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A New Approach For Routing In Ad Hoc Networks Increasing The Speed Of Reliable Data Transferring

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Abstract: Ad hoc (MANET) is a kind of unique networks in which the topology of network is continuously being changed due to motion of nodes and also the fact that it is a wireless network. Today, many researches are being carried out on Ad hoc due to their wide use in urban societies especially in earthquake stricken regions and also military areas. Since the nodes of this type of networks are able to move, then the challenges of these networks are continuous changing of network topology and error of nodes which may lead to interruption of data transferring between nodes. In current methods, most volume of data is transferred through a high QOS route. Thus, the possibility of finishing the energy of engaged nodes may cut the relation of nodes which in turn leads to network collapsing. In this paper, we propose a new approach for data transferring with respect to service quality, communication capabilities and processing specifications of nodes issues. Our object is to recognize those routs whose capabilities and characteristics introduce them as backbone routs for routing and data transferring in network. We design a mechanism by which the processes of routing and data transferring are carried out through distribution of traffic across network regarding current traffic of network and processing levels of nodes. Numerical computations and simulations reveal that this method increases the speed of reliable data transferring and decreases end to end delay and making an optimum balance in the energy to be consumed by nodes. All these advantages will lead to increasing network lifetime.

Key words: Reliable Routing, QOS, delivery rate, DSR protocol, Traffic Distributed, network lifetime, bandwidth

INTRODUCTION

MANET networks are among those kinds of networks which are increasingly developing due to their wide and various applications in routine life and some important situations like military regions. This type of networks has dynamic topology due to motion of nodes. They are also very flexible due to lack of fix infrastructure.

Users can benefit from the advantages of this network from any place they wish. They can connect to internet in multi media form or use phone cells or even share files (Henderson *et al*., 2004). The object of this type of network is to support and control the traffic of large scale MANET networks like networks of universities or big cities in which users use a large scale of communications or wireless internet or networks or wide military regions in which the quality and security of communications are most important issues (Karrer *et al*., 2003; Nokia Networks, 2001).

In this paper, a new approach for routing based on QOS metric is proposed. This method relies on nodes as backbone of routing problem and distribution of traffic between nodes with maximum liability and maximum level of transferring distributed data. Selection of valid nodes and low traffic routes along with transferring of data in distributed form are advantages of this method which has made a tremendous evolution in the speed of data send and receive process.

If we wish to present multi media services through MANET network, the QOS (Quality of Service) would be the main challenge. This is true as the user of this system should make sure that his/her information will be quickly sent to destination node with high degrees of security and reliability (Grossman, 2002; Nichols and Carpenter, 2001; Shenker *et al*., 1997). This object is reachable just through contribution of all mobile nodes moving between source and destination node across the route or in other words by distribution of routing and data transferring tasks between all reliable and engaged nodes across the route. In wired networks, as we have full access to links which are available between source and destination, then the level of QOS is high. In MANENT networks all traffic between mobile nodes are created due to competition of nodes on gaining an intermediate node which has higher capability in data transferring. Thus, the nature of wireless networks raises the problem of generating communication channel and meeting all required sources which are necessary for a reliable and correct communication. These sources include: band width, battery or required energy and processing speed. Interference between multiple Hops and also competition issues may face us with complex

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problems in selecting available resources. Therefore, accurate prediction about necessary sources for quick and accurate data transferring based on QOS metric is a very important problem. In MANET networks, communications between nodes are in distributed form. There is no nod which is responsible for central controlling of resources. Each node is responsible just for traffic passing itself and it is not aware of traffic between other nodes. Thus, rout discovery mechanisms which are designed for data transferring from source node to destination node should adopt with methods by which data should be transferred to destination in distributed form regarding capabilities of nodes and links which are available across route. By applying such mechanism we obtain an optimum balanced energy between nodes which leads to significant increment of network lifetime. Also, in this way data arrive at destination node more quickly and accurately and the PDR (Packet Delivery Ratio) will be increased too.

The rest of this paper is structured as follows. In section 2 the history of work is presented. In section 3 we present our proposed approach and section 4 covers simulations and conclusions.

Related Work:

QOS of MANET network is considered as the set of all limitations and characteristics which should be set in a communication between 2 nodes in order to make that a successful communication and causes data to arrive at its destination safely (Crawley et *al*., 1998). We can describe a communication by measurable indexes like minimum band width, maximum PDR, maximum consumption of energy and maximum missed packets. Following acceptance of user request, network should make him/her sure that his/her request will be done (Bheemarjuna Reddy *et al*., 2006). In MANET communications, the main challenge is to guarantee QOS which is almost unquestionable in wired networks. The challenges of QOS based mobile ad hoc networks are as follows: a) the intermediate communications between nodes are not reliable i.e. are faulty, b) the topology of network is changed easily and is not predictable due to free motion of nodes, c) due to continuous processing of packets and contribution in transferring other node's data, nodes have low energy or their energy are being decreased (Quintero *et al*., 2004; Srivastava and Motani, 2005). Moreover, in order to retain the performance of MANET networks in different protocols, we should adjust them regarding their environment, nodes traffic during data sending and the object or purpose of that network (Gerla, 2005). For example in some applications, data security is the first preference, so user prefers to receive data with high levels of security and time is not important to him like military applications. In contrast, in some applications like multi media services, the quality and delivery time of information packets are more important issues.

MANET networks include 3 classes as follows. a) The first class is Reactive or on-demand class in which a route between source and destination is created provided that there is route request (RREQ) from source node to destination node. It should be noted that the topology of this kind of networks is continuously being changed due to motion of nodes.

AODV protocol is a famous protocol of this kind acting in this way (Quintero *et al*., 2004; Perkins *et al*., 2003). In this protocol a route is created between source and destination nodes only when the source node broadcasts a rout request (RREQ) towards destination node. Each mobile node within this protocol acts like a router and do its best in discovering a route towards destination node through transmitting route discovery packets. This protocol offers loop free routs and when a link is corrupted it employs link defining mechanism in order to select another rout and transfer rest of packets through this fresh rout. This mechanism is employed because this protocol is not able to carry out routing process continuously due to reduction of band width. b) Proactive routing protocols keep all pre-routed routes from source to destination in MANET networks by which some information has transferred towards destination. Routing table is continuously updated in pre-defined periods regarding node's motion and dynamical characteristics of network. One disadvantage of this type of protocols is that as it keeps routing table and updates it continuously, it has the maximum level of overhead in communications. Another disadvantage of this protocol appears in cases in which nodes have high speed and links between nodes are corrupted quickly. This events decrease the efficiency of this type of protocols. (Quintero *et al*., 2004; Kumar *et al*., 2008). Indeed, in cases in which the mobility rate of nodes is high and the topology of network is changed quickly, this protocol has not quick responding ability which in turn leads to continuous corruption of links across source and destination routes. c) The 3rd type of protocols is location-based protocols. They find a route from interior layers of network to the other side of it based on the location of destination node. The location of destination node is defined by GPS and the protocol creates the best route from source node towards destination node passing through the best and most capable nodes (Abolhasan *et al*., 2004). When a QOS-based routing protocol creates a route towards destination node it uses those nodes and links which have necessary resources for creating a successful and high quality communication. In other words, the route is characterized via the existence of applicable resources which will be used fore data transferring purposes in future (Wang and Crowcroft, 1996). Efficient routing protocols should benefit from source management mechanism in order to empower themselves to create a reliable route in network meeting all QOS requirements. For example, we should take into account end to end delays management, availability of band width, low rate of data packet missing, total counts of Hops and reliability issues. Since the probability of route corruption is high due to motion of nodes, QOS-based routing protocols should also have the capability of route maintenance. In ref. (Shengming *et al*., 2004) a new QOS-based routing approach has been suggested which has the ability of reducing negative effects of node's motion. This approach presents a table covering all links for DSR protocols which is suitable for nodes with higher rate of motion.

In Ref. (Chen and Heinzelman, 2005) a QOS awareness routing protocol has been suggested in which a combination of control and feedback plan is used in order to meet all QOS requirements in real-time applications. This method uses an approximate estimation of band width for assessing network probable traffic. In Ref. (Du, 2004) a new QOS routing in heterogeneous Ad hoc networks (MANET) based on nodes classification has been suggested in which a node can contribute in routing process if it is located is transferring path and has sufficient band width and high reliability. In this method, the QOS of route is measured via band width index. In Ref. (Rahebi and Asadi, 2009) a method has been suggested improving QOS and high reliable routing in MANET networks. This method introduces energy as a main criterion of network. In this plan, a reliable route for transferring data from source node to destination node based on plan's 4 main criteria i.e. route stability, residual energy of route nodes, the numbers of Hops and error counts, has been presented.

Most protocols or routing plans have a platform by which support QOS of MANET networks. For example, in Ref. (Lee *et al*., 2000) signal band protocol has been used for distributing QOS information. At first information is written inside the head of packets and then available resources of each station is calculated. So, packets move towards destination with low traffic. Both (Chen and Nahrstedt, 1999) and (Chen *et al*., 1997) references use distance vector protocol which obtain QOS information through both *Hop to Hop* and *diffusion or cascade* approaches. In Ref. (Sinha *et al*., 1999) a distributed routing algorithm called *Core Extraction* has been suggested by which a routing algorithm is presented based on central self organizing method in which central nodes (Core) create a QOS-based route.

The main idea of most researches carried out about QOS of MANET networks is to prevent the interruption of nodes and most of them focus on multipath issue. The issue of Energy-QOS of MANET networks have been recently attracted more attentions. Wide studies are being done on discovering multipath routes and on-demand routing protocols. So, the problems of decreasing short routes in AODV protocol and DSR protocol have been discussed in references (Perkins *et al*., 2003) and (Johnson *et al*., 2001), respectively. Also the problems of maximum record of route discovering, attempts of iterating route discovery and the possibility of improving functional power of data transferring have been studied. Ref. (Marina and Das, 2001) discusses about AOMDV protocol i.e. AODV multipath protocol and prepares loop free protocols. Ref. (Park *et al*., 2008) estimates on-demand multipath based on signal to interference which is investigated in physical layer.

1 - Proposed Method:

Our proposed method includes 3 layers as follows:

1) creation of route discovery algorithm
2) calculation of required energy and specifying the method of distributing data across selected routes in network level
3) route maintenance

1-1 Route Discovery Algorithm:

In our proposed approach rout discovery process initiates when a node within network layer receives a request for making communication with other nodes. After receiving such a request, at first the requested node refers to routing table. If a rout has been previously assigned to this note, then data transferring will be started immediately otherwise, route discovery process will be started. We assume that all nodes within wireless networks have been equipped with GPS system. So, neighborhood nodes would be aware of location related information like speed and direction of movement, radio range, residual energy and available band width between two nodes. Regarding these conditions the source node computes its specifications and compares them with neighborhood node. By this way it selects just those nodes which own characteristics of handling a successful and reliable data transferring and can execute routing process and broadcasts route discovery packets towards neighborhood node based on following criteria:

1) links should have maximum stability
2) rout nodes should have enough energy for data transferring
3) nodes should support maximum band width

We may involve with various types of data in data transferring process in MANET networks. For example, in military applications we need special cares due to this fact that data of this field are very critical. So, it is very important to broadcast data with high levels of security. In contrast, in some cases like listening to music through wireless internet service user pay less attention to data disarray. We should use proper mechanisms for critical data in order to specify whether user needs QOS or normal applications.

Regarding these matters it could be said that in critical applications neighborhood nodes and links between them should have enough QOS in order to transmit RREQ packets and future data. A new field called QOSNode is added in RREQ packet. The source node saves in the RREQ packet the required criteria for route nodes enabling them to contribute in data transferring process. When the RREQ packet arrives at any neighborhood node, it compares the information of current node with information saved in RREQ packet. If node information is in accordance with all criteria then a QOS label is attached to that node and this node is introduced as high reliable node and this is announced to neighborhood nodes. Henceforth, whenever the source node wishes to find a route towards destination node at first it refers to the labels which have been saved in routing table and selects just those nodes which have QOS label and also enough band width and energy for broadcasting RREQ packet to destination node. Mobile node receiving a RREQ packet for the first time register the ID of that packet and discard next packets with the same ID.

The movement scenario of RREQ packet towards neighborhood nodes would be as follows:

- When an RREQ packet passes through each Hop, one count is added to the number of Hops within RREQ packet.
- If the RREQ packet has QOS label it will define the maximum and minimum band width of the route.
- The required energy for transmitting all data called RREQ is saved in RREQ packet by the source node. When the RREQ packet passes through nodes each node compares the residual energy of itself with the required energy for transmitting all data which has been saved in the packet. If the node has sufficient energy it is selected for transferring data otherwise, no RREQ packet broadcasts from this node towards neighborhood nodes.
- A field called ECD is embedded in RREQ packet with initial value of zero. During traverse of RREQ packet through first node if the node has sufficient energy for contributing in routing process, the residual energy of that node is saved in the ECD field. When the packets passes through next node, the saved value in the ECD filed is compared with the energy of this new node. In this case two scenarios will be available. If this new node has less energy than the energy saved in the ECD field its energy is replaced by the energy of the ECD field otherwise, no replacement is done. In this way when the RREQ packet arrives at destination node, the saved value in ECD field would be the maximum energy which could be supported by the route.
- When the RREQ packet passes through each node, the value of EC (Error Count) or the counts of previous errors of links between a node and its neighborhood, which had the initial value of zero, is added to previous value. In this way, at the end of the route, the total EC of the route will be defined accurately.
- When the RREQ packet arrives at each node, link stability level i.e. LET, Link Expiration Time, is calculated and compared with the packet's value. If the obtained value is less than the packet's value it is replaced by the packet's value otherwise, no replacement is done and the packet continues its path provided that all other conditions are met.
- When the RREQ packet starts to leave source node, the value of band width between source node and neighborhood node is embedded in BW field and the packet is broadcasted towards neighborhood nodes. In this way, similarly to finding link stability in destination node, the minimum band width of route's links is considered equal to maximum bandwidth of the route which could be supported by nodes. This is done to prevent congestion of data packets in links with lower band widths.

When destination node receives all route's discovery packets it starts to rank the routes as follows.

The final saved LET in the RREQ packet is considered as the maximum route stability i.e.

$$MinLET=MaxRET \tag{1}$$

The final saved BW in RREQ packet is considered as the maximum band width which could be supported by the route i.e.

$$MinBW=MaxBW \tag{2}$$

Also, Max. EC, Min Hop and the route with maximum energy are defined too and the value of W_i i.e. route ranks is derived through following equation (3):

$$W_i = C_1 \times (\frac{RET_i}{MaxRET}) + C_2 \times (\frac{EC_i}{MaxEC}) + C_3 \times (\frac{HC_i}{MaxHC}) + C_4 (\frac{BW_i}{MaxBW}) + C_5 (\frac{ECD_i}{MaxECD}) \tag{3}$$

In which c_1, c_2, c_3, c_4 and c_5 are coefficients varying based on various conditions but the absolute magnitude of sum of them should be always equal to 1. For example, in some cases stability and route errors are the critical factors for us. So, higher values are assigned to these coefficients. It is obvious that in such cases Hop numbers and the value of band width or route energy will have secondary priority. We have:

$$|C_1| + |C_2| + |C_3| + |C_4| + |C_5| = 1 \tag{4}$$

When source node receive all rout's RREQ packets it sorts these routes descending based on their ranks which have been saved in its routing table. The common problem of most routing protocols is this: when a reliable route is selected between source and destination, data transferring through this route is initiated. But the excessive use of this route leads to corruption of links of this route due to exhausting their energy which in turn leads to network collapsing.

In our proposed method, we use more than one route for data transferring purposes. In this method, the responsibility of transmitting data is submitted to appropriate routes based on their ranks and capabilities through a relation which will be proposed later. So, instead of a single path we use multi paths for transmitting data based on their ranks and capabilities. In this way, data are transmitted through multi paths simultaneously based on their ranks. We propose following equation (5) for assigning data to each path:

$$DATA_{Size} = \left(\frac{RANK_i}{\sum_{i=1}^{n} RANK_i} \right) * File_{Size} \tag{5}$$

In which $RANK_i$ is the rank of i[th] path, $\sum_{i=1}^{j=n} RANK_i$ is total sum of ranks of paths and $File_{Size}$ is the size of file to be transmitted to destination. Paths with higher ranks are responsible for higher amount of data to be transferred to destination node. In this way, we use all paths based on their ranks and capabilities and no path is overused. Thus, we see no path collapsing due to overuse. Therefore, network node's energies are balanced and consequently network life and the speed of data transferring will be enhanced significantly. Fig. 1 clarifies this matter by a numerical example.

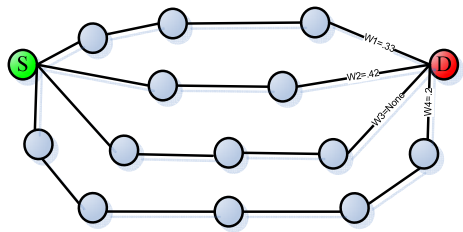

Fig. 1: Four-weight path leading to the destination node

As we can see in this figure, after calculating the weights of 4 paths leading to destination through following equation, the amount of data of each path which is responsible for broadcasting the assigned data to destination is calculated.

$$W_{Total} = w_1 + w_2 + w_3 + w_4$$

As we can see nodes belonging to the 3[rd] path can not contribute in data transferring process due to energy shortage. So, for example if we wish to broadcast a 100MB file, then we have:

$$W_{Total} = .33 + .42 + 0 + .2 = .95$$

$$Data_{W_1} = \left(\frac{0.33}{0.95} \right) \times 100 = 34.7$$

$$Data_{W_2} = \left(\frac{0.44}{0.95} \right) \times 100 = 44.2$$

$$Data_{W_4} = \left(\frac{0.2}{0.95} \right) \times 100 = 21.3$$

In the proposed method when data packets are being broadcasted towards destination node, traffic cost within each node is calculated through the proposed equations in Ref. (Rahebi *et al*., 2010). If the cost of a node, which is between zero and 1, approaches to one, the node broadcast a packet towards the source node to let it know to decrease data broadcasting to the specified node proportionally with its cost or to stop data broadcasting to that node completely. This method ensures a smooth traffic flow between source and destination of all paths. The above mentioned equation (6) is as follows:

$$Cost = \alpha \sum \frac{1}{1 + ER_i^t} + (1 - \alpha) \sum \left(1 - \frac{1}{1 + (Q_i^t * E_{tx})} \right) \tag{6}$$

In which ER_i^t is the residual energy of the i[th] node at time t, Q_i^t is the count of packets waiting for receiving service in i[th] node at time t and E_{tx} is the required energy for transmitting data. The first side of the equation i.e.: $\alpha \sum \frac{1}{1+ER_i^t}$ indicates the residual energy of node and the second side indicates the buffer of node. We use variable α in order to balance two sides of equation. More value of α means more traffic in path. When α equals to 1, it means that the second side of equation equals to zero i.e. the buffer is completely full and data broadcasting towards this node should be completely stopped. Since source node assigns a number all nodes, when they arrive at destination node, it can sort them based on their numbers. If after a short period of time the destination node receives no packet or packets, it broadcasts a packet called RPM (Request Package Missing) towards source node. This packet includes the number of missed packets which have not been arrived at destination node yet by which the destination node ask source node to resend them. Applying this method will lead to reliable and higher QOS data transferring towards destination. As in this method different paths with different capacities are used or in other words data transferring is done in a distributed manner, packet delivery ratio PDR increases and packet will arrived at destination node with high reliability. Also, network life time will be increased due to energy balance across network.

3- Equations for Computing the Elements of Route Selection:

3-1 link stability between two neighborhood nodes:

Assume that n1 and n2 have the same radius of action in a given radio wave radius of r. (x1,y1) and (x2,y2) stand for positions of n1 and n2, respectively. v_i, v_j, θ_1, θ_2 stand for n1 velocity, n2 velocity, n1 angle and n2 angle, respectively. Duration of link stability between n1 and n2 is calculated through following equation (7) (Rappaport. T. S, 1995)

$$D_t = \frac{-(ab+cd)+\sqrt{(a^2+c^2)r^2-(ad-cd)^2}}{(a^2+c^2)} \tag{7}$$

$$a = v_1\cos\theta_1 - v_2\cos\theta_2 \qquad b = x_1 - x_2$$

$$c = v_1\sin\theta_1 - v_2\sin\theta_2 \qquad d = y_1 - y_2$$

The links stability between 2 nodes is calculated through above equation. Also, the RET value of route stability between source and destination is defined through specifying the minimum LET among LET values of the route's links i.e. the minimum LET of the route's links will show the maximum route stability.

$$RET_i = Min(LETs_i) \tag{8}$$

3-2 calculating the required energy for transmitting whole file through a node:

The required energy for transmitting a data packet is computed through following equation (9) (Woo. K and Lee. B, 2001)

$$E_{tx} = \frac{Packet_{size} \times P_{tx}}{BW} \tag{9}$$

In which $Packet_{Size}$ is packet size, P_{tx} is the required power for data transferring and BW is the bandwidth of link. A mobile node controls the power of route during data transferring process. The required energy for transmitting data between two nodes is derived through following equation (10):

$$E_{tx} = Kd^{\alpha} \tag{10}$$

In which k is proportional constant and d is the distance between 2 nodes and α is ambient dependant parameter ranging from 2 to 4. The minimum distance between source and destination requires the minimum amount of energy. Total required energy for each node is obtained through following equation (11):

$$REQ_e = n \times (E_{tx} + E_{Proc}) \tag{11}$$

$$n = \frac{File_{Size}}{Packet_{Size}}$$

In which, n is total numbers of packets. Total required energy for data processing is shown by E_{Proc} which is less than E_{tx}.

Source node uses following equation to compute total required energy for data transferring (Wang *et al*., 2007). In radio model the following equation (12) is used for calculating the required energy for transmitting k bits of energy in distance d.

$$E_{Tx}(k,d) = E_{elec} \times K + E_{amp} \times K \times d^2 \tag{12}$$

In which E_{elec} is the consumed energy for sending and receiving 1 bit of data which is computed as follows: $E_{elec} = 50njoule/bit$

When the distance between 2 nodes is d then the energy loss is obtained through this relation: d^2E_{amp} in which E_{amp} is the consumed energy for amplifying data transferring process. The consumed energy for receiving packet is computed as following equation (13):

$$E_{Rx}(K) = E_{elec} \times K \tag{13}$$

Total required energy for data send and receive is obtained through following equation (14):

$$E_{Total}(K) = E_{elec} \times K + E_{amp} \times K \times d^2 + (E_{elec} \times K) \tag{14}$$

In RREQ packet there is a field called ECD showing the residual energy of each node. When RREQ passes through each node this field is updated as follows:

- If the residual energy (ECD) of current node is less than ECD of previous node then the ECD of packet is replaced by ECD of current node.
- If the ECD of current node is higher than the ECD of previous node then no replacement is occurred.

In this way, when RREQ packet arrives at destination node the ECD of packet would have the maximum amount of energy which could be supported by the path.

The structure of RREQ packet:

In DSR protocols route discovery packet is formed through adding some fields as follows and is broadcasted towards destination node.

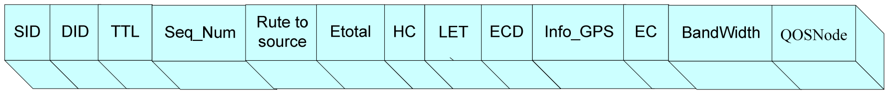

Fig. 2: RREQ packet format

The structure of RREP packet:

After calculating the ranks of all paths as Fig.3 a field named Rank is added to standard RREQ packet. This field includes the rank of current path. This packet is broadcasted towards source node via the same path which had been broadcasted towards destination node before. The format of RREP packet is as follows:

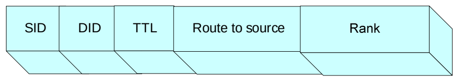

Fig. 2: RREP packet format

The structure of RPM packet (Required Packages are Missing):

When all packets arrive at destination node, it checks them. Since all packets have ID No. it can identify whether or not there are missed packets. Then, it broadcasts a packet named RPM towards source node. This packet includes the ID No. of the missed packets. The source node resends the missed packets after receiving RPM packet. Fig. 4 shows the format of RPM packet.

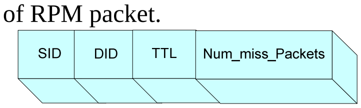

Fig. 4: packet format RPM

Route maintenance procedure:

In data transferring process sometimes we face situations in which link between two neighborhood nodes is cut due to high mobility of nodes. In such a case, the process of route maintenance will be initiated. In the proposed method route maintenance proceeds in some stages as follows:

Stage 1:

As each node is aware of next and previous node's information, it embeds next node's address within a packet called RREQ-R and broadcasts it towards neighborhood nodes. This packet includes ID NO and address of the corrupted node, the field showing the necessary energy for transferring rest of data and LET field.

Stage 2:

When intermediate nodes receives RREQ-R packet they compute their energy and compare it with the required energy for transferring rest of data. If they meet all necessary conditions for data transferring especially they have necessary energy for transferring rest of data they compute the amount of LET between themselves and previous nodes using their location information. Then, they embed ID NO and LET field of node in RREQ-R packet and broadcast them towards neighborhood nodes.

Stage 3:

Finally, when RREQ-R packet arrives at a node which has the address of corrupted node, all required conditions for data transferring like RET or route stability are estimated and computed similar to routing process. If the route meet all required conditions it broadcasts a packet called RREP-P towards source node. This packet includes the addresses of all nodes up to destination node. Otherwise, it deletes RREQ-P packet and don't let it to pass. This process is shown in Fig 5.

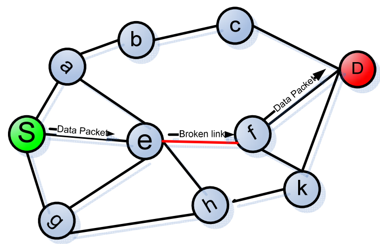

Fig. 5: Data Flow

Immediately after finding a fresh route, as Fig. 6, the data transferring process is again initiated through the fresh route. If no route is found, a packet is broadcasted towards source node to let it know to broadcast rest of data belonging to corrupted route through other routes.

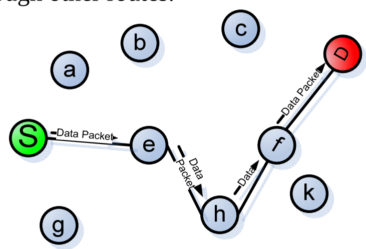

Fig. 6: Data flow in new route

Experimental Results:

In this section we compare our proposed method with DSR routing protocol. We use OPNET soft ware for simulating. First of all, we introduce some parameters employed in simulation process:

Simulation is done in a 2000*2000 m^2 area and the number of nodes ranges from 50 to 100. The object of this simulation is to increase the number of nodes gradually and then estimate distributed traffic across network and compare the efficiency of the proposed method with DSR protocol which is the base protocol in wireless networks. The motion velocity of nodes ranges from 0 to 25 m/s and the pause time is 10 sec. We consider Random Way Point model as the pattern of node's motion. This model is movement pattern of most routing protocols.

1- Rate of Throughput:

The rate of throughput is considered as the number of packets received by destination node during simulation time.

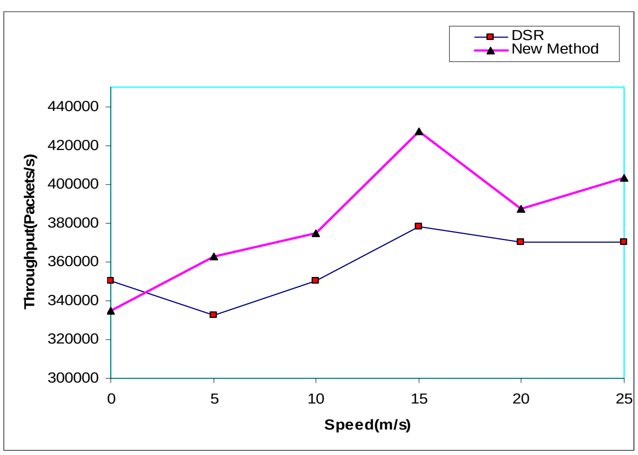

Fig. a (1): shows scenario for 50 nodes

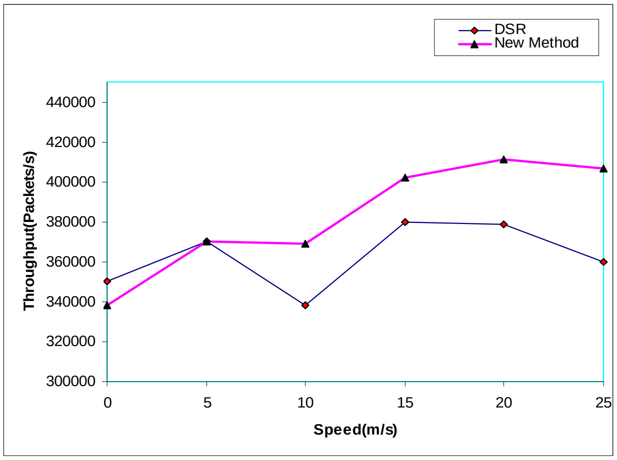

Fig. a (2): repeats the same scenario for 100 nodes.

Figures a(1) and a(2) show throughput rate of 2 data packets containing 50 and 100 nodes in various velocities. This simulation reveals that the throughput rate of the proposed method is higher than that of a DSR protocol.

Packet Delivery Ratio (PDR):

PDR is considered as the ratio of data packets received by destination node to total packets broadcasted by source node. Figures B(1) and B(2) show average PDR of the proposed method versus DSR protocol for two node congestion scenarios i.e. 50 and 100 nodes in velocities ranging from 0 to 25. Fig. B(1) shows that when the number of nodes is 50, the values of PDR of two methods have no meaningful difference. But as soon as the nodes start to move and the routes are corrupted this value become higher in our proposed method compared with DSR protocol. Fig. B(2) reveals that as the number of nodes increases, the value of PDR improves more in the proposed method compared with DSR protocol.

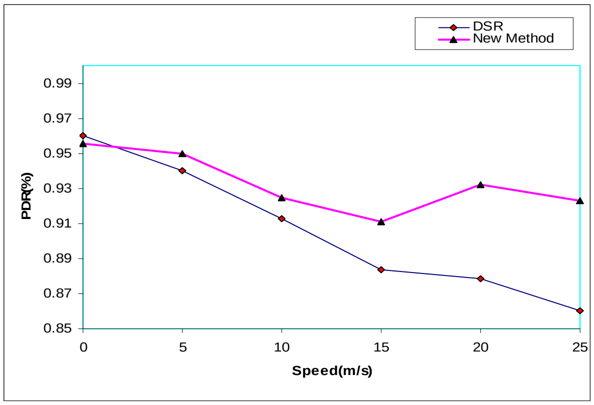

Fig. B (1): show simulation results for 50 nodes.

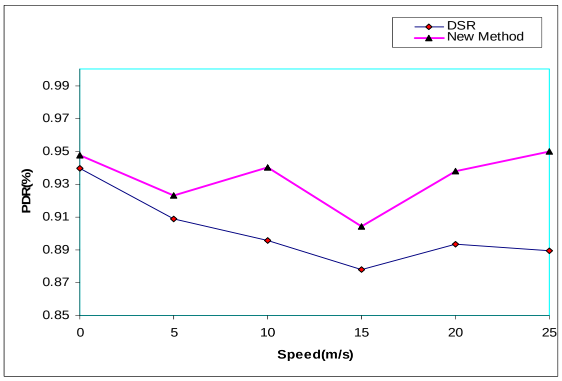

Fig. B (2): show simulation results for 100 nodes.

Network life time:

Network life time is considered as the number of silent nodes after a given period of time, for example 120 minutes. In our proposed method the network life time is increased more compared with DSR protocol because we use a mechanism by which loads are distributed across network and also we use all authorized nodes. Figures C(1) and C(2) show simulation results for 50 and 100 nodes, respectively.

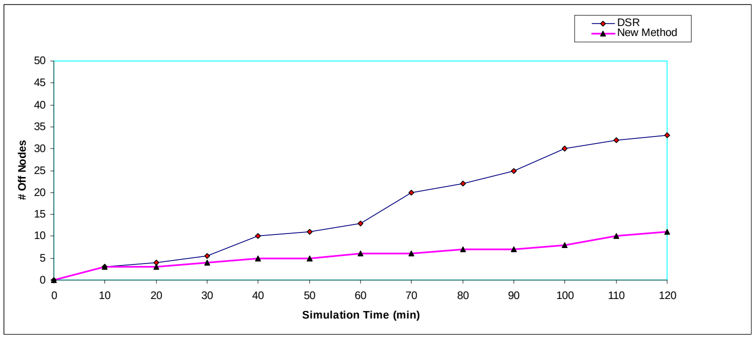

Fig. C(1): show simulation results for 50 nodes.

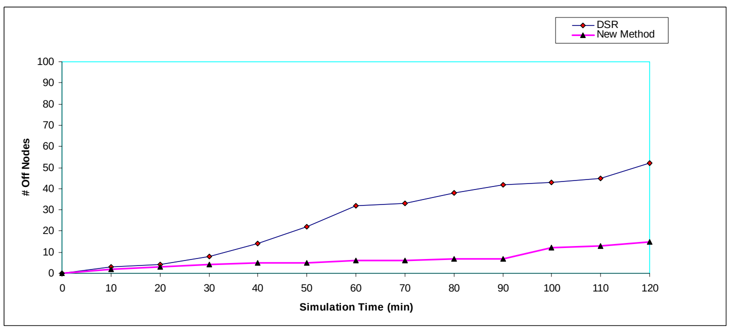

Fig. C(2): show simulation results for 100 nodes.

Conclusion:

In this paper, we propose a routing algorithm and data transfer based on the distributed traffic in the surface of all the participants' nodes. According to the ability of the node in each route including energy, the reliability of the route, the bandwidth of the route etc. which at the end makes the weight of the route, the data has been adjusted based on the route. The comparison of the proposed method with the DSR protocol shows that by using this method the network traffic is controlled and throughput and Packet Delivery Ratio is increased. In this method, also by decrease the total energy consumption, network lifetime has been increased. Experimental results show that the proposed method outperforms DSR protocol.

REFERENCES

Abolhasan, M., T. Wysocki, E. Dutkiewicz, 2004. A review of routing protocols for mobile ad hoc networks, Ad Hoc Networks, 2(1): 1–22.

Asadi, M., S.Rahebi, S.Nourizadeh, 2010. "High Reliable Routing method for mobile ad hoc networks underlining Efficient Energy Consumption" , Australian Journal of Basic and Applied Sciences, INSInet Publication

Bay area wireless users group. http://www.bawug.org.

Bheemarjuna, T., I. Karthigeyan, B.S. Manoj, C. Siva Ram Murthy, 2006. Quality of service provisioning in ad hoc wireless networks: a survey of issues and solutions, Ad Hoc Networks, 4(1): 83–124.

Chen, L., W.B. Heinzelman, 2005. QoS-aware routing based on bandwidth estimation for mobile ad hoc networks, IEEE Journal on Selected Areas in Communications, 23(3): 561–572.

Chen, S., K. Nahrstedt, 1997. Distributed Quality-of-Service Routing in Ad-Hoc Networks. *IEEE Journal of Selected Areas in Communications*, 17(8).

Chen, T., M. Gerla and J. Tsai, 1997. QoS Routing Performance in a Multi-hop, Wireless Network. In *Proceedings of the IEEE ICUPC'97*, San Diego, CA, October .

Crawley, E., R. Nair, B. Rajagopalan, H. Sandick, 1998. A framework for QoS-based routing in the Internet, RFC2386, IETF.

David, B., Johnson, A David. Maltz, & Josh Broch, 2001. "DSR: The Dynamic Source Routing Protocol for Multi-Hop Wireless Ad Hoc etworks", Ad Hoc Networking, Addison-Wesley, pp: 139-172.

Du, X., 2004. QoS routing based on multi-class nodes for mobile ad hoc networks, Ad Hoc Networks, 2 (3): 241–254.

Gerla, M., From battlefields to urban grids, 2005. new research challenges in ad hoc wireless networks, Pervasive and Mobile Computing ,1(1): 77–93.

Grossman, D., 2002. New Terminology and Clarifications for Diffserv. Request For Comments (Draft Stardard) 3260, Internet Engineering Task Force.

Henderson, T., D. Kotz, and I. Abyzov, 2004. The Changing Usage of a Mature Campus-wide Wireless Network. Technical Report TR2004-496, Dartmouth College, Computer Science, Hanover, NH .

Jiwon, P., Sangman Moht & Ilyong Chung, 2008." Multipath AODV Routing Protocol in Mobile Ad Hoc Networks with SINR-Based Route Selection", International Symposium on Wireless Communication Systems, IEEE, pp: 682-688.

Karrer, R., A. Sabharwal, and E. Knightly. Enabling Large-scale Wireless Broadband, 2003. The Case for TAPs. In *Proceedings of HotNets 2003*, Cambridge, MA.

Kumar, B.R.A., L.C. Reddy, P.S. Hiremath, 2008. Performance comparison of wireless mobile ad-hoc network routing protocols, nternational Journal of Computer Science and Network Security, 8: 6337–343.

Lee, S., G.-S. Ahn, X. Zhang, and A.T. Campbell, 2000. INSIGNIA: An IP-Based Quality of Service Framework for Mobile Ad Hoc Networks. Journal of Parallel and Distributed Computing, Special issue on Wireless and Mobile Computing and Communications, 60: 374–406.

Marina, M. K. , S. R. Das, 2001. "On-Demand MultiPath Distance Vector Routing in Ad hoc Networks", Proceedings of the Ninth International Conference on Network Protocols (ICNP},IEEE Computer Society Press, pp: 14-23.

Mesh Networks Inc. Mesh Networks Technology Overview. http://www.meshnetworks.com.

Nichols, K. and B. Carpenter, 2001. Definition of Differentiated Services Per Domain Behaviors and Rules for Their Specification. Request For Comments (Draft Stardard) 3086, Internet Engineering Task Force.

Nokia Networks. Nokia rooftop wireless routing, 2001. http://www.americasnetwork.com/americasnetwork/data/ articlebrief/ americ as network /412003/34898 /article.pdf .

Perkins, C., E.M. Royer, S.R. Das, 2003. Ad hoc on-demand distance vector (AODV) routing, RFC3561.

Quintero, A., S. Pierre, B. Macabéo, 2004. A routing protocol based on node density for ad hoc networks, Ad Hoc Networks, 2(3): 335–349.

Rahebi, S., M.Asadi, 2009. WBRR: A Weight Based Reliable Routing Method in Mobile Ad Hoc Networks , Australian Journal of Basic and Applied Sciences, 3(3): 1888-1897.

Rappaport, T.S., 1995. Wireless Communications: Principles and Practice, Prentice-Hall, Upper Saddle River, NJ

Shengming, J., L. Yaoda, J. Yuming, Y. Qinghe, 2004. Provisioning of adaptability to variable topologies for routing schemes in ANETs, IEEE Journal on Selected Areas in Communications, 22(7): 1347–1356.

Shenker, S., C.Partridge and R. Guerin, 1997. Specification of Guaranteed Quality of Service. Request For Comments (Draft Stardard) 2212, Internet Engineering Task Force.

Sinha, P., R. Sivakumar, and V. Bharghavan, 1999. CEDAR: A Core-Extraction Distributed Ad Hoc Routing Algorithm. In *Proceedings of the IEEE Conference on Computer Communications (INFOCOM)*, pages 202–209, New York, NY.

Srivastava, V., M. Motani, 2005. Cross-layer design: a survey and the road ahead, IEEE Communications Magazine, 43(12): 112–119.

Wang, N.C., J.S.Chen ,Y.F. Huang , Yu-Li Su, 2007, "A Power-Aware Multicast Routing Protocol for Mobile Ad Hoc Networks With Mobility Prediction " Wireless Per Commun, Springer Science+Business Media, LLC.

Wang, Z., J. Crowcroft, 1996. Quality-of-service routing for supporting multimedia applications, IEEE Journal on Selected Areas in Communications, 14(7): 1288–1294.

Woo. K and B Lee., 2001, "Non blocking localized routing algorithm for balanced energy consumption in mobile ad hoc networks," Proc. IEEE MASCOTS'01, pp:15–18.