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RESEARCH ARTICLE

EFFICIENT ROUTING IN DELAY TOLERANT NETWORK USING CLUSTERING TECHNIQUE

Pradosh Kumar Gantayat, Satyabrata Das, *Sambit Mohanty and Sudeep Gochhayat

Department of Computer Science, DRIEMS, Tangi, Cuttack, Odisha

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ABSTRACT

Delay Tolerant Networks (DTNs) have the vast potential to connect devices and different area of the world that are instantly under-served by current systems. A fundamental test for Delay Tolerant Network is to decide the routes through the network ever having an end-to-end, or knowing which "routes" will be connected at every instant of time. The issue has an additional requirement of constrained size off buffers at each node. This situation limits the applicability of traditional routing techniques which categorized lack of path as failure of nodes and try to seek for existing end-to-end path. In this paper we attempt to deal with the topology by utilizing k-means algorithm and amplify the message delivery rate without trading off on the request of message dispose of and attempt to route the message starting with one node then onto the next. The amount of message discarded has a direct relation to the bandwidth used and the battery consumed. The more the message discarded more is the bandwidth used and battery consumed by every node in transmitting the message. At the same time, with the increase in the number of messages discarded, the cost for processing every message increases and this adversely affects the nodes. We have also focused on passing the messages to those nodes which is highest trusted node, as the nodes moving away have a greater probability of disseminating the messages throughout the network and hence increases chances of delivering the message to the destination.

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INTRODUCTION

Today wireless networking makes easier to access the global digital infrastructure i.e. internet for sharing of resources. Wireless technology are mostly used in portable computing devices like personal digital assistant (PDA),cellular phones, laptops to access the global resources. (Vahadat and Becker, 2000) These technologies are powerful and successful but still can`t reach everywhere i.e. there are some areas or situations where it is not possible to use these technology because the current networking technology is based upon TCP/IP.TCP/IP assumed symmetrical bidirectional data transfer continious end to end communication, low error rate and low delivery latency. But the networks which operates extreme environment can`t satisfy these criteria (Feng and Chin, 2012). So TCP/IP is not suitable for these applications. So a network is designed to operate over those extreme distances known as Delay Tolerant Network or Disruption Tolerant Network. In these networks the nodes are mobile and them is no prediction about their node mobility. So the connection between nodes are irregular. So in these type of network a store and forward method is used for data transmission (Warthman, 2003). Here a node stores a packet and forwards to other nodes when they come in its transmission range. As the nodes are intermittently connected so it is also called as intermittently connected mobile network. DTN are mostly used for interplanar communication, disastermanagement, military operation, wildlife conservation etc.

******Corresponding author:* **Sambit Mohanty,**
Department of Computer Science, DRIEMS, Tangi, Cuttack, Odisha

Features of DTN

There are some properties of DTN which separates DTN from traditional wireless network like

Intermittentconnectivity: As the nodes are mobile and there is no information about mobility of nodes so the connection between nodes are irregular. DTN lacks of end to end connectivity between source and destination.

Limited resource: In DTN all the nodes are mobile so they have to operate limited resources. Power consumption is the main factor with each transaction node energy level decreases.

Storing Facility: DTN operates on the strategy of store and forward so each node have a buffer to store the data packets.

However the buffer has a limited storage facility.

Long delay: In DTN the nodes are not connected always and there is no end to end connectivity between source and destination so data transmission takes a long time under different scenarios the data transmission delays varies.

Assumption data rates: Due to lack of regular connectivity between nodes the data transfer rate varies asymmetrically. The data transmission rate is low.

Opportunistic communication: The nodes can communicate with each other only when they come within contact. Each nodes has a limited transmission range when other node comes within that zone then anode can transmit/receive data packets from other. (Carlos o. Rolim *et al*., 2013)

Routing issues in DTN

There are different factors comes in to mind when we consider about the routing in DTN. Few of these factors are:

Resource Utilization

In traditional TCP/IP based network there is no requirement of storage of data packets but in DTN data packets are stored until delivery so resources like battery power, buffer storage are utilized. So unnecessary transaction may consume resources which influences the routing process.

Buffer Space

In DTN there is no end to end connectivity is present between source and destination. Each node can transmit to other node only when nodes come in to their transmission range. So each node has to store the message in its buffer until it is delivered. As the buffer size is limited so if excess message is generated during transaction then buffer management is important. (Warthman, 2003)

Contact available

In DTN the connectivity are intermittent i.e these network are partially connected so routes are not always available for data transmission. So the node encounters other nodes randomly.

Security

DTN is a type of wireless adhoc network so any node can leave or join the network at any time. In DTN various types of selfish and malicious nodes are present which hampers the routing process in different ways. So to achieve better security of data packets some kinds of authorization and authentication needs.

Epidemic Routing

Epidemic routing (Demers *et al*., 1987) protocols is a type of flooding based routing protocol. It floods the message in to the network. The node which wants to send a meesage known as source node sends the message to the other node to whom it encounters. Similarly the next node sends the message to other node to whom it meets. In this way the message is spread through out the network and finally reaches the destination. The main objective of (Vahadat and Becker, 2000):

(i) Epidemic routing protocol is to efficiently distribute the message through out the network.
(ii) Maximize the delivery ratio

In epidemic routing (Demers *et al*., 1987) protocol each node has a small storage called buffer which stores the message i.e the message generated from other nodes and also from its own. Each node maintains a table to store the entries of the message stored in buffer.that table is called as summary vector (Vahadat and Becker, 2000) which uses hashing methods for indexing the message. When two node comes within their transmission range, before transmission of data they starts matching their summary vectors. This process is called as anti-entropy session (Douglas B. Terry *et al*., 1995). Here the node having smaller identifier starts the anti- entropy session with larger identifier node. The main aim of anti-entropy session is to ensure about the redundant messages. Then the nodes exchanges only those messages which are not present in their buffer.

Similar process continues until the message reached at the proper destination.

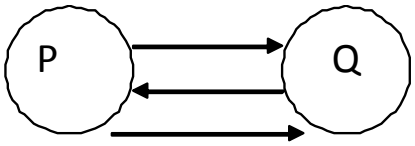


Fig.1. Epidemic routing process

In this fig 1 the node p comes within the transmission range of Q and strats the anti- entropy session. In first step node P sends its summary vector SVp to Q. Summary vector of P represents all the messages stored at P. in second step Q performs a logical AND operation between SVp and ~SVq . in next step node Q sends request to P to transmit those which are required by Q. then P sends those to Q. it continues when Q comes in contact with any other and continues until reaches at destination. Here the buffer capacity is an important factor during the process of routing. As the buffer capacity is limited so managing buffer is important. The simplest policy is FIFO policy i.e the older messages will bne automatically deleted from buffer when sufficient new message enter in to buffer. If the buffer capacity is likely to be grater than the number of message transmission then it does not creat any problem for old messages (Vahadat and Becker, 2000)

Cluster in DTN

Clustering divides the DTN in to different groups (Jane and Peter H.J Chang, 2005). Each group contains number of nodes according to a specific rules. Same type of behaving nodes are included in same cluster. In a cluster there are different types of nodes are present likely cluster head, cluster gateway, cluster member. The cluster head is the co –ordinator of all the nodes present in a cluster. All the nodes communicates through the cluster heads i.e when a data packet comes from other clusters then it comes to the cluster head then cluster head forwards it to other node. The cluster gateway is a node which forwards in formation between clusters i.e helps in inter cluster communication. Cluster members are the nodes which have no inter cluster link called ordinary nodes which only receives message from cluster head and sends message to cluster head (Kalker, 2001).

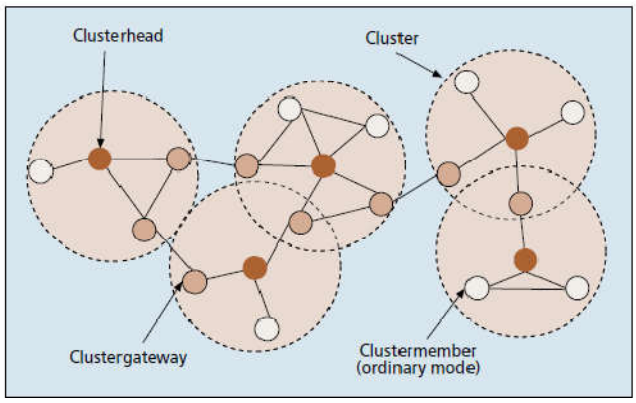


Fig.2. Cluster based network

K-Means Clustering:

K- means clustering is the simplest flat based clustering method (http://people.revoledu.com/kardi/tutorial/kmeans/index.html). It has easy implementation and fast convergence so it can be applicable to DTN. If the number of node are huge then K-means clustering is computationally faster than hierarchical clustering. If we keep the number of cluster small K means clustering produces tighter cluster than hierarchical clustering (Ndlovu, 2015). So we take K means clustering for cluster formation. The objective of K means clustering is to minimize the average squared Euclidian distance from their cluster centre (Shirazi and Mirabedini, 2016). In the first step select initial cluster centre K. the algorithm uses a simple method to sort out a specific data group through the distinct number of cluster say K cluster. The main objective is to determine K centroid each centroid belongs to one cluster. (Shirazi and Mirabedini, 2016)

Algorithm steps

Algorithm will follow the below steps until convergence i.e continue until the network becomes stable i.e no node move from cluster.

(i) Determine the coordinate of centroid d.
(ii) Determine the distance of each node from the centroid
(iii) Form the cluster depending upon minimum distance d.

$$d = \sqrt{(x2 - x1)^2 + (y2 - y1)^2}$$

Qualitative comparison of epidemic with K means clustering

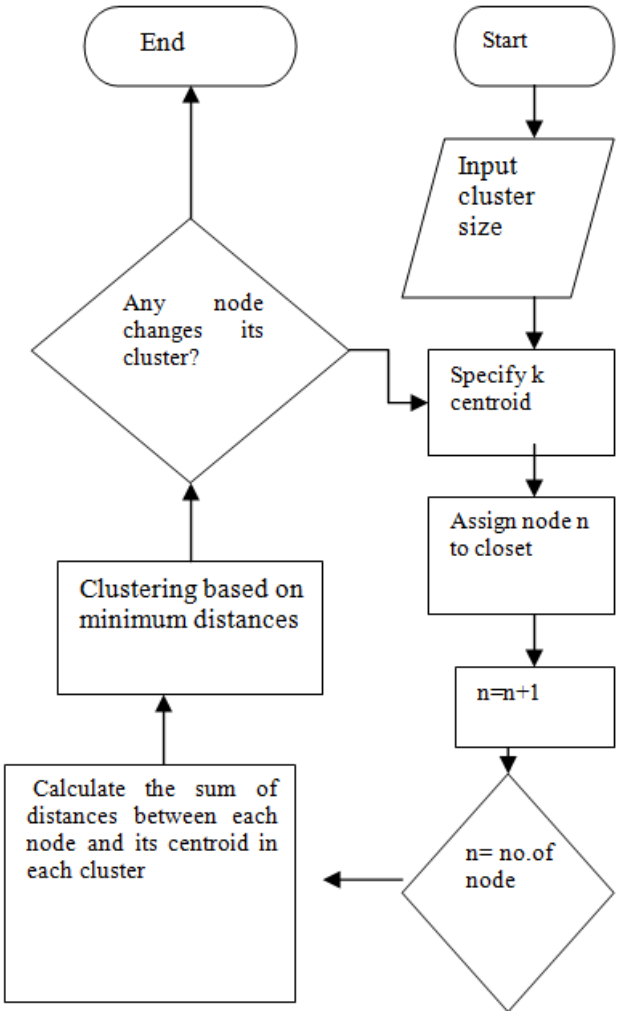
Table 1. Qualitative comparision

protocol	scalability	performance	Delivery ratio	Decision based on
Epidemic	limited	low	high	flooding
k- means cluster	high	high	high	Group of node mobility pattern

Table 2. Routing parameter comparision

protocol	Buffer size	Hop count	latency	Resource consumption
Epide-mic	limited	one	Depend on buffer size	high
k- means cluster	limited	one	less	less

Flow chart of K means clustering



Conclusion

In this paper we want to describe the features of K-means clustering and described flow chart for development of use of k means clustering in DTN routing. We provided a qualitative analysis of k- means clustering and epidemic routing and also listed some of the routing issues in DTN. It provides a basic idea about use of k- means algorithm in cluster formation ion DTN.

REFERENCES

Carlos o. Rolim Valderi R.Q Leithardt, Anubis G. Rossett Tatiana, F.M. dos santos Adriano M. souza Claudio F.R geyer," Six degree of separation to improve routing in opportunistic network", *Internatrional Journal of Ubicomp*, Vol 4, No.3, July 2013

Demers, A., D. Greene, C. Hauser, W. Irish, J. Larson, S. Shenker, H. Sturgis, D. Swinehart, and D. Terry. EpidemicAlgorithms for Replicated Database Maintenance. In Proceedings of the Sixth Symposium on Principles of Distributed Computing, pages 1–12, August 1987

Douglas B. Terry, Marvin M. Theimer, Karin Petersen, Alan J. Demers, Mike J. Spreitzer, and Carl H. Hauser. Managing Update Conflicts in Bayou, a Weakly Connected Replicated Storage System. In Proceedings of the Fifteenth ACM Symposium on Operating Systems Principles, pages 172–183, December 1995.

Feng, Z. and Chin, K. 2012. "A unified study of epidemic routing protocol and their enhancement IPDPSW 2012, IEEE 26th International Parallel and Distributed Processing, Symposium Workshop (pp 1484-1493) IEEE Explorer IEEE.

http://people.revoledu.com/kardi/tutorial/kmeans/index.html.

Jane Y.Yu and peter H.J Chang, 2005. "A survey of clustering scheme for MANET", IEEE communication surveys, First quarter, vol.7, no.1

Kalker, T. 2001. "Consideration on clustering security in proc," IEEE Int. Workshop on Multimedia signal processing, cannas, france, pp201-206

Ndlovu, A. " Improved energy efficient AODV routing using K means algorithm for cluster Head selection", *IJCSMC*, vol.4, Issue 8, Aug-2015, pg177-187

Priyanka Goyal, Vintara parmar and Rahul Rishi, 2011. "MANET: Vulnerabilities, challenges, Attacks, Application", *IJCEM*, Vol. 11, January 2011 ISSN (online):- 2230-7893.

Shirazi Z.Z. and S.J. Mirabedini, "Dynamic K- means Algorithm for optimal routing in MANET", *IJCSES,* vol 7, no.2, April 2016.

Shivi Shukla, amit Munjal and Y.N singh, "Routing protocol approaches in Delay Tolerant Network"

Vahadat A. and D.Becker, 2000. "Epidemic routing for partially connected adhoc Networks", technical report CS-200006, Duke University, April.

Warthman F. 2003. "Delay Tolerant Network: A Tutorial".

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