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Performance Analysis of OLSR in both UDP and TCP environment

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Abstract—In this paper we have discussed about advanced version of Link State Protocol i.e. OLSR (Optimized Link State Protocol. OLSR is a Proactive routing protocol which mainly can be used for dense network because of its nature to reduce the retransmission of packets substantially. Here we have seen how the performance of OLSR protocol varies when number of nodes are changed and how it perform when the speed of nodes changes with change of pause time interval of fixed position. The discussion is based on graph of 2 dimensions in both TCP and UDP environment where the performance metrics are on x-axis, and number of node and node mobility are on y-axis (Abstract)

Keywords—OLSR; TCP; UDP; MPR; PACKET (key words)

I INTRODUCTION

In this communication world, Mobile Ad hoc network has sprung to be one of the most reliable and essential technology. It is a less resource technology where for communication one not to depend on access point. Here each node makes its own communication route to send packet, engulfed with packet header [2].

Lots of routing technology has evolved for Mobile Ad hoc network. But for reliable communication some are not fit enough to cause a good throughput of packet processing for sending it to receiver node. Routing technologies are mainly divided in two categories.

- Proactive routing protocol
- Reactive routing protocol

In Proactive routing, it is mainly table driven, where for communication it access the table, that has build before hand for communication. Through table, sender comes to know about the route to receiver node. With periodic updates of routing overhead the content of the table changes with time and for reliable communication this process should be fast enough [9]. Some of the protocols are DSDV, OLSR, CGSR, FSR etc.

In Reactive routing protocol there is no periodic updates of control overhead. Rather it goes for on demand route discovery whenever it needed. This mainly for scenario where there is constant change of Manet topology in network. So there is no use of maintaining up to date route for packet delivery. Some of the protocols are AODV, DSR, and TORA etc.

II OLSR PROTOCOL

OLSR(Optimized Link State Routing Protocol) is an advanced version of Link State Routing Protocol where every node knows about the topology of the network. Here periodic broadcast of packets take place with retransmission of packets to the same node, and duplicate packets to other nodes which eventually leads to routing overhead. So flooding is must for every node to know about the topology of the network. But for OLSR there is difference with retransmission of packets. In OLSR, MPR (Mulipoint Relays) nodes are selected from one hop neighbor nodes for transmission of packets and broadcasting of routing overhead messages. By this control overhead can be reduced to some extent and retransmission can be halted.

A. Sensing Neighbor

At first to know about the directly connected neighbor HELLO message are broadcasted from its interfaces to its directly connected neighbor and with that it discover about the link i.e bidirectional or Unidirectional with the neighbors. After that it send HELLO message again to its neighbor to share its information of the neighbor to other neighbor and subsequently this neighbor node send information its own neighbor node. This is how update information is spread throughout the network and periodic update keep get spread until the node receives what is has sent. In HELLO messages with the address of the neighbor, link state information of the connection is also broadcasted. Not only that, we got sequence number for every periodic update to choose the recent one and TTL of the packets is also there. HELLO message also helps in selecting the MPR for transmission of packets and in link status MPR nodes are mentioned while sending messages to other nodes [2].

B. MPR(Multipoint Relays) Selection

The MPR selection can be done from one hop neighbor. Here at first those one hop neighbors are chosen which are connected to isolated two hop neighbor. By isolated, we refer those two hop neighbor which are connected to single one hop neighbor then from non isolated nodes, those nodes are chosen which can relay packets to maximum number of two hop neighbor and the process should be done till the whole two hop neighbor get cover. Doing so might sometimes take the whole set of one hop neighbor to be MPR. Update information of MPR takes place by HELLO messages as MPR set of certain will keep on changing with the topology change of the network [3,5].

C. Topology Control Iinformation

TC(Topology Control) messages are usually to provide information to every node about link state for route calculation. Each node of the network maintain a topology table, in which it records the information of topology of the network obtained from TC messages. In TC messages the MPR selector set are also been embedded i.e. nodes which has selected the node to be there MPR with the sequence number associated with the MPR selector set[4]. The interval of transmission of two TC messages depend upon whether MPR selector set is changed or not, since the last TC messages transmitted.

III SIMULATION PLATFORM CREATION AND PERFORMANCE METRICS

For Simulation we have used ns2.35 software with NAM tool on Ubuntu 14.4 and for graph generation Xgraph tool has been used.

In our simulation environment we have taken the application of CBR(Constant Bit Rate) and FTP(File Transfer Protocol) for UDP and TCP, respectively for packet transfer. In our environment at first nodes are placed at some fixed positions then with change of time all the nodes start moving at same direction towards the left down corner of the simulation environment and while doing so these nodes also start sensing neighbor and start sending and receiving packets to each other. Then after reaching left down corner the nodes get randomly distributed to random direction and keep on changing position and direction with respect to time. Throughout this phase these nodes keep on sending and receiving packets for communication until the time of 10.0 min.

In performance evaluation we present the measurement of various parameters by implementing the simulation environment based on complexity of the nodes. As we increase the number of nodes and node mobility for performing the simulation of OLSR protocol, number of sent and delivered packet changes, which in turn changes the throughput and avg. end to end delay, Packet delivery ratio and Routing overhead. The graph's shows, throughput and avg. end to end delay ,Packet delivery ratio and Routing overhead on X-axis and the number of nodes and node mobility on Y-axis.

The goal of our experiments is to examine and quantify the effects of various factors and their interactions on the overall performance of ad hoc networks. Each run of the simulator accepts as input a scenario file that describes the exact motion of each node. The performance metrics helps to characterize the network that is substantially affected by the routing algorithm to achieve the required Quality of Service (QoS). In this work, the following metrics are considered.

The definition of performance metrics are.

- **End-to-End Delay (EED):** It is the time taken for an entire message to completely arrive at the destination from the source. Evaluation of end-to-end delay mostly depends on the following components i.e. propagation time (PT), transmission time (TT), queuing time (QT) and processing delay (PD). Therefore, EED is evaluated as:

  EED = PT + TT + QT + PD.
- **Throughput:** It is the measure of how fast a node can actually sent the data through a network. So throughput is the average rate of successful message delivery over a communication channel.
- **Packet Delivery Ratio:** It is the ratio of packets received to the packets send by the nodes during the complete simulation timeframe, packet size is 512 bytes.
- **Routing Overhead:** It is the variation in control overhead of packets between packets arriving, caused by network congestion, timing drift, or route changes.

IV OLSR SIMULATION BASED ON NODE NUMBER(UDP)

Table 1: Simulation Parameter for OLSR in CBR environment

No of Nodes	**2 to 45**
Rate of Transfer Packet	**1 Mb/sec**
Maximum Packet per Node	**10000**
Interval of Packet transfer	**0.1 sec**
Node Speed	**1000 cm/sec**
Simulation Time	**0.0 to 10.0min**

We performed the simulations over an area of 500 ×400 cm^2 . All the simulations were averaged over 20 runs with each simulation running for 1000 s.

- **Throughput**

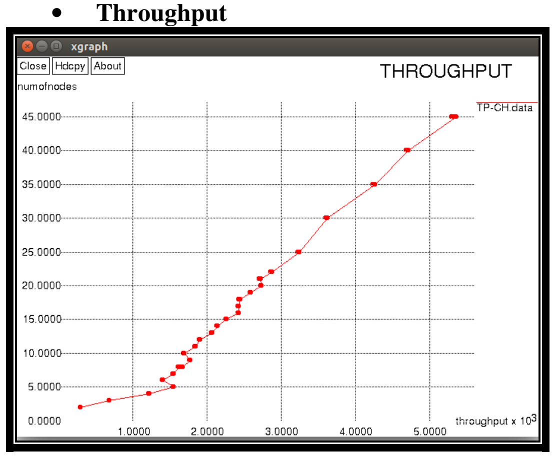

Fig 1: Throuhput vs No. of nodes(UDP)

Here we can see that in OLSR with increase of number of nodes the performance of the throughput increase with CBR(constant bit rate) application . So we can say that even with the overload of table with growing network size the message delivery within less time increases.

- **Packet delivery fraction (PDF)**

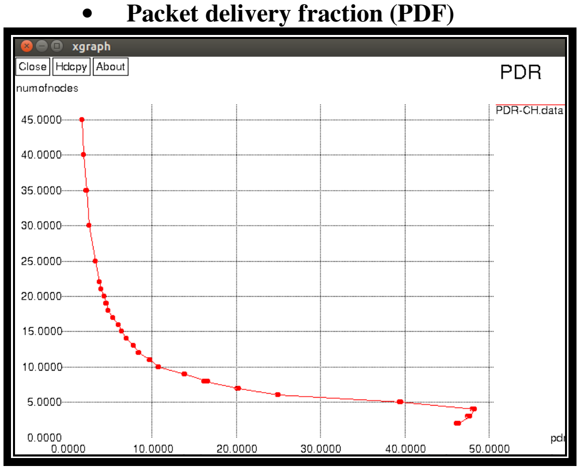

Fig 2: PDR vs No. of nodes(UDP)

In this graph at first there is slight bit of increment with less no of nodes then with growing number of nodes the delivery ratio decreases and eventually it turns to be constant with number of nodes. Here the loss of packet can be predicted for collision, congestion which greatly effect the ratio of delivery . But with MPR selector to some extent the loss of packet is avoided and finally it turns out to be constant.

- **End-to-End delay**

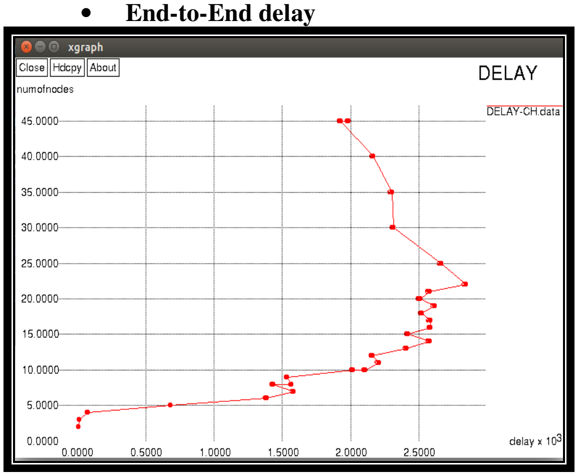

Fig 3: End to End delay vs No. of nodes(UDP)

Here with growing amount of node the average delay increases at first then a changes take place by lowering the delay as the density increases with the number of nodes. As with low number of nodes the MPR formation is really hard timing . So it becomes sames as other table driven routing protocol. But with large number we can see the delay of packet is improved

- **Routing Overhead**

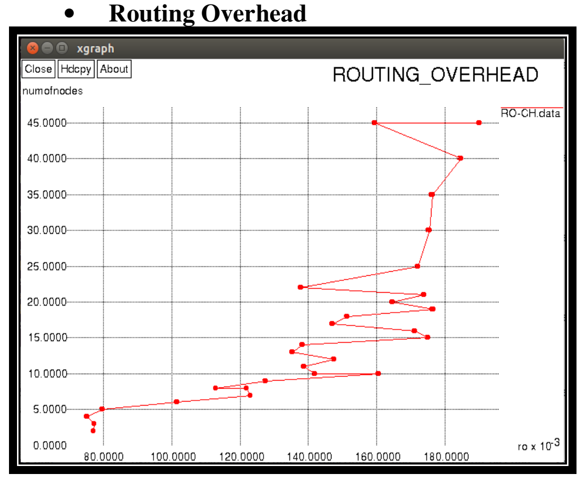

Fig 4: Routing overhead vs No. of nodes(UDP)

Here with the increase of number of nodes the overhead of routing information follows a zigzag path as MPR selector helps in reducing control overhead of each node .but with the mobility of every node the MPR could not help as the loss of node from the range is quite often . Which ultimately lead to big overhead of routing for every node.

V OLSR SIMULATION BASED ON NODE NUMBER(TCP)

Table 2: Simulation Parameter for OLSR in FTP environment

No of nodes	**2 to 45**
Rate of Transfer Packet	**1 Mb/sec**
Maximum Packet per Node	**10000**
Interval of Packet transfer	**0.1 sec**
Node Speed	**1000 cm/sec**
Simulation Time	**0.0 to 10.0min**

We performed the simulations over an area of 500 ×400 cm^2. All the simulations were averaged over 20 runs with each simulation running for 1000 s.

- **Throughput**

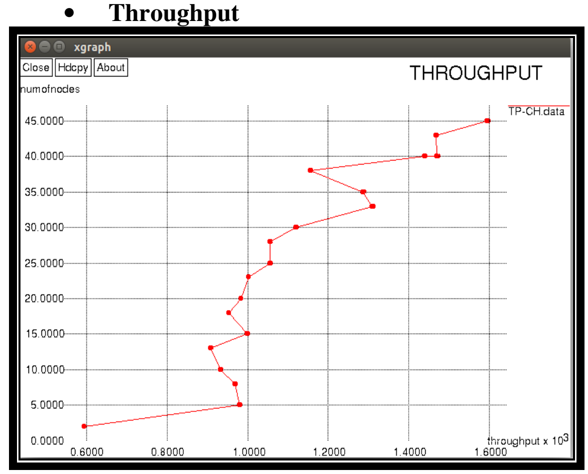

Fig 5: Throuhput vs No of nodes(TCP)

Here we can see that in OLSR with increase of number of nodes the overall performance is good. But for TCP acknowledge message the MPR selection is quite slow as in addition of UDP hello messages. Which leads the lag in performance of packet within short duration of time.

- **Packet delivery fraction (PDF)**

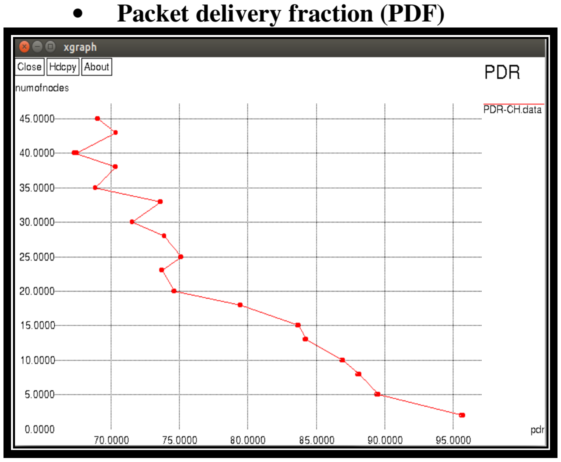

Fig 6: PDR vs No. of nodes(TCP)

In this with less no of nodes then with growing number of nodes the delivery ratio decreases and eventually it turns to be constant with huge number of nodes. Here the loss of packet can be predicted for collision, congestion which greatly effect the ratio of delivery. But with MPR selector and the density of nodes to some extent the loss of packet .

- **End-to-End delay**

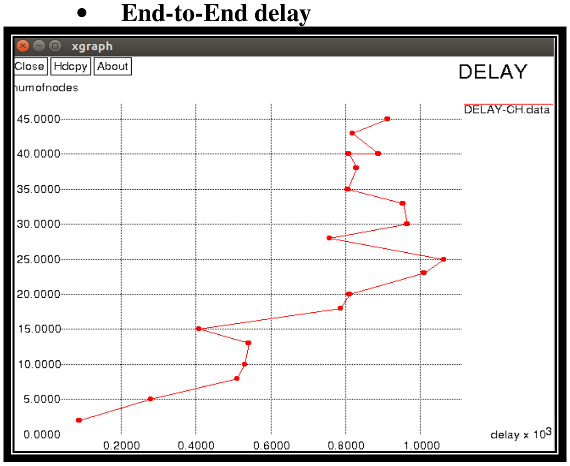

Fig 7: End to End delay vs No. of nodes(TCP)

Here with growing amount of node the average delay increases at first then a changes take place by lowering the delay as the density increases with the number of nodes. Here with low number of nodes the MPR formation is really hard timing. So it becomes same as other table driven routing protocol. But with large number we can see the delay of packet is improved.

- **Routing Overhead**

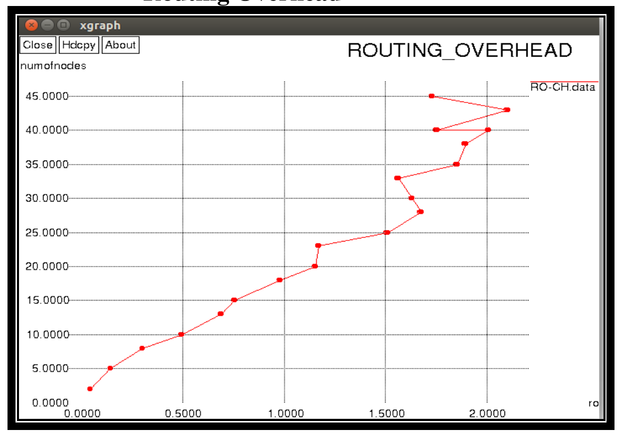

Fig 8: Routing overhead vs No. of nodes(TCP)

Here with the increase of number of nodes the overhead of routing information follows a zigzag path as MPR selector helps in reducing control overhead of each node .but with the mobility of every node the MPR could not help as the loss of node from the range is quite often . Which ultimately lead to big overhead of routing for every node.

VI OLSR SIMULATION BASED ON NODE MOBILITY(UDP)

Table 3: Simulation Parameter for OLSR in CBR environment

No of nodes	**10**
Rate of Transfer Packet	1 Mb/sec
Maximum Packet per Node	10000
Interval of Packet transfer	0.1 sec
Node Speed	200 to 10000 cm/sec
Simulation Time	0.0 to 10.0min

We performed the simulations over an area of 500 ×400 cm^2. All the simulations were averaged over 20 runs with each simulation running for 1000 s.

- **Throughput**

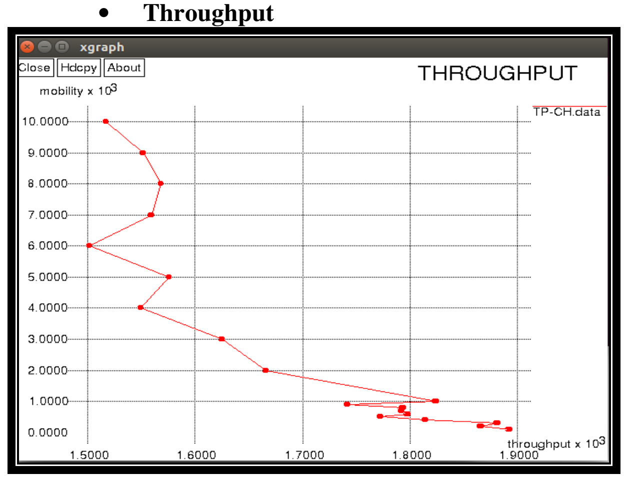

Fig 9: Throughput vs Speed of Node(UDP)

With the increase of speed of node the throughput decreases as the sufficient time is not engulfed for traveling of message from one node to another .Also with the speed of node mobility some pause time increases at the higher level so with that throughput decreases further. But for MPR selectors to some extent we can see increase of throughput at some points. As with pause time MPR get the convenient time.

- **Packet delivery ratio (PDR)**

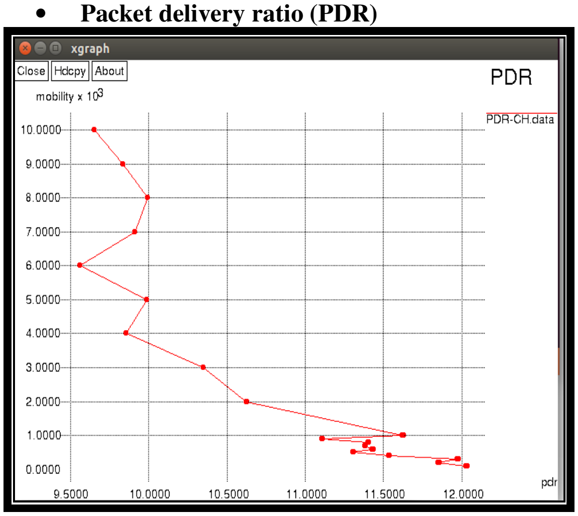

Fig 10: PDR vs Speed of node(UDP)

Here likewise throughput , the packet delivery also decrease the reason is same, as not sufficient enough time used by the nodes. With that collision effect get increased.

- **End-to-End Delay**

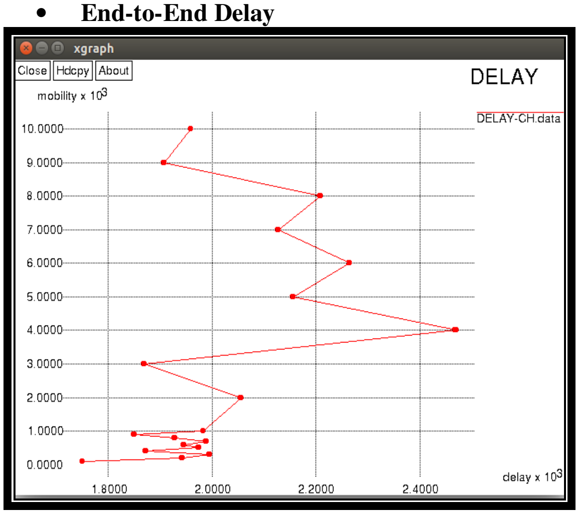

Fig 11: End to end DELAY vs Speed of nodes(UDP)

Here the Zigzag path is quite frequent with increase of speed as it tend to break the linkage quite often and also with load of routing the overall performance is delayed further . But during the pause time due to MPR selector delay is overcome at some points.

- **Routing Overhead**

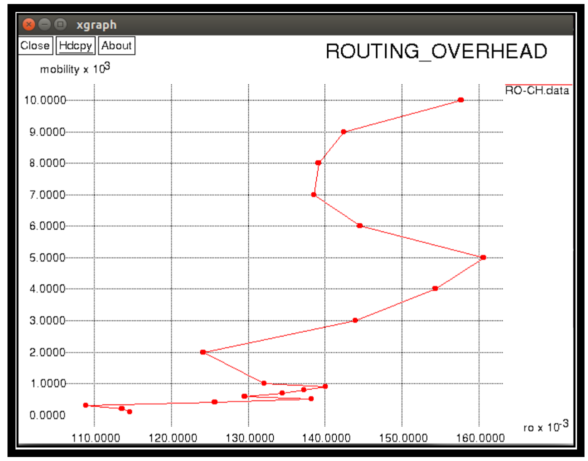

Fig 12: Routing overhead vs Speed of nodes(UDP)

Here with the increase of speed of nodes the overhead of routing information increases but with slight change of curve. As here the pause time increases the routing overhead to some extend can be lowered with MPR selector broadcasting method.

VII OLSR SIMULATION BASED ON NODE MOBILITY(TCP)

Table 4: Simulation Parameter for OLSR in FTP environment

No of nodes	**10**
Rate of Transfer Packet	1 Mb/sec
Maximum Packet per Node	10000
Interval of Packet transfer	0.1 sec
Node Speed	200 to 10000 cm/sec
Simulation Time	0.0 to 10.0min

We performed the simulations over an area of 500 ×400 cm^2 . All the simulations were averaged over 20 runs with each simulation running for 1000 s.

- **Throughput**

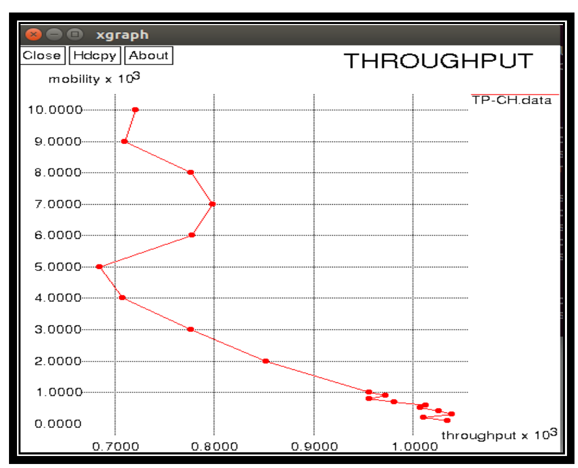

Fig 13: Throughput vs Speed of nodes(TCP)

With the increase of speed of node the throughput decreases as the sufficient time is not engulfed for traveling of message from one node to another .Also with the speed of node mobility some pause time increases at the higher level so with that throughput at some point increases .

In compare to UDP it is more curve towards as the pause for TCP effect the packet delivery as with acknowledge there throughput get extent to some point but with the delay it transform back to lower value of packet delivery with respect to time.

- **Packet delivery Ratio (PDR)**

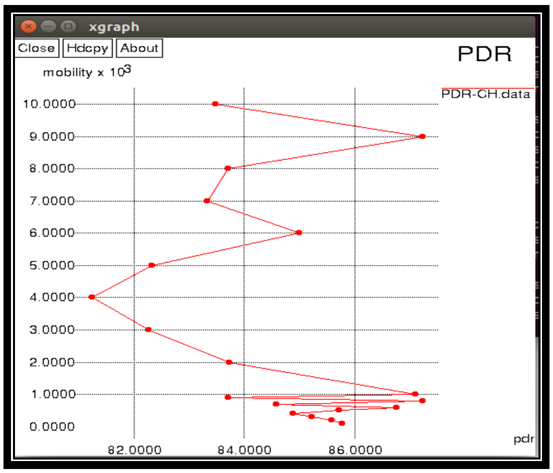

Fig 14: PDR vs Speed of node(TCP)

Here we see a zigzag path for packet delivery ratio. The reason is the randomness of packet delivery as with speed of node its quite uncertain in case of TCP to follow certain path. Here the messages are enclosed in queue in high order which get delivered but in late order also linkage break down between nodes cause the effects. So a zigzag curve is caused with the pause time and moving time of nodes where delivery mostly took place during pause time at the upper end follow which there is no delivery due to sudden movement of nodes.

- **End-to-End delay**

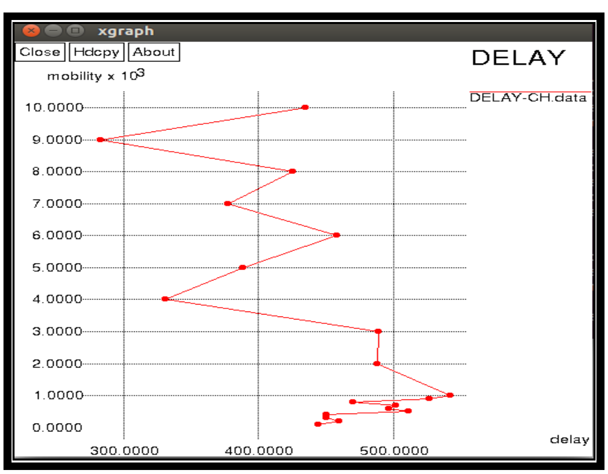

Fig 15: End to end DELAY vs Speed of nodes(TCP)

Here the Zigzag path is quite frequent with increase of speed as it tends to break the linkage quite often.

But the overall performance don't seem to be tend towards higher delay like in UDP as with the speed of nodes the pause time also increases and also with the loss of packet for delivery takes place. So this the pause time on which the most of the delivery takes place for TCP .

- **Routing Overhead**

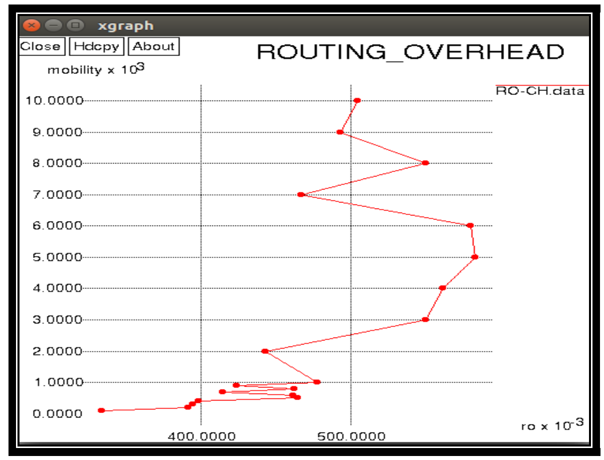

Fig 16: Routing overhead vs Speed of nodes(TCP)

Here with the increase of speed of nodes the overhead of routing information not increases linearly here the constant upward growth can be seen as with pause time increases the MPR formation and also reduced control packet exchange takes place.

VIII CONCLUSION

In both, number of nodes, and node mobility environment we have seen that how throughput changes in reliable environment of TCP which is much better in compare to UDP environment. Also the PDR is much better in TCP environment. But delay, hamper the TCP environment in compare to UDP.

As per the literature, the concept of MPR Nodes in the OLSR protocol was introduced in order to reduce the routing overheads of proactive protocols. Theoretically, this concept is alright but, experimentally it did not perform well. One of the reasons for consistently higher control overheads in OLSR protocol is, comparatively small control message transmission interval (by default) i.e. control messages are transmitted more frequently in OLSR protocol.

References

[1]. Boppana Rajendra V. Marrina Mahesh K.,P Jacquet, Styadeva P.: An Analysis of Routing Techniques for Mobile and Ad Hoc Networks, 1999. <http://www.cs.utsa.edu/faculty/boppana/papers/ Hip c99-preprint.pdf>[2P.Jacquet, Broch Joch, Maltz David A., etc.: A performance Comparison of Multi-Hop Wireless Ad Hoc Network Routing

Protocols, Fouth Annual ACM/IEEE International Conference on Mobile Computing and Networking, 1998. http://www.cs.pdx.edu/~singh/courses/ass1pap.pdf

[2]. Rahman M. and Muktadir A. Al, ―The impact of data send rate, node velocity and transmission range on QoS parameters of OLSR and DYMO MANET routing protocols‖, In proceedings of IEEE 10th international Conference on Computer and Information Technology, ICCIT, Dec. 2007. pp. 1–6.

[3]. Chen Tsu-Wei and Gerla Mario: Global State Routing: A New Routing Scheme for Ad Hoc Wireless Networks. http://www1.ics.uci.edu/~atm/adhoc/paper-collection/gerla-gsr-icc98.pdf

[4]. E.Mahadipour, Francisco J. Ros, ―um-olsr-1.0.tgz‖, University of Murcia, Spain, available online at http://masimum.inf.um.es/ fjrm/development/um-olsr/ and http://sourceforge.net/ projects/um-olsr/, 2006. Accessed in Jan. 2015.

[5]. Zhen Yihui ,Chen T.-W., Tsai J. T. and Gerla M.: QoS Routing Performance in Multihop, Multimedia, Wireless Networks, 1997. http://www1.ics.uci.edu/~atm/adhoc/paper-collection/gerla-qos-routing-icupc97.pdf

[6]. Deepali Arora, Huhtonen Aleksandr, ―Comparing AODV and OLSR Routing Protocols‖, Telecommunication Software and Multimedia Laboratory. HUT T-110.551 Seminar on Internetworking, Sjokulla, available online at www.tml.tkk.fi/ Studies/T- 110.551/2004/ papers/ Huhtonen.pdf, 2004, pp. 1-9.

[7]. Mohapatra S. and Kanungo P., ―Performance Analysis of AODV, DSR, OLSR and DSDV Routing Protocols using NS2 Simulator‖, International Conference on Communication Technology and System Design, available online at www.sciencedirect.com, www.elsevier.com/locate/procedia, Procedia Engineering, 2012, pp.69-76

[8]. L.Sakeer, Kumawat Ramprasad and Somani Vinay, ―Comparative Analysis of DSDV and OLSR Routing Protocols in MANET at Different Traffic Load‖, In proceedings published by International Journal of Computer Applications-International Conference on Computer Communication and Networks (CSI-COMNET), 2011, pp. 34-39.

[9]. Utpal Barman et al.,Performance Analysis of DSDV, in IJARCCE vol 5, Issue 1, January 2016

[10]. Ritika Kachal et al. "Comparative Study and Analysis of DSR, DSDVAND ZRP in Mobile Ad-Hoc Networks" in IJCSEonline vol 2. Issu 5 and E-ISSN: 2347-2693

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