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A Survey on AODV Routing Protocol for MANET's Using Bayesian Probabilistic Approach

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Abstract: Mobile Ad-hoc Network is a temporary infrastructure less internet where node can travel across anywhere anytime without loss their connectivity with the rest of the world .For any communication operation over the MANET source node broadcast a message to all the other nodes in the network. Network wide broadcasting in Mobile Ad Hoc Network provides important control and route establishment functionality for a number of unicast and multicast protocols. Broadcasting in MANET poses more challenges than in wired networks due to node mobility and scarce system resources. Broadcasting is categorized into deterministic and probabilistic schemes .This paper give a bird's eye view over probabilistic routing approach ,besides the basic probability scheme it's also includes recent advancements .This review paper identify which protocol gives better performance in terms of reach ability, saved rebroadcast and average latency in rebroadcasting a route request message.
Keywords: MANET, Probabilistic Algorithm, Bayesian Approach.

1. Introduction

The history of wireless networks started in the 1970s and the interest has been growing ever since. During the last decade, and especially at its end, the interest has almost exploded probably because of the fast growing Internet. The tremendous growth of personal computers and the handy usage of mobile computers necessitate the need to share information between computers. At present, this sharing of information is difficult, as the users need to perform administrative tasks and set up static, bi-directional links between the computers [3].

A temporary infrastructure less wireless network having no central access point or any centralized administration is known as Mobile Ad-Hoc Network (MANET) [1]. Mobile ad-hoc networks pusses' verity of features, such as the dynamic network topology, limited bandwidth and energy consumption in the network. Mobile ad hoc network is significant for military operation to provide communication between squads, emergency case in out-of-the-way places, medical control etc. Whereas higher degree of node mobility lead to changes network topology because of that routing is a challenging task in ad-hoc network ever since it's came into existence [2].

Presented paper gives an idea regarding ad-hoc network and their routing protocol especially probabilistic routing algorithm, Bayesian probabilistic routing algorithm and value of affinity index, mutual affinity index and other parameter for probabilistic routing algorithms.

The presented paper is divided in seven sections including this one. The second section gives an idea of mobile ad-hoc network and its protocol hierarchy. The third section describes about the probably in the MANET. Fourth section throws some light on previous work of MANET. Finally the paper concludes in fifths section

2. Mobile ad-hoc network

Mobile ad-hoc network is ad-hoc network where node having the mobility ie nodes can move anywhere within the network and network having no center authority between for communicate. This is use for the temporary arrangement of a network. Generally this is used by military. It is also use at the time of natural digesters in order to establish communication channel. In such sort of network all node works a independent router having transmitter and receiver. Each node has the limited range

of radio frequency for transmission and limited battery power. Figure 1 shows the snap of a temporary network [1,4].

Cooperative ad-hoc networks are formed by several homogeneous wireless stations. All the stations cooperate with each other, i.e., the traffic for the stations that are more than one hop away is routed by the intermediate stations. The intermediate stations are called relaying stations. There is various application of mobile ad-hoc network like Military or police exercises, Disaster relief operations, Sensor networks, Vehicle communications, Personnel Area Network (PAN) for communication of several portable devices etc [5].

The basic advantages of MANET are to provide access to information and services regardless of geographic position. It can also be set up at any place and time. In spite of having positive points there are some limitations. In MANET there is Limited resources and physical security. Here there is Lack of authorization facilities. Volatile network topology makes it hard to detect malicious nodes [4,5].

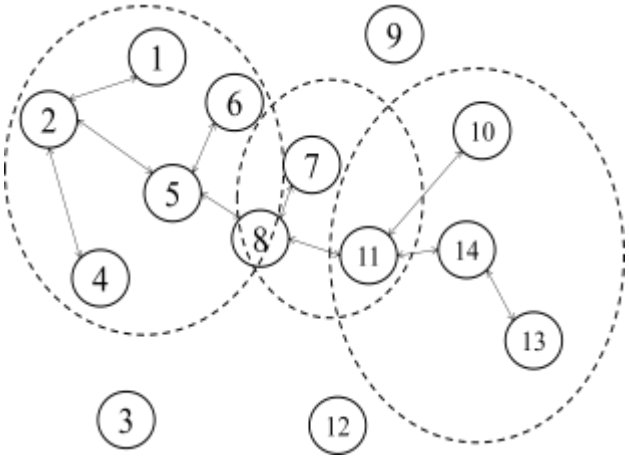

Figure 1 Scenario of MANET

There are three types of major protocol works for MANET. These are proactive protocol, Reactive protocol and Hybrid protocols. As shown in figure 2 there is a hierarchy of these protocols. On one hand Proactive MANET protocols (PMPs) continuously update network topology information and ensure that it is available to all nodes. PMPs reduce time delay of system in a network but increase data overhead by continuously updating routing information. On other hand Reactive MANET protocols decide routing paths only when there is need of the path. They are linked with lower protocol overheads but longer packet delays. The Hybrid MANET routing protocols is a combination of proactive and reactive MANET protocols. The resulting hybrid protocol gets better results than the individual protocols. It is also capable of regulating packet dynamically on the basis of different network conditions. DSDV, WRP, CGSR are the example of proactive protocols. AODV, DSR and TORA are the example of Reactive protocol whereas ZRP works on the hybrid protocol [6].This paper gives a bird eye over probabilistic approach in reactive routing protocol mainly concentrate over probabilistic flavor of AODV table 1 describe different reactive and AODV protocol.

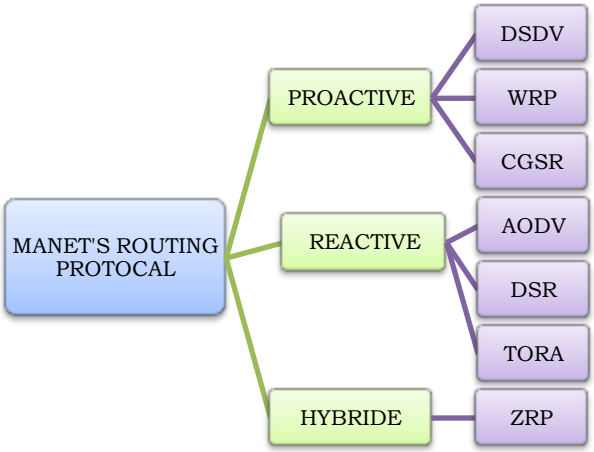

Figure 2 Hierarchy of MANET Routing Protocol

3. Probabilistic algorithm

Among the deterministic and probabilistic approaches probabilistic scheme is one of the best ways to reduce rebroadcast. In a probabilistic scheme, nodes rebroadcast the message with a pre determined probability p. the studies in shows that probabilistic broadcast incurs significantly lower overhead as compared to blind flooding. Several probabilistic schemes have been proposed in the past these include probability-based, counter-based and distance-based.

Each probability model is represented by the equation [5,6,7]:

$$P = f(N, P)$$

Where P is the probability that a node forwards the broadcast packet and N is the number of nodes in the

network. The function f depends on the specific protocol being analyzed.

Bayesian approach is a probabilistic method. This method works in two important factors. These are the input data and pre-analysis. Both the factors are works as a input for Bayesian Approach. Figure 3 shows the basic functionality of the Bayesian Approach.

$$P\left(\frac{w}{l}\right) = \{\frac{P\left(\frac{l}{w}\right)P(w)}{P\left(\frac{l}{w}\right)P(w) + P\left(\frac{l}{m}\right)p(m)}$$

Table 1- Advantage And Disadvantage Of Different Reactive Protocol

Protocol	Advantage	Disadvantage
DSR	Multiple routes, Promiscuous overhearing	Scalability problems due to source routing and flooding, Large delays[16]
AODV	Adaptable to highly, dynamic topologies	Scalability problems, Large delays, Overhead due to Hello messages
AODV-BR	Better throughput performance than AODV	Not efficient in heavily loaded frequently changing networks.
AOMDV	Reduces routing overhead, low intermodal coordination overhead.	Do no scale well in moderate to sparse networks due to equal length multiple paths.[18]
AODV-ABR	More adaptive to variation of network topology, smaller control overhead[18,19]	Lower probability of finding an alternate route
TORA	TORA provides the supports of link status sensing and neighbor delivery, reliable, in-order control packet delivery and security authentication.[17,18]	It depends on synchronized clocks among nodes in the ad hoc network & dependence over intermediate lower layers for certain functionality presumes with higher overhead[17,20].

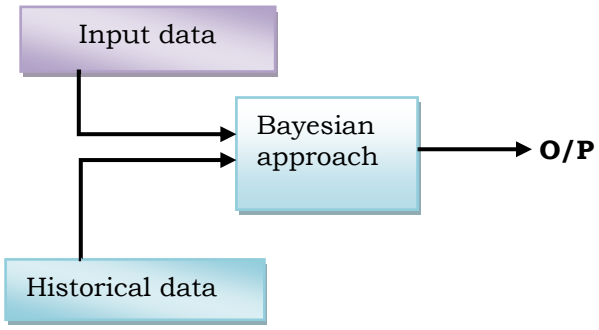

Figure 3 Bayesian Approach

Mutual Affinity index (AI) is a probability based upon historical data. Through this we can find out how much likely it is for a particular node to transfer the data packet to the desired destination. It is calculated by using the belief Theory [9,10].

Here, W is the class showing whether reply was received for the RREQ sent. And L = {l1,……., l} i.e. the various attributes upon which the probability will depend. P(L)

Does not depend upon Wi is used only for normalization. So P(W/L) will be maximum when P(L/W) P(W) is maximum. Hence,

$$M_{ai}\left(\frac{w_i}{l_j}\right) = \pi_{j=1}^{m}\left[l_{ij_1} + l_{ij_2} + l_{ij_3} + \cdots + l_{ij_k}\right]/n_i$$

$$M_{ai} = \pi_{j=1}^{m}\left[\frac{\sum_{r=1}^{k} w_{ijr}}{n_i}\right]$$

Now since we are multiplying the probabilities of each and every attribute hence; even if one of the attributes has a zero probability; the whole index will become zero. Because of this; zero probability will be replaced with a very low probability (0.001).

4. Previous work

Many research works has been done in this area. Some of them are presented here.

The author presents and shows obtained results in his research. This work is based on Bayesian approach, Queuing theory and reliability theory. Here the methods bound of application of Bayesian approach to some problems of queuing theory and reliability theory. This approach could be used, for instance, for calculating moment and quintile characteristics for performance and reliability characteristics of large groups of systems or devices [11].

Nadia Bali [12] proposed a hierarchical Markov model for the sources with a common hidden classification field which is modeled via a Potts–Markov field. Classical methods of dimensionality reduction in hyper spectral imaging use classification methods either to classify the spectra or to classify the images in classes where is, in general, much less than the number of spectra or the number of observed images. However, these methods neglect either the spatial organization of the spectra or the spectral property of the pixels along the spectral bands.

The processes for decision making problems based on the use of the Dempster-Shafer (D-S) theory can be able in different ways according to the requirements of each single problem. In this input the authors present a decision making scheme based on Dempster-Shafer (D-S) theory. Jose M. Merigo [13] proposed the use of a hybrid averaging operator (2-THA) which uses the 2-tuple linguistic representation model. Due to use of 2-THA in D-S theory, obtained a new aggregation operator: the belief structure - 2-THA (BS-2-THA) operator and studied some of its main properties and then show the descriptive example of the new approach in a decision making problem.

Nidhi S Kulkarni [14] study and analyses the on demand routing protocols in deep and gives an overview of the existing on demand routing protocols and a parametric comparison is made with the recently developed protocols, also covers some important conventional routing protocols and the recently proposed extensions of AODV. These protocols are the multipath extensions of Ad Hoc On Demand Distance Vector routing protocol (AODV) such as AODV with break avoidance (AODV-BR), Scalable Multipath on demand routing (SMORT).

One of the typical routing methods in mobile ad-hoc networks use on demand distance vector, or Ad-hoc On-demand Distance Vector (AODV). The key concern in this protocol is the cost of route establishment. Rusheel Jain [15] suggested an efficient routing algorithm for mobile ad-hoc networks with a route establishment technique using Bayesian approach. They consider both time and space information to compute the route from source to destination. The results show that there is major improvement in delivery ratio, control packets overhead w.r.t. mobility and control packet overhead w.r.t. network size.

5. Conclusion

Probabilistic routing work over historical and probabilistic traffic information of time and space of each node to compute route from source to destination and reduce the probability of collision, rebroadcast at the expense of reach ability and enhanced scheme has higher throughput, lower latency and better reach ability.

In future we will try reducing degree of collision by using a Dumpster- Shafer belief function over Bayesian probabilistic routing approach in order to limit the flooding of broadcast requests and increase packet delivery ratio, throughput and decrease routing load in compare to previous Bayesian probabilistic approach.

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