iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 10 **Issue:** X **Month of publication:** October 2022

DOI: https://doi.org/10.22214/ijraset.2022.47192

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue X Oct 2022- Available at www.ijraset.com

Markovian Implementation Methods using Mobile Ad hoc Networks

Servesh Gupta[1], Pratik Tawde[2]
[1, 2]Department of Electronics & Telecommunication Engg, Vidyalankar Polytechnic, Mumbai, India

Abstract: In this proposed emerging paper approach that indicated storage buffer and security for mobile ad hoc network using via improved delay analysis. Optimal route allocation is first made by applying dynamic routing protocol. This is to reduce the communication bandwidth cost between the unbreakable optimal paths. Finally, security between the nodes is ensured through MUHC method. An extensive simulation is conducted to illustrate the efficiency of our delay analysis as well as the impacts of network parameters PDR, Delay RO and size of the sending packet.
Keywords: MANET, Routing, Protocol, QoS, Delay, Markovian Queuing.

I. INTRODUCTION

End-to-End Delay method in Buffer-limited (E2ED-B) MANETs indicated two-hop communication paths delay analysis. The E2ED-B framework combined the theories of fixed-point (FP), quasi-birth-and-death process, and embedded Markov chain. To the occupancy states of relay buffer, the Markov chain theory was then applied to categorize packet delivery process. However, the end-to-end delay method in buffer limited constraints with 2HR (E2ED-B) did not take into consideration the security aspects and the constraint on buffer space was not addressed. The paper is developed as follows. In the next section (Section 2), we discuss some related work in delay analysis in MANET.

In this paper, we propose an effective End-to-End delay method detector based on the combination of cooperative network and dynamic routing protocol. We provide an Optimal Route Allocation framework to select the best combination. The MQORA method provides a way for safe and secure transmission of data packets between mobile nodes in MANET.

A. ORAMHR Method

In the proposed MQ-ORA and MHR scheme is introduced to provide better connection between mobile nodes in network mathematically denoted as given below.

$$R = (t, RN_i) \qquad \textbf{(1)}$$

$$RP_j \rightarrow \sum_{i,j=1}^{n} S_i SN \qquad \textbf{(2)}$$

where source node possess several pivotal points 'P_k', each point for different session. It is mathematically formulated as given below.

$$s \rightarrow \sum_{k=1}^{n} P_k \qquad \textbf{(3)}$$

Developed work minimizes the total packet relaying delay using Integer programming method. Let us consider a time-slot and relay node of a route. Let 'T_max' and 'RN_max' denote maximum time-slot.

$$x\,(p,t) = \begin{cases} 1, if\ p\ \in V\ is\ assigned\ a\ time\ slot\ t \\ 0, otherwise \end{cases} \qquad \textbf{(4)}$$

$$y\,(q,RN) = \begin{cases} 1, if\ p\ \in V\ is\ assigned\ a\ relay\ node\ RN \\ 0, otherwise \end{cases} \qquad \textbf{(5)}$$

Optimum Route Allocation using Integer Programming, called, Integer Programming-based Optimum Route Allocation algorithm is provided below.

Input: Source Node 'SN', Session 'S_i', maximum time-slot 'T_max', maximum number of relay nodes 'RN_max'
Output: Optimized route allocated
1. Begin 2. For each Source Node 'SN' 3. Measure relay path using eq. (2) 4. Obtain pivotal point using eq. (3) 5. Measure the route using eq. (4) and eq. (5) 6. End for 7. End

Algorithm 1 – Integer Programming-based Optimum Route Allocation algorithm

Markovian Queuing method, the service providers in the proposed framework adopt FIFO where the mobile node in MANET is serviced in order of arrival.

$$if\ mn\ in\ service\ cell\ ahead = empty \quad (6)$$
$$if\ mn\ is\ waiting\ cell\ ahead = occupied \quad (7)$$

From (6) and (7), the service providers see to that if the mobile node 'mn' is in service or waiting. This is because only two configurations are said to be possible. They are either '$empty$' or '$occupied$'.

B. Secured Multiple Unique Hash Chain method

An objective of using the Diffie-Hellman-Hash algorithm in the proposed framework is that it possesses a method of securely exchanging cryptographic keys over a public channel, using multiplicative group of integers 'p' and 'q' respectively.

$$q = primitive\ root\ (p) \quad (8)$$

The pseudo code representation of Diffie- Hellman-Hash algorithm for providing security is provided below.

Input: Source Node 'SN', Session 'S_i', maximum time-slot 'T_max', multiplicative group of integers 'p', 'q'
Output: Secured data packet transmission
1. Begin 2. For each Source Node 'SN' with Session 'S_i' 3. Obtain the value of 'p' 4. Evaluate the value of 'q' using eqn (8) 5. End for 6. End

Algorithm 2 – Diffie- Hellman-Hash algorithm

The above algorithm using Division Remainder method enhances the security for the data packets being delivered and therefore reducing the delay in packet transmission between mobile nodes.

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 10 Issue X Oct 2022- Available at www.ijraset.com

II. PERFORMANCE EVALUATION

This section evaluates the proposed multi hop routing scheme by simulation results by adopting NS2 simulator. Study presents the performance of Markovian Queuing-based Optimum Route Allocation (MQ-ORA) method and compares with its traditional End-to-End Delay in Buffer Limited [E2ED-BL] method. To evaluate the performance of MQ-ORA method, we consider a network consisting of 70 nodes within the 1000 * 1000 rectangular area and uses Random Waypoint Method as the mobile method. The source destination combination for MQ-ORA method is spread in the network in random form where the data packet generating rate is set as 10, 20, 30,…, 70 packets / second.

III. DISCUSSION

In this section the result analysis of MQ-ORA method is made and compared with the existing method, End-to-End Delay in Buffer Limited [E2ED-BL] [1] in MANET. In this section the scenario with 70 mobile nodes within the defined area and the number of data packet size in the range of 100KB and 700KB is considered. Each mobile node moves with the velocity of 0 – 15 m/s and the simulation method were executed 7 times. To evaluate the efficiency of MQ-ORA method, the following metrics like end-to-end delay, packet delivery ratio, storage buffer in MANET is measured.

$$E2E_{delay} = \sum_{i=1}^{n} Time\ (DP_i)_{SN \to DN} \quad (9)$$

From (9), end-to-end delay is measured using the data packet size 'DP', with source node and destination node denoted by 'SN' and 'DN' respectively. Figure 3 shows the end-to-end delay comparison of the proposed MQ-ORA method with the existing E2ED-BL [1] method. To conduct experiments and analyze end-to-end delay, a network scenario with data packet size in the range of 100KB to 700KB is considered. The resulting graph is plotted in figure1. Its performance increases with the increase in the number of data packets, though linearity is not said to be observed due to the topological changes. In figure 3 we can see that the Integer Programming-based Optimum Route Allocation algorithm deployed in MQ-ORA method performs better in terms of end-to-end delay compared to the other conventional method [1]. Table -1 shows the tabulation for end-to-end delay measured in terms of milliseconds.

Table: 1 End-to-End Delay

Data Packet size (KB)	End-to-end delay (ms)	
	MQ-ORA	E2ED-BL
100	35.42	43.52
200	41.32	49.43
300	52.31	60.41
400	68.76	76.86
500	51.90	59.23
600	63.14	71.23
700	71.85	95.32

While E2ED-BL [Table 1] method improved end-to-end delay but at the cost of buffer, whereas by applying the Integer Programming-based Optimum Route Allocation algorithm not only the data end-to-end delay rate is improved but at the rate of improved buffer. Packet delivery ratio refers to the average rate of successful data packets received at the destination over a communication channel. It is measured in terms of packets/second.

$$PDR = \frac{DP_r}{DP_{gr}} \quad (10)$$

Table 2 Tabulation for Packet Delivery Ratio

Data Packet generating rate	Packet Delivery Ratio (pps)	
	MQ-ORA	E2ED-BL
10	8	6
20	15	12
30	25	19
40	35	31
50	43	39
60	56	51
70	65	60

To depict this issue, packet delivery ratio for rendering quality of service is measured. It is the ratio of data packets received to the data packet generating rate. Table 2 shows the quantitative results to compare the packet delivery ratio performance of the two methods. To investigate the impact of packet delivery ratio utilization, we ran a simulation varying the data packet generating rate in the network. Specifically we fix the maximum speed of mobile node to 40 m/s and vary the number of mobile nodes from 10 to 70. Table 2 shows that the packet delivery ratio with varying mobile nodes increases as the number of mobile nodes increases by applying all the methods.

Storage buffer refers to the number of temporary storage of data packets of other nodes, i.e., waiting to be sent to a device or node. It is measured in terms of kilobits per second (Kbps). Table 3 illustrates the storage buffer rate for storage of other node's packets versus data packet generating rate. As shown in the figure, the storage buffer is proportional to the data packet generating rate. As the data packet generating rate increase and the data packet size also increases, the MR-ORA method occupies higher storage buffer compared to E2ED-BL.

Table 3 Tabulation for storage buffer

Data Packet generating rate	Storage Buffer (Kbps)	
	MQ-ORA	E2ED-BL
10	50	42
20	65	57
30	72	64
40	75	67
50	82	74
60	73	65
70	80	72

Table 3 illustrates the storage buffer comparison. From the graph and results, we observed that as the data packet generating rate increases though storage buffer increases, comparatively the performance of MQ-ORA method is better than that of E2ED-BL by 13%. As a result, storage buffer is said to be ensured and therefore transmit the total packets to the destination in an efficient manner.

IV. CONCLUSION

This paper represents a significant step towards the end-to-end delay modeling in MANETs. With the help of the theories of Optimum Route Allocation-based Multi Hop Routing, Markovian Queuing and Secured Multiple Unique Hash Chain method, a novel theoretical framework has been developed to efficiently depict the highly dynamics in such networks. Also, it is expected the framework can shed light on the E2E delay modeling for multi-hop MANETs. By measuring the optimal routing, we propose a Diffie- Hellman-Hash algorithm based on the cryptographic keys to ensure genuine data packet transmission with the aid of division remainder method. Extensive simulations have been conducted to validate the efficiency and applicability of our framework.

REFERENCES

[1] Jia Liu, Min Sheng, Yang Xu, Jiandong Li, and Xiaohong Jiang, "End-to-End Delay Methoding in Buffer-Limited MANETs: A General Theoretical Framework", IEEE TRANSACTIONS ON WIRELESS COMMUNICATIONS, VOL. 15, NO. 1, 2016.

[2] Fraser Cadger, Kevin Curran, Jose Santos and Sandra Moffett, "Mobility and Delay in Greedy Geographic Routing", International Journal of Service and Computing Oriented Manufacturing.

[3] Prabha R. and Ramaraj N., "An improved multipath MANET routing using link estimation and swarm intelligence", EURASIP Journal on Wireless Communications and Networking, 2015.

[4] C-K Toh, "Adhoc Mobile Wireless Networks", Pearson edition, Vol.3, 2011.

[5] R Ahlswede, et al, "Network information flow", IEEE transactions on information theory, Vol.56, No.12, 2010, pp: 5893-5905

[6] C. E. Perkins, "Ad-hoc networks", Vol.2, No.1, 2010.Ch. Niranjan Kumara, N.Satyanarayanab, "Multipath QoS Routing for Traffic Splitting in MANETs", International Conference on Intelligent Computing, Communication & Convergence, Elsevier, May 2015.

[7] C. S. R. Murthy et al, "Adhoc Wireless Networks Architecture and Protocols", Prentice Hall, Vol.2, 2007.

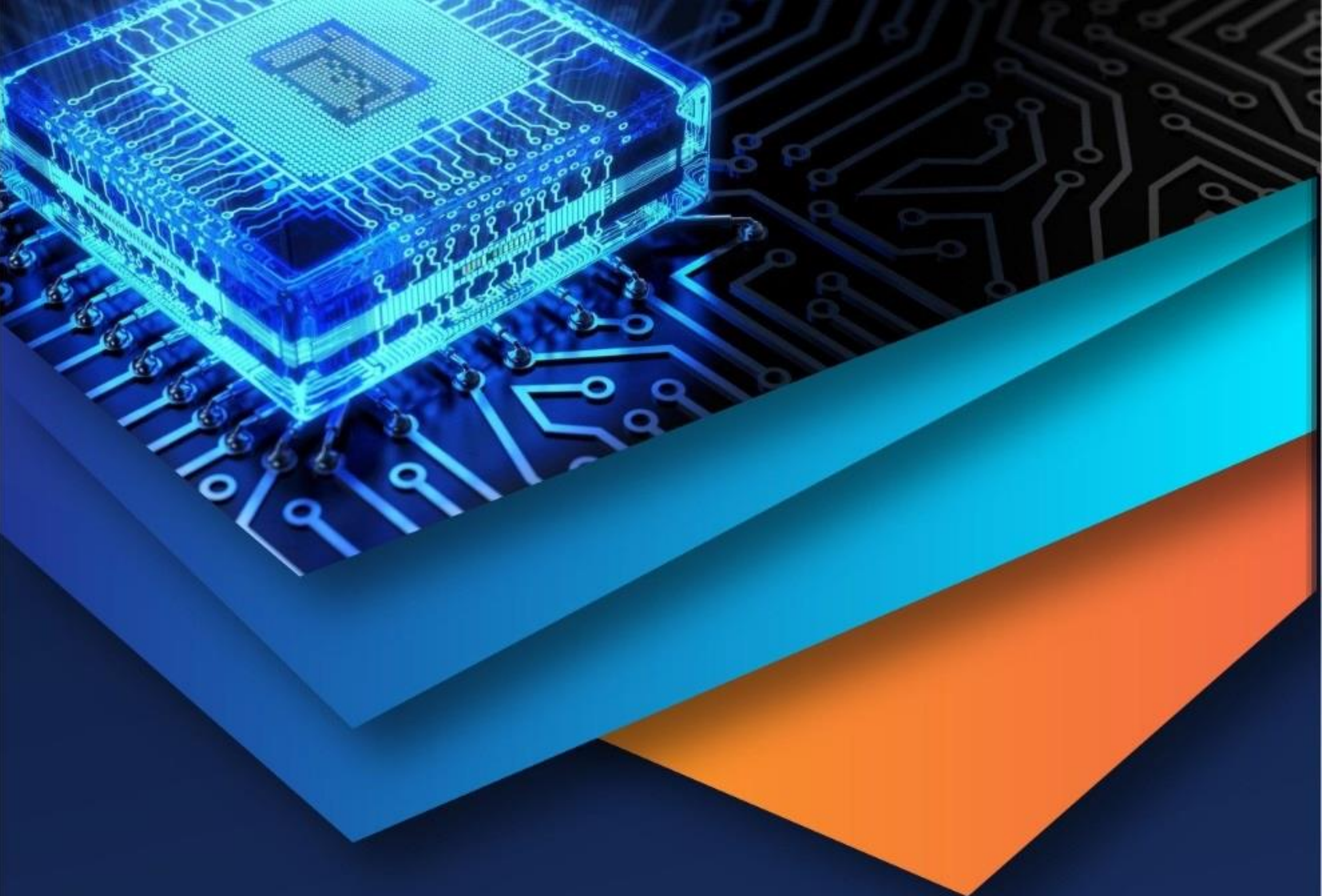
[8] Jyoti Prakash Singh, Paramartha Dutta, Arindrajit Pal, "Delay Prediction in Mobile Ad Hoc Network using Artificial Neural Network, Computer, Communication, Control and Information Technology, Elsevier, 2012.

[9] Seyed Hossein Hosseini Nazhad, Mohammad Shojafar, Shahaboddin Shamshirband, Mauro Conti, "An efficient routing protocol for the QoS support of large scale MANETs", Wiley, 2017.

[10] Imielinski, et al, "Mobile Computing", Springer publications, Vo.76... No.12, 2010, pp: 1281-1293
[11] Basagni.S, et al, "Ad Hoc Networking", IEEE Press Wiley, Vol.6, No.2, 2003, pp: 46-55.
[12] M. Frodigh, et al, "Wireless ad hoc networking: the art of networking without a network" Ericsson Review, Vol .77, No.4, 2000, pp: 248-263.
[13] G.Forman and J.Zahorjan, "Mobile Wireless Computing", IEEE Spectrum, Vol.27, No.4, 1994, pp: 38-47.
[14] Swati, et.al, "A Survey Routing Protocols in MANET" IJCA, Vol.96, No.13, 2014, pp.7-12.
[15] A. Mishra, et al, "Security in Wireless Ad Hoc Networks, in Book The Handbook of Ad Hoc Wireless Networks" (Chapter 30), CRC Press LLC, 2003,

BIOGRAPHY

K. Thamizhmaran received his BE, ME, PG diploma in yoga and MSC in yoga from Annamalai University, Tamilnadu, India in 2008, 2012, 2018 and 2019 respectively. He is currently pursing Ph.D in network security in the Department of Electronics and Communication Engineering, Annamalai University, Annamalai Nagar, Chidambaram, Tamilnadu, India. He is currently working as an Assistant Professor of ECE (from 2008 to till date) in the Department of Electronics and Communication Engineering, Governemt College of Engineering, Bodinayakkanur, Theni, Tamilnadu, India. His research interest includes networks security, ad-hoc networks, mobile communications, and digital signal processing. He has published more than 109 technical papers at various national / international conferences and journals. He is a life member of more professional bodies.



10.22214/IJRASET