Performance Estimation on Opportunistic Routing Protocol based on Reliability Analysis

Prof. SmitaShukla Patel[1], Dr. M.Mohanpriya[2]
[1]Computer Science Department ,Karpagam University ,India
[2]Computer Science Department ,Karpagam University ,India
[1]Smitapatel7122006@gmail.com,[2]mohanapriyaasaithambi@gmail.com

Abstract - This paper discuss various opportunistic routing algorithm which is based on broadcast nature of opportunistic network and also provide novel solution of routing which have less data loss.

This research work proposed broadcasting nature of wireless network to implement Opportunistic routing algorithm. This is Extension of ExOR routing protocol which is based on opportunisticrouting. Here introducing new algorithm which is resource aware. In

This algorithm capacity will calculate at each node and according to capacity it will provide privilege rank. High prioritynode act as a forwarder among the candidates. When destination will reached, it will send acknowledgement that is destitution reached.

Paper discuss various merits and demerits of existing mobile opportunistic routing protocol .paper also introduced novel improved resource aware protocol which maximize the throughput and minimize the packet loss.In a last section of paper RAOR (resource aware opportunistic routing protocol) resulthas compare with other previous opportunistic routing protocol.

Keywords: ExOR, Opportunistic routing, Ad-hoc network.

1. Introduction

Mobile ad hoc network (MANET) is a type of wireless ad hoc network. MANET doesn't require base station and doesn't pass on standing infrastructure. So, mobile ad hoc networks are self- organizing networks.

The characteristics of MANET are dynamic topology, network partitions and constrained resources. Due to this, there are many issues while designing routing protocol for MANET. The issues such as error prone channel state, hidden and exposed terminal problem, bandwidth constrained, and variable capacity links and energy constrained operations are found. For efficient data transmission and to improvise throughput and avoid retransmissions in MANET, various opportunistic routing techniques were used.

Opportunistic networks are liable to frequentpath loss and communication delays and it uses candidate list instead of next hop to forward data from source to destination. The routing protocol used for opportunistic networks are different from opportunistic forwarding used in MANET. The opportunistic routing in MANET is used to fully utilize the broadcast nature of wireless medium and to improve transmission reliability. [5][6][8]

1.1 Limitation of opportunistic routing:

The challenges in designing and implementing opportunistic routing in MANET are given by

The first issue is selection of forwarding candidates. Selecting the size and the specific nodes of the set of forwarding nodes is critical in opportunistic routing. Selecting the most appropriate nodes to forward will increase the system throughput and reduce the latency and choosing the right size of the forwarding nodes will increase thenetwork utilization and decrease the network overhead. The coordination overhead among the candidate nodes should be minimum. [4]

The second issue is the priority of the candidates. The priority is given according to the nearest of the destination. [4][5]

The third issue is when relays should forward packets.[4]

1.2 Previous work

1.2.1. ExOR (Extreme Opportunistic Routing Protocol):Broad research has been done to use propagation nature of wireless links, instead of making wireless links as good as wired one. ExOR is the milestone piece of work in this area. Routing protocols based on the inherent nature of wireless link (i.e. broadcast) trigger the opportunity to extensively used network layer to maintain the correct path for Mac layer.[1]

In ExOR, 90% of batch data packets are transmitted by ExOR and the remaining 10% of packets are transmitted by traditional routing. ExOR increases throughput by 35% than traditional routing. But there are some challenges in designing ExOR protocol. Initially, the batch size or group size have to be determined, it is complicated in ExOR. ExOR doesn't use spatial reuse and it doesn't extend for multicasting. Hence MORE is introduced to obtain these functionalities.[7][1]

1.2.2. MORE (Mac Independent Opportunistic Routing and Encoding Protocol):MORE is a MAC independent Opportunistic Routing and Encoding protocol. ExOR ties MAC and routing, this restricts the access of medium and its leads to underutilization of the wireless medium. ExOR doesn't extend for multicasting. To overcome these disadvantages of ExOR, MORE is introduced. MORE uses intra-flow network coding. It doesn't use strict schedule on medium access and it is supports for multicasting.[7]

2. Proposed work

In proposed work opportunistic routing based on capacity calculation and battery calculation at each node, here forwarder list selection based on energy rank. Nodes which has more energy rank has higher priority than other node and higher priority node send the data and other nodes listen that transmission.

Recourse based protocol operates on timer. When timer out its start sending data and second timer indicate how much time data can be hold, so by using theses timers nodes can coordinate in an efficient manner.

It is acknowledge based system. Acknowledge send from the receiver that data has been successfully received .After that next set of data can be transferred.

By using timer, capacity calculation and acknowledgement network can efficiently recover data. And packet loss ratio and throughput will increase because high capacity node will is in use to transmit data.

2.1 Neighborhood Discovery

In a MANET packet transmission HELLO message has been sent, Hello message gives initial establishment of network connection.

In this research advanced controlled HELLO messaging is used, which is a modified version of traditional MANET HELLO message protocol to contain node's resources capacity.

2.2 Capacity Calculation:

BATTERY_RANK = Abs ((REMAINING_BATERRY_PERCENTAGE/ MEMORY_CONSUMPTION_PERCENTAGE) * TOLERANCE_FACTOR)

PROCESSING_POWER = Abs((AVAILABLE_STORAGE + VIRTUAL_MEMORY)/ MEMORY_CONSUMPTION_PERCENTAGE) * TOLERANCE_FACTOR)

2.3 Traditional Opportunistic broadcast routing is used. Following are the routine steps every forwarder will follow:

2.3.1Route Candidate Selection: Source use the ***route table*** to identify the candidate for packets to be sent. Candidate selection will be based on **NODE_CAPACITY.** Selected candidates will be embedded in Packet's header as proposed forwarder list. Nodes in the list are ordered according to the **FORWARDING_CAPACITY.**

Algorithm 1: Identify forwarder candidate's priority

```
Forwarder candidates = []
MAX_PRIORITY = 0
while(entry in node_table){
        candidate = nil
        candidate .node = entry.node
candidate .priority =  Average(entry. battery_rank,
entry.processing_power)
        Forwarder_candidates.push(candidate)
If(candidate.priority> MAX_PRIORITY)
MAX_PRIORITY = candidate.priority
}
}
while(candidate in Forwarder candidates){
candidate.priority = MAX_PRIORITY - candidate. priority
}
```

2.3.2 Receiver priority in 'routing path list' is based on link strength. Traditional opportunistic protocol doesn't consider the resources availability in prioritized receiver node.

Broadcast the Acknowledge to confirm as sender. Based on priority forwarder. Every other forwarder holds on, and waits for ***CONFIRM_SENT*** signal.

- If receiver is ultimate destination, it will broadcast the **REMAING_PACKET_REQUEST** or PACKET**_RECIEVED_MESSAGE**

Algorithm 2: Receiver Routing Strategy

```
If(is_ack_packet(destination reached){
Discard packets (packet numbers…)
broadcast_ack(destination reached);
}
else{
If(NOT isRetainTimerStarted()){
        RETAIL-TIMER_EXPIRE = 1s * [n – privilege rank ]
        //N factor equal to Number of Forwarder candidates
         startRetainTimer();
}
if(amI_Source){
discard packets()
}
if(alreadyRetainedPackets -> for same destination){
discard packets()
retainNewPackets()
}
BROADCAST_TIMER_EXPIRE  = 200ms * privilege rank

start_BroadcastTimer()
while(retainTimerExpire){
                discard packets()
}
while(broadcastTimerExpire){
                broadcast Packets()
}
if(amI_destination){
        broadcast_ack(destination reached);
}
}
```

3. Evaluated Result

We evaluated performance of proposed work again ExOR and MORE. Simulation is based on different number of nodes in network and energy level. We observed improved performance as compare to ExOR and MORE both in all metrics.

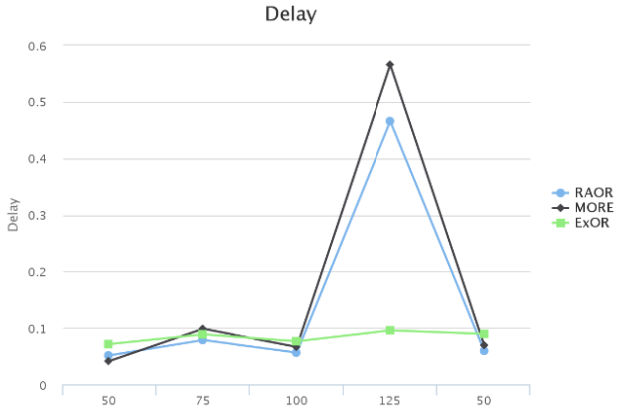

Fig 1: Delay metric comparison among ExOR, MORE and RAOR

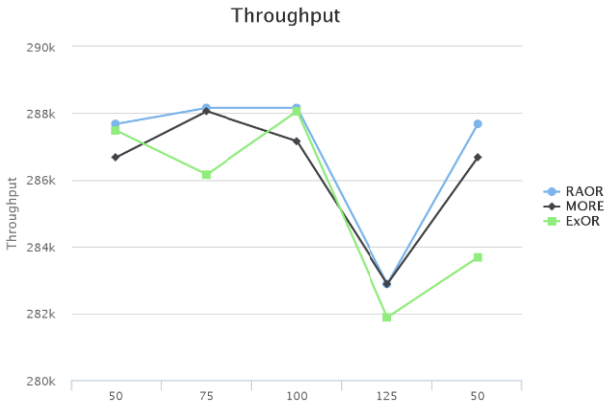

Fig 2: Throughput metric comparison among ExOR, MORE and RAOR

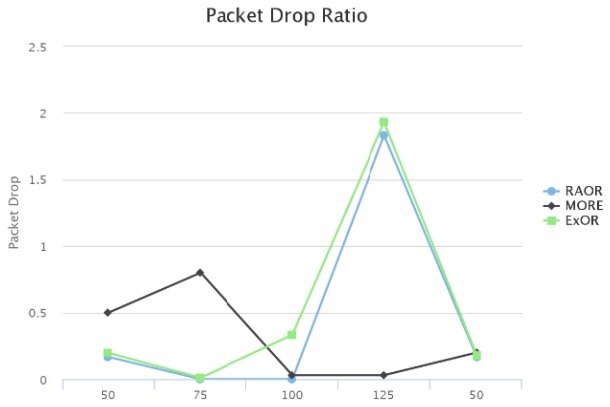

Fig 3: Packet Drop Ratio metric comparison among ExOR, MORE and RAOR

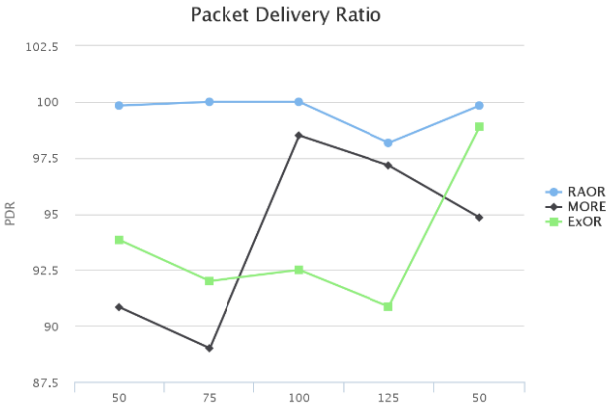

Fig 4: Packet Delivery Ratio metric comparison among ExOR, MORE and RAOR

4. Conclusion

So many algorithm are available for opportunisticrouting. This paper proposed routing algorithm which is extension of resource based extended opportunistic routing algorithm.

This paper discuss various opportunistic routing algorithm which is based on broadcast nature of opportunistic network and also introduced novel resource aware routing which have less packet loss and high packet delivery ratio..

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