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Reliable LET with Performance Evaluation of Routing Protocols in Mobile Adhoc Networks

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Abstract: Link reliability is a major problem in wireless communication. We have proposed a link expiration time estimation scheme which finds out estimation of LET for the mobile nodes having same distance with the source node in a definite cell and LET is compared for the two scenarios and actual LET is evaluated. Mobile nodes get combined and start forwarding of packets on the communication path. From the two calculated link expiration time least one will be treated as the actual expiration time. QualNet simulator with dimension 1500x1500 is used. Simulation provide transmissions for data packets of sender in reliable manner and increase the efficiency of scenario, such as the delivery ratio, average delay, average jitter, time spent in transmitting and receiving packets and the total number packets received resulting in maximum tendency of ZRP for number of packets received and AODV for various MAC layers parameters.

Keywords: LET (link expiration time); Packet Delivery Ratio; Average Delay and average jitter, QualNet simulator; AODV, MAC and ZRP routing protocols

I. INTRODUCTION

A Mobile Adhoc Network (MANET) [1] is a group of wireless mobile devices that form a pseudo environment network without a centralized architecture backbone or wired infrastructure. Due to nodes being in motion, the network topology of MANETs is dynamic, that make it more difficult to find the paths that message packets use. Packets are passed with the help of a particular node to node path in typical Mobile adhoc network routing techniques, such as Adhoc On-Demand Distance Vector Routing (AODV) [2] and dynamic source routing [3] and many more. For increasing the quality of service of the system, a standard routing mechanism is given to form different links between the sender and receiver nodes.

In multi-hop wireless MANET mobile ad-hoc networks, routing protocols are important because nodes have inadequate power. However, it is also a problem due to two important factors: First, the nodes are mobile; second, the dynamically changing topology. In ad hoc network, need is to organize a better routing mechanism that considers more situations on adhoc network at the same time. A efficient routing protocol increase not only life time between the nodes of the networks but also increase up delivery of data between mobile nodes and consider energy of nodes is limited.

The main problem as compared from the wired networks architecture is high packet loss ratio of the nodes in mobile adhoc networks. Due to the changes movement of the mobile devices in the system these problems mainly arises. Whenever the links gets connected, the routing mechanism tries to cop up the disconnected link between the nodes. Main aim is to again establish the connection by using proper mechanism. Mainly node failure, node congestion, movements and transmission error are problem that causes this packet loss. Source node communicates with destination that changes their topology with time they are unaware of changes in the topology and data will be transmitted though originally created link that is way we cannot guarantee the link reliability of the system.

The flow highlight as attribute in MANET, remote way is unstable. Usually, the way re-setting up methodology is activated when the connection loss is recognized. Clearly, information conveyance is upset amid the time of way re-foundation. Subsequently, the interference in correspondence will be associated with the deferral and jitter of bundles at the receiver hub. Then again, without considering the unwavering quality of the end-to-end way, most directing systems for the most part set up the way with the metric of jump check [4], so the progression of administration can't be adequately ensured. Since the way breakage proportion and QoS debasement can be diminished by picking solid connections, way unwavering quality can be enhanced by using the most dependable way in MANET.

Link reliability [5] is controlled by dependability and accessibility of every connection over a connection. More often than not, the measures of connection lifetime is utilized to portray the unwavering quality of connection, and it can be characterized as the leftover time of a connection before it splits up brought about by the development of the hubs. Knowing these factors, repetitive information bundles can be sent to upgrade the node to node parcel conveyance proportion or change to the reinforcement ways to keep transmitting sensibly. To estimate the connection remaining lifetime turns out to be diligent work on the grounds that hub versatility is eccentric. As per the numerical aftereffects of different research, the evaluated link expiration time may not be sufficiently exact. In this manner, it can't be utilized only as the directing parameter in the course revelation process.

To upgrade the reliability of nodes, we utilize the connection strength mindful versatile multipath steering component to transfer repetitive data in the multiple part of the node-node way. If the number of nodes is sufficiently high, entire hub disconnection ways can be assembled. Then again, just part of the node-node path has multiple sending ways, in this manner way reliability can in any case be improved. Join the node to node delay and the evaluated link expiration time and more dependable ways can be chosen as the valid way, accordingly the rerouting period can be diminished, and the Quality of Service [6] is ensured. By transmitting the packets among various nodes and checking the reliability of communicating links we will ensure the perfect routing mechanism for sending. Finding the expiration time and taking the least one as the actual expiration we are providing minimum delay for the transmission and the simulator.

Qualnet is a network simulator that is commercial and which was developed by Scalable Network Technologies as the successor of GloMoSim. It is widely used and easily available for operating systems all around (MS Windows, UNIX, Linux, Mac OS X, and Sun Solaris etc) and also compatible with environments like parallel computing. It provides us good explained models and can be correlated with user defined modules too. The product Qualnet provides us various graphical tools for designing, running and analyzing various simulation scenarios. It helps in providing simulation for different routing protocols that gives the reliability for the system.

II. LITERATURE REVIEW

MANET routing protocols are of three major types: proactive, reactive and hybrid

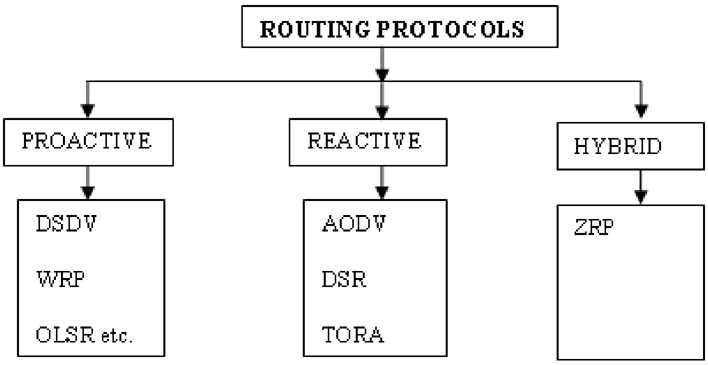

Table Driven Routing Protocol (proactive): This type of protocols is called table driven routing protocols (also called proactive protocols) in which, the information of the path for all the system nodes is stored in routing table of nodes. Packets are transferred over the route that is earlier known in the routing table. Acc to this scheme, packets move forwards in faster form but the main problem is its higher routing overhead because entire system routes are defined before sending the packets. Proactive protocols are of lower suspension because it needs to store the information all the times even when, when it is not in use and it requires more memory. E.g. are DSDV, WRP and Optimized Link State Routing. [7]

On-Demand routing Protocols: This type of routing protocol do not update the routing information with time. Information is exchanged or updated as per the requirement of the path by the source medium. Here routing is made on desired time for example at the point when a node needs to send information to the destination, at that point, it begins a route delivery method for finding the way to the destination by communicating the route demand packet if the route doesn't exist in the source hub table. In this way, there is no need for keeping up route to every single hub in the system constantly. In these conventions when a hub either leaves or enters the system, it doesn't need to make its presence known to different nodes means it can voluntarily comes and leaves the network. Some of the examples of reactive routing protocols are AODV, DSR, TORA.[7]

Hybrid Routing (mixed) Protocols: this type of routing protocol are combination of both type defined earlier types that is table driven as well as On-demand routing protocol and takes benefit of these two protocols that results, faster the routes are managed in the routing zone. E.g. ZRP (Zone Routing Protocol) [7] Out of the available protocols we would take some of them to demonstrate the performance and reliability of links in mobile nodes of MANET. Due to movement of nodes, links are connected or got disconnected. MANETs has the numerous application areas, i.e. in

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military field, natural calamity rescue or disaster operational areas and in conferences as per its requirement. Routing protocols maintains the path, wherever is needed. To get the result, the above routing protocols are compared.

III. PROPOSED SCHEME

The main points of the paper are:

1. An effective link expiration time estimation scheme has been proposed and where the estimation of LET was same for the path with the mobile nodes having same distance with the source node in a definite cell.
2. The relation among the dependability of node to node association and quantity of link is broke down, where most extreme links helps ensure the reliability is limited to two links. The way building method is given to set up many paths as indicated by the present system topology and the evaluated expiration time of link; in this manner the speed of nodes and reliability of the different paths could be ensured in the efficient form.
3. We have used a tool QualNet version 7.3 for reliable packet transmission for analysis and network performance is evaluated based on various protocols.

There are various techniques which are applied to determine the availability of link. In spite of taking the nodes movement, it is supposed that nodes having high signal strength will be having longer life. Actually, link expiration time is calculated by not only the distance between neighboring nodes, but also by the movement of the nodes in relation of each other. The authors in [8, 9] proposed a prediction based path availability estimate mechanism to check link efficiency among the nodes. By using larger number of simulations by a simulator in this proposed scheme a variable is taken to calculate the availability of path which depends on the nodes and the transmission range of the network. In addition, this algorithm required correct set of data provided by GPS also. Apart from this, different mathematical properties have been applied to find the actual LET such as sine formula, cosine formula and various others properties of triangle. For the two different arrangements of triangles all the properties has been applied all over again for different set of variables to take LET and MIN of the two LET is treated as actual LET[10]. In [11], the moving nodes uses strength of signal from the data received to calculate the link disconnection period, and warned the source node by sending a warning message if the link break down. The Source node performed a proactive routing mechanism [12] to avoid disconnection. We have proposed an algorithm using some mathematical work to calculate the link expiration time of a link between two different node, where the basic idea is that estimation of expiration is same for the path with the mobile nodes having same distance with the source node in a definite cell.

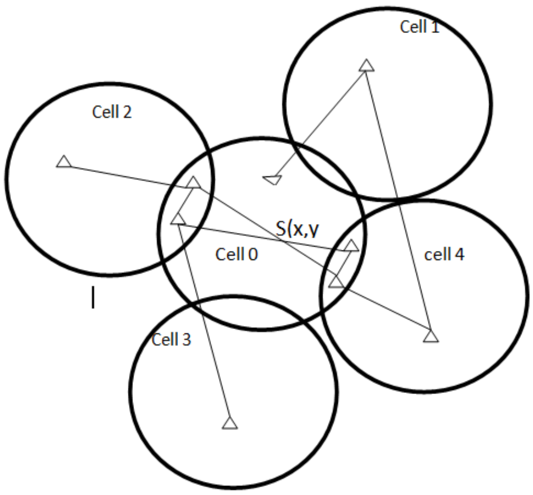

Figure 1

In the above figure, showed 5 cells in which mobile nodes are moving with their own speed and direction. The mobile nodes in cells are communicating in their transmission range. As shown node source node S(x,y) in cell0 communicating with several others nodes of different cells.

Assumptions

1. Cell 0 having Source node was already known and fixed.
2. Nodes in different cells move randomly, According to the random waypoint mobility model.

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3. The starting node S was known already, nodes were connected if found within a transmittable range R. routing deliver mechanism and support was performed without failure and at once. Fixed range R of transmission and relative speed was taken for the scheme.
4. All nodes were of equal performance, capability (range) and reliability.
5. Node failures were independent to each other and were not repaired during the transmission i.e. a node was either completely ok or not ok.

Range of transmission is *R*; S node is the node that aims to calculate the time of link expiration. Initially the node was at point A and moving in left direction say C, D and A till the range finishes. The present position of node is at point D; nodes A and C are the position of the same neighbor node while it sends messages back to node S. it is shown in figure 2 B point is on the position when the neighbor travels from communication network of S node. Clearly, the link expiration time is calculated by the relative speed v and distance L. we need to monitor signal strength of the network arrangement in a dynamic scenario "Hii" messages are transferred after regular intervals. In our scheme which we have proposed, the "Hii" packets of data are used to find the values of signal strength. However, time interval of message sending of "Hii" is unequal.

Taking the triangles SAD and triangle SCD we will compute the various mathematical properties and applying those to find signal strength.

By the property of triangles, sum of angles on a straight line is 180^0
For $a + b = 180^0$…………………… (1)

According to Law of cosines, the cos value of a and b can be obtained as follows: keeping (a) on side and shifting (b) on other and taking cosines on both sides.

cos a = - cos b, we have:

$$\frac{(v*t_2)^2 + d_j^2 - d_k^2}{2d_j * v * t_2} = - \frac{(v*t_1)^2 + d_j^2 - d_i^2}{2d_j * v * t_1}$$

Where the distance between source S and the positions of neighboring A, C, D nodes are d_i , d_j and d_k , as per order, and these could be achieved from the value of strength signal which is received, [9]

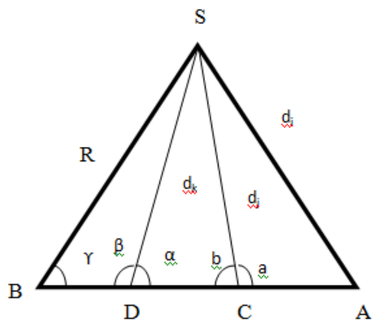

Figure 3

Signal strength V= $\sqrt{\frac{di2*\Delta t1+dk2*\Delta t2-dj2*(\Delta t1+\Delta t2)}{(\Delta t1+\Delta t2)*\Delta t1*\Delta t2}}$

To calculate the link lifetime, the values of received strength of sig.... and proce... computing L

$$\frac{R}{\sin\beta}=\frac{SD}{\sin\gamma}=\frac{L}{\sin\emptyset} \quad \text{………………….(a)}$$

This is calculated by using sine formula.

$$\text{angle}\gamma = \sin^{-1}\frac{SD * \sin\beta}{R}$$

Cross multiplying first two and taking inverse of sine for finding angle γ
Sides of triangle SAD are known, angle $\beta=180^0$ –angle α ,so
on a straight line, sum of all the angles is 180^0.

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$$\text{angle } \alpha = \cos^{-1}\frac{SD2+AD2+SA2}{2*SD*AD} \quad \text{.........................} \text{ (b)}$$

Here we have implemented "Cosine Formula" for the above triangle
For
angle $\emptyset$=angle α-angle γ
And
angle β=180^0-angle α
The expression of angle$\emptyset$ and angle β are not provided because they are easy to be computed;
the expression L can be found out to be

$$L=\frac{R*\sin\emptyset}{\sin\beta}$$

Therefore,the link expiration time can be shown as

$$T_{w1} = \frac{R*\sin\emptyset}{V*\sin\beta} \quad \text{...........................} \quad (2)$$

We would compute the link lifetime for all the respective nodes among these working areas.
Now we would take another lifetime among different combination of nodes to look for the optimal LET that would be the minimum of the above calculated LET's.

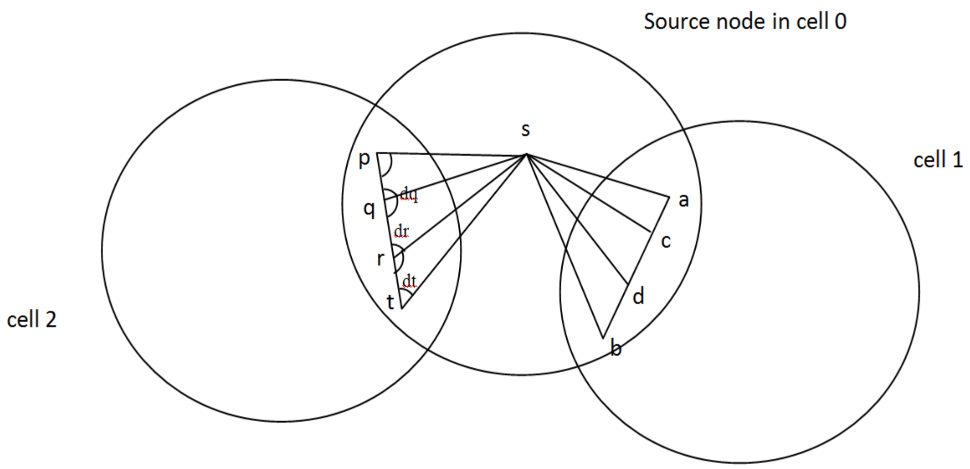

Figure 4

We have taken another triangle SQP for w_2 (second working area) performing the same calculation for this triangle again, we get LET
Repeating the same procedure, sending same hello message to calculate the strength and this signal
Strength given by

$$\text{Strength signal} = \sqrt{\frac{dt2*\Delta t3+dq2*\Delta t4-dr2(\Delta t3+\Delta t4)}{(\Delta t3+\Delta t4)\ \Delta t3\Delta t4}}$$

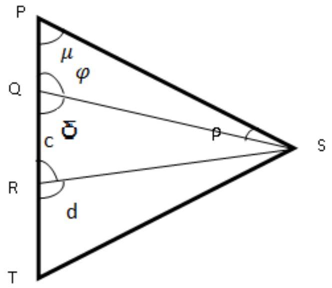

Figure 5

Using sin formula for the triangle SQP

$$\frac{R}{\sin\varphi} = \frac{SQ}{\sin\mu} = \frac{L}{\sin\rho} \quad \text{............................(c)}$$

This is "Sine formula" used for the above triangle SQP. And calculating the value for

$$\mu = \sin^{-1}(\frac{SQ.\sin\varphi}{R})$$

All sides length is supposed to be known and angle ρ = 180^0-angle δ

$$\text{Angle } \delta = \cos^{-1}(\frac{SQ2+QT\ 2-ST\ 2}{2SQ\ QT}) \text{ .... (d)}$$

Here we have again used "Cosine Formula" for the triangle
Angle ρ = angle δ - angle μ
Angle φ=180^0- angle δ
As we know, on a straight line, sum of all the angles is 180^0.
Exp L = $\frac{R\ \sin\rho}{\sin\varphi}$
Link expiration time for the 2nd working cell is found to be

$$Tw_2 = \frac{R\sin\rho}{\sin\varphi} \text{ .... (3)}$$

As the $\theta, \beta, \rho, \varphi$ *are same in their values for their respective triangles i.e why the above calculated values are same*
Now, Of the two calculated link expiration time (2) and (3) we would take the least one and that would be treated as the actual expiration time for the network of the cells.
Comparing the T_{w1} and T_{w2} $=\tau * \min(T_{w1,\, Tw2})$ .... (4) [10]
Evaluating the time .i.e. will be taken as link expiration time.
We introduced an effective link lifetime estimation strategy and showed that the estimation of LET is same for the path with the mobile nodes having same distance with the source node in a definite cell.

Elaborated the proposed approach on five nodes using LET:-
At the point when some data of information is required to be transmitted utilizing a MANET, a piece of certain information is lost because of the handoffs as well as connection breakages.[13] To dodge this loss of information, a safe connection ought to be formed; this connection must ensure the time taken as given at a definite rate of data is transmitted by the network. It would confirm that the block of data that is given, is to be transmitted. The methodology used in this research to represent the time of uninterrupted link is the link expiration time (LET). LET was introduced as an assumed derivation to predict the average distance of the relay node within the scope of the nodes. Let us assume two nodes i.e. *i* and *j* within the range of transmission. Let (p_i, q_i) be the coordinates of *i* node and (p_j, q_j) be the coordinates of *j* node. Let v_i and v_j be their respective speeds, θ_i ($0 \le \theta_i$) and θ_j ($\theta_j \le 2\prod$) be their directions of motion for node *i* and *j* respectively. Then, the expiration of time between two moving nodes will be given as

$$LET = \frac{-(ab+cd)+\sqrt{(a^2+c^2)r^2-(ad-bc)^2}}{a^2+c^2} \quad [8]$$

Let us consider an example for 5 nodes:-
Suppose five nodes with coordinates as follows: node 0 (20, 200), node 1 (200, 200), node 2 (220, 200), and node 3 (400, 200), node 4(600,220). Nodes 0, 1, 3 and 4 travels in same direction at speeds of 15 m/s, 10 m/s, 5 m/s and 10m/s respectively; however, node 2 travels in the opposite direction at 20 m/s. Thus, the nodes at the distant ends (node 0 and 3) are out of range of communication and thus a direct route cannot be formed. Nodes 1 and 2 between them, act as intermediate nodes for communication with nodes 0 and 3. At particular time i.e. 1.0 seconds, node 0 tries to connect to node 3, and sends a RREQ. These RREQs are received by nodes 1 and 2 i.e. intermediate nodes. On receiving the RREQ, nodes 0 and 1 will calculate the respective Link Expiration Time. When 1node receives the RREQ from node 0, it will calculate the LET using equation. The following parameters are calculated:

At simulation time "1.0"
$a = V_{Xr} - V_{Xs} = V_{X1} - V_{X0} = 0 - 0 = 0$,
$b = X_r - X_s = X_1 - X_0 = 200 - 20 = 180$,
$c = V_{Yr} - V_{Ys} = V_{Y1} - V_{Y0} = 20 - 5 = 15$, and
$d = Y_r - Y_s = Y_1 - Y_0 = 0 - 0 = 0$.

The supply LET[14] was then calculated as
LETS(0-1) = $-(0+0)+\sqrt{[(15^2+250^2) -(0-180*15)^2]}/(0^2+15^2)$
= 11.57 seconds.
In the same way, the Link Expiration Time of link 0-2 was calculated to be approximately LET (0-2) = 6 seconds.

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In similar way we have calculated the LET's for all the nodes and after calculating the LET a table was constructed as

Node	Co-ordinates	Speed	direction	LET calculated
0	20, 200	5m/s	same	(0-1) 11.57 sec
1	200, 200	20m/s	Opposite	(1-4) 4.50 sec
2	220, 200	20m/s	same	(0-2) 6 sec
3	400, 200	5m/s	same	(1-3) 7.58 sec
4	600,220	10m/s	same	(2-4) 8.88 sec

Table 1 showing the data for the LET calculated for various nodes. For calculating the LET for node 0 with node 1 we have taken their coordinates, speed and direction using those values we have found LET (0-1) to be 11.57 sec. similarly performing the same calculation for all the nodes we can get all LET.

Simulation and Evaluation of Performance:
All the simulations operations are done using a known network simulator called Qualnet v 7.3. The source and final node used for the transmission of data and receiving are discrete in nature using Random way-point placement model. In addition, the results given below are achieved by taking average of all the nodes. Somewhere in our network scenario we have introduce backward congestion using three Constant Bit Rate (CBR) at different nodes. Traffic created by these CBR sessions has these properties: (a) transmission of packets per second in the network. (b) Each packet is of 512 bytes. In spite of these properties, the network is arranged using different simulation parameters given in table 2.

Relationship between average delay, average jitter and no. of packets received.
Total number of received packet [16]**:-** it is the rate of successful data transmission inside a network. It is termed as the amount of information received by network means how much data is successfully transmitted during the communication. It is also a good metric to compare the utilization of network resources because it provides an insight into the amount of data lost during the simulation.

Average delay (E2E):- node to node delay [17] can be termed as the delay that is taken when packet suffers from the time of leaving the sending application to time of arriving at the receiving application. The average point to point delay is the average of such time delays endured by all information packets received inside the system; dropped packets are not taken into consideration. This method determines that node velocity and also ensures that determining of LET during simulations do not significantly hike up the node-to-node delay of the network system.

Average jitter: A network where no latency is there has no jitter. Term jitter is defined as the average of the deflection from the network mean latency. Basically jitter is the difference in the average delays.

Analysis of link reliability and performance using simulation QUALNET [19] with different protocols:

Simulation Table

PARAMETER	VALUE
Simulation time	30 sec
Number of nodes	Between 10-50
Simulation Area	1500x1500
Placement model	Random way-point; two-way ground model
Propagation model	Two-ray
Number of packets per flow	20
data rate	2mbps
Physical layer	802.11
Routing protocols	AODV, bellman ford, ZRP
Frame size	512 bytes

Table 2
Scenario: for evaluating the performance of the current scenario we would take the routing protocols of all types, one of each type (AODV, bellman ford, ZRP) [20] for the system.

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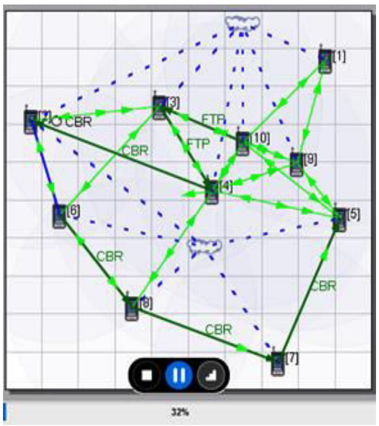
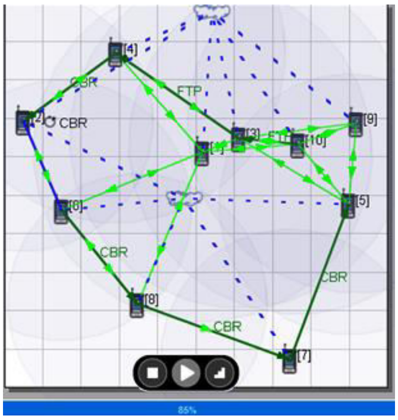
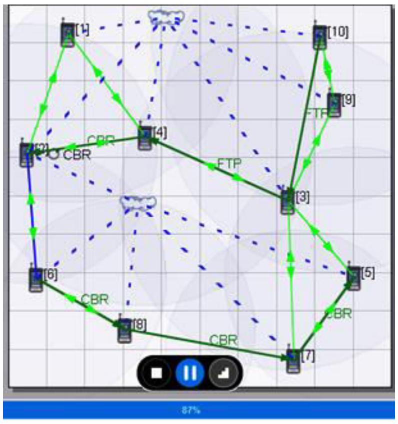


AODV



BELLMAN FORD



ZRP

IV. SIMULATION SCENARIO

Here we have taken a scenario on these three routing protocols AODV, BELLMAN FORD, and ZRP. Simulation ran on the simulator QUALNET as shown in the above figure in their running phase. Basically we have taken 10 nodes and two subnets. Some number of nodes in each subnets and applied some techniques such as they were arranged in random fashion by random way point model and on some nodes we have applied ftp and CBR type transfer of data. Figures that shown above, showing how the data has been transmitted along the nodes. Flow of data was according to rules of scenarios applied in the simulation.

We have analyzed these protocols using QUALNET on different parameters of scenarios present in the system that is layers of OSI like physical layers, MAC layer and network layer. Analysis of the data has been done and data that was obtained by using QUALNET is represented in tabular form that was again used to obtain graphs for their respective protocols and parameters.

Here in these tables and graphs, we have taken 10 number of nodes and hence analyzed on these nodes different parameters of MAC and network layer.
For the MAC

802.11MAC Broadcast packets received clearly :
1) In MAC layer, 2 parameters are used:
a) Broadcast packet received clearly

Here table 3 and figure 6 clearly shows for Broadcast packet received clearly, AODV reflects maximum receiving of packets clearly then ZRP and thereafter bellman ford. At node 4 in subnet 1 shows maximum packets has received clearly and at node 6 in subnet 2 as they are directly connected in our experiment of QUALNET scenario for dimension 1500x1500.

Table 3 showing the values of AODV, BELLMAN ford and ZRP protocols for Mac parameter Broadcast packet received clearly

Value nodes	AODV	Bellman ford	ZRP
1	18	3	51
2	31	8	65
3	45	15	139
4	1388	7	59
5	0	0	0
6	2962	8	65
7	99	1	1
8	31	7	72
9	21	4	49
10	1472	7	57

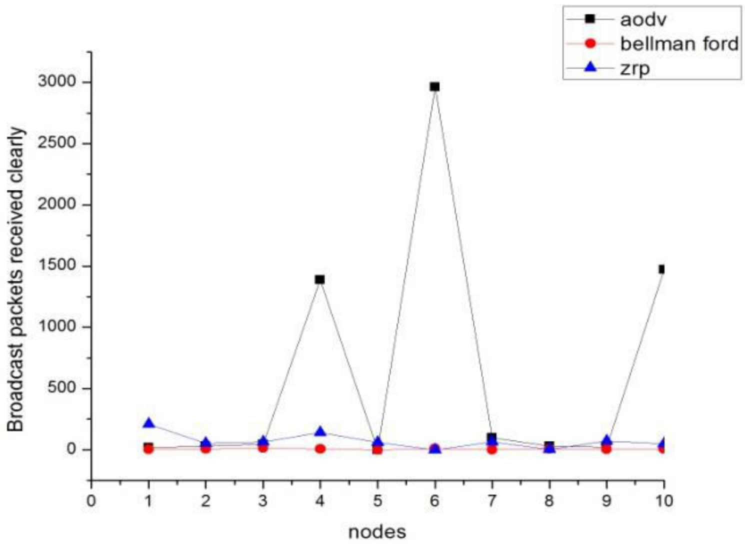


Figure 6 of scenario experiment in QUALNET displaying data packets at different number of nodes for protocol

b) Broadcast packet sent to channel.

Table below shows the number of broadcast packet sent to channel for all nodes in all the three routing protocols.

Value Nodes	AODV	Bellman ford	ZRP
1	177	153	210
2	177	154	212
3	1641	153	204
4	163	155	218
5	178	153	215
6	177	153	213
7	177	152	221
8	3244	154	208
9	177	153	218
10	177	154	215

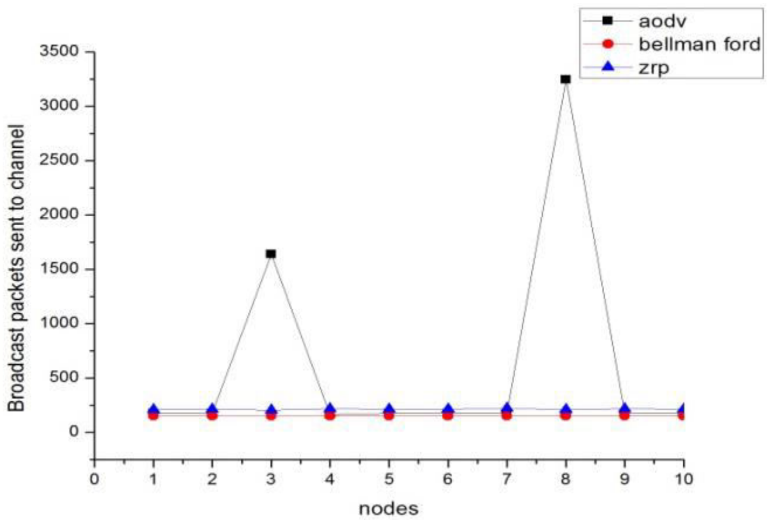


Figure 7 displays the sent packet in QUALNET at different number of nodes for protocols.

Table 4 showing the values of AODV, BELLMAN ford and ZRP protocols for mac parameter Broadcast packet sent to channel. Table shows consistent packet delivery for bellman and ZRP protocols but at 3 and node 8 in both the subnets showing hike just because of applying CBR at these nodes.

1) In networks layer (IPV4)

a) Average delay termed as the delay that is taken when packet suffers from the time of leaving the sending application to time of arriving at the receiving application. The average point to point delay is the average of such time delays endured by all information packets received inside the system; dropped packets are not taken into consideration. This method determines that node velocity and also ensures that determining of LET during simulations do not significantly hike up the node-to-node delay of the network system.

Table 5 showing the values of average delays of AODV, BELLMAN ford and ZRP protocols at all nodes taken in seconds

Value nodes	AODV	Bellman ford	ZRP
1	0.000917664	0.00114994	0.00083374
2	0.00102256	0.00121651	0.00119733
3	0.000933777	0.000976115	0.000996375
4	0.000830909	0.000919004	0.000758899
5	0	0	0
6	0.00110622	0.00110187	0.0010512
7	0.00105873	0.00114341	0.00135141
8	0.000933589	0.00106419	0.000955515
9	0.000946711	0.00122153	0.00091427
10	0.00082918	0.0009191	0.000759046

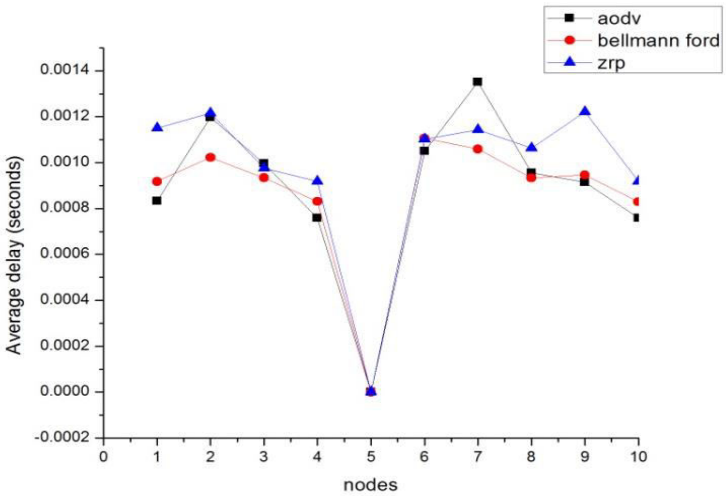


Figure 8 proves that data delay occurred at the connection of both the subnets as both the subnet joins at node 5 causing min average delay at this point means packets rapidly moves to other node without any delay

b) Average jitter

Table 6 shows stats for average jitter. Basically jitter is the difference in the delays at two different nodes.

nodes	AODV	Bellman ford	ZRP
1	0.000297413	0.000145999	0.000255
2	0.000226166	0.00018388	0.000356
3	0.000338935	0.000421177	0.000327
4	0.000215297	0.000356	0.000204
5	0	0	0
6	0.000231801	0.000186057	0.000148
7	0.000276449	0	0
8	0.000346567	0.000113333	0.000296
9	0.000304199	0.000235322	0.000312
10	0.000218058	0.000356	0.000211

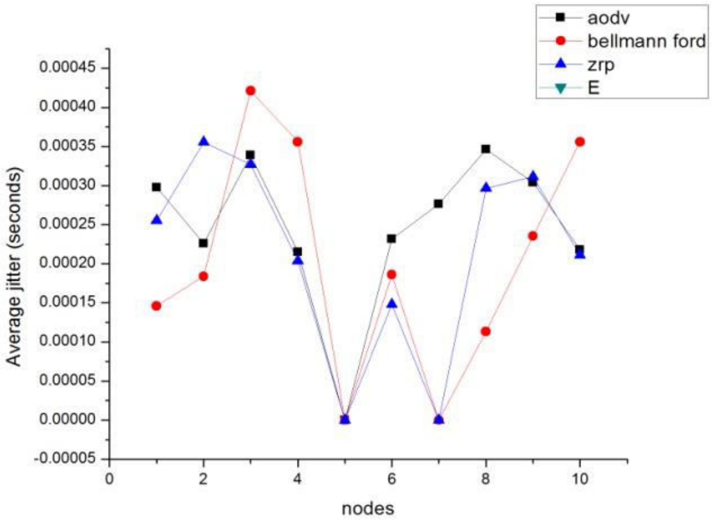


Figure 9 displaying statistics for average jitter at nodes.

c) Number of packets received

Scenario experiment for the networks layer parameter number of data packets received at different nodes proves that ZRP hybrid protocols shows maximum tendency for the receiving packets at node 2. However, AODV and BELLMAN ford shows consistent behavior at all the nodes for this parameter.

Table 7 showing data for protocols at the network layer for number of data packets received

Value nodes	AODV	Bellman ford	ZRP
1	0	2	51
2	10	14	197
3	3	10	139
4	3	4	59
5	24	0	0
6	0	10	131
7	24	0	1
8	24	4	72
9	0	2	49
10	0	4	57

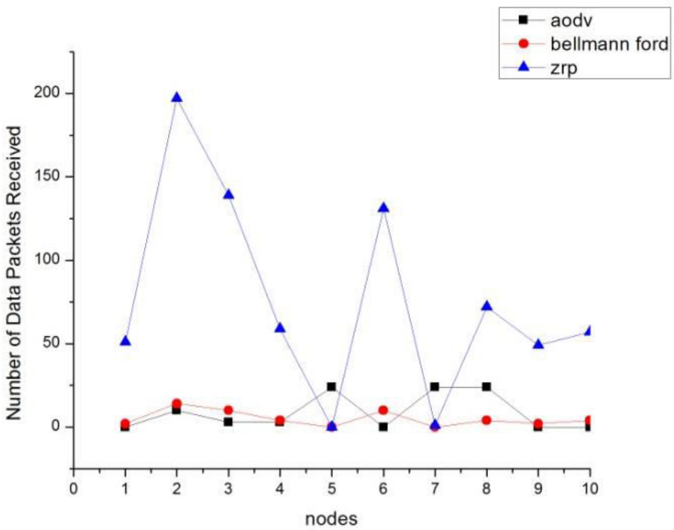


Figure 10 displays the ZRP as maximum values for data receiving for almost all the nodes for both the subnets. At node 5 where the two subnets joins with each other ZRP shows minimum delivery of packets. Similarly goes with node 7. While other two protocols show consistent behavior at all nodes.

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V. CONCLUSION AND THE FUTURE SCOPE

In this research paper, we have proposed a link expiration time calculation scheme for the mobile nodes in the MANET and showed that the estimation of LET is same for the path with the mobile nodes having same distance with the source node in a definite cell. Later on we have analyzed the performance of networks and reliable transmission using QUALNET using scenarios of mobile networks and produced the results for the same in QUALNET for various routing protocols and analyzing for different-different parameters of layers such as average delays, average jitter, number of data packets received for the networks and mac layers etc. For the future work to proceed we are left with various other protocols to check their performance and that for different scenarios in other dimensions. Here we analyzed protocols like AODV suits well for mac layers for broadcast packet sending and receiving clearly and ZRP shows inclination for networks layer parameters such as number of packet received.

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