointless above in course recuperation.

The author [27] emphasized that for approaching the power saving problem in Ad-hoc network On-line power aware is the best method. This plan takes specific consideration to course messages through the organization productively, limiting the energy utilized in correspondence. Their work is reciprocal to that of Range, which looks to limit energy utilization by placing hubs in a dozing state when they are not required. Their work likewise presents a new directing plan, called zone steering, that exploits their way to deal with online power saving.

stikmal et al [3] Mobile Ad hoc is a network that does not have the infrastructure and have the ability to manage its network independently, in the future this network process use as a system key to the development of network features. In this paper we use organized routing protocols in mobile ad hoc network (MANET), the optimization is done on the routing protocol DSR (Dynamic Source Routing) which is reactive routing protocol using ant algorithm for analysis and describing the performance of this routing protocol in various scenario and compared the result with standard DSR routing protocol
The authors [28] stated that MANET is an organization that doesn't have the framework and can deal with its organization freely, later on this organization interaction use as a framework key to the improvement of organization highlights. For analysis and describing the performance of routing protocol in various scenarios and for comparing the result with standard DSR routing protocol authors organized routing protocols and optimization is done on the routing protocol DSR (Dynamic Source Routing) by using ant algorithm.

Proactive routing protocols are basically table-driven system that is the routing tables which exchanged periodically between nodes which results in more energy consumption as stated by the authors [29]. Authors in the paper strengthen to go for DSR and AODV to increase the throughput thereby reducing the routing overhead and jitter between nodes.

Author [30] proposed an approach which is extremely straightforward and further develops energy productivity with practically no data about neighbor hubs. In the proposed plan when a hub gets a RREQ, the hub computes the energy level back off time, which is conversely relative to the got force of the RREQ. After course disclosure, source and halfway hub communicate parcels to the objective.

3. Proposed Scheme

In ordr to achieve better results with battery status, new algorithms have been proposed for two most popular protocols. These two protocols taken for case study are DSR and AODV.
In case of DSR cache is used and in AODV beckoning is done. Both are able to give packet delivery reaching 95-98 percent.
In the present case emphasis is on Battery usage. Whenever a node participating in route gets depletion of battery, it fades out and a break occurs. This can cause loss of packets. The two algorithms have been proposed to take care of this battery issue.

Algorithm 1:

Algorithm for implementing power management in DSR:

1: RREQ phase is initiated (no change in this, same as DSR)

2: RREP is invoked; once the route request process is over and the route is established, the Route Reply packet is broadcast by the destination

3: **DIST(x1, x2)** Distance Function is called.
The immediately previous node in the selected path determines the distance between itself and the destination, by means of the time taken by the Route Reply packet to reach it.

4: Route Table Updation
All the nodes in the selected path follow the same procedure and the distance between the nodes is determined and stored in the cache.

5: Power Calculation
The transmitted power is determined using the following formula,
Transmitted Power = $(a \times d^4) + c$ ----- (1)
Where‘d’ is the distance between two adjacent nodes
‘a’ and ‘c’ are arbitrary constants
$a = Pr * k$ ----- (2)
Pr = Minimum Received power , k is constant

6: Transmitted power is varied in accordance with the distance

This algorithm is used for DSR routing. Battery status is updated in cache and then route is re-established in case of failures. Route Request is same as of DSR. In case of link break a new scheme is incorporated.

First Distance is calculated and then this value is used to calculate battery status. The transmitted power factor is calculated using equation and this power factor is transmitted to all nodes for stale routing.

Algorithm 2

Algorithm for power management in AODV:

Proposed Scheme

1. **Route Request**: RREQ phase is invoked. The source node ***S*** broadcasts an *RREQ* message containing threshold value T_B, and current estimated distance *D*B*s* from ***S*** to destination ***D***.

2. At any node *N*

Case 1: *E*B*n* > *E*B*th* && *T* - *T(N)*< *T*B*th*
A reply message RREP *containing* the route length is sent

Case 2: *E*B*n* > *E*B*th* && *D*B*s* > *D*B*n*
An *ACTIVE_NEG* message is sent
Case 3: *E*B*n* < *E*B*th*
No reply is sent

where, *E*B*n* is the energy level of the node, *E*B*th* is a pre-defined threshold, *T* and *T(N)* are the current time and the time when last packet had been forwarded *D* through *N* respectively and *D*B*n* is the current estimated distance of the node from the destination.
3. at the source node ***S***

Case 1: All received RREP messages are scanned. The path with shortest active route is selected for forwarding the data and other nodes are stored as alternate nodes in the event of a link failure. RREQ message is sent to the selected node.
Case 2: If S receives only *ACTIVE_NEG* messages. Neighbour with minimum distance *D*B*n* is selected for forwarding data. Other nodes are kept as backbone nodes for future use in case of a link failure.
4. A node receives *RREQ message*. It forwards it on the available active route. The destination node D sends back *RREP* on the reverse path.
6. After *S* receives *RREP*, route is established. Data is forwarded over the established route.

In these schemes major emphasis is to provide an efficient, more stable and long lasting route from source to destination. This routing scheme is designed for mobile ad hoc networks with large number of nodes.

This scheme will be able to handle low, moderate and relatively high mobility rates. It will handle a variety of data traffic levels.
To avoid overhead and reduce cost factor in selection of routes, maximum changes have been made in repair phase. In DSR route selection procedure is updated in cache and in AODV changes are made in local repair.

4. Results

The simulation results are presented here. These have been obtained using the NS-2 [20] simulator (version *ns-2.34*). Simulations are run over a 1Km × 1 Km square flat topology. The number of wireless mobile nodes was fixed to 50 and 100 nodes. The random waypoint model [21] is used to model mobility. All random scenarios have been generated for a maximum speed of 15 m/s and a pause time of 0 seconds and 500 seconds. Traffic sources are chosen as TCP-IP with a packet-size of 512 bytes. All traffic sessions are established at random times near the beginning of the simulation run and they remain active until the end of the simulation period. Simulations are run for 500 simulated seconds. NS-2 inbuilt 714 MHz Lucent Wave LAN Direct Sequence Spread Spectrum (DSSS) Model with various simulation parameters used for generating energy patterns.

Table 1: Simulation parameters

Frequency	915e+6
Transmitted signal power	0.2818 W
Power consumption for transmission	1.6 W
Power consumption for reception	1.2 W
Idle power consumption	0 W
Threshold	10 db
System loss factor	1.0
Data rate	1 mbps
Transmission range	200 mtr
Area	1000 × 1000
Packet size	512 byte

a) Total Energy Consumption
Total energy consumption (in joules) can be defined as the difference between the total energy supplied to the network and the residual energy with the network. The initial energy supplied to the network in each scenario is 5000 Joules.
In first case: Pause Time: 0 Second, Number of Sources: 10 - 25, number of nodes are 50.

Fig. 1 illustrates the behaviour of AODV and DSR for 0 pause time (max. mobility) and varying number of sources. It is observed in the Fig. 1 that AODV consumes an average of 28.26 Joules of energy less than DSR for the pause time of 0 seconds. For such a network of continuously moving nodes with varying number of sources the performance of AODV is better than DSR, except for the number of sources between 25 to 35. Many ups and downs have occurred. Overall, AODV outperforms DSR.

In second case: Pause Time: 500 Seconds, Number of Sources: 10 to 25 and number of nodes are 50.
For a large pause time of 500 seconds, Fig. 2 illustrates that DSR consistently consumes 55.70 Joules more than AODV. As the number of sources increase, the total energy consumed in AODV is less as compare to DSR except for the numbers of sources between 20 to 27. This corresponds to a better performance of AODV with respect to DSR in a network of stationary nodes.

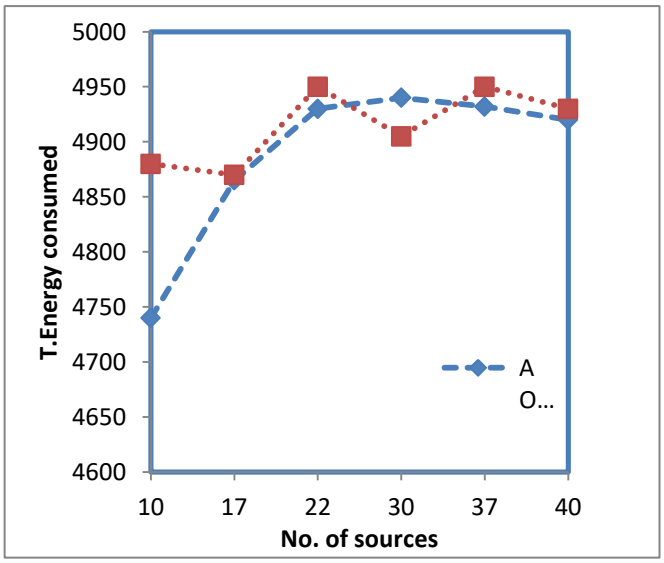

Fig. 1: Total energy consumed (50 nodes) Pause time 0

The DSR performance is due to the fat that routes are stored as cache and all routes are maintained, so it takes a bit of extra energy.

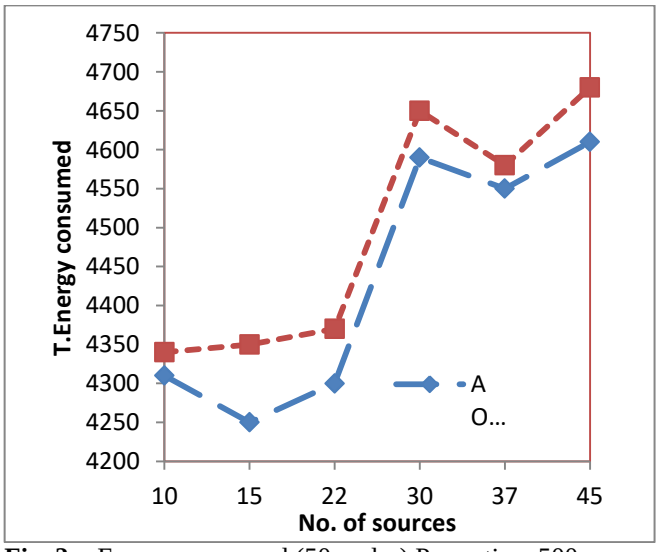

Fig. 2: Energy consumed (50 nodes) Pause time 500

b) Number of Exhausted Nodes

This is the number of nodes that die-out at the end of each simulation run, due to the consumption of all the 100 Joules of energy supplied to them at the start of the simulation.
In case 3: Pause Time: 0 Sec; Number of Sources: 10 to 25, Nodes: 50

It can be observed from Fig. 3 that for 0 pause time and various numbers of sources, on an average, only 74 % of the total nodes died till the end of simulation run in case of AODV while 78% of deaths were reported in the case of DSR.

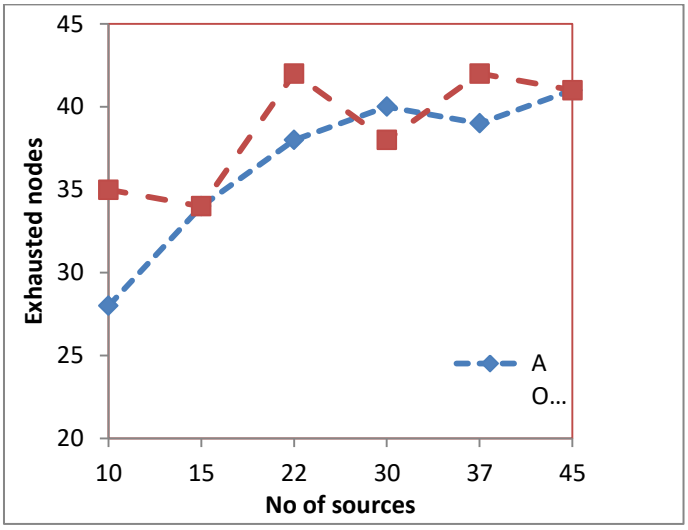

Fig 3: Exhausted nodes: 50 nodes pause time 0

In case 4: Pause Time: 500 Sec; Number of Sources: 10 to 25, Nodes: 50
As shown in Fig. 4, an average of 52.34% of total nodes gets exhausted when DSR is employed, against 49% deaths in AODV for a large value of pause time and for various traffic loads. Hence, AODV outperforms DSR in terms of number of exhausted nodes whatever be the mobility and traffic load conditions in a network of 50 nodes.

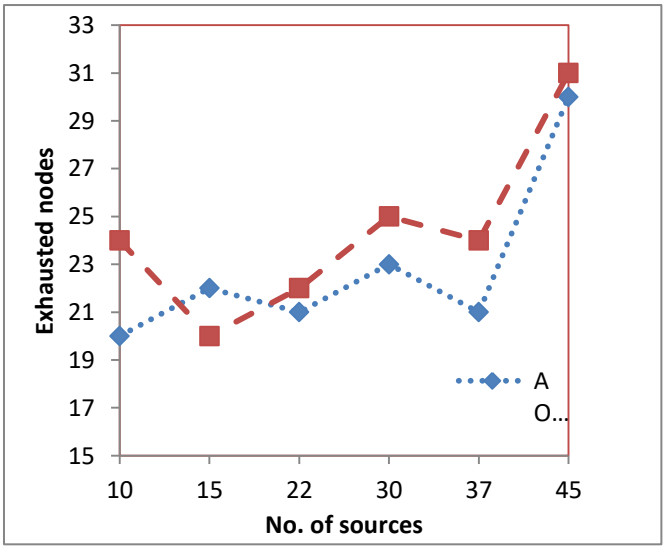

Fig 4: Exhausted nodes: 50 nodes pause time 500

5. Conclusion

A new scheme with developed algorithms has been proposed. It works on a reactive approach. It is able to utilize alternate paths by satisfying a set of energy based criteria. The two algorithms have been proposed and are incorporated in

AODV and DSR. The Major emphasis is on energy factor. The scheme can be incorporated into any ad hoc on-demand routing protocol. This will help in to reduce frequent route discoveries. Most important factor is that alternate routes are utilized only when data cannot be delivered through the primary route.

As a case study, the proposed scheme has been applied to AODV and DSR and a significant improvement in performance was observed. Simulation results indicated that the proposed scheme provides robustness to mobility and enhances protocols performance. Average increase in packet delivery occurs for different network scenarios. Efforts are on to work the scheme in sparse medium and compare results with other related schemes.

Data Availability: None

Conflict of Interest: None

Funding Source: None

Authors' Contributions

After studying literature it is found that a lot of improvement in the existing methodology for the performance of AODV and DSR is required. Therefore author designed a scheme for power management in DSR and AODV.

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