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Energy Efficient Optimized Path in Ad Hoc Network

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Abstract—As ad hoc networks have dynamic nodes which have limited power so network lifetime can be small. Any node can enter or leave network anytime, therefore, routing is a critical problem in ad hoc network. Various routing protocols like AODV, DSR have been already discovered to optimize the paths in ad hoc networks but each of them has some problems. In this work extended AODV has been presented by incorporating DIJKSTRA algorithm in it and also taking into account various factors like energy of nodes, transmission range of the nodes and distance between the nodes. The proposed work is then compared with AODV on NS-2 simulator.

Keywords—AODV, DSR, DIJKSTRA algorithm, Data rate and Delay Rate

I. INTRODUCTION

Wireless networks give the concept of distributed architecture so that the sharing of information as well as resources can be done effectively. In last few years, different kind of ad hoc networks come into the existence. With the advancement of internet and the growth of personal computers, the use of mobile computers is been increased very fast. There are different mediums of performing the communication over the network. This all results an effective sharing of information and resources. While performing the communication in such network there is the requirement of more effective information sharing techniques. The main vector that differentiates a mobile network with any other network type is the used communicating devices called mobile devices. The mobility is the main feature of such networks. Due to the mobility, the special feature points considered here is the design solution of such kind of network. The issues associated and the characteristics difference between fixed networks and MANETS is the mobile nature of the nodes. To control the mobility network and the communication over the network, there is no requirement of any such design issue associated with the network type [1]. One of the challenge while define a wireless mobile network is the representation of the network under different scenes and the scenarios. Each scenario is having the different network architecture and the configuration. The presented paper is about the analysis of work under three different network scenarios.

The organization of paper is as follows: Section 2 covers recent literature. Section 3 consists of the proposed protocol and section 4 shows the simulation results and in the last section, conclusion has been presented.

II. RECENT SURVEY

In the existing work, many authors have done work on mobile network under different parameters. Different authors defined the specifications based on different topologies, scenarios and the scenes. The work done by earlier researchers under different parameters are discussed in this chapter.

In year 2012, Chirag Kumar has performed a work on the performance of mobile network in realistic environment. Author has analysed the work under different real time situations and defined work on different simulators. The work is here been checked on different scenario, shapes to attain the effective output from the system. The node analysis over the system is performed in obstacle condition. The work also includes the network limitation identification so that the improvement over the network can be achieved in near future [2]. Another work on QOS optimization to resolve different issues in mobile network was considered by R.Lakshmi Priya in year 2009. Author defined a study work on the different ideas respective to the QOS optimization in mobile network. Author presented the work with different implementation work with qualitative restrictions. The work includes the comparative analysis to achieve the effective throughput from the work [3]. In year 2006, Patrick Stuedi presented a throughput analysis on multihop mobile network respective to the network capacity. The capacity is the major property, performance analysis based on network strength estimation based on physical parameters such as propagation, unidirectional links, scheduling etc. The work is based on the probabilistic capacity calculation by performing the graph scheduling over the network. The capacity analysis is defined under the realistic network model under different configuration model. The analysis is performed in ns2 environment based on throughput analysis on sink node [4]. In year 2007, J Abdullah presented a GA based QOS routing approach for the mobile network under the mobility constraint. The work is to analyse and improve the route quality under the random mobility model. The work also defined respective to the fitness variable and the GA based QOS optimization. The work is performed on the DSR protocol. The GA is the intelligent optimization tool that is used to achieve the efficiency as well as reliability over the network [5].

In year 2006, Dijiang Huang has explored a work on the traffic analysis under the unlinkability measure for a mobile network. The work is based on two major analytical approaches called statistical approach and the evidence based

approach. These two approaches are used in a series to identify the unlinkability over the network as well as its effect over the network. The network transmission model respective to channel definition and analysis is presented in this work. The analysis is performed on the receiver side based on the evidence theory to obtain the maximum throughput over network[6]. In year 2009, A Simulation based analysis is performed on AODV protocol by Md. Monzur Morshed. The author has analysed the network under the protocol specification for the different parameters. The parameter includes the efficiency, reliability, loop free routing etc. The Author has defined different network scenarios and performed the variation in terms of network delay, jitters etc and the relative effective is analysed and presented in the form of graphs. The work is the verification of performance of AODV protocol under different network formations as well as the parameters [7].

In year 2008, Quan Le-Trung presented a work to analyse the effect of load balancing on mobile network. Mobile network is one of the busy networks. The author is includes the hybrid metric discussion based on quantitative analysis in terms of packet transmission ratio over the network under ad hoc routing protocol. The work is about to perform analysis to get better performance in terms of packet delivery ratio and transmission delay at the cost of signalling overhead [8]. In year 2006, Moussa Ayyash presented a work on the performance analysis respective to the network infrastructure. The author has perform analyse on the network based routing protocol optimization under different metrics and the behaviours. The author has proposed a QOS virtual backbone to achieve the robustness for routing and monitoring. The QOS is basically selected based on routing and monitoring. The work also includes the stability and availability analysis respective to the bandwidth analysis [9].In Table 1, comparison of different routing protocols involved in the path optimization is explained:

TABLE I

Protocol	**Technique used**	**Routing overhead**	**Network lifetime**	**End to end delay**	**Packet delivery ratio**
TAODV[41]	Query localization	Less	Increases	Less	Increases
Quantum algorithm[42]	Wave-like properties	Less	Increases	Less	Increases
Genetic algorithm[43]	Memory scheme	Increases under mild conditions	Depends on topology	Less	Depends on topology
Improved ant colony [44]	Ants technique	Less	Increases	Depends on phoremone concentration	Depends on phoremone concentration
SMR[45]	Uses less control packets	Less	Increases	Less	Increase
Asymmetric game matrix algorithm[46]	Topology compression	Increases with long network division	Increases	More with more load	Increase
Improved AODV[47]	Distance and hop count	Less	Increases	Less with less number of hops	Increase
Algorithm for MIMO[48]	Optimizing power	Less	Increases	Less with high mobility of nodes	Increases with mobility
Homogeneous network's algorithm[49]	Residual path lifetime	Less	Increases with path set-size	Increases with path set-size	Decreases with path set-size
Path duration algorithm[50]	Long path duration	More with large path duration	Increases with expected path duration	Decreases with path duration	Increase

III. PROPOSED WORK

This algorithm considers an Ad Hoc network consisting of nodes that are randomly distributed in the network. Each node in the network possesses some energy. The nodes having energy greater then threshold energy $E_{critical}$ are called

active nodes and can take part in transmission while other nodes with energy less than $E_{critical}$ are called idle nodes. $E_{critical}$ is calculated by taking average of the energy of nodes in the network. Various factors have been taken like transmission range of the node, distance between the nods and energy of the nodes in this algorithm.

In the following algorithm, it finds the shortest distance between source and destination in an ad hoc network:

1. Make an adjacency matrix for the nodes in network based on their transmission range i.e.

Aij =1, if node I and j are within transmission range of one another0, otherwise

2. Then make a weight matrix using Aij where weight represents distance between the nodes

wij = wn ,if Aij=1 where wn is distance between nodes

0 , otherwise

3. Using matrix drawn in steps 1 and 2 we will find multiple paths between source and destination. Out of these paths we will select only those paths where energy of each node on the path is equal to or greater than $E_{critical}$ where $E_{criticia}$ is a predetermined energy i.e.

$E_N => E_{critical}$, E_N is energy of each node

4. These paths are stored in cache of each node in network.

5. Apply DIJKSTRA algorithm to find shortest path between source and destination. If all the nodes on this path have energy equal to or greater than $E_{critical}$ than this will be the primary shortest path, otherwise the path with shortest distance found in step 3 will be selected as the primary path

6. In case of any link failure also, select any alternate path found in step 3.

IV. SIMULATION RESULT

In this present work an improvement to the existing route generation algorithm is done under the energy parameter specification. In this work, distance and energy adaptive algorithm is suggested to generate the effective communication route and analyse the work under different parameters. In order to be able to compare the various network topologies and the scenarios some parameters are required to estimate the network cost. The network cost is basically in terms of communication over the network. Here the communication estimation is further divided in few parameters: Number of Packets Transferred, packet loss, data rate and delay rate .In Table 2, simulation scenario is given:

TABLE 2

Parameters	Values
Number of Nodes	20
Protocol	AODV
Simulation Time	150 Sec
Packet Size	512
MAC protocol	802.11

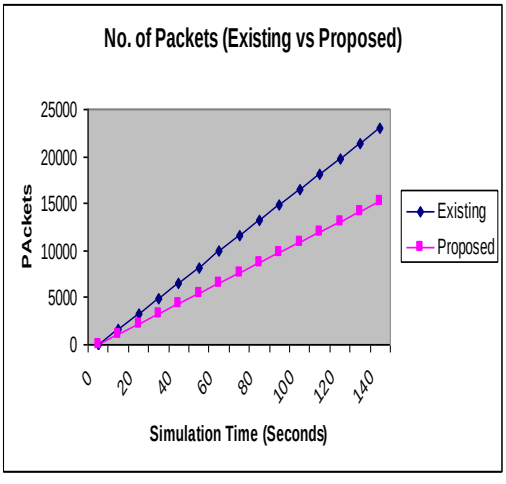

Figure 1 : Packet Transmitted (Existing Vs. Proposed)

The figure 1 is showing the comparison graph to represent the number of packets transmitted over the network in existing and proposed approach. Here XAxis represents the simulation time and the y axis represents the number of packets transmitted over the network. In case of proposed work, the energy adaptive algorithm is implemented to resolve the problem of Wormhole attack. The result shows that the presented work has improved the network throughput.

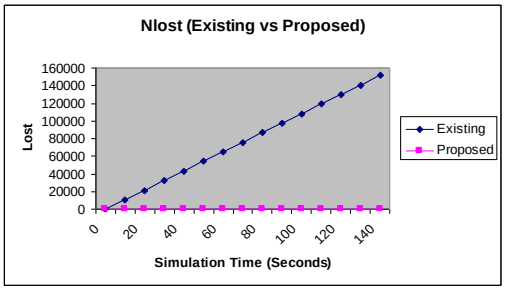

Figure 2 : Packet loss (Existing Vs. Proposed)

The figure 2 is showing the comparison graph to represent the number of packets lost over the network. Here XAxis represents the simulation time and the y axis represents the number of packets lost in the network. In case of proposed network, the energy adaptive is implemented. The results shows that the presented work gives the packet lost initially, but as the algorithmic approach is implemented and the route reconfiguration is done, after that no more data lost is there.

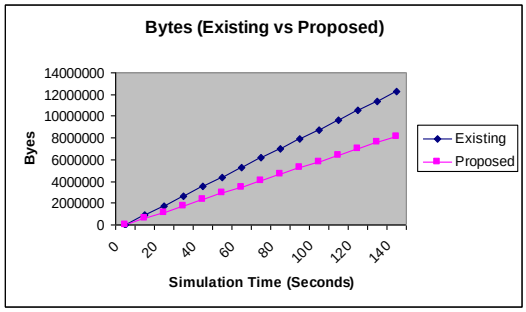

Figure 3 : Bytes Transmitted (Existing Vs. Proposed)

The figure3 is showing the comparison graph to represent the number of bytes transmitted over the network. Here X Axis represents the simulation time and the y axis represents the number of bytes transmitted over the network. The results show that the presented work has improved the network throughput.

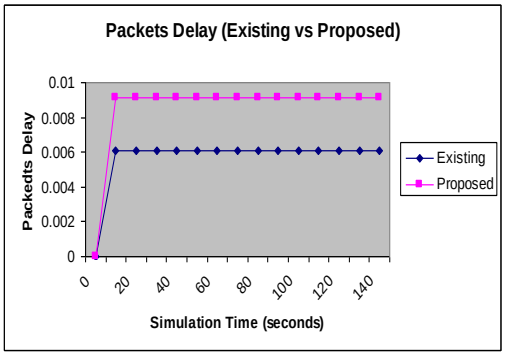

Figure 4: Packet Delay (Existing Approach)

The figure 4 is showing the comparison graph to represent the number of packets delay over the network in Existing and Proposed Approach. Here XAxis represents the simulation time and the y axis represents the number of packets delay in the network. The results show that the packet delay in proposed work is reduced.

V. CONCLUSIONS

A mobile network is one of the most busy and required public area networks. In most of the real time scenes are communicated under the mobile network. In this present work, the mobile communication in some such network scenarios is been discussed and simulated. The work is here been performed to improve the exiting DIJKSTRA algorithm with the inclusion of energy constraint. The work is about to generate the energy adaptive communication path so that reliable communication will be drawn over the network. The work is here been implemented in NS2 environment. The analysis of work is done under different parameters such as packet transmission, loss rate, communication rate and communication delay. The results show that the presented work has improved the communication rate and reduce the communication loss over the network.

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