JOURNAL OF COMPUTING TECHNOLOGIES

ISSN 2278 – 3814

Available online at www.jctjournals.com

Volume 1 , Issue 2 , June 2012

Cluster Analysis and Elimination Algorithm (CAE) for MANETs

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Abstract: **- MANETs are networks capable of communicating in a set of small, low cost, low power sensing devices. A wireless sensor networks is totally based on the limiting factor i.e. energy consumption. A wireless network consists of large number of nodes distributed or scattered in particular network region. MANETs consist of node that is highly mobile, so in particular the range of the nodes is very important. Each device in a MANETs is free to move independently in any direction, and will therefore change its links to other devices frequently. The energy and the bandwidth of such path are of major concern. The lifetime of the network depends upon these parameters. Cluster formation is the major threat to the MANETs structure that increases the delays that ultimately decreases the efficiency of the network structure. In this paper, we proposed an algorithm CAE to eradicate cluster formation that will ultimately decrease the delays and hence optimize the performance of the network structure. The base protocol is our own protocol DSPO that we have already proven to be better than the AODV protocol. The result analysis carried by us is done using NS-2 simulator.**

Keywords: **Clusters, DSPO, CAE, fault tolerance, transmission sensor system.**

I. INTRODUCTION

MANETS are ad hoc networks that have a route able networking environment on top of a Link Layer ad hoc network. Many academic papers evaluate protocols and the abilities assuming varying degrees of factors within a bounded space, usually with all nodes within a few hops of each other and usually with nodes sending data at a constant rate. Different protocols are then evaluated based on the packet drop rate, the overhead introduced by the routing protocol, and other measures. The concept of our model is based on CPACL-AODV and DSPO protocol that has been given on basis of cross layer design [6] [9]. The CAE algorithm given in this paper is the enhancement of the above written algorithm. Also,

the MANETs structure as increases in its complexity, the complexity increases in terms of transmission. The reason for increasing complexity is due to increase in number of hops under transmission. In the paper, we have worked upon the cluster formation that is major problem of most of the efficiency improving protocols. By using the embedded code of CAE algorithm in the protocol formation, the cluster formation will be eradicated from its root and that will ultimately eradicate any sort of delays that may arise due to such critical condition. We termed the cluster formation as stage of fault. In the next section of paper, we will be discussing the system model followed by the explanation regarding cluster and finally its elimination by use of CAE algorithm.

II. SYSTEM MODEL AND DESIGN

The network model consists of k number of hops from source to destination. Therefore, the number of relaying nodes between source and destination will be k-1 [6][1]. Let de be the end to end distance between source and the destination. If di is the distance between the relaying nodes then the value of di is given as: $\alpha i de$ where $0 < \alpha i < 1$. Note that for k number of hops the summation of $\alpha i \geq 1$. This determines that it is not necessary that all the nodes are not always in the straight line [6]. The characteristics and the requirements of the nodes are: 1. Has a common power amplifier characteristics, (2) experiences the same propagation environment, (3) transmission is independent of each other that is from node to node, (4) requires energy Ep [J] to process a received symbol.

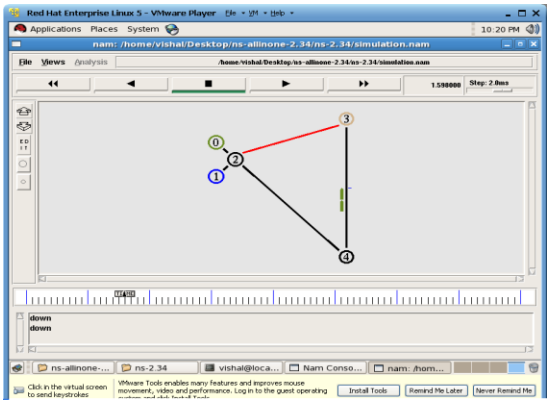


Fig. 1

The factors to be considered for the system model are Ep as already defined is the receiver's processing energy, the power amplifier characteristics is described by two functions fc and fo [12]. As assumed in paper [12] Pin denote the input power to power amplifier, Pdc the consumed power to drive the power amplifier to generate the desired output and Pout the desired output power of the power amplifier [6].Now the characteristics can be given as:

$$Pout = fo\ (Pin)$$

$$Pdc = fc\ (Pin) \text{..... [6]}$$

Both the above function are strictly increasing function of Pin and the difference between the consumed power to drive the power amplifier and the desired output power of the power amplifier is equal to the heat loss in the power from the power amplifier of the transmitter on each node i.e. Ph= Pdc - Pout.. Here Ph is considered to be constant [6]. Also the simplifier power amplifier is considered with the following expressions:

$$fo\ (Pin) = \rho\ Pin,\ 0 < Pin < P1$$

$$PSAT,\ P1 < Pin \leq Pmax$$

$fc\ (Pin) = fo(Pin) + Ph$ ……..[6] Where

ρ and Ph are constants. Also it is considered that Pmax = P1. The values for the constant are ρ=50(17) dB, P1=1.5 mW, PSAT=75 mW, and Ph=35 mW. The attenuation of the transmitted signal power along distance d is given by [6]:

$$Pr = \beta\ Pout / d\eta, \quad \text{where } d > 0.$$

III. CLUSTER ANALYSIS AND ELIMINATION

A. *Clusters:*

Cluster is defined as grouping of Manet's node together forming a hub that looks like some bunch if looked upon from some distance. The cluster is a major problem that may arise due to improper contact based service between the nodes. Fig.2 shows the actual clusters formed in the ad hoc networks.

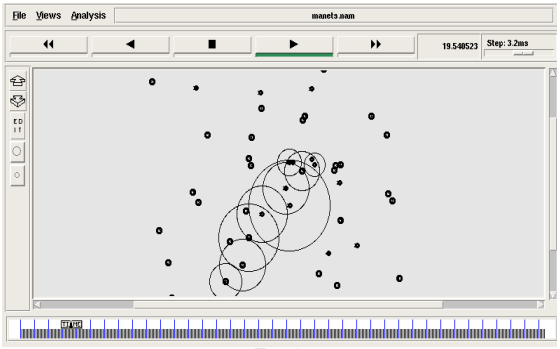


Fig. 2

The figure above shows the exact cluster formation that causes the link speed to decrease to such extent that the whole transmission becomes slow and ultimately stops. This is the stage of fault. The fault is not among the nodes but among the poor evaluation of transmission position.

B. *Cluster elimination:*

Cluster formation is slow process and thus can be controlled by providing some intermediate controlling unit. Our methodology includes the presence of intermediate controlling unit that provides the software base for prevention of cluster formation. In this process, any node can act as centralized wireless hub that has the necessary information installed about the network structure. This node generates the signals in terms of location messages that give it the information regarding nodes present in the particular area in the network structure. The device we decided to embed is the SDRs i.e. Software Defined Radio. These devices can be integrated with the GPS system to identify the node position and thus, prevent formation of clusters.

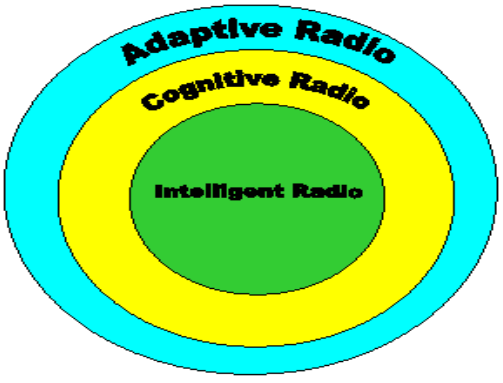


Fig. 3

Fig. 3 shows the advance relationship among the wireless technologies. We also divided the SDR approach into the above defined categories. The GPS system can be embedded with adaptive radio. This advance integration is the new technique that will certainly eliminate any type of cluster formation and thus, allow the network structure to perform efficiently and also the life time of the network structure will definitely increase

.

C. Cluster Analysis and Elimination Algorithm (CAE):

This algorithm is derived from our simulation that we carried using NS-2 simulator.

```
Set centralized_node== node (0)
While ( Ring_Search (n) ==True)
{
Set node_location=GPS Reading
Generate Postion_Signal
If (Node_location==Common)
{
Change_direction (node (n))
}
Else
{
Reset_GPS
}
Maintain GPS_Table
Check for Transmission value
Compute Efficiency
If (Efficiency<Expected)
{
Re-Routing
}
Else
{
Continue Transmission
}
}
```

The result of the above algorithm on Fig. 3 is shown in the Fig. 4

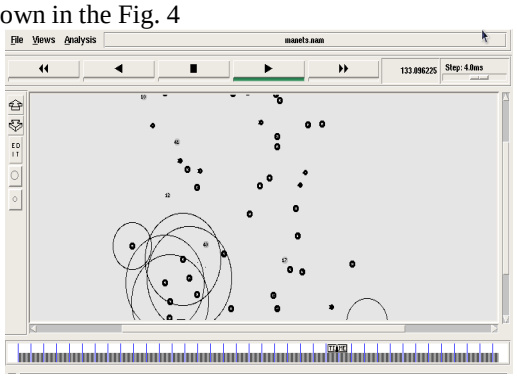


Fig. 4

Clearly, there is no cluster formation after application of CAE algorithm along with the concerned routing protocol. On broader view this algorithm result is shown below in Fig. 5.

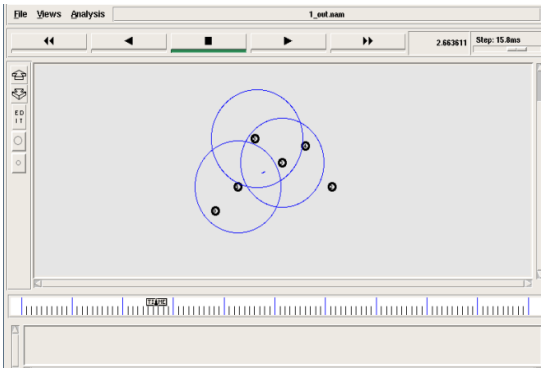


Fig. 5

Fig. 5 shows the enlarged view showing how actually transmission signals will be sent that contains the GPS information and the position defining signal to maintain location table for future use to perform efficiency transmission among the network structure.

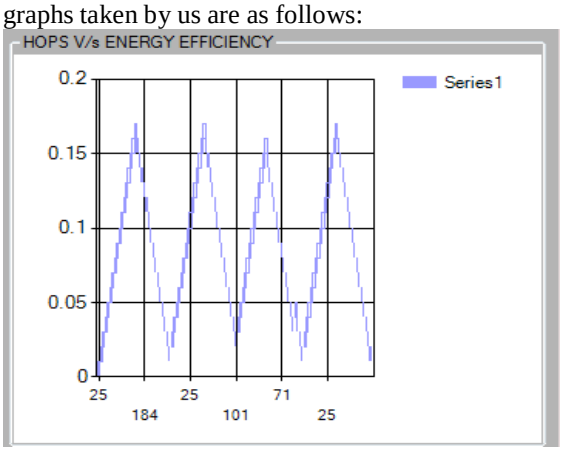
IV. SIMULATION RESULTS AND ANALYSIS

A. Performance Metrics

We simulated the typical MANETs for hop and calculated the results for bandwidth, energy, throughput of the network structure taking mobility and the antenna range as the basis of the technique. We have taken values as constant to compute our results. The simulation has been performed for the area ranging over 1500x1500. Also, the values for the transmitter energy are taken to be 0.38 µJ and that of receiver processing energy is 0.25 µJ.

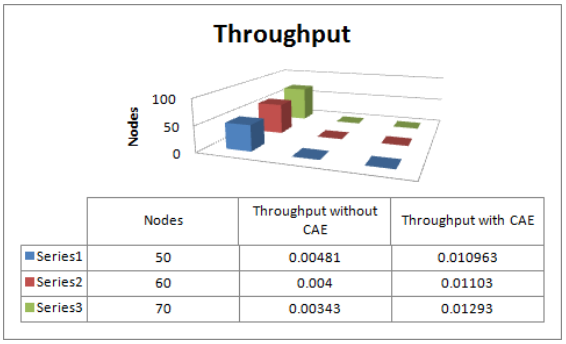
B. Graphical Analysis:

The graphical analysis is carried out by comparing the trace file of the newly designed and previous version of protocol. The comparison is carried out by use of files present in the x graph of NS-2. The graphs taken by us are as follows:



Graph 1

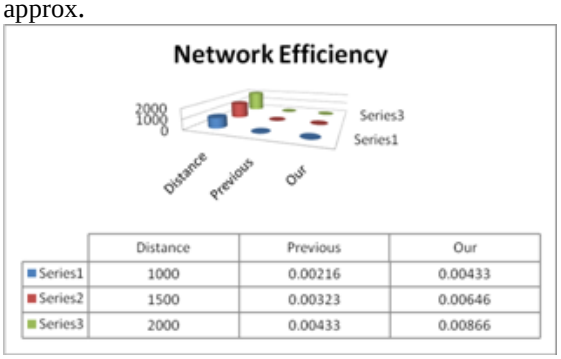
Graph 1 is the relation between the efficiency and hops of our protocol on embedding with CAE.



	Nodes	Throughput without CAE	Throughput with CAE
Series1	50	0.00481	0.010963
Series2	60	0.004	0.01103
Series3	70	0.00343	0.01293

Graph 2

Graph 2 shows the relation between the throughputs of the AODV protocol without using CAE algorithm and with using CAE algorithm. There has been increase of about 50 percent approx.



	Distance	Previous	Our
Series1	1000	0.00216	0.00433
Series2	1500	0.00323	0.00646
Series3	2000	0.00433	0.00866

Graph 3

Graph 3 shows the network efficiency comparison between the AODV before use of CAE and after user of CAE. There has tremendous improvement in the life time of the network on use of our proposed algorithm.

V. CONCLUSION

Thus, from the paper, it is noticed that in order to increase the performance of the network, the delays of the system must be managed. In this paper, we have proposed CAE Algorithm. As shown in the analysis carried out by us using ns-2, we claim that the proposed model is capable of handling delays for network structure. Also the power consumption of the network has been minimized with increased efficiency there by resulting in increased lifetime of the network structure. Further, work can be carried out to develop such integrated low cost devices that can easily perform as single unit for both GPS and cluster managing device.

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