Survey on Power Aware Routing in Multi-Path DSR

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Abstract— The aim of this research is to study how to increase the lifetime of network .The Ad-hoc wireless networks are power constrained which means they are operated with battery .The objective is to study the various power aware routing protocols and also energy efficient protocols which are based on the mechanisms of DSR.

Keywords— Mobile Ad-hoc network (MANET), EA-DSR protocol, DSR , MME –DSR , Residual energy;

I. INTRODUCTION

A Routing as one of the cornerstones of any network including Manets is needed whenever data packets need to be handed over several nodes to arrive at their destinations. The Routing protocols are used to find routes for packet delivery and make sure that the packets are delivered to the correct destinations. [1] A mobile ad hoc network is a set of wireless mobile nodes can be connected dynamically in an arbitrary manner. The nodes of these mobile Ad-hoc networks behave as routers and take part in discovery and maintenance of routes to other nodes in the network. [2]. While a fixed infrastructure wireless network is a static network where its different components have to be set up permanently prior to the establishment of the communication. It takes not only huge time but also involves a huge cost for establishing the network. [3]

A mobile ad hoc network [MANET] can be characterized by the mobile nodes which have freedom to move at any direction and have the ability of self-configuring, self-maintaining and self-organizing themselves within the network by means of radio links without any fixed infrastructure like base station, fixed link, routers, and centralized servers. As in the network there is no base station or central coordinator exists, so the individual node plays the responsibility as a router during the communication, participating in the network communication. Hence all the nodes are incorporated with a routing mechanism in order to transmit a data packet from source to destination. [3]

Nodes are operated by battery which is having limited capacity and they all suffer from severe battery consumption, especially when they participate for data communication for various sources and destinations. For an uninterrupted data transmission from source to destination it requires a continual updating of path. If any moment path is not found from source to destination, then Route Discovery Process has to be called. And multiple times route Discovery Process may introduce heavy power consumption. A number of routing approaches have been proposed to reduce various types of power consumption caused by various reasons in the wireless ad hoc network, which in result not only prolongs the life span of individual nodes but also reduces the network partition and enhances the performance of the network. [3]

A. Classification of Routing Protocol's in Manet
Routing protocols in mobile Ad-hoc network are divided in to 2 main groups:-

- o Table driven or Proactive Protocols

- o On Demand or Reactive Protocols

1) Table driven or proactive protocols :
Proactive Protocol as the name signifies, each node keeps all routing information to every other nodes in the network by maintaining one or more routing tables. This routing information gets updated periodically in the table to maintain the latest view of the networks. It comes in use when a node requires a path to a destination. Some of the existing table driven protocols are DSDV, DBF, GSR, WRP, ZRP and many more. This paper does not cover all these table driven protocols as it is focused on DSR and different modification made on DSR protocols. [3]

2) Reactive or On demand protocols :
The protocols which fall under this category are completely different from the previous one. Here the protocols are On Demand routing protocols do not update the routing information periodically as there is no routing table present for keeping routing information. Each node has route cache. [2] Rather than routing table where it keeps all latest paths from source to destination. A path is obtained when it is to establish a communication path between a source to a destination. And that path is stored in the cache of that node whenever request is generated it consults its cache. Some of the example of on demand routing protocols are DSR, AODV, TORA, ABR etc. [3]

Dynamic Source Routing (DSR)

The key distinguishing feature of DSR is the use of source routing. Dynamic Sourcing routing is a reactive protocol i.e. it does not use periodic advertisement to update the route. It computes the routes when necessary and then stores them in its cache. Source routing is a routing technique in which the sender of a packet determines the complete sequence of nodes through which the packet has to pass; the sender explicitly lists this route in the packet's header, and then identifies each forwarding hop by the address of the next node to which to transmit the packet on its way to the destination [4]

Now, when a node in the Ad-hoc network attempts to send a data packet to a destination for which it does not have any route, it uses a route discovery process to dynamically determine such a route. The Route discovery process works by flooding the network with route request (RREQ) packets [4]. This route request contains address of the destination, address of the source and a unique identification number that is generated by the source node only [3]. Each node receiving a RREQ packet rebroadcasts it, if and only if it is not the destination node or if its route cache has a route to the destination. Such a node replies to the RREQ packet with a route reply (RREP) packet that is routed back to the original source that generated the request. The RREQ builds up the path that has been traversed till now. The RREP routes back itself to the source node by traversing this path in the backward direction. The route carried back by the RREP packet is then cached at the source node for future use. [4]

If any link on a path that is discovered for route discovery process is broken, the source node is informed by using a route error (RERR) packet. On receiving the route error message the source removes any route using this link from its cache. Now a new route discovery process must be initiated by the source, if this route discovered is still needed. By DSR it makes very aggressive use of source routing and route caching. No special mechanism is used to detect routing loops. [4]

II. RELATED STUDY

Ehsan Khosrowshahi Asl [1] used an ant-colony optimization method to provide global information. The simulation results concluded that the EMP-DSR outperforms MP-DSR both in finding reliable paths and end-to-end delay with a little tolerable overhead.

Mamoun Hussein Mamoun [2] presents a New Technique for Route Selection (NTRS) in DSR routing protocol to minimize the load by choosing the most stable path. His proposal mechanism estimates the stability of the path by means of the received signal strength.

Baisakh [3] presents a comprehensive summery of different energy efficient protocols that are based on the basic Mechanism of DSR and enlightens the effort and commitment that has been made since last 10 year to turn the traditional DSR as energy efficient routing protocol. From various different performance analysis and results, it is seen that DSR has been an outstanding routing protocol that outperforms consistently than any other routing protocols. But it could not take the same place when the performance was considered in term of energy consumption at each node, energy consumption of the networks and energy consumption of node due to different overhead. Because, DSR protocol does not consider energy as its parameter. And as MANET is very sensible towards the power related issues and energy consumption as it is operated by the battery with the limited sources, it is needed to be used efficiently, so that the lie time of the network can be increased and performance can be enhanced.

P.S. Patheja [4] presents that the destination will accept at most first three route request packets from the same source for the same transmission (i.e. same ID) which gives the source, with multiple paths from source to destination for transmission. It then utilizes all these discovered paths for data transmission. Also multiple paths allow load balancing and faster delivery.

Kulbir Nain [5] The Dynamic Source Routing is a simple and robust protocol designed for use in multi-hop wireless ad-hoc network of mobile nodes [10]. Under DSR protocol, Ad-hoc network nodes have to co-operate in packet forwarding and route discovery procedures for the network to operate. Some nodes, in order to save resources, may exhibit a selfish behaviour and does not co-operate in data transmission, thus damaging the efficiency of entire network. The author proposed a set of minor extensions to the DSR protocol proposed by a working group called IETF MANET ,which implemented a reputation based scheme , that enable to increase the performance of the network. This proposed mechanism allows a node to independently evaluate the "reputation" of its neighbours based on the completion of the requested services.

Naigende Duncan [6] proposed EEDSR, which is an extension of DSR that reduces routing overhead by limiting the number of route discovery and maintenance packets in the MANET. This mechanism involves bigger packet headers for the source route discovery packets since they contain information about the energy levels of the nodes in their route cache. In EEDSR, since the RREQ packets are flooded once for each communication period, routing overhead is also minimized. The author presented this theory since the routing overhead generated by routing algorithm still leaves substantial amounts of energy being wasted. If the Route Request (RREQ) and Route Maintenance packets are not controlled they may generate overhead control packets which may occupy bandwidth, consume energy and overwhelms the network.

Vinay Rishiwal [7] proposed an algorithm that maximizes the network lifetime by minimizing the power consumption during the route establishment from source to destination. The algorithm proposed from the case study has been incorporated along with the route discovery procedure of AODV and by simulation it is observed that proposed algorithm's performance is better as compare to AODV and DSR in terms of different energy related parameters like Total Energy Consumed, Average Energy that is Left Per Alive Node, Node Terminating Rate, and Network's Lifetime for different network scenarios.

Morteza Maleki [8]   assuming that all nodes start with a finite amount of battery capacity and that the energy dissipation per bit of data and control packet transmission or reception is known ,presents a new source-initiated (on-demand) routing protocol for mobile ad hoc networks that increases the network lifetime. Ad hoc wireless networks are power constrained since nodes operate with limited energy of battery. In order to maximize the lifetime of these networks (defined by the condition that a fixed percentage of the nodes in the network "die out" due to lack of energy), transactions related to network through each mobile node must be controlled such that the power dissipation rates of all nodes are nearly the same.

Abdelwadood Mesleh [9] proposes two energy-aware routing algorithms: energy aware ad hoc on-demand distance vector (e-AODV) and an energy-aware dynamic source routing (e-DSR), and compares their performance with the well-known AODV and DSR routing algorithms. Results reveal that e-DSR is able to work best in terms of averaged energy consumption and averaged end-to-end delay over different mobility speeds. Glomosim is used to simulate and to compare the performance of the four routing algorithms (AODV, DSR, e- AODV and e-DSR) in terms of average energy consumed, end-to-end average delay and average drop of packets.

Kavita Sharma [10] proposed energy efficient dynamic source routing algorithms for Ad hoc network since a Mobile Ad-hoc Networks (MANET) are consisting of nodes that have limited battery power so the energy efficiency is taken one of the primary metrics of interest.

Sangheetaa Sukumran [11] proposed that mobile ad-hoc network does not have any centralized authorities like an access-point or a router as in case of wireless and wired networks to have control on routing. This type of routing has become a greater challenge to these types of networks .now the author here presents a new reputation based routing protocol based on DSR (Dynamic Source Routing) and through simulation results proves that the proposed method performs well compared to normal DSR.

S.Harous [12] presented the performance analysis of an Energy Aware Multi-path Dynamic Source Routing protocol (EA-MPDSR). This protocol is based on the existing on-demand Dynamic Source Routing protocol (DSR). It is energy aware and uses a multi -path technique. EA-MPDSR reduces the energy consumed per received data bytes as well as prolongs the network lifetime which leads to improvement in the performance of the network. The simulation results show the EA-MPDSR protocol performs better than conventional DSR and Maximum of Minimum Energy DSR (MME-DSR) protocols.

Nandini Prasad K S [13] proposed routing protocol that is an extension and enhanced version of DSR. Energy as a metric is considered during route selection process to choose an optimal path in terms of overall energy of the nodes along the path, and "low energy notification" method is used during route maintenance process to increase the lifetime of the 'bridge' nodes to avoid network partitioning. The performance of Energy Aware DSR (EADSR) and DSR protocol are compared under different scenarios through NS2 simulation. In every case, it is seen that EADSR protocol out-performs DSR protocol by energy saving in efficient manner.

III. COMPARISON OF DSR WITH EA-DSR BASED ON VARIOUS NETWORK TERMS
Table1

PROTOCOL	NO. OF NODES	EXHAUSTION TIME T(in seconds)	RESIDUAL ENERGY (in joules)	NETWORK LIFETIME T(in seconds)	PACKET DELIVERY RATIO
DSR	100	137	63	140	0.983
	200	117	80	120	0.995
	300	115	118	120	0.997
EA-DSR	100	139	69	149	0.998
	200	120	95	125	0.99
	300	120	118	125	0.993

In the above table we have taken 100, 200and 300 nodes and concluded the result for DSR and EA-DSR in terms of Exhaustion Time, Residual energy, Network Lifetime, Packet Delivery. It was concluded from the results that the EA_DSR keeps the network Stable and also increases network Lifetime.

IV. COMPARISON OF NODE SPEED VS TOTAL NO. OF PACKETS DROPPED IN DSR , EA-DSR AND MME-DSR

Table 2

Protocol	Node speed(m/s)	Total Packets Dropped
DSR	1	500
	5	647
	10	800
	15	898
	20	960
EA-DSR	1	409
	5	440
	10	500
	15	430
	20	450
MME-DSR	1	427
	5	480
	10	580
	15	600
	20	540

The above table shows that no of packets dropped in DSR are maximum as compared to MME-DSR as well as EA-DSR Thus EA-DSR provide better results as compared to conventional as well as MMEDSR

V. CONCLUSION

Since the information on location, remaining energy, and available bandwidth of nodes fluctuates in MANET, it is important to keep such information up-to-date. Conventional routing protocols do not consider the power budget where the routes between nodes are built by the shortest path routing algorithm. Our main motive is to analyse several power aware routing algorithms based on DSR. As Mobile Ad-hoc Networks (MANET) are consisting of nodes that have limited battery power so the energy efficiency is taken one of the primary metrics of interest.

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