DESIGNING AN OPPORTUNISTIC ROUTING SCHEME FOR ADAPTIVE CLUSTERING IN MOBILE AD-HOC NETWORKS

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Abstract

Mobile networks have received great deal of attention during last few decades due to their potential applications such as large scale, improved flexibility and reduced costs. This proposed work addresses two problems associated with mobile network such as method to reduce overhead between the nodes, and energy balanced routing of packets by Co-Operative opportunistic routing for cluster based communication. We propose a modified algorithm that uses On-Demand Opportunistic Group mobility based clustering (ODOGMBC) for forming the cluster and predicting the cluster mobility by neighbourhood update algorithm. Cluster formation involves election of a mobile node as Cluster head. Each cluster comprises of cluster head and non-cluster head node that forms a cluster dynamically. Each node in the network continuously finds it neighbour by communicating with them, and nodes have consistent updated routing information in route cache by neighbourhood update algorithm. In routing process packet forwarded by the source node is updated by intermediate forwarder if topology undergo changes. This opportunistic routing scheme provides responsive data transportation and managing the node effectively, even in heavily loaded environment. Thus, our proposed routing technique helps us to reduce overhead, increases efficiency and better control of path selection.

Keywords- Clustering, Forwarder, MANET, Prediction, Reactive, opportunistic routing.

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1. INTRODUCTION

A mobile ad-hoc network (MANET) is a self-configuring infrastructure less network of mobile devices interconnected by wireless network. Each mobile device in mobile networks is free to move independently, and will therefore change its links to other devices frequently. The primary challenge in building a MANET is equipping each device to continuously maintain the information required to properly route traffic, end-to-end data transfer, security, and providing support for real-time multimedia streaming. Such networks may operate by themselves or may be connected to the larger Internet. Rapid advancement in mobile computing platform and wireless communication technology lead us to develop a method to elect cluster-heads and form clusters [5] in wireless Manet [9]. Multi-cluster, wireless network should be able adopts dynamically. Each cluster contains a cluster head and non-cluster head node. The cluster-head is responsible for allocating the resources and monitors communication within a cluster. In a cluster [5], nodes are mutually closer to each other than to nodes in other clusters. Cluster-Head maintains consistent cluster structure when a new node enters or the old one leaves the network, and also the nodes with limited battery power [2].Prediction the location of the Mobile Node by neighborhood update algorithm. The past history is used in predicting the future one based on information found in the routing table. Based on this information Clustering is performed. When it is compared to the Original Position the resulting Cluster Formed are the same. Thus the beacon message sent from the member nodes to the Cluster-Head regarding the Current location can be minimized. This will reduce the power consumption [1], limited Bandwidth and Increase the Stability of the Cluster.

2. RELATED WORKS

Cluster based opportunistic routing in mobile network has drawn a lot of research interest about the routing algorithm, emerges with special emphasis to overcome difficulties in MANET.S. Biswas and R. Morris focused on ExOR, an integrated routing and MAC technique that realize some of the gains of cooperative diversity on standard radio hardware such as 802.11.ExOR choose each hop of a packet's route after the transmission for that hops [3]. S. Yang, et al proposed a novel protocol called Position based Opportunistic Routing (POR) which takes full advantage of the broadcast nature of wireless channel and opportunistic forwarding [4]. (Zehua Wang, et al, 2010, 2011, and 2012) concentrated on opportunistic data forwarding, and the local cooperative relay for (ODF) in MANET allows more nodes to participate in the opportunistic data forwarding even the node is not presented in the forwarder list. It was an extension work of EXOR [8, 6], and also they tackles the problem of opportunistic data transfer in Manet. Our solution is called Cooperative Opportunistic Routing in Mobile Ad hoc Networks (CORMAN) [7].

A Light weight proactive source routing protocol is used for gathering the neighboring node information, so that each node has complete information about its neighbors'. Opportunistic data forwarding to another level by allow nodes that are not listed as intermediate forwarders to retransmit data if they believe certain packets are missing. PDR is constantly around 95% while that of AODV varies between 57% and 82% at very high network density. A number of clustering algorithms have been proposed and based on some of criteria to choose cluster-head such as speed and direction, mobility [2], energy, position, and the number of neighbor's node. It has some advantages and also has some drawbacks as a high computational overhead for both clustering algorithm execution and update operations.

3. PROPOSED SYSTEM

3.1 Problem definition:

The objective is to develop a multi-hop non-overlapping reactive clustering protocol. i.e. every node is member of at the most one cluster at an equivalent time. Otherwise, the routing methodology and addressing mechanisms would have to deal with the situation of multiple nodes. This is often not the first goal, because it ends up in accrued complexity. The clusters should be the basis for hierarchical routing. Each and every node in the cluster has unique value, the cluster members need to know their current leader, but not vice versa.

3.2 Neighbourhood update algorithm

Step 1: Initialize network (number nodes).
Step 2: For every node of network find (N).
Step 3: For each node which is alive
Find neighbour(s, d); Detect neighbors' of the node and add it to the neighbour table where s is the source and d is destination.
Find average (n, di); Calculate the average distance of all neighbour of node.
Sort them in ascending order
Step 4: For (all nodes)
If (node is alive)

Transmit the message to the neighbour having maximum energy among the neighbours whose distance is less than or equal to the calculated average distance.

Deducts the topology, if it undergoes changes new information is updated in the routing cache. Find new routing path

If (node is not alive)
Node information is deleted from the routing table neighborhood trimming.

Deduct the new neighbour to find the best forwarder which ensures reliability.

3.3 On-Demand Opportunistic Group mobility based clustering Algorithm

The Proposed reactive clustering algorithm is used in Mobile Ad-hoc network to reduce communication overhead, and increases the lifetime and stability of the network.Neighborhood update algorithm, monitors the nodes in the network, and maintains their information in Route cache. The route cache was refreshed when new routes were discovered and also recognizes its neighbors, which are appropriate for clustering.

Step 1: Broadcast a beacon message to all its neighbor nodes in the Cluster within the transmission range [12].
Process the beacon message received from the neighbor nodes in the network and forms the routing table.
Calculate the cost and distance between the nodes from source and destination and maintain consistent routing information.
Step 2: Broadcast the routing information to all its neighbour nodes;
Step 3: Process the message received from the neighbor nodes in the network and identifies the distance of the neighbor.
Step 4: Find the node with minimum distance and cost in the neighborhood.

If (Dv is high)
Declare itself as the Cluster-head;

Else
Send request to join the Cluster formed by the neighbor with least Dv;

Repeat this step for other clusters in Manet

4. SYSTEM ARCHITECTURE

Co-Operative opportunistic routing [11], for cluster based communication has responsive data transportation and energy efficient routing techniques. Each node in the network continuously finds it neighbor by communicating with them, and nodes have consistent updated routing information in route cache by neighborhood update algorithm.

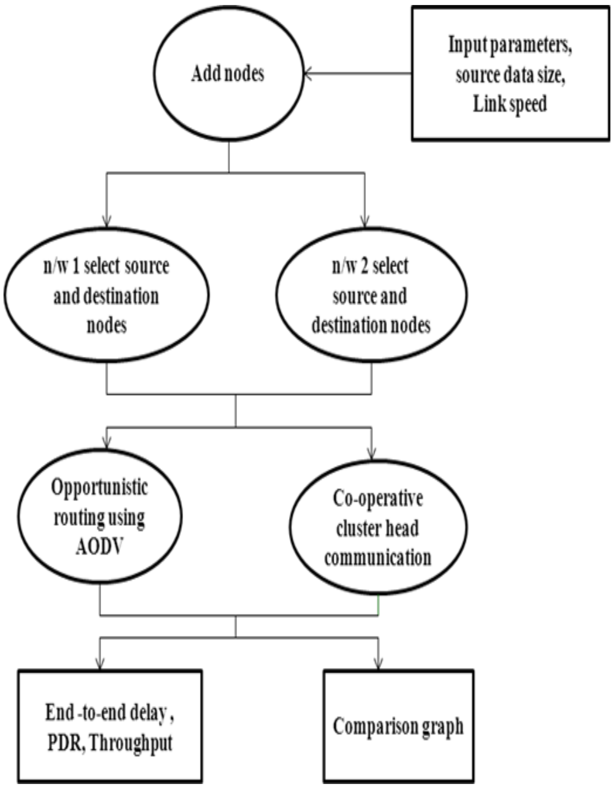

Fig.1. System Architecture

4.1 Discovery of Route:

The route discovery process involves sending route request packets from a source to its neighbor nodes in the network, which in turn forwards its request to their neighboring nodes, and so on [10].Once the route-request message reaches the destination node, it responds by a route-reply packet back to the source node via the neighbor from which it first received the route-request. When the route-request message reaches an intermediate node that has a sufficiently update routing information, it stops forwarding and sends a route-reply message back to the source node. Once the routing path is established, route maintenance process is carried on each node. Each node maintains internal data structure of route path information is called a route-cache until the destination becomes inaccessible along the route.

4.2 Intermediate Route Update:

When data packets are received and stored by a forwarding node, the node may have a different view to forward them to the destination. The node which is closer to the destination than the source node, (i.e.) forwarding node has more updated routing information. In this case, the forwarding node updates the part of the forwarder list in the packets. When the packets with this updated forwarder list are broadcast by the forwarder, the update about the network topology change propagates back to its upstream neighbor. The neighbor makes change to the packets in its route cache. When these cached packets are broadcast later, the update cache is further propagated towards the source node. Routing table is maintained in route cache of each and every node, and sender finds an optimal routing path based on the routing information and minimum hop count, and data packet is forwarded to the destination node.

4.3 Small Scale Retransmission:

To enhance the reliability of packet transmission between two listed forwarders in the batch map, a small scale retransmission is used. If a packet is not reached the downstream node properly, the node which is not a forwarder but present between the two listed forwarders can retransmit the packet if it is closed to the listed forwarders. The node separation distance can be estimated using the RSSI (Received Signal Strength Indicator) [7] recorded when packets are received. We use a scoring function to find a best transmitter.

5. PERFORMANCE EVALUATION

We compare On-Demand Opportunistic Group mobility based clustering (ODOGMBC), with non-cluster AODV and its functionality and performance, is simulated by Network Simulator (version 2.34). There are 200 movable (nodes) dispersed over a quadratic area measuring 2000 m X 2000 each movable nodes is equipped with an 802.11-capable device. Routes are determined with AODV and its default parameters. Each of the result was compared against varying network dimension. In this model, each node moves towards a series of target positions. The rate of velocity for each move is uniformly selected from [0, vmax]. Once it has reached a target position, it may pause for a specific amount of time before moving towards the next position. In our tests, we have a mobile scenario using this mobility model. The first series of scenarios have a fixed vmax, a constant number of nodes, but varying network dimensions. We inject CBR (constant bit rate) data flows in the network. The performance graph is given below.

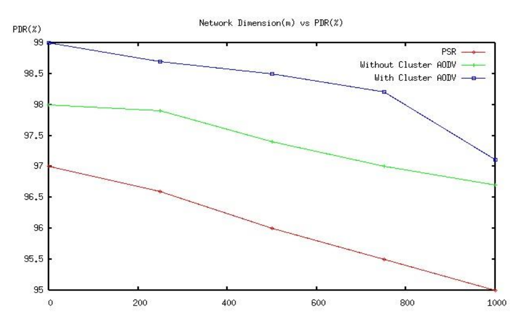

Fig.3. PDR vs. Network Dimension

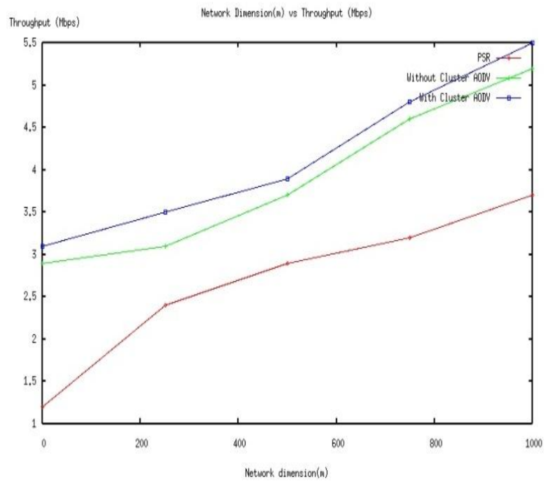

Fig.4. Throughput vs. Network Dimension

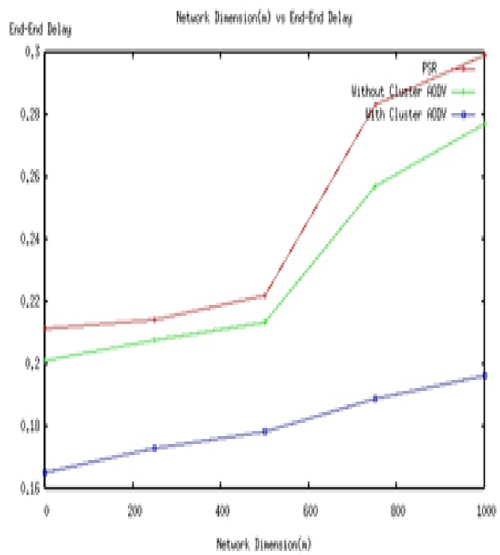

Fig.5. End-End Delay vs. Network Dimension

CONCLUSION AND FUTURE WORK

The proposed On-Demand Opportunistic Group mobility based clustering (ODOGMBC), routing scheme for mobile ad hoc networks, reduce overhead, and enhance reliability, higher packet delivery ratio, throughput and fewer delay.

In future we can compare these parameter with varying node velocity i.e. in heavily loaded environment, which reduce overhead further , and the security based routing scheme can be used for secure data transportation.

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