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Stable Path Routing Protocol based on Power Awareness

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Abstract— Mobile Adhoc Network consists of a large number of mobile nodes that communicate with each other in the absence of any fixed infrastructure. In such an environment each node must work as router to forward the data packets in the network. The principle characteristics of ad hoc network are the dynamic topology and the limited energy of mobile nodes. Nodes in the network are dependent on limited battery power for their operations. One of the major issue in providing QoS in these network. QoS service cannot be guarentted without managing the link failures. One of the reasons for link failure is discharge of battery. Link failure causes packet drop and reinitailization of route finding process which leads to lot of bandwidth consumption, decrese in throughput and increase in delay. Here, in this paper we are proposing a new approach for minimizing the link failure. The basic idea behind the proposed work is to find more stable path from source to destination in terms of remainig life time of battery.

Index Terms— Battery life, MANET, Path stability, QoS, SPR.

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1 INTRODUCTION

IN recent time QoS in Adhoc network become an area of interest for many researchers. QoS has various parameters like: bandwidth, delay, packet drop, packet delivery, throughput, jitter etc.Many protocols have been proposed in order to provide QoS by managing the bandwidth consumption [1,2,3,4,5,6,7]. Some protocols [8,9,10,11,12] have been proposed in order to provide power aware routing. Power aware routing has been divided under following five categories [13]: multicasting/broadcastion protocols, active energy saving protocols, maximizing network life time protocols, topology control protocols, and passive energy saving protocols.

Here, in this paper we are proposing a new approach"**S**table **P**ath **R**outing Protocol based on Power Awareness" (SPR). SPR is a broadcasting protocol which tries to maximize the network. SPR will help in reduction of link faiure by finding a stable path for data transmission. Stable paths will be calculated on the bases of remaining battery life or power of nodes.

2 PROPOSE WORK

The idea behind the proposed work SPR is not only to provide the QoS in term of bandwidth but also in terms of increase in throughput by providing more stable path. One reason for link failure or path breakage is arbitrary movement of node. Another major reason of link failure is the instability of path due to limited battery power. If a path is selected where delay is minimum, but remaining battery life is also smaller. This path is more prone to link failure. So, an optimal path should be selected where the required bandwidth for data transmission is available along with the maximum link stability. SPR is a protocol which selects only those nodes as intermediate node where bandwidth is available. Also, path selected by the destination node will be the most stable path in term of remaining life.

SPR is an on-demand routing protocol. On request for data transmission, source node will initiate a RREQ packet with a sequence number. This RREQ packet will be helpful in determining the path from source to destination. RREQ packet will contain source address, destination address, required bandwidth, remaining life in terms of time left, and a unique sequence number. Sequence number field will be helpful in identifying the RREQ packet uniquely. Format of RREQ packet is shown in Fig. 1:

0	8	12	16	32
RBW	ML	TTL	Seq_No	
Source Address				
Destination Address				
Address 1				
|				
Address n				

Fig. 1 RREQ Packet Format

- RBW: Required Bandwidth for data transmission
- ML : Minimum remaining life at the path

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- TTL : Time to live
- Seq_No: Unique Sequence Number that uniquely identifies the RREQ packet
- Source Address: Address of the source node
- Destination Address: Address of the intended destination node
- Address 1---- Address n : Address of visited nodes

RREQ packet generated by source node contains two important fields: Required bandwidth and Minimum Battery Life. Battery life is calculated in terms of remaining time left. Battery life is helpful in the discovery of stable paths. RREQ packet is then broadcasted in search of routing path. On receiving the RREQ packet, intermediate node will compare its own address with destination address. If both the address matches with each other, node consumes the RREQ packet and sends back the RREP packet along the path from Address n ---- Address 1.

If intermediate node is not the destination node, then the node will check for the availability of required bandwidth. If required bandwidth is not available then it will drop the RREQ Packet. If node has sufficient bandwidth for data transmission then it will reduce time to live (TTL) by 1. TTL field is helpful in restricting the number of intermediate nodes between source and destination. If TTL becomes 0, node will drop the RREQ packet and sends an error message to source node. After reducing TTL, node will calculate the minimum path life by comparing its own remaining life with Minimum life in ML Field. Node will reset the ML field by minimum of both the values. Node will append its own address in the address list and rebroadcast the RREQ packet. Before broadcasting, node will maintain the different information like source address, destination address, RREQ sequence number and Minimum life of path.

If any intermediate node receives more than one RREQ packet with the same sequence number then node will check that the ML of RREQ with stored ML. If the new RREQ packet has more stable path i.e. ML of path is greater than the previously forwarded RREQ packet then node will re-broadcast RREQ packet. Otherwise RREQ packet is dropped.

After receiving the first RREQ packet, destination node will wait for some predefined amount of time. This will help the destination node in finding the best and most stable path where the chances of link failure due to battery life are minimum.

Algorithm to handle RREQ Packet at intermediate node will be as follows Fig.2:

Find_Route(RREQ Packet)
```
{ if(RREQ. dest_add== node.add)
  { for (t=0 ; t=Xt ; t++) //Xt is the predefined time
for which destination will wait
     { if(Prev_RREQ.ML< New_RREQ.ML)
        { drop Prev_RREQ;
          Prev_RREQ=New_RREQ;
        }
      else
       { drop New_RREQ;
       }
     }
     Consume Prev_RREQ;
     Send RREP;
  }
  else
  { if(node.avail_bw>=RBW)
     { MLn = Min(node.RL, RREQ.ML)
       if(MLn > storedMLn)
        { L_V_N=L_V_N+ node.add;
          Rebroadcast RREQ;
        }
      }
    else{drop RREQ; }
  }
}
```

Fig. 2 Algorithm for route search

3 Example and Analysis of SPR

In order to analyze the functionality of SPR, let us take an example of adhoc network (Fig. 3). This network consists of 10 nodes having random topology. N1 is the source node and N10 is the destination node. Required bandwidth for data transmission is 90 bps. According to SPR N1 will broadcast RREQ in order to find a route to N10. Various paths from N1 to N10 can be:

N1→N2→N3→N8→N9→N10
N1→N2→N3→N8→N9→N7→N10
N1→N2→N4→N3→N8→N9→N10
N1→N2→N4→N3→N8→N9→N7→N10
N1→N2→N4→N5→N6→N7→N10

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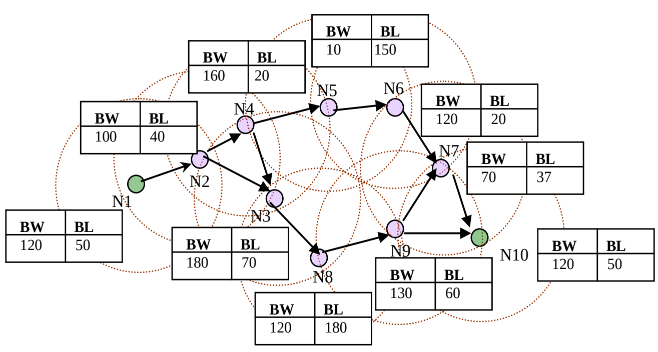

Fig. 3 Available Bandwidth and Battery Life of nodes in network

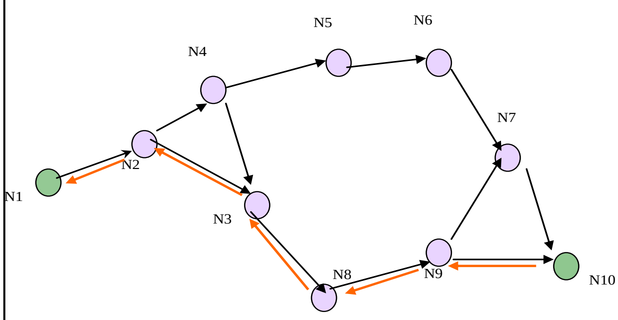

Fig. 5 Paths followed by RREP Packet

Following figure (Fig. 4) shows the various paths followed by RREQ packet from N1 to N20. From Fig. 5.7 it is clear that node N3 will drop the RREQ packet if it is coming via path N1→N2→N4→N3. This is because the minimum life (ML) of earlier RREQ packet coming via path N1→N2→N3 was 40 minutes whereas the ML of new path will be 20. SPR will forward only those RREQ (having same sequence number) where ML is more than the ML of earlier RREQ packet. Node N5 will drop RREQ packet as the required bandwidth to forward data packet is not available on N5.

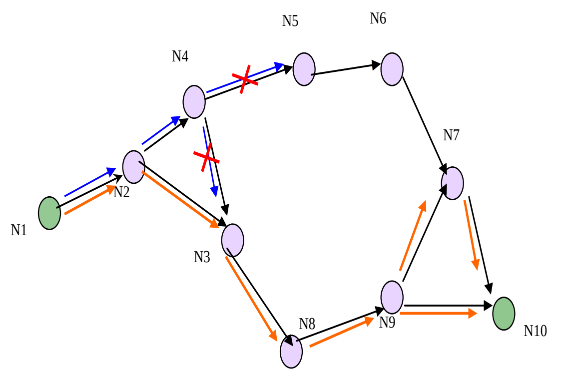

Fig. 4 Paths followed by RREQ Packet

At node N10 two RREQ's will reach. One path is N1→N2→N3→N8→N9→N10 having ML = 40. Other path is N1→N2→N3→N8→N8→N9→N7→N10 having ML=37. Let's assume both reach within the specified time.

On comparison destination node N10 will send RREP packet (Fig. 5) through path N9→N8→N3→N2→N1. This backward path is chosen as this path is more stable in terms of remaining battery life. Also, this path will provide the required bandwidth for data transmission between source node to destination node.

4 Simulation Results

The proposed work was simulated using Matlab 7.0.4. Number of nodes in the network varies from 50-250. Network topology was randomly generated. Area for simulation was 1000 X 1000 m². Available bandwidth at various nodes lies between 0-100. Required bandwidth was taken as 40. Node vicinity was taken as 50 m.Here, results of proposed protocol were compared with results of standard DSR. Simulation work shows that the network life is longer in case SPR. In some cases the path followed by both the protocols was same. In rest of the cases, SPR was found to have more stable path than DSR.

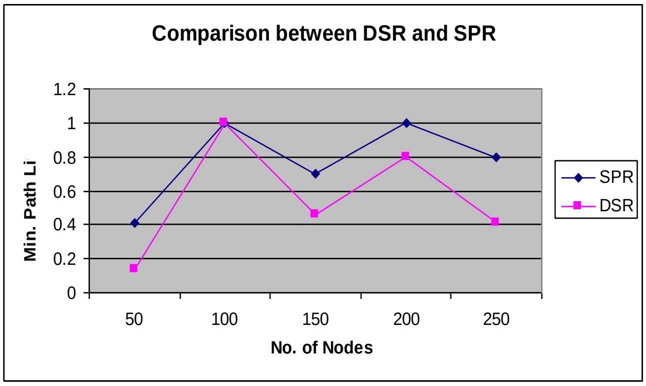

Fig. 5 Comparison of Minimum path life between DSR and SPR

5 Conclusion

In this paper, we presented a novel approach for finding stable path from source to destination. Nodes satisfying required bandwidth constraints can forward the RREQ packet further. Nodes can forward mulitlple RREQ packet with same sequence number only if the newly received RREQ has the more stable path. This work will be helpful in increasing the network life , reduction in packet drops and increase in throughput.

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REFERENCES

[1] R. Braden, D. Clark, and S. Shenker, "Integrated services in the Internet architecture: an overview," 1994, IETF RFC 1633.

[2] S. Blake, D. Black, M. Carlson, E. Davies, Z.Wang, andW. Weiss, "An architecture for differentiated services," 1998, *IETF RFC 2475*

[3] Hannan XIAO, Winston K.G. SEAH, Anthony LO and Kee Chiang CHUA, "Flexible Quality Service Model for Ad-HOC Networks", Proc. *IEEE Vehicular Technology Conference*, Tokio, Japan, May 2000.

[4] [ACLZ99]G-S. Ahn, A.T. Campbell, S-B. Lee, and X. Zhang, "INSIGNIA", Internet Draft, draft-ietf-manet-insignia-01.txt,Oct 1999.

[5] R. Sivakumar, P.Sinha, and V. Bharghavan.CEDAR: A Core Extraction Distributed Ad Hoc Routing Algorithm, In IEEE JSAC, Special Issue on Ad hoc Networks aand Applications, Vol 3 N 8, august 1999

[6] Qi Xue , Aura Ganz "Ad hoc QoS on-demand routing (AQOR) in mobile ad hoc networks ". Journal of Parallel and Distributed Computing,(63), 154-165, 2003.

[7] Dinesh Dharmaraju, Ayan Roy-Chowdhury, Pedram Hovareshti, John S. Baras, "INORA - A Unified Signaling and Routing Mechanism for QoS Support in Mobile Ad hoc Networks," icppw, pp.86, 2002 International Conference on Parallel Processing Workshops (ICPPW'02), 2002.

[8] B. Venkatalakshmi1 and S. Manjula ,"Power Aware On Demand Multicast Routing protocol", *Mobile and Pervasive Computing* ,CoMPC–2008.

[9] Morteza Maleki, Karthik Dantu, and Massoud Pedram, " Power-aware Source Routing Protocol for Mobile Ad Hoc Networks" *ISLPED'02,* August 12-14, 2002, Monterey, California, USA.

[10] J. Ma " Power-aware Routing in Ad hoc Networks" *Kowloon*, Hong Kong, December 2003.

[11] J-C.Cano and D.Kim, "Investigating Performance of Power-aware Routing Protocols for Mobile Ad hoc Networks," *IEEE MobiWac '02*, 2002.

[12] Jiageng Li, David Cordes And Jingyuan Zhang, " Power Aware Routing protocols in Adhoc Wireless Networks", *IEEE Wireless Communication*, December 2005.

[13] Guanjie Huang, Wei Guo, and Kai Wen, "Time-based Broadcasting for Power-aware Routing in Wireless Adhoc Networks", *IEEE Conference on Communications, Circuits, and Systems,* pp. 378-382, 2008.