AD HOC ROUTING PROTOCOLS FOR MOBILE LOCAL AREA NETWORKS

Белорусский государственный университет информатики и радиоэлектроники
г. Минск, Республика Беларусь
Zaid Ihsan Nuri

Хоменок М.Ю.. – к.т.н.,доцент

Abstract. Mobile ad hoc networks are systems that have ability to self-organize and create temporary networks. Article reflects first step for studying of ad-hoc network protocols to examine several different routing protocols on base of network simulator using performance metrics.

Keywords: Mobile network, Routing protocol, Performance Metrics, Clustering.

The formations of mobile ad-hoc network other words MANET occurs, when the group of wireless mobile nodes dynamically forms a temporary network topology without the use of any existing network infrastructure. The nodes presented in network can move in any direction and acts as a router. However, in the event that it becomes necessary to connect this ad hoc network to another network, for example, such as the same or the Internet, one of these sites in the episodic network may be assigned the rights of a base station or some coordinator of that network. The nodes of the episodic network have a limited transmitter power, because of this they also have limited "radio visibility". Another important property of nodes of such an episodic network, not including reception and transmission, is the ability to retransmit information and route. Therefore, the question arises: how should the work of the episodic network be organized, so that if the nodes are unpredictably moved in the network, it would be possible to guarantee the delivery of information to the desired addressee.

To provide communication in such network, a routing protocol plays a important role to set up optimal route among pair of nodes.

Mobile ad hoc networks use many different routing protocols to route data packets among nodes. Various routing protocols have been developed, and their usage depends on the application and network architecture. As result to survey one can use different classification principals for their taxonomy, figure 1.

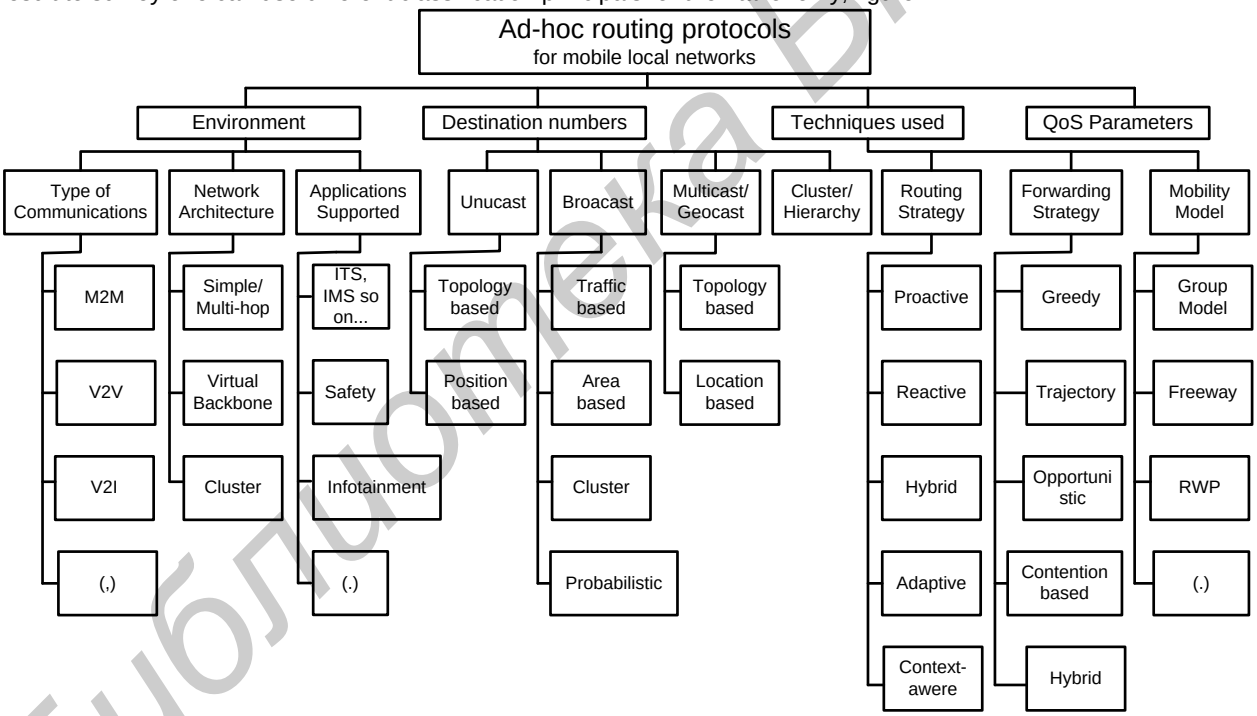

Figure 1. Taxonomy of Ad-hoc routing protocols.

Mobile ad-hoc routing protocols can be categorized into three categories: reactive, proactive, and hybrid. The main characteristic of reactive protocols is that they set up the routes on-demand. When a node wants to start communication with a node to which it does not have any route, the routing protocol will try to establish such a route.

In networks where a proactive routing protocol is used, every node maintains one or more tables that demonstrate the entire topology of the network. There is a need to maintain up-to-date routing information from each node to every other node; thus, the tables are updated regularly. To achieve this, topology information needs to be exchanged between the nodes on a regular basis, leading to high overhead on the network.

For simulation purposes the performance of protocols were evaluated using Average Delay, Control Overhead, Dropping Ratio, Jitter, Normal Overhead, Error Rate, Packet Loss, Latency, Packet Delivery Ratio, and Throughput.

In heterogeneous networks which have a hierarchical structure to opposite homogeneous networks routing protocols have a hybrid principal to realize and routing goes according to a cluster method of communication, figure 2.

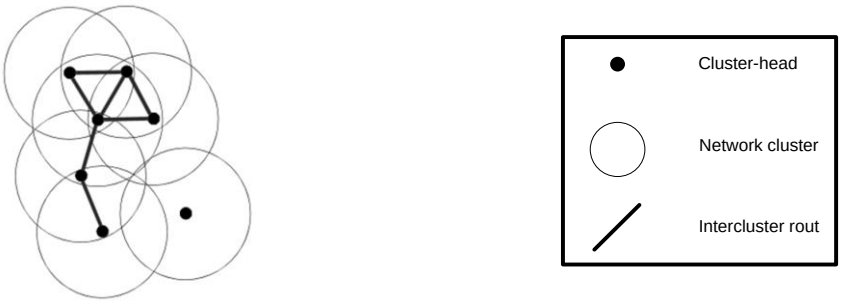

Figure 2. Cluster structure of network

Hybrid protocols combine routing table generation mechanisms inherent in proactive and reactive protocols. In particular, the network allocates a number of subnets within which one of the types of proactive protocols is used, and routing between subnets is performed on the basis of reactive protocols. This approach reduces the size of the routing tables of nodes within the corresponding subnets and reduces the amount of current service information, since the bulk of it circulates within subnets.

The general algorithm of clustering looks like this [1] :

1. Bring the original data to the desired form (data preparation);
2. Choosing a measure of proximity;
3. Choice of algorithm (meta-algorithm) of clustering;
4. Implementation of the algorithm;
5. Presentation of the results;
6. Interpretation of the results.

At the first stage, the data is prepared for clustering. Data for clustering is most often represented in the form of tables, where each column is one of the attributes and a string is a data object.

In the second stage, choose how to characterize the similarity of objects. To this end, various measures of proximity are used, that is, in fact, assessments of the proximity of two objects to each other. Proximity measures are chosen based on the properties of the objects. The proximity measure is selected individually for specific data types. Sometimes it is not possible to find an adequate measure of proximity, and we have to invent it ourselves.

At the third stage, choose the algorithm by which we will build a data model, that is, group objects. The choice of the algorithm is complicated, and it is often necessary to use several algorithms before the desired (interpreted) result is obtained. Sometimes clustering algorithms combine to get a meta-algorithm, the result of doing one when it serves as an intermediate result of the performance of the other.

At the fourth stage, the algorithm is implemented, and its result is the constructed data model, that is, the clustering of objects over clusters.

At the fifth stage, the grouping is attempted to be presented in the most convenient form for interpretation. The algorithms of clustering at the output are given only by groups and objects belonging to them. The presentation of the results of clustering is intended to help to interpret the results of the algorithm most accurately.

Finally, at the last stage of clustering, the results of the execution of the algorithm are interpreted, from which knowledge is obtained, that is, useful rules that can be used in the future to classify new objects as belonging to one group or another -the cluster.

Clustering in mobile ad hoc network can be defined as the virtual partitioning of the dynamic nodes into various groups. A group of nodes identify themselves to be part of a cluster. A special node, designated as cluster-head is responsible for routing, relaying of intercluster traffic, scheduling of intra-cluster traffic and channel assignment for cluster members. The cluster members do not participate in routing. An optional gateway node is also used in some of the clustering schemes, which belongs to more than one cluster, acting as a bridge between cluster heads. Inter-cluster communication is achieved either by cluster-heads or gateways, if present, whereas communication within each cluster is made through direct link. As the complexity and mobility of the network increases, the selection of cluster heads and the management of clusters becomes a challenging task.

The highly dynamic and unstable nature of MANETs makes it difficult for the cluster based routing protocols to divide a mobile network into clusters and determination of cluster heads for each cluster. An optimum cluster-head and gateway selection algorithm is based on maximum resource utilization, fast route discovery, maximum area of coverage and several other factors including stability. In [2] is proposed The Survey of Cluster-based Routing Protocols in Mobile Ad hoc Networks and performed comparative analysis with traditional networks

Cluster Based Location Routing algorithm enables a dynamic, self-starting, and multi-hop routing between nodes. The link will be maintained only if there is at least one header in the intermediate cluster. Since, only the header needs to find the destination path, the routing overhead is less and it is proportional to the number of clusters.

References

1. Methods and means of data analysis. http://bourabai.ru/tpoi/analysis6.htm

2. Survey of Cluster-based Routing Protocols in Mobile Ad hoc Networks. www.ijcte.org/papers/414-G1106.pdf