A Clustering approach in Mobile Ad-hoc Networks Routing

Ipsita Panda

Sr. Lecturer, Dept of CSE, S.I.E.T
Dhenkanal, India
Email:-ipsita.panda24@gmail.com

Abstract— A mobile ad-hoc network (MANET) is a self-configuring infrastructure less network of mobile devices connected by wireless. MANETs are restricted to a local area of wireless devices, while others may be connected to the Internet. Cluster techniques used to grouping the mobile nodes to sending data simultaneously to the each group. Each and every group have their cluster header that storing information about the receiving and sending node information. Cluster approach is proved to be more efficient for solving the scalability problem in wireless network. In this paper, we propose cluster technique in mobile ad hoc network (CTMAN), which composed of PSR, DSDV and Dijkstra's algorithm. It speedup the performance and maintains the data loss between the source node to destination node for large area networks.

Keywords— DSDV, Cluster, CTMAN, MANET, PSR, PRN, Dijkstra's algorithm.

I. INTRODUCTION

Mobile ad hoc network MANET is a self organized and self configurable network where the mobile nodes move arbitrarily. It is an autonomous system in which mobile hosts connected by wireless links are free to move randomly and often act as routers at the same time. Because MANETS are mobile, in early form they use wireless connections to connect to various networks. Because of dynamic nature of MANETs, they are typically not very secure, so it is important to be cautious what data is sent over a MANET.

Routing protocols in mobile ad hoc networks can be differentiated using an array of criteria.

A. Table-driven or Proactive Protocols:

Proactive routing protocols attempt to maintain consistent, up-to-date routing information between every pair of nodes in the network by propagating, proactively, route updates at fixed intervals. Representative proactive protocols include: Destination-Sequenced Distance- Vector (DSDV) routing, Clustered Gateway Switch Routing (CGSR), Wireless Routing Protocol (WRP), Optimized Link State Routing (OLSR)and *The Fisheye State Routing (FSR).*

B. *On-demand or Reactive Protocols:*

A different approach from table-driven routing is reactive or on- demand routing. Reactive protocols, unlike table-driven ones, establish a route to a destination when there is a demand for it, usually initiated by the source node through discovery process within the network. Representative reactive routing protocols include: Dynamic Source Routing (DSR), Ad hoc On Demand Distance Vector (AODV) routing, Temporally Ordered Routing Algorithm (TORA) and Associativity Based Routing (ABR) [1, 2].

Destination-Sequenced Distance-Vector Routing (DSDV)

Destination-Sequenced Distance-Vector Routing (DSDV) is a table-driven routing scheme for ad hoc mobile networks based on the Bellman-Ford algorithm [3]. The main contribution of the algorithm was to solve the Routing Loop problem. DSDV works in the following way. Each routing table entry carries hop distance and next hop for all available destinations (as in B-F). In addition, each entry is tagged with a sequence number which originates from the destination station. The routing information is advertised by broadcasting periodically and incrementally. Upon receiving the routing information, routes with more recent sequence numbers are preferred as the basis for making forwarding decisions of the paths with the same sequence number; those with the shortest hop distance will be used. That information (i.e. next hop and hop distance) is entered in the routing table, along with the associated sequence number tag. When the link to the next hop has failed, any route through that next hop is immediately assigned a 1 infinite hop distance and its sequence number is updated. When a node receives a broadcast with an infinite 1 metric, and it has a more recent sequence number to that destination, it triggers a route update broadcast to disseminate the important news about that destination. For graphs with only non-negative edge weights the faster Dijkstra's algorithm also solves the problem.

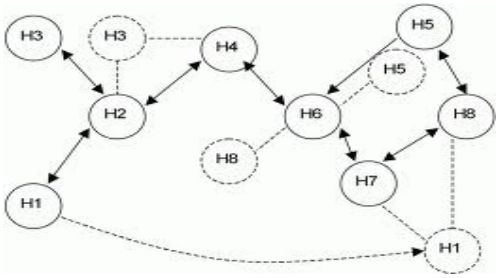

Fig.1. Example of DSDV

Advantages: -
1. It is quite suitable for creating ad hoc networks with small number of nodes.
2. The DSDV protocol is proven to guarantee loop-free paths to each destination at all instants.

Disadvantages:-
1. DSDV requires a regular update of its routing tables, which uses up battery power and a small amount of bandwidth even when the network is idle.
2. Whenever the topology of the network changes, a new sequence number is necessary before the network re-converges; thus, DSDV is not suitable for highly dynamic networks [4].
3. Since no formal specification of this algorithm is present there is no commercial implementation of this algorithm.

Cluster Technique in Mobile ad hoc network (CTMAN)

MANETs are restricted to a local area of wireless devices, while others may be connected to the Internet. Cluster techniques used to grouping the mobile nodes to sending data simultaneously to the each group [7]. Each and every group have their cluster header that storing information about the receiving and sending node information. Each cluster consists of one header nodes and has the backup administration If any data packet is missing in mobile nodes will be referred with the header node. Cluster approach is proved to be more efficient for solving the scalability problem in wireless network.

Two clusters are combined together called super cluster. It also connects with base station and internet. In this paper, we propose cluster technique in mobile ad hoc network (**CTMAN**) it increase the performance and maintain the data loss between the source node to destination node from huge wireless network area. It is more effective and increases the efficiency between the source nodes to destination node.

Advantages and Disadvantages

Advantages
- *Reusability*: spatial reuse of resources at nodes
- *Simplification*: of addressing
- *Stability and Localization*: smaller and potentially mode stabile sub-network structures

Disadvantages
- *Explicit control messaging*: clustering related information exchange
- *Ripple effect*: rebuild of cluster structure in case of network structure changes
- *Stationary period*: collect and exchange information for cluster formation
- *Computation rounds*: number of rounds to complete the cluster election
- *Communication complexity*: amount of control messages exchanged

II. ROUTING IN CLUSTER

A. Route discovery

When the source node wants to send a message to the destination node and does not already have a valid route to that destination, it initiates a path discovery process to locate the destination. When a source node S seeks to set up a connection to a destination D, S send route request message (RDemand) to its cluster head. RDemand message includes the following fields: IDdest, IDsource, DSN, HC, and LT. It may be the case node D may be available within the cluster or across the cluster. If node D falls within the cluster or cluster head has(CH) a valid route to the destination node, then the cluster head sends RResponse message to the node S. Otherwise, S forwards the RDemand message to the cluster heads available in its CHNEIGHBOR table and updates the its

routing table. When an intermediate CH node receives the RDemand from its neighbors, it first increases the hop count value in the RDemand, to account for new hop through the intermediate node if the packet should not be discarded.

If the originator sequence number of the RDemand is not greater than existing value, the intermediate node discards it. If the originator sequence contained in the RDemand is greater than the existing value in its route table, the relay CH creates new entry with the sequence number of the RDemand. Once the RDemand has arrived the destination CH or an intermediate CH with an active route to destination, node forwards the message of finding the route in the reverse route (RRespone message). To prevent any rooting loop, any route discovering message has a number which with the association of the beginning id, produces a unique number. When Source node by receive the RRespone from the destination node it update its routing table and starts forwarding packets.

B. Route maintenance

In routing tables, the address of the next CHs is saved for any destination. In the previous methods if a node failed within a route or become far from its neighbor nodes, it causes the route to fail and leads to the recreating of path. But here since the route is expressed due to the CHs, in case of the fail of a node in a route, the CH of that node can use another node to forward a packet to the next existed in the route (Figure 2). In this method, only when a cluster fails or corrupts the needs for the recreating of the path arises, which regarding the attempt for creating more stable clusters, happens less often. When a CH node detects a link break for the next hop CH of active route, it sends a route error packet (RERR) back to all precursors. The format of this message is RERR (ID, SEQNUM). Here, ID is the destination address and SEQNUM is destination sequence number. When a CH node receives a RERR from a neighbor CH for one or more active route, it forward the packet to precursors stored in its route table [6]. When a source node receives a RERR, it initiates a new route discovery if the route is still needed.

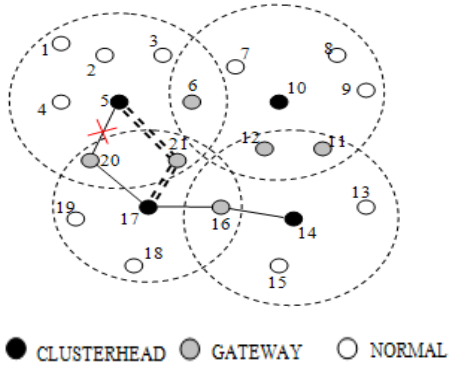

Figure 2: Local route repair

III. RELATED WORK

In order to make more effective here we present a polynomial time algorithm for finding the minimum cost transmission power assignment that maintains connectivity for arbitrarily distributed collinear points, where the cost of an assignment is defined as total power usage. They also provide a 2-approximation algorithm for finding the minimum cost assignment in the case where the hosts are arbitrarily distributed in three dimensions.

A common model for such networks is called the packet radio network (or PRN) model. The earliest MANETs were called packet radio networks, and were sponsored by DARPA in the early 1970s. We can model a multihop packet-radio network as an undirected graph G = (V, E) where Vis the set of nodes and Eis the set of edges. Each node consists of a transceiver and a router. A link between two nodes i and j in G means that i can hear j's transmission and j can hear i's transmission. Each node uses an omnidirectional antenna for transmission and the network works in half-duplex mode. A routing protocol is assumed to create and update the routing table used at each node [8]. This routing protocol provides information about who the node's active neighbors are; this involves adding to the neighbor list new neighbors when they come up and deleting neighbors which are no longer active. The routing protocol is assumed to have some form of neighbor discovery mechanism such as a HELLO exchange. Nodes process messages they receive and links transmit packets in the FIFO order [9].

IV. PROPOSED WORK

The main contribution of the Bellman-Ford used in Destination-Sequenced Distance-Vector Routing (DSDV) algorithm was to solve the routing loop problem. When using the clusters technique to group the nodes for easy to transfer the data between the networks. In this we are using dijkstra's algorithm to overcome the drawback in the spanning tree algorithm. It finds and decides the shortest path between the nodes and selects the fast transmission route and transmits the packets to the destination from the source [9].

In Cluster technique for grouping the mobile node technique, the network topology is divided into non overlapping clusters. The cluster head (CH) maintains the client node information. And it is selected by the cluster members based on the power level and connectivity of the nodes.

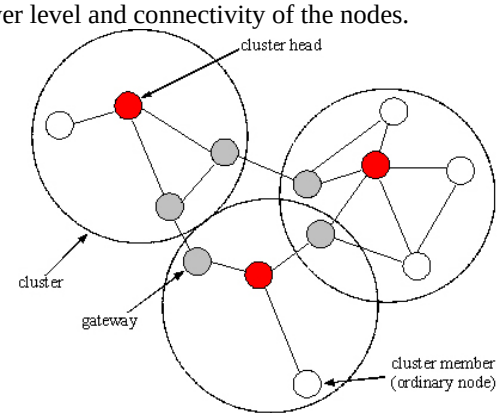

Figure 3: Cluster heads, gateways and ordinary nodes in mobile ad hoc network clustering.

Here we are implementing MANET by using proactive Source Routing Protocol (PSR) and cluster technique with the help of dijkstra's algorithm to find the shortest path. This can be divided into following modules:-

A. Shortest Path dijkstra's algorithm
B. Proactive source routing protocol (PSR)

A.Shortest Path

PSEUDO CODE

```
1. function Dijkstra (Graph ,Source);
2. for each vertex v in Graph;
3. dist [v] = infinity;
4. previous  [v] = undefined;
5. end for;
6. dist[source] = 0;
7. Q = the set of all nodes in Graph;
8. While Q is not empty;
9. U = vertex in Q with smallest distance in dist [ ];
10. Remove u from Q;
11. If dist[u] = infinity:
12. Break;
13. Enf if;
14. For each neighbor v of u:
15. alt = dist_between(u,v);
16. if alt  <dist[v]:
17. dist [v] = alt;
18. previous [v] : = u;
19. decrease-key v in Q;
20. end if;
21. return dist;
```

(Dijkstra's algorithm)

Dijkstra's Algorithm complexity

The Dijkstra's algorithm has the complexity of O ((|V| + |E|) log|V|).Where as the time complexity of Bellman-Ford algorithm is O (|V| |E|).

In this we are using dijkstra's algorithm to overcome the drawback in the spanning tree algorithm. This system finds and decides the shortest path between the nodes and selects the fast transmission route and transmits the packets to the destination from the source.

B. PSR (proactive source routing)

Proactive Source Routing Protocol (PSR) requires each node to maintain one or more tables to store routing information.

PSR is a source routing algorithm in that every node has a BFST of the entire network rooted at itself after convergence. To do that, nodes periodically broadcast network structure information to the best of its knowledge. By using the Proactive Source Routing Protocol (PSR) require each node to maintain one or more tables to store routing information. Each node responds to changes in network topology by propagating updates throughout the network in order to maintain a consistent network view [10]. Based on what has been collected from its neighbors in the current iteration, a node can expand the scope of its knowledge about the network structure. This knowledge is exchanged among all neighboring nodes in the next iteration.

Each node responds to changes in network topology by propagating updates throughout the network in order to maintain a consistent network view. PSR achieves this with the same communication overhead as proactive distance vector algorithms, such as DSDV, which is significantly smaller than that of the link state routing algorithms like OLSR [11]. The operation of PSR is iterative and distributed among all nodes in the network. At the beginning, a node v is only aware of the existence of its neighbors by listening to their beacons. Therefore, it is able to construct a BFST rooted at itself within $N1$ (v), *i.e.*, the star graph centred at v. In each subsequent iteration, nodes exchange their spanning trees with their neighbors.

To fulfil the needs of rapid data transportation with a small end-to-end delay when designing PSR, our primary goal is to minimize the communication overhead without sacrificing the network performance. It has the following distinct features [12]. First, we do not need timestamp links. Instead, only the topological information is used for tree updates in order to reduce the communication overhead. Second, PSR always maintains a breadth-first spanning tree at each node, to provide responsive data transportation services. Third, we utilize both full dump and differential updates to strike the balance between efficient and robust network operations. Last, we use source routing to forward data rather than IP forwarding as in STAR, which can potentially support opportunistic data transfer in MANETs.

We can run Proactive source routing (PSR) in the background so that nodes periodically exchange network structure information. Each node has a spanning tree of the network indicating the shortest paths to all other nodes .Large scale live update when data packets are received by and stored at a forwarding node, the node may have a different view of how to forward them to the destination from the forwarder list carried by the packets. Small-scale retransmission a short forwarder list forces packets to be forwarded over long and possibly weak links. In DSDV (Destination Sequenced Distance Vector) each node sends and responds to routing control message the same way as PSR, no hierarchical structure. Avoids the resource costs involved in maintaining high-level structure. Scalability may become an issue in larger networks.

V. CONCLUSION

In this paper, we have proposed a Cluster Techniques using mobile ad hoc networks (CTMAN). Cluster techniques used to grouping the mobile nodes to sending data simultaneously to the each group. The cluster creation speed increases, and causes the network services to be more accessible. Recreating of clusters is rarely executed, and when two clusters locate in the same range, one of them becomes the gateway of other node. This causes to prevent the creation of most constructions. In the proposed protocol the routing is also done quickly. We have also discussed the route discovery and route maintenance phase of routing in cluster. The CTMAN is composed of three components. First, Proactive source routing (PSR) protocol used to eliminate the traffic over head. Second, Destination Sequence Distance Vector (DSDV) to maintain the data loss and third, using the Dijkstra's algorithm to find out the shortest path between the sources to destination node using minimum time complexity as compare to bellman ford algorithm. These explicitly utilize the broadcasting nature of wireless channels and are achieved via efficient operation among participating nodes in the network. Essentially, when packets of the same flow are forwarded, take different paths to the destination.

REFERENCES

[1] I. Chlamtac, M. Conti, and J.-N. Liu, "Mobile Ad hoc Networking: Imperatives and Challenges," Ad Hoc Networks, vol. 1, no. 1, pp. 13–64, July 2003.

[2] Azzedine Boukerch,Begumhan Turgut,Nevin Aydin,Mohammad Z. Ahmad,Ladislau Bölöni ,Damla Turgut,"Routing protocols in ad hoc networks: A survey", Science Direct Volume 55 issue 13. 15 September 2011, Pages 3032–3080.

[3] Elizabeth M. Royer and Chai-Keong Toh, ―A Review of Current Routing Protocols for Ad-Hoc Mobile Wireless Networks‖, IEEE Personal Communications, April 1999.

[4] C. E. Perkins and P. Bhagwat, "Highly Dynamic Destination- Sequenced Distance-Vector Routing (DSDV) for MobileComputers,"ComputerCommunication Review, pp. 234–244, October 1994.

[5] C. E. Perkins and E. M. Royer, "Ad hoc On-Demand Distance Vector (AODV) Routing," RFC 3561, July 2003. [Online]. Available:http://www.ietf.org/rfc/rfc3561.txt..

[6] M. Rezaee, M. Yaghmaee, "Cluster based Routing Protocol for Mobile Ad Hoc Networks" Available: www.dcc.ufla.br/infocomp/artigos/v8.1/art05.pdf.

[7] An Huiyao, Lu Xicheng, and Peng Wei, "A Cluster-Based Multipath Routing for MANET".Available: http://www2.ece.ohio-state.edu/medhoc04/ medhocnetfiles/papers/S10.4.pdf

[8] P. Larsson, "Selection Diversity Forwarding in a Multihop Packet Radio Network With Fading Channel and Capture," ACM Mobile Computing and Communications Review, vol. 5, no. 4, pp. 47–54, Octob.er 2001.

[9] J.J. Garcia-Luna-Aceves, Jyoti Raju,"DISTRIBUTED ASSIGNMENT OF CODES FOR MULTIHOP PACKET-RADIO NETWORKS".Available:*ccrg.soe.ucsc.edu/publications/jyoti.milcom97.ps.gz*

[10] S. Nithya, G. Arul Kumar and P. Adhavan, "Destination-Sequenced Distance Vector Routing (DSDV) using Clustering Approach in Mobile Adhoc Network". 2012 International Conference on Radar, Communication and Computing (ICRCC), SKP Engineering College, Tiruvannamalai, TN., India. 21 - 22 December, 2012. pp.319-323. 978-1-4673-2758-9/12/$31.00 ©2012 IEEE.

[11] Z. Wang, Y. Chen, and C. Li, "A New Loop-Free Proactive Source Routing Scheme for Opportunistic Data Forwarding in Wireless Networks," IEEE Communications Letters, to appear.

[12] Zehua Wang, Cheng Li, and Yuanzhu Chen," PSR: Proactive Source Routing in Mobile Ad Hoc Networks". IEEE Communications Society subject matter experts for publication in the IEEE Globecom 2011 proceedings.

[13] Wang, Zehua ; Chen, Yuanzhu ; Li, Cheng "A New Loop-Free Proactive Source Routing Scheme for Opportunistic Data Forwarding in Wireless Networks", Communications Letters, IEEE Volume: 15 , Issue: 11 .

Short Biography

Ms. Ipsita Panda is a Sr. lecturer in theDepartment of Computer Science and Engineering at Synergy institute of engineering and Technology (S.I.E.T), Dhenkanal, Odisha, India. She has more than five years of teaching experience. She has authored number of papers which have been published in both national and international journals. Her research interest is in the area of Mobile Computing and wireless sensor network.