

Data Transmission in a Cluster based Delay Tolerant Mobile Networks using UTDG and RER Protocol

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Abstract— In DTMN the nodes with similar mobility pattern are grouped into a cluster. The cluster can help to reduce the network overload because it can interchange the resources among the nodes in the cluster. During data transmission, the delay tolerant network can lose connectivity and take a long time for data transmission. This can be reduced by using UTDG protocol and RER protocol. UTDG protocol has three phases – tree formation, data collection and data transmission, and updating phase. UTDG protocol constructs a tree in each cluster. It reduces transmission overhead and lowers the delay in data delivery. A reliable energy-aware routing protocol increases the node life time by increasing the energy level of the node. A hop by hop transmission mechanism is used to guard the reliability of message transmission.

Keywords: Delay tolerant mobile network, clustering, Unicast tree based data gathering protocol, tree formation, data collection

I. INTRODUCTION

Delay Tolerant Network is a computer network architecture which lacks constant network connectivity. These networks operate in mobile or extreme terrestrial environment. In these networks end-to-end connection is impossible. Routing in these networks is based on the node's contact probability. For the efficient transmission the contact probabilities must be maintained and updated correctly. The best approach for improving scalability is clustering. Clustering reduces the network overhead.

Clustering is the process of grouping the mobile nodes of similar mobility pattern. The resources can be shared by the nodes among the cluster. By sharing the resources, the network overhead can be reduced. For the better performance a good algorithm must be used for clustering. One of the algorithms for clustering is distributed clustering.

II. DISTRIBUTED CLUSTERING

Distributed clustering algorithm is an efficient algorithm for clustering. This is done in two phases. In the first phase every node in the network learns their direct contact probabilities to other nodes. In the second phase, a node joins or leaves the cluster. The node becomes a part of the cluster based on its contact probability to other nodes. Once clusters are formed, inter-cluster communications are done through gateway nodes.

An effective approach for online estimation of contact probabilities is exponentially weighted moving average. By using exponentially weighted moving average a list of contact probabilities is maintained and updated. Fractional clusters may occur due to errors in the estimated contact probabilities. To avoid the fractional clusters merging is done.

III. THE RELIABLE ENERGY-AWARE ROUTING PROTOCOL

A reliable energy-aware routing protocol increases the node life time by increasing the energy level of the node. A hop by hop transmission mechanism is used to guard the reliability of message transmission. For reliable transmission RER introduces routing paths between the nodes based on the residual energy capacity of the nodes.

The nodes have different residual energy. This affects the energy consumption of nodes. I.e. The same energy consumption affects the nodes differently. The less residual energy nodes use their energy continuously to avoid the destruction of life due to weariness of energy. This decreases the lifetime of network. Distance also affects the energy consumption of the nodes and its lifetime.

IV. UNICAST TREE BASED DATA GATHERING PROTOCOL

UTDG protocol is a route forwarding protocol. It built a tree in each community on the basis of transmission ranking, contact probability and the link expiration time. UTDG has three phases- tree formation, data collection and transmission, and the updating phase. UTDG constructs a tree for each community. The factors for constructing tree are node's location, contact probability, rankings of transmission and link expiration time. After constructing the tree, the next hop node is selected based on the tree structure and data which is unicast to the parent node in the tree. In the last phase of UTDG, the tree in each community is updated at each time slot.

UTDG performs well when it is used in a clustered delay tolerant network. The UTDG constructs tree in the first phase. It constructs the tree based on the contact probabilities. In clustering the nodes of similar contact probabilities are grouped into a cluster. So UTDG can create a tree for every cluster. So by clustering the performance of UTDG protocol can be increased.

The UTDG protocol characterizes three parameters - contact probability, transmission ranking and link expiration time.

V. CONTACT PROBABILITY

The chance of a node to node is known as contact probability. A simple method to calculate contact probability is exponentially weighted moving average. In this method node *i* store a list of contact probabilities of every other node *j*. The list is initialized with zero and updated in every time slot.

VI. TRANSMISSION RANKING

Transmission rankings specify the degree of possibility that a node will communicate with the other node. The transmission ranking of a node is high means that the probability of the node to communicate with other node is high.

VII. LINK EXPIRATION TIME

Each mobile node can learn its location by GPS and all the nodes have synchronized clock. So each mobile node can calculate its speed and direction.

VIII. UTDG ALGORITHM

The UTDG algorithm has three phases- tree formation phase, data collection and transmission phase, and updating phase. The nodes in each cluster form a tree with different levels.

In the tree formation phase the tree is constructed for each cluster in the network. At this time the number of levels in each cluster is calculated. The node with highest ranking is placed at the zero level. After assigning a level to the nodes, the children are connected to their parents by using the contact probability and link expiration time.

After constructing the tree, each node asks its parent to send data by means of Ready to send message. The child node sends the RTS message and the parent node send CTS messages to their children. These messages contain the ID of the node which send RTS message.

The last phase of the algorithm is the updating phase. When a node moves from one level to another in the tree, its level must be recalculated. If it is in the range of its parent, there is no need to re-join the tree. Otherwise the node selects its parent and joins in that group.

IX. CONCLUSION

In this paper, UTDG protocol is proposed for the data transmission in DTMN. UTDG works in three phases. It generates a tree structure in each cluster of the DTMN which reduces overhead and time delay. A reliable energy-aware routing protocol increases the node life time by increasing the energy level of the node.

REFERENCES

- [1] K.fall, A delay tolerant network architecture for challenged internets, in Proc. ACM SIGCOMM pp.27-34
- [2] Zeynab Mottaghinia, A unicast tree based data gathering protocol for delay tolerant mobile sensor networks, Journal of information systems and telecommunication, vol.4 2016,
- [3] A. Voyiatzis, A survey of delay and disruption tolerant networking applications, J.internet Eng.,vol,5, 2012
- [4] Delay tolerant networking research group. <http://www.dtnrg.org>
- [5] Y.Wang, Delay/fault tolerant mobile sensor network: A new paradigm for pervasive information gathering, IEE Transaction on mobile computing, vol. 6, 2006
- [6] G. Bencan, A tree based routing protocol in wireless sensor networks, ICECE, 2011 International Conference on DOI:10.1109/ICECENG.2011.6057953 Publishing year: 2011.
- [7] Xuebin Ma, Reliable Energy-Aware Routing Protocol in Delay-Tolerant Mobile Sensor Networks, Wireless Communications and Mobile Computing Volume 2019, Article ID 5746374, 11 pages