NORWA- Non Selfish Adaptive Opportunistic Routing for Wireless Ad-hoc Network

Febeena M and Anisha S S

Abstract--- *The performance of opportunistic routing in wireless Ad-hoc network depends on selection of next relay node. While selecting next relay node should consider the selfish nodes and congestion present in the network. In this paper, propose a technique CreditRisk to improve performance of the distributed adaptive opportunistic routing protocol. The CreditRisk allows routing by dealing with selfish and congested nodes. Due to selfish node or congestion present in the network, loss packet may occur. NORWA deals with these problems and produce better and efficient routing.*

Index Terms--- *Opportunistic Routing, Creditrisk, Selfishness, Congestion*

I. Introduction

ROUTING is the process of transferring data from the source to destination node. In Ad–hoc network it will take multiple hops from one node to another one. Conventional routing attempt to find fixed path along which packets are transferred [1]. Such fixed path scheme fails to take advantage of broadcast nature and opportunities provided by the wireless medium and results in unnecessary packet retransmission. In contrast opportunistic routing has been recently proposed a new paradigm, which exploits the broad cast nature of the wireless channel to increase the reliability of packet transmission. Opportunistic routing algorithm implements forwarding decision in a hop-by-hop fashion and defer the selection of next hop for a packet until they have learnt the set of nodes which is actually received that packet. Opportunistic Routing is a promising approach for improving the throughput of wireless multi-hop networks. While most of the conventional wireless network models use wire-like point-to-point links that try to mask the fact that wireless transmissions are broadcasts by nature.

The figure 1 shows a multi-hop relaying of packets. A source node broadcast the packet to the within the range (one hop distant) known as neighbors of the source from that a particular forwarder is selected and then the forwarder broadcast the packet. This is continued until the destination reached.

In distributed adaptive opportunistic routing scheme [2] packets are opportunistically routed in a wireless multi-hop network when zero or erroneous knowledge of transmission success probabilities and network topology is available.

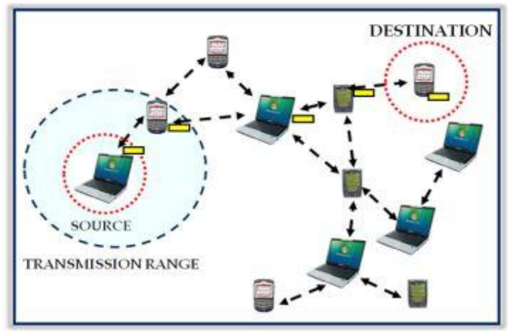

Fig 1 Multihop Routing in Ad-hoc Network

Distributed adaptive opportunistic routing algorithm (d-AdaptOR) is low-complexity, low-overhead, distributed asynchronous implementation. The significant characteristics of d-AdaptOR are that, it is oblivious to the initial knowledge about the network, distributed, and it is asynchronous. It uses a reinforcement learning framework in order to enable the nodes to adapt their routing strategies [3] .The d-AdaptOR routing based on three-way handshake between DATA, ACK(Acknowledgement) and FO(Forwarding control) packet, loss of this packet will significantly reduce the performance of d-AdaptOR. The loss of packet may be due to selfish node or congestion present in the network.

Most of the routing protocol assumes that nodes will altruistically forwarding packets. This assumption is unrealistic in Ad-hoc network. The proposed work allows routing by dealing with selfish and congested nodes. A selfish node is a node which acts according to its own interests. In general, the result of local optimization by many selfish network users with conflicting interests does not possess any type of global optimality; hence, this decreases network performance [4].Congestion in the network is caused by sending more packets than the device can accommodate, thus causing buffer on such device to fill up and the possibility of overflow. This result in delayed or lost packet congestion is a global issue, involving the behavior of all devices.

The paper is organized into, section1 brief introduction about the area ,section 2 the brief discussion about the related work ,section 3 system model and discuss about the problem, section 4 the protocol overview discuss how the protocol will work ,section 5 conclusion about the work

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II. Related Works

S.Biswas and R.Morris (2005) [5] Introduced an integrated routing and MAC protocol that increases throughput of large unicast transfers in multi-hop wireless networks. The source broad cast the packet subset node receives the packet perform a protocol to discover and which node to forward the packet. It uses ETX (Estimated Transmission count) to select candidate forwarder. ExOR (Extremely Opportunistic Routing) uses this fact to its advantage: In a wireless network a link exists between every pair of nodes, although the error rate may be rather high for some of these links. All packet transmissions (which are layer 2 broadcasts) can potentially be received by every remote node, with a certain non-zero probability. This brings up the opportunity that a packet might skip a few nodes on its forwarding path if current radio propagation conditions are favorable. ExOR uses this approach to significantly reduce the average path length of most end-to-end transmissions.

Bhorkar et al (2012) [2] It is a distributed adaptive scheme to route packets in an opportunistic Ad-hoc network scheme work well with zero network information utilizes three way handshake. It uses EBS (Estimated Best Score) to select next forwarding node. The EBS is calculated on the basis the number of times packet passed through node and the number of time it acknowledged. But d-AdaptOR does not deal with congestion in the network and selfish nodes which may cause packet loss and will affect the performance of the routing

III. System Model

Consider the problem of routing packets from source node ‘O to destination node ‘D’ in a wireless Ad-hoc network of d + 1 nodes. Let the set S denote the neighbor nodes. The time is slotted and indexed by n >= 0. A packet indexed by m >=1 is generated at the source node ‘O’. The data packets are forwarded source ‘O to ‘D’. The packets are routed by utilizing 3-way handshake and d-AdaptOR algorithm. The packets are forwarded on basis of estimated best score. The node i transmit packet to its neighbor. The routing decision at any given time is made based on the reception outcome and the routing decision involves retransmission, choosing the next relay, or termination. d-AdaptOR makes such decisions in a distributed manner via the following three-way handshake between node.1) Node transmits a packet. 2) The set of nodes who have successfully received the packet from node, transmit acknowledgment (ACK) packets to node. In addition to the node’s identity, the acknowledgment packet of node includes a value known as Estimated Best Score (EBS). 3) Based on the EBS selects next forwarding node. Assumes a fixed transmission cost Ci>0 incurred upon transmission from a node i.

The termination event for packet m to be the event that packet m is either received by the destination or is dropped by a relay before reaching the destination. The termination events is as follows: assume that upon the termination of a packet at the destination (successful delivery of a packet to the destination) a fixed and given positive reward r is obtained, otherwise no reward

Problem (p) - select a best sequence of relay nodes in a network where selfish and congested nodes are present

In the next section propose CreditRisk function which solves the problem (p).This technique improves the performance of distributed adaptive opportunistic routing protocol

IV. Protocol Overview

The major challenge in opportunistic routing is the selection of node which will forward the packet when a node wants to send data to a destination it broadcast the data all of its neighbors let N(i)be the neighbors of the node i and A(S) set of allowable action .The node i will broadcast the DATA packet. The neighboring will send the ACK packet to source node if any of ACK is lost there is a chance of in correct selection of the forwarding node. In another case if all ACK have received and FO packet is send. If FO is lost the DATA will not reach the destination. So when selecting relay node should consider CreditRisk of the node

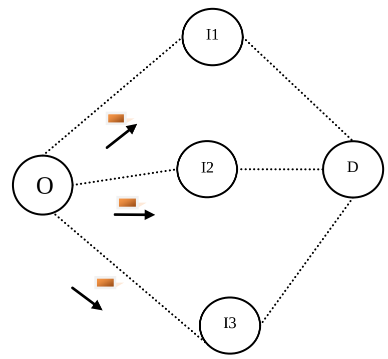

Fig 2 Source Node O Broadcast DATA

The figure 2 shows an Ad-hoc network. O is the source node, I1, I2, I3 intermediate node and D is the destination node. The source node broad cast the data to intermediate node after receiving the data packet the intermediate nodes will respond with ACK packets. The figure 3 shows possible worst case possible for d-adaptOR

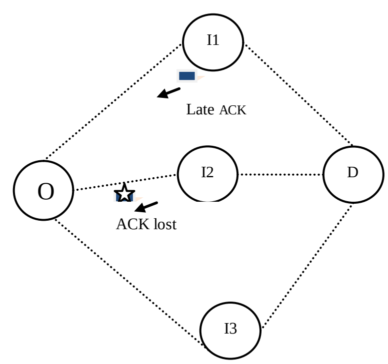

Fig3 Intermediate Nodes Response

Intermediate I1send ACK after the waiting time. ACK packet send by I2 is lost and I3 is a selfishnode so it does not respond in this case the DATA packet will not reach destination D.

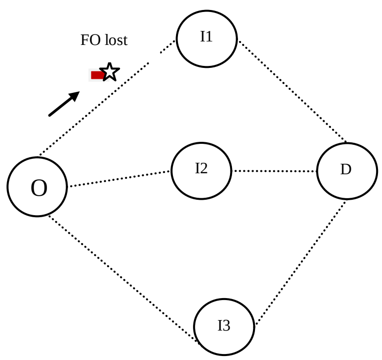

Fig 3 Source sends FO

If all ACK are successfully received by the source O. will select forwarding node on the basis of EBS .If it selects I1 as forwarding and broad cast it if FO packet is lost or reached late the DATA packet will not reach destination. So selection of forwarding node on the basis of EBS is not sufficient.

CreditRisk evaluation

The CreditRisk value is a dynamic one which changes over the network conditions. It is calculated on the basis of different set parameters. The parameters associated with the ACK and FO packets are EACK (Expected ACK), RACK(Received ACK), LACK(Late ACK),EFO (Expected FO), RFO (Received FO), LFO (Late FO) , let i be a source node which identify the selfishness of the neighboring node j is i{n,m}in the neighbor list N(i) for m un received packets at time n .Then the CreditRisk is represented as

$$\text{CreditRisk}= \Lambda_s(i) = [\sum_{k=1}^{j} i_k(m,n)] \quad \text{where } j\in N(i)$$

When the node i start transmitting packets the EACK is incremented. After receiving the ACK packets from j RACK is incremented if EACK is equal to the RACK then the neighboring node is non selfish. If not it may be selfish node or there is problem in the physical layer like congestion. If ACK is received after the waiting time LACK is incremented. While transmitting the ACK the node j will wait for the FO packet so j increment EFO value, after receiving the FO packets RFO is incremented if received EFO is equal to the RFO then the node i is non selfish to node j.LFO is incremented if FO are received after waiting time. Let N (Ep) number of expected packets, N (Rp) number of received packet, N (Lp) number of late packets then

$$m=N\ (Ep)-(N\ (Rp)\ +N\ (Lp))$$

The value of m is calculated on the basis both ACK and FO packet by the node i towards all of its neighbor and then calculate CreditRisk ($\Lambda_s(i)$).m value of ACK packets is used to calculate CreditRisk to select the forwarding node .The value of FO packets used to calculate CreditRisk of source node. Along the Estimated Best Score (Λimax) the CreditRisk value is used to select the forwarding node

NOTATION USED

Symbol	definition
A(S)	Set of available actions
N(i)	Neighbor of node i including node i
$\mathcal{V}$ n(i,S,a)	Number of times nodes S have relieved the packet and action is taken
$\Lambda_s(i)$	CreditRisk calculated by i
M	Number of packet lost
Λ^i_{max}	Estimated Best Score
Ep	Expected number of packet
Rp	Received number of packet
Lp	Lost number of packets

THE ALGORITHM

Step1: initialize the adaptive score vectors Λs (i) =0, m =0

Step2: node i want to transmit will broadcast the data packet to the neighbor nodes and increments EACK while Receiving the ACK from neighbor increments RACK

Step3: neighbors nodes while sending the ACK it increments its EFO, the RFO is incremented when it gets the FO packet

Step4: node i calculates the CreditRisk and select the for forwarding node on the basis of CreditRisk and received EBS score

Step5: if node i receives late ACK or FO packets after the waiting time will increment corresponding LACK and LFO calculate CreditRisk

V. Conclusion

NORWA implements a better and efficient routing by considering selfishnode and congestion present in the network. This paper implements CreditRisk function to select best relay node in addition to EBS. From the value obtained by the CreditRisk whether a node is congested or selfish

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