A MDR BASED DTR PROTOCOL TO INCREASE THROUGHPUT, CAPACITY AND SECRECY OF WSN

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ABSTRACT

In hybrid wireless networks it incorporate MANETs and Infrastructure networks, so dynamic, efficient and decisive data routing is important for high capacity and throughput. A challenge here is if we can co-ordinately develop an efficient routing algorithm and effective reputation management for reliable routing. This paper presents a Distributed Three-hop Routing protocol (DTR) for hybrid wireless networks with a chance of peer-to-peer (P2P)-based Market-guided Distributed Routing mechanism (MDR). To take full advantage of the widespread base stations and effective reputation management and trading market management for reliable data routing .Furthermore, sending segments to a number of base stations simultaneously increases throughput and makes full use of widespread base stations. Theoretical analysis and simulation results show the superiority of DTR in comparison with other routing protocols in terms of throughput capacity, scalability and mobility resilience. The results also show the effectiveness of the congestion control algorithm in balancing the load between base stations. Here further propose market-based policies to strengthen cooperation incentives.

Key Words: Hybrid wireless networks, Routing algorithm, reputation systems, trading market model.

1. INTRODUCTION

In the last ten years, we witnessed various efforts to offer mobile internet access using different technologies and business models. . Today's public Wireless LANs are restricted to hotspots. With the current technology, providers can only target a small audience and in turn charge high prices for their service to generate revenue. Hybrid wireless networks is important solution, which allowing mobile clients to achieve service access in a seamless manner independent of their existence in Wireless LAN communication. The hybrid protocols are more flexible, reliable, and have better performance than the traditional wireless network protocols. However, most routing protocols for these networks simply combine the ad-hoc transmission mode with the cellular transmission mode, which inherits the drawbacks of ad-hoc transmission. An efficient data routing protocol is important in such networks for high network capacity and scalability. However, most routing protocols for these networks simply combine the ad-hoc transmission mode with the cellular transmission mode, which inherits the drawbacks of ad-hoc transmission. So proposed framework for efficient and secure data routing protocol to increase the throughput and capacity of hybrid networks through highly efficient and reliable manner .A defiance here is, if we can take benefit of the widespread base stations to co-equally develop an efficient routing protocol and effective co-action incentives for reliable routing. The routing algorithm make easy the implementation of the cooperation inducement to overcome former detriments. To handle this challenge, we propose a peer-to-peer (P2P)-based Market-guided Distributed Routing mechanism (MDR). MDR takes advantage of widely-spread base stations to expedite highly efficient single- relay distributed data routing. In the single-relay distributed data routing the message are segmented then transmitted directly or indirectly to base stations in allocated manner through multiple relay nodes. By using the single-relay transmission characteristics, base stations can oversees the actual transmitted packets of relay nodes to assess their reputation and execute trading market management, and also monitor falsely reported reputation challenges. Thus, a node's reputation is based on i) its actual relaying decency, and ii) all

rather than partial reputation information, for calculate more accurate reputation. With this all feature here overlook into the chances of modification by including three hop DTR protocol for increasing capacity of hybrid wireless networks. DTR aims to changeover the routing difficulty from the MANETs to the infrastructure network by taking advantage of widespread base stations in a hybrid wireless network. Instead of using one multi-hop path to transmit a message to one base station, DTR uses at most two hops to relay the segments of a message to different base stations in a distributed manner. There by simplify the routings in the infrastructure network for clarity. When a source node wants to send a stream of messages to a destination node, it abscind the message stream into a number of partial streams called segments and transmits each segment to a neighbour node. Based on the QoS requirement of application each neighbour node locally decides between direct transmission and relay transmission over the receiving segments from the source node. The neighbour nodes forward these segments in a appropriated manner to convenient base stations. By using the infrastructure network routing, the base stations further send the segments to the base stations where the destination node resides. The destination base station reorganize the segments into the actual. If the destination moves to another base station during segment transmission, then it uses the cellular IP transmission method to send segments to the destination.DTR always attempts to limit the number of hops. The first hop fully utilize the resources by forwarding distributes the segments of a message in different directions and the possible second hop forwarding ensures the high capacity of the forwarder.

DTR significantly increases the throughput capacity and scalability of hybrid wireless networks by Using self-adaptive and distributed routing with high speed and short-path ad-hoc transmission, by defeat the three infirmity of the former routing algorithms. It has the following features:

* *Hot spot reduction:* The mobile gateway nodes can easily become hot spots. But DTR mitigates traffic profusion at mobile gate way nodes while makes full use of channel resources through a distributed multi-path relay.

* *High reliability*: DTR uses small hop path length with abbreviate physical distance in each step, it mitigates noise and adjacent interference and eliminates the unfavorable effect of route failure during data transmission. Thus, it decrease the packet drop rate and makes full use of spacial reuse, in which several source and destination nodes can communicate simultaneously without interference.

* *Low overhead*: DTR tries to avoid overhead come out with the route ascertainment and sustenance in the ad-hoc transmission mode, especially in a dynamic environment.

The rest of this paper is systematized as follows. Section 2 specifics a review of the MDR mechanism with descriptions of the different MDR components. Section 3 details the DTR protocol, with an emphasis on its routing methods, and base station congestion control. Section 4 shows the behaviour of the DTR protocol in contrasting to other routing protocols. Finally, Section 5 concluding the paper with a discussion on the importance of reputation management.

2. MDR: PEER-TO-PEER-BASED MARKET-GUIDED DISTRIBUTED ROUTING MECHANISM

In this section, describes the four components respectively.

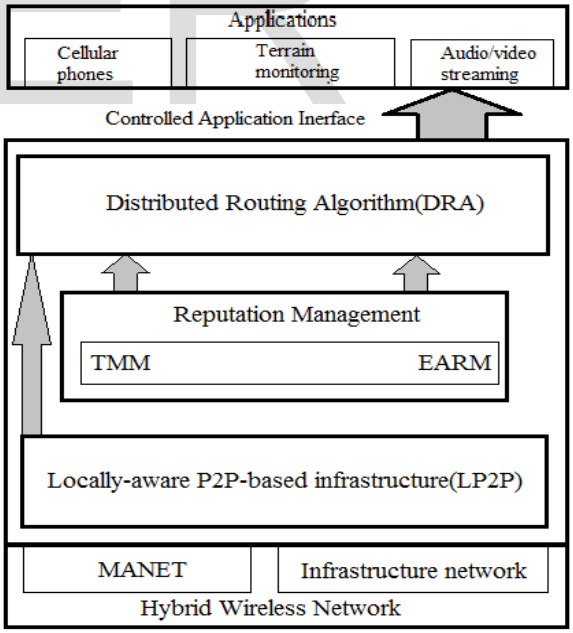

Figure 1: A high-level view of the MDR mechanism.

2.1: Locality-aware peer-to-peer based infrastructure

MDR builds LP2P for the substrate of the infrastructure component of a hybrid network like shown in Fig 1. In mobile and pervasive

environments, segment of data may be transferred and distributed among several system entities. Such data can be generated by context sensors, cultured and adduce by context processors, and dominated by context clients. This features can be achieved in a high level allotted system using peer-to-peer (P2P) modelling. .The overlay network includes two main functions i) Insert(ID, object) and 2) Lookup(ID) to save an entity to a node accountable for the ID of the entity, and to recover the entity based on its ID, respectively. In LP2P, the logical adjacency cogitation derived from the overlay network similar the physical adjacency information in reality, which enables base station to communicate with their physically nearest nodes for high efficiency and capacity.

2.2 Distributed Routing Algorithm(DRA) using single-relay transmission.

As shown in Fig. 2, to send a message D from the source node to the destination, DRA is constitute of five steps as follows:

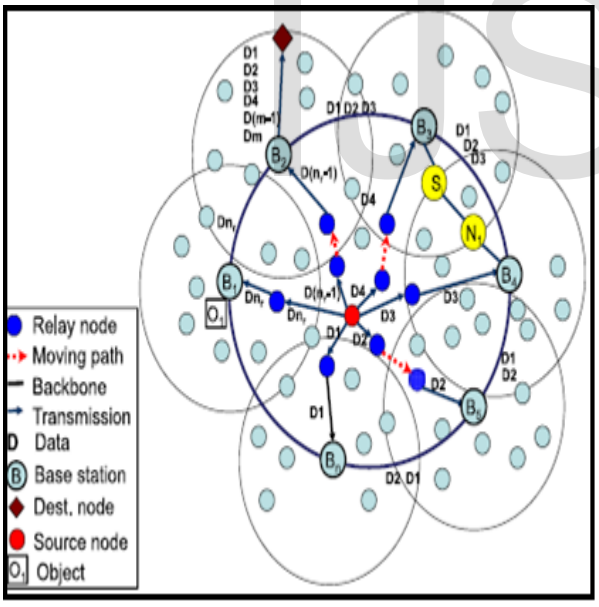

Figure 2: MDR demonstrated in a hybrid wireless network

a) By using erasure coding technique the source node initially encode the message D into D1 to Dnr coded segment.

b) The source node transmits these segments to various capable neighbours arranged in a allocated nature. To do that, the source node first broadcasts a request with the segment length to Its neighbours with sufficient energy for the forwarding reply to the source node. The source node relies on EARM and TMM for reliable and cooperative relay node selections on the basis of reputation management. It then transmits its segments to the selected relay nodes.

c) The relay nodes bring the segments and transmit the segments to base stations when they enter their coverage areas.

d) The base station then transmits the segments to the base station where the destination resides. To find the destination base station, DRA takes advantage over locally p2p for final destination tracking. Each mobile node has a P2P ID which is the encrypted hash value of its IP address. It has an owner base station which is the owner of its ID in the P2P. Each mobile node location is sustained in its owner base station.

e) Forwards the segments of a message to the destination node, where the destination base station resides and the destination reorganize the message.

In DRA, only single relay transmission is used to transmit a segment between the source node and base station. So the problem arises in this mechanism is traffic congestion. In the existing methods does not demonstrate any of the congestion control mechanisms. To deal with this problem, we propose to over look into advanced feature of new routing protocol DTR described in section 4.

2.3 Trading Market Model (TMM)

TMM dominates data transmission functions between source nodes and relay nodes for conscientious and efficient data transmission. Initially a certain amount of credits assigned to each node when it joins the system. Source nodes pay credits to relay nodes and relay nodes charge source nodes for data forwarding services. Since the data forwarding cost is directly related to the data length. To determine the forwarding service price, TMM uses the product of the data length and unit service price per byte. Pricing Policy based on the determination of each node over its service price based on the supply and demand equilibrium. Precisely, a node deal with two factors: the business competition between nodes and its QoS. For the former, depends on the node that can

provide high QoS. For the latter, in order to attract more business to earn more credits and higher reputations, nodes should offer lower price and vice versa.

If the source node cannot able to have the service charge of any relay node, it needs to earn more credits by sending data for others. Thus, TMM not only deters the behaviours of uncooperative nodes by deprived their credits but also serves as an effective means to provide cooperation incentives. The previous theoretical analysis work proves the effectiveness of the node cooperation incentives in business based systems. Node balancing can be done by enabling nodes to automatically adjust their service price based on the supply and demand equilibrium with the TMM policies.

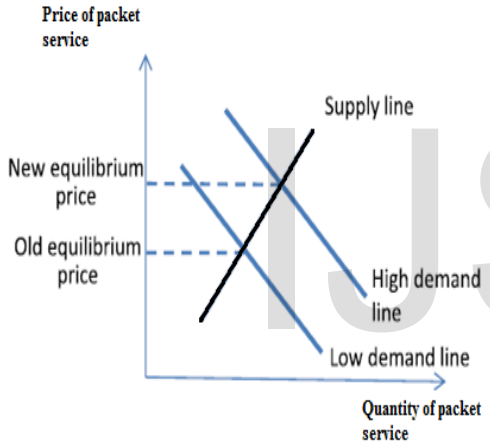

Figure.3. Equilibrium price in the market.

Based on the foregoing basic trading market model, if we entirely let the nodes individually determine the price in the market, a low-traffic region accomplish low equilibrium price and a high-traffic region generates large equilibrium price. This is because the abundance of packet service in demand in low-traffic region is smaller than that in the high traffic area. Given a supply line, a lower demand acquire a lower market equilibrium price, as shown in Fig. 3.There by result shows, cooperative nodes in a low-traffic region cannot earn many credits since they cannot sell their services at a critical high price, and thus cannot buy services. In contradiction, uncooperative nodes in a high-traffic region can still sell service at a high price because the service demand in this region is high.

2.4 Efficient and Accurate Reputation Management (EARM)

Elimination of selfish nodes is one of the main dispute in reliable data routing .EARM helps acquire this objective while offering incentives for node cooperation in routing mechanisms. Related to conventional reputation systems, EARM has some of benefits: (1) In preference, depending on repeated local information dealing among neighbours, which does not assure the precision of reputation values due to fractional reputation information for reputation calculation and incurs a high overhead, EARM works on locally peer-to-peer to efficiently observe and collect all reputation information on each node that helps to find more precise reputation values; (2) Taking benefits of the single-relay feature of DRA, EARM calculates a node's reputation value depending on its original number of forwarded bytes instead of other nodes' feedback, which may be deceitfully reported by misbehaving nodes; and (3) Depending on LP2P, EARM offers efficient global reputation catechize.

Reputation value calculation. Authorized telecommunication companies or government maintained base stations which are generally authentic, we use base stations to treat as dominion to responsible the transmissions between source nodes and relay nodes in order to increase the throughput and capacity of hybrid wireless networks. In EARM, the reputation is calculated by a value within 0 and 1. Initially every node is considered to be capricious with zero initial reputation value.

Reputation value collection and querying. A base station finding the local reputation value of node in its own information based on the number of bytes forwards to it, and continuously reports the value to LP2P by using Insert (IDi,Ri). Local reputation values are then collected in its owner base station based on the P2P object assignment policy, 's. The owner BS calculates the moderate of the local reputation values of global reputation value, and stores it locally.

3. DISTRIBUTED THREE-HOP ROUTING PROTOCOL

The assumptions that there are no bandwidth and power constraints on transmissions between base stations, since base stations are connected with a wired backbone. The relay nodes denoted using intermediate nodes that function as gateways bridging an infrastructure wireless network and MANETs. Here assume that every mobile node is dual-mode; that is, it has ad-hoc network interface such as a WLAN radio interface and infrastructure network

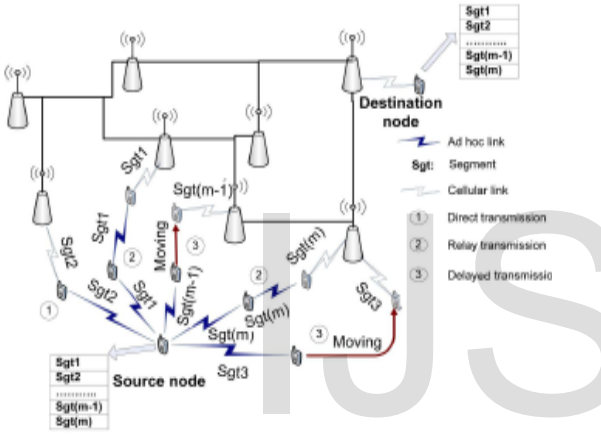

Figure 4. Data transmission in the DTR protocol.

DTR aims to shift the routing difficulties from the ad hoc network to the infrastructure network by taking benefits of widespread base stations in a hybrid wireless network. Instead of using one multi-hop path to transmit a message to one base station, DTR uses at most two hops to relay the segments of a message to different base station in a accomplished manner, and relies on base station to combine the segments demonstrates the process of DTR in a hybrid wireless network. We simplify the routings in the infrastructure network for clarity. When a source node wants to transmit a message stream to a destination node, it divides the message stream into a number of partial streams called segments and transmits each segment to a neighbour node. Upon receiving a segment from the source node, a neighbour node locally decides between direct transmission and relay transmission based on the QoS requirement of the application. The neighbour nodes forward these segments in a distributed manner to nearby base station. Relying on the infrastructure network routing, the base station further transmit the segments to the BS where the destination node resides. The final BS rearranges the segments into the original order and forwards the segments to the destination. It uses the cellular IP transmission method to send segments to the destination if the destination

The data routing process in DTR can be divided into two steps: uplink from a source node to the first BS and downlink from the final BS to the data's destination. Critical problems that need to be solved include how a source node or relay node chooses nodes for efficient segment forwarding, and how to ensure that the final BS sends segments in the right order so that a destination node receives the correct data. Also, since traffic is not evenly distributed in the network, how to avoid overloading BSes is another problem.

3.1 Congestion control in base stations

Cellular wireless networks have become an imperative part of the communication infrastructure. In comparison to the preceding routing algorithms in hybrid wireless networks, DTR can distribute traffic load among mobile nodes more constantly. If the traffic load is not distributed evenly in the network, some base station may become overloaded while other base station remain lightly loaded. So a congestion control algorithm is decisive to avoid overloading base station in uplink transmission and down link transmission. To avoid the problems of long-path multi-hop routing in the MANETs, DTR reduces the path length of uplink routing into two hops. Particularly, in the uplink routing, initially a source node divides its message stream into a different number of segments, then send these segments to its neighbour nodes. The neighbour nodes forward segments to base stations, which will forward the segments to the final destination base station. After the destination base station collect the segments of a message, it reorders the segments into the actual message and then transmit it to the final destination mobile node. A basic issue is assuring that the

segments are combined in the proper order., DTR describe a segment structure format for this purpose. Each segment includes eight fields, including: source node IP address, destination node IP address, message sequence number, segment sequence number, QoS indication number data, length of the data and checksum. First five fields are consider as segment head.

In the hybrid wireless network, for the authentication purpose base station send beacon messages to nearby mobile nodes. Taking benefits of this beacon policy, once the workload of a base station, exceeds a pre-defined threshold, base station adds an extra bit in its beacon message to broadcast to all the nodes in its transmission coverage range. Then, nodes closest to the base station, know that which is overloaded and will not send segments to base station. When a node near base station, needs to forward a segment to another base station, it will send the segment to first base station based on the DTR algorithm. In this congestion control mechanism, because of first base station is overloaded, more than targeting base station, second one will forward the segment to a lightly loaded neighbouring base station. To this end, node mi first queries a multi-hop path to a delicately loaded neighbouring first base station. The second node will broadcasts a query message into the system. The query message is forwarded along other nodes until a node near a lightly loaded base station is reached. Due to broadcasting, a node may receive multiple enries of the same queries. Each node only remembers the node that forwards the first query (i.e., its preceding node), and eliminates all other the same queries. In this way, a multi-hop path between the source node and the lightly loaded base station can be formed. Thus, each node knows its preceding node and succeeding node.

Assume that the destination base station is overloaded. Then, it sends the segment to lightly loaded neighbouring base station of the destination base station from its routing table. If an attempted neighbouring base station does not respond during a certain period of time, it is also finding as overloaded. Then, the base station remains other neighbouring base stations until finding lightly loaded base station. Redundant neighbouring base station are selected in order to increase routing reliability.

4. MISBEHAVIOR PREVENTION BASED ON MDR PERFORMANCE ANALYSIS

In this section, briefly exploit the strategies to handle node misbehaviors that exploit the vulnerabilities of MDR to gain unfair advantages

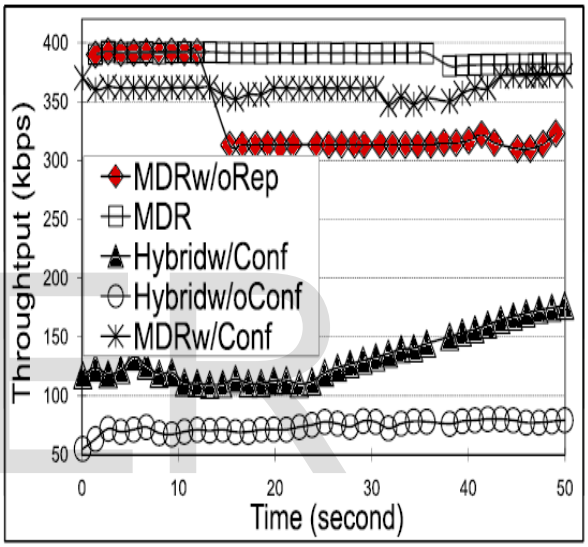

Figure 5. Throughput vs. number of hops.

and the effect of DRA and TMM on the enhancement of system throughput, respectively. Here consider that the nodes are independent and identically distributed (i.i.d.) in the entity.

Packet forging and modification: node's reputation is calculated by the size and the number of packets forwarded, for higher reputation a selfish relay node may send bogus packets or insert junk data into the packet. To avoid these challenges, we use symmetric key to ensure the authenticity and integrity of the packets, considering that the public key authentication. Basically, every node shares a symmetric key with all the base station and sends messages with Message Authentication Code (MAC) computed by this key. Then, once receiving a packet from a relay node, the base station confirm the authenticity and integrity of the packet by re-computing MAC with the key of the source node.

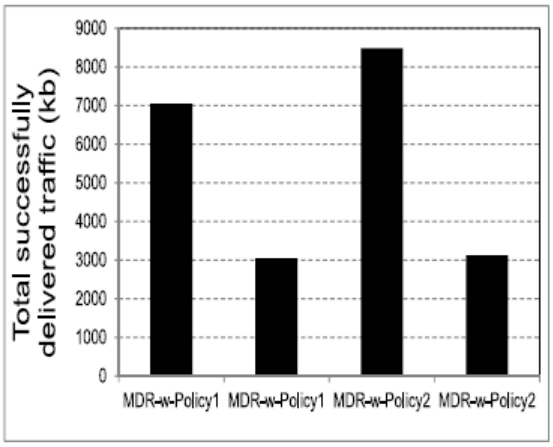

Figure 6. Total delibvered ratio

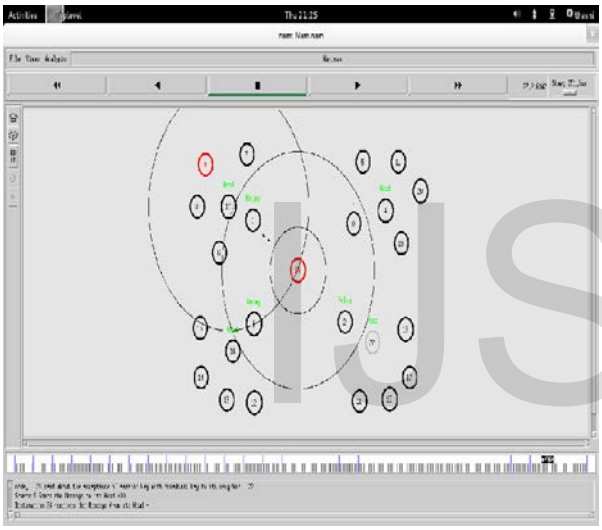

Figure 7. Topology formation in simulation platform

False transaction reporting. A source node needs to pay price for the packet forwarding service, it may address a smaller number of packets to its owner base station than the original number in order to pay less amount. The source's owner base station and relay's owner base station act as the proxies for the relay service payment. The relay's owner base station verifies the exactness of the source's reported packet size before payment. In the relayed packets, MACs can serve as a signature of the source node, which eliminates the source node from error in reporting the number of packets it has sent. If the relay's owner base station find that the number of packets reported by source node is smaller than the exact number of packets forward by other base stations, it notifies the source's owner base station, which will reduce the reputation of source node.

5. CONCLUSIONS

Hybrid wireless networks have been receiving more attention in current years. We propose a P2P-based Market-guided Distributed Routing mechanism to enhance the throughput and the DTR protocol to increase the capacity of hybrid wireless networks, where channel resources are rigid and nodes may not co-operate in data transmitting. Existing routing protocols for hybrid networks do not fully exploit the base station for efficient routing, which eliminate them from achieving higher system capacity. Also, current reputation methods are not enough efficient and effective for reliable routing. In this paper, we propose a Distributed Three-hop Routing (DTR) data routing protocol that combines the dual characteristics of hybrid wireless networks in the data transmission process. We fully utilize the base station by forming them into a LP2P overlay, on which we cultivate a distributed routing algorithm, efficient and accurate reputation system and trading market model. In DTR, a source node break a message stream into segments and send them to its mobile neighbours, which then send the segments to their destination through an infrastructure network by making relay nodes guided by EARM and TMM, and relies on LP2P to collect distributed segments at the destination. DTR makes significantly lower overhead by eliminating route monitoring and maintenance. EARM is above to current reputation systems due to its efficient reputation information collection, querying, and more accurate reputation values finding based on over all information of actual relayed packets of relay nodes.DTR also has a congestion control algorithm to avoid load congestion in base station in the case of unbalanced traffic distributions in networks. Theoretical analysis and simulation results show that DTR can improve the throughput capacity and scalability of hybrid wireless networks due to its high scalability, efficiency, and reliability and low overhead. In our future work experiments, the bounce between DTR, EARM and TMM will be further studied. Misbehaviors to gain benefits in EARM and corresponding strategies to avoid the misbehaviors will be examined. Also, here examine how to adapt EARM and TMM to multi hop routing.

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