Weight based Backbone Clustering Implemented for Multicast MANET

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ABSTRACT

This paper highlights the idea of selecting high energy and high transmission range nodes select as head nodes for forming cluster based backbone network for application of slow movement scenarios rely with multicast MANET. The networks are implemented by using these techniques are suitable for moving emergency or specific as well as temporary purpose network. The back bone routing algorithms, CH selection, Clustering formation algorithms are presented here.

Keywords: MANET, Multicast, Backbone, Weighted Clustering, Location Clustering

I. INTRODUCTION

This research concept explores the idea of forming network for emergency or specific purposes. After the purpose of network is over the nodes are used for any other purposes. The Applications of these types of networks is may be in cricket stadium, conference, political meetings, events etc. Based on the factors the networks size may vary but the type of network, communication technology, communication devices are remaining same. Generally an Ad hoc network is decentralized network each node communicates with each other through intermediate nodes or communicates directly within transmission range. Normally Ad hoc network is decentralized network but this paper explores the idea making centralized Ad hoc networks. To avoid single point failure making more number of centralized nodes is the new idea of using Clustering backbone technology on this research work.

When the network size is becoming large it's difficult to routing and manage. Suppose the network is movable networks means the topology many change frequently. Moving of nodes may cause communication failure. To overcome these problems some new routing algorithms are proposed here, the Wireless devices are suitable for these proposed network is cell phones, Laptops, computers, PDAs, Tabs, packet PCs, Palm top, Note book.

The network is broadly classified as two types: Physical Networks (wired) and Logical Networks (wireless). Today our Society in wireless era. The Wireless networks are working in infra structured and infra-structure less ways. In Infrastructure based wireless networks the wireless nodes are connected to the base stations, Access point, Cell towers etc.. Installation cost is high used by the government and big organization, hospitals, colleges etc, for e.g.: cellular networks, Wi-Fi etc. Infrastructure less wireless networks are decentralized type of networks does not rely on pre-existing networks, self forming and dynamic networks called Ad hoc networks. This proposed network is implemented in these ways. E.g. Blue tooth, Zig-bee, Share it etc,.

II. WBMM CLUSTERING TECHNIQUE

Clustering is a technique through this we can achieve fast communication, better routing and topology management of BMM Protocol. The clustered MANET is the extension of normal MANET architecture, when the size of the network increases resources such as band with becomes limited. Clustering able to dividing a network into subnetwork , then some of the nodes are selected together to form a backbone network. Process of clustering is 1) Cluster Head selection 2) Connecting Cluster Heads 3) Connecting nodes with Cluster Heads.

A. Clustering Algorithm

Step 1: create number nodes for MANET

Step 2: All the nodes should forward "Hello" Message to all of its neighbour and its presence.

Step 3:Elect a Cluster Head broad cast a cluster form message to construct Cluster all the nodes hear the message, if they want to join in a cluster they must send response message.

Step 4: Connecting cluster heads.

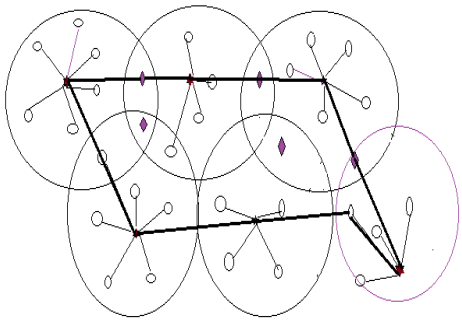


Fig 1: Hop Clustering

★ Head Node (HN) Existing node (EN)
♦ Gate way node (GN) New Node (NN)
○ Member Node (MN) Transmission range (Tr)
Source Node (S) Degree of particular node Dp)
Acknowledgment (Ak) Destination node (D)
Degree Difference of particular node (Δp)
Route Request (Rrq) Desired node Degree (Ngp)
Current node Degree (Cdg) Mobility (M)
Distance (Dt) Weight (Wt)
Remaining Battery power (Br)

HEAD NODE (HN): HN is responsible for coordination among the nodes within their cluster as well as other cluster.

MEMBER NODE (MN): MN is the normal nodes in the cluster.

GATEWAY NODE (GN): GN is the non cluster heads with intercluster links forwarded between two clusters.

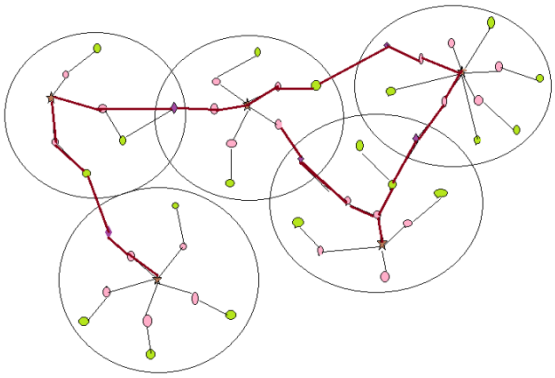


Fig 2: Hop Clustering

B. Algorithm for slow movement scenario

i) Battery power (Bp):

Wireless nodes are equipped battery power , if battery losses energy it won't able communicate with other node in the mobile ad hoc network.HNs are need high energy than other nodes.HN run out energy then re clustering will occur. So it is very important to maintain high energy for HNs the only the reliability of cluster will improve. When the node moves out of the transmission range of HNs it will join with nearby clusters within transmission range called re clustering.

The battery management schemes are

- Battery scheduling
- Lazy packet Scheduling
- Modelling and shaping of battery discharge pattern
- routing based on battery status

Routing based on energy status

Measures the energy level of nodes and the node with maximum energy level as HN, the interval time must be set for HN. To stay as HN particular time period after the time over next maximum energy level among the other nodes will be selected as a HN

The category of energy nodes as

1. Energy uses by the nodes measures the signals from the target.
2. Energy uses for essential functions
3. Energy of mobile nodes sends the decision to HN

Most energy consuming task is forwarding and receiving of messages so it is very important to maintain high energy for HNs. Let initial energy of Bp, the period time is (T), energy consumed by the node is calculated by

Ec (T) = Trp + Rcp ;
Trp-transmission of packets
Rcp-receiving dat packets

Energy consumption for transmitting of N bits Etr

$$Etr(N,Dt) = Ec * N + \delta amp \times N \times Dt - Ew(PDR)\delta$$

Ew - waste energy
PDR -packet drop
δ amp - transmitter amplifier
Dt - distance

ii) Transmission Range (Tr):

When a node enters into a cluster the maximum distance of the node calculated. The radius of coverage area is maximum distance. The transmission range is calculated by following formula

$$Tr = \sqrt{Ndg / Cdg} \Big/ radius$$

//Ndg - desired node degree
Cdg - current node degree
Ndg = (Node density * R) +1

$$R = Dt(HN, NN) = \sqrt{\sum_{t=1}^{n} (NN_t - HN_t)}$$

When the algorithm selects high transmission range of the nodes as cluster head it reduces the number of clusters because single cluster head can cover large area. If any node not within avg transmission range then the node considered as out of range of the cluster.

iii) Combine weight metrics based clustering Algorithm

Head node selection

The HN has high responsibility among other nodes, it is the coordinator of the neighbour nodes, and it has to perform routing and forwarding packets of extra tasking. So, while selecting HN have to consider some parameter then only able to analyze which is the best node among other nodes.

In these research work selection of HN based on two parameters batter power and transmission range. Based on these identify which node is high battery power (Bp) as well as high transmission range nodes (Tr) that should be HN.

Choose cluster head based on battery power and transmission range based values

$$CWt = Ec(T) + Tr$$

Which node is high weight-age choose as a cluster head node.

Head node connects neighbour nodes either 1- hop or 2-hop distance to form a cluster which help in routing message from a node to any other node. Frequent head node changes will affect the performance of network, so good clustering scheme is important.

Clusters creation

While starting position all the nodes is in undecided state, Initially broadcast "hello" message to all its neighbour receive reply. In dynamic network all the nodes broadcast their ID's along with weight values within transmission range. A node receives broadcast from its neighbours and store information this information helps to find smallest weight. Low weight nodes as Head nodes and not two immediate nodes will assign as HN. Connect 1 hop and 2-hop nodes with HN, Use intermediate node as a gateway nodes. Forming a virtual Cluster HN with 2 Hop nodes. Connect all the HNs each other for start communication.

Cluster Maintenance

Nodes are any time join and leaving the cluster, whenever the nodes are joining initiate merging state. Nodes are leaves the network change the cluster formation. Its supports the HN leaving from cluster discovery stage is initiated.

Head node can operates in dual working power mode

- High power for inter cluster communication
- Low power for intra-cluster communication

Large number head nodes will lead to computationally expensive system.

Case 1: If two HN moves into each other out of range then its wait for intervals then re clustering is performance.

***Case 2*:** HN battery power is less no longer maintains cluster then HN selects with high battery power.

III. ROUTING ALGORITHMS

Inter cluster Routing: if sender wants to establish a connection with the destination, the route request (Rrq) can be transmitted through Head Node of the both Clusters.

***Intra-Cluster Routing*:** Sender and receiver will directly communicate within same cluster.

i. ***Routing algorithm for Source node:***

```
If (S needs to communicate with D)
 {
Check(Route availability)
  {
    Send Rrq to HN of S;
    Wait for Ak:

If(Ak is received )
     Communication begins;
    Else
      Re-initiate Rrq to HN of S;
 }
}
```

ii. ***Cluster Head* :**

```
If (there is a route between S and HNs)
  // Sender HN-Cs, receiver HN-Cd
{
  Send Ak;
     For every GN until Cd
     Forward Ak;
 }
 Else
   Discard it;
```

```
If (HN has enough resources for   communication )

    Communication begins
Else
   Reserved for demand resources
      After communication is over
   Release reserved resources
```

iii) Gateway Node:

```
If (route is available between S and GN)
{
Update Ak;
Start Communication

If (GN is the D)
   Sent Ak to S;
{
For (each adjacent HN )
 Sent Ak;
}
Else
{
Discard it;
}
If(GN has enough resources for this connection)
{
Reserve the demand resources;
Send Ak;
Else
Send error msg;
}
```

iv) Destination Node

```
If (node D received Rrq fromS)
{

If  (Route Available between S and D)
   Update Ak;
S starts communication to D)
   }
```

E. Route Recovery

Case 1: In a route failure is detected by an intermediate node along the path in destination. Source does not receive any error message.Route recovery as soon as as possible by local search to repair the broken path.

Case 2: Suppose Case 1 is failure in this case route failure is detected rout error message send back to source. Source re-initiate route discovery is to search new path.

```
If  S is MN and D is in Tr
    Send Rrq

Else if S is GN
    Send Rrq to HN

Else if S is HN
     Record Rrq
Else Discard Rrq.

If D is a neighbour or two hop Dt
     Send Rrq to D
Else
  Broad cast Rrq to intermediate HN
End if
```

Cluster Formation

Each node as unique Identifier, maximum number of nodes in cluster to be fixed number of nodes.

Re-Clustering

A lower weight nodes enter into a cluster then re-clustering occurs, it compare weight with existing cluster head, suppose a new node is less weight it's should be cluster head.

i) While a new node (NN) enters into a cluster:

The distance (Dt) among nearest cluster.

```
If
{
 Dt(HN,NN)  <  Tr(HN)
 Join NN as a neighbor
}

Else If
{
Wt (NN) > Wt(HN)
Join NN as a Ordinary node
}
Else If
{
Wt(NN)  <  Wt(HN)
HN.msg(NN)
HN=NN
}
Else If
{
 Wt(NN)== Wt(HN)
{
Br(HNBr  > NNBr )
```

Remain hn is in same position otherwise NN will be the cluster

```
}
}
End If
```

***ii) The nodes move from the cluster*:**

```
If
{
 Dt( EN,HN) > Tr (HN)
 Moves out from the Cluster
}
End if
```

Heavy load on CHs reduces throughput when huge size network. Small size of clusters may increase the backbone size. So, upper and lower limit of nodes connected to Cluster heads is important for load balancing. Stability of CH saves the battery power. The energy consumption of Cluster head is more than normal node. So, the high battery power node is to be selected as Cluster head is also a important parameter. Otherwise Cluster head will not stable the CH selection is important.

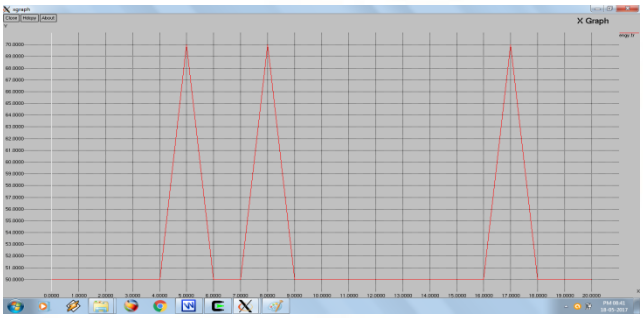
IV. SIMULATION STUDY

This proposed network implemented with NS2.35 simulation methods to evaluate the performance. The simulation area randomly 700*700, assumes the transmission range and energy as some predefined values. Based on high transmission range and high energy nodes select as a head node. The other nodes are connected to the HN and HNs are connected together virtually.

The performance of the network is measures through some parameters like throughput, packet delivery ratio, energy, and transmission range.

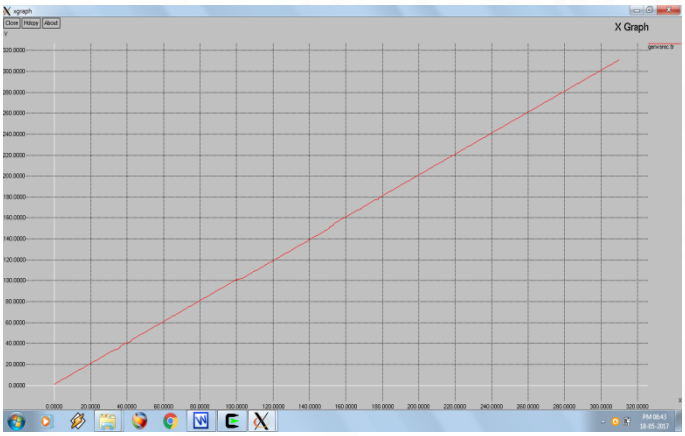
Experiment results:

Energy graph

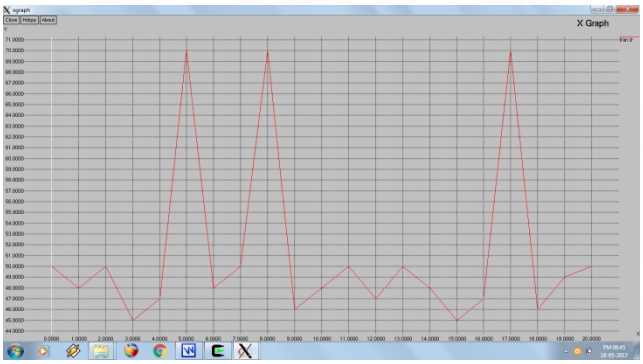


PDR

PDR is packet delivery ratio of total packet transmitted and total packet received at the destination. In this proposed algorithm achieved 100% accuracy due to load balancing no packet loss.

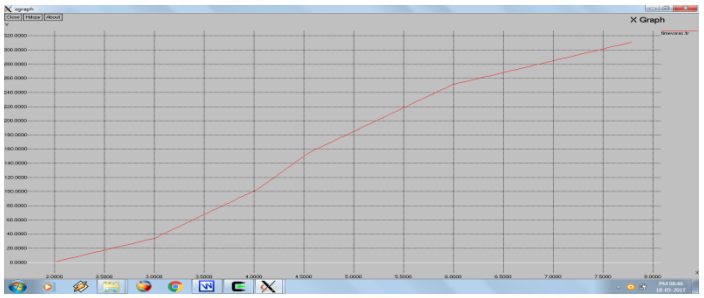


Transmission



Throughput

This proposed work achieved better throughput than WCA, because some cluster heads may overloaded. This paper uniformly assigns the number of nodes for selected cluster heads through good through put is achieved.



V. RESULTS AND CONCLUSION

This paper proposed weight based backbone clustering Algorithms for dynamic multicast Manet, which may changes topology frequently So, after the particular periods of time the head nodes may changes based on transmission range and energy. The Head Node selection algorithm and routing algorithms are increases route lifetime of networks. The selection of head node based on transmission range and energy increases the performance of PDR, throughput of network. Implementation with NS2 for slow movement with small network achieves 98% result network size increase efficiency little bit reduces.

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