A CROSS LAYER APPROACH TO IMPROVE THE PERFORMANCE OF THE NETWORKS

R. Mohan[1] | M. Shivaranjani[2] | K. Manoj[3] | V. Gokul[4] | P. Ajay Kumar[5] | D. Venkatesh[6]
[1](Associate Prof & Head, Dept of ECE, M.P.Nachimuthu M.Jaganathan Engg College, Erode, lakshin2004@gmail.com)
[2](Assistant Professor, Department of ECE, M.P.Nachimuthu M.Jaganathan Engineering College, Erode)
[3 - 6](Final Year, Department of ECE, M.P.Nachimuthu M.Jaganathan Engineering College, Erode)

Abstract— *In today's world, internet plays a vital role due to technology development. As we know, internet follows the TCP/IP stack; in the stack each layer is designed to perform a specified task. In modern days, the number of users for the internet getting increased enormously and the processing speed of the device is getting increased by the routers didn't modified. This may result in the packet drop or the possibility of congestion high. Basic TCP/IP fails to operate wisely in those cases. If there is a feedback mechanism to indicate the status of the intermediate nodes congestion and the packet drop can be avoided. For this Explicit Congestion Notification (ECN) is proposed. The ECN works under the cross layer approach that inter relates the Transport Layer with the Network Layer. In this paper, we are going to propose a new cross layer approach with multi-level marking to know exactly about the status of the intermediate nodes. The proposed algorithm is designed and implemented using Network Simulator (NS2) and the parameters like throughput, goodput, packet drop and the end to end delay of proposed algorithm is compared with the standard protocol which are ISO standard. By the comparison, we understand that the proposed method performs well compared to the ECN.*

1. INTRODUCTION

Internet plays an important role in our life. Internet follows the TCP/IP stack. This is the reference model which comes in practice in order to bring the network in a standard format. The reason for preferring TCP/IP model is because of whatever the device may be, whoever designed and where ever the device located but the device can communicate with one another. TCP/IP model consists of five layers from physical layer to application layer, among those the paper mainly focusing on the network layer and transport layer. Network layer is responsible for the routing and provides the proper path for the transmission of data and the transport layer is responsible for the complete transmission from the end to end source to destination port.

By default, TCP/IP architecture has assigned a standardized method of doing specific task for each layer without any detail interruption or combination with other layers. Since the number of packets to be sent becomes more than the buffer size in the network layer, that leads to the packet loss in the transmission and also the delay of the transmission get increased resulted in reduction in throughput.

To overcome the drawbacks the ECN single level marking is proposed. It is a cross layer approach designed by combining these network and transport layers can provide the buffering as efficient to prevent the data from packet loss by wisely reducing the sending rate by the indication of the intermediate node's buffer capacity. In normal case congestion is noticed by the sender only if it receives the packet drop. But in ECN packet drop is avoided by reducing the sending rate before packet drop occurs. The existing ECN has only the single level marking that is the queue level is 50% and above it will mark the packets. If the queue is filled then it works as a normal queue that it will drop the packet.

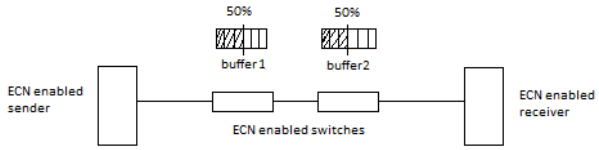
We are going to design a multi level marking. This will gives the exact status about intermediate nodes to the sender, so that the sender can reduce the sending rate based on the actual status not blankly by half.

2. LITERATURE SURVEY

M. A. Alnuem[1] has proposed the design of an error discriminator that can be added to a TCP sender to differentiate between congestion drops and drops because of wireless link failure.

Chong Han[2] has proposed the design cross layer between he physical layer and data link layer through framework.

Shalli Rani[3] has proposed the cross communication technique between the physical layer and the data link layer for IoMT using MATLAB. The insecured nature of communication and the poor management of heterogeneity in network become the major drawback in this proposal



Ridhima Mehta[4] has proposed the method for the cross communication between the data link layer and the network layer. The performance limited only up to the hop to hop communication.

The above shown models are used to enhance the performance of the network but still it cannot achieve the needed performance enhancement because it fails to

identify the exact status of the possibility of the congestion rate increase in the intermediate nodes. In proposed model, by using the multiple level marking is implemented.

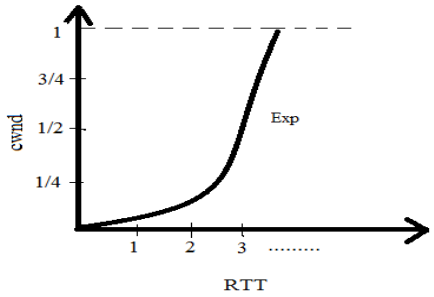
3. EXISTING METHOD

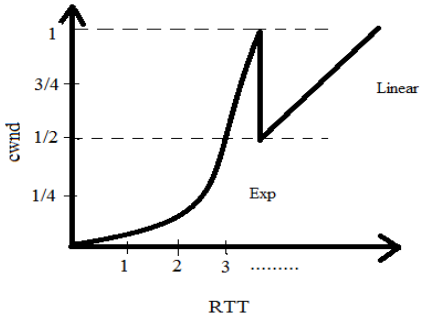
In order to identify the congestion there are two methods are used. The first one is no feedback mechanism. That is the congestion is identified only if there is a packet drop. The sender and the receiver don't know about the status of the intermediate nodes as shown in Fig. 1.

So the sender only knows about the end receiver node values and cannot know anything about the status of intermediate nodes. Each layer in the architecture does only the specific task of the layer which means no cross layering is implemented.

The second method involves of Explicit Congestion Notification as shown in Fig. 2

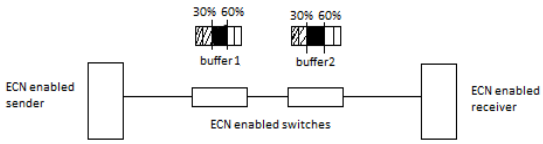
In second method, there is a feedback mechanism. The statuses of the intermediate nodes are indicated to the receiver and also to the sender. While sending data to the receiver, the congestion window increases the sending rate exponentially as shown in Fig. 3. If the intermediate node's buffer size is above its half of its max level, it will start to mark the ecn field in the packet that will reach the receiver. If the receiver receives ecn, it will mark ecn field in the ack for the sender's notification. If the sender receives the ecn, it will reduce the sending rate by the half as shown in Fig. 4, So that the congestion in the intermediate node is controlled. So that we can avoid the packet drop





4. PROPOSED METHOD

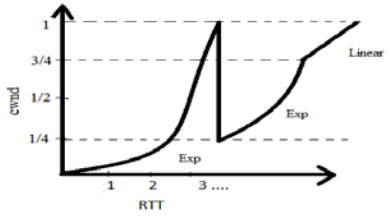
A multi level marking cross layer approach is implemented between network and transport layer in TCP/IP architecture. Since the network layer is responsible for node addressing and the route defining process on the one hand and on the another hand the transport layer is used for the process to process delivery of network, by crossing network and transport layer the performance can be improved and the delay can be reduced.



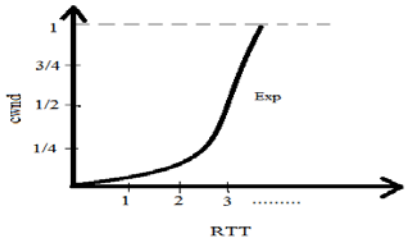
Double marking technique of ECN is implemented as shown in Fig. 5 to pre-notify the sender in the case of congestion occurs.

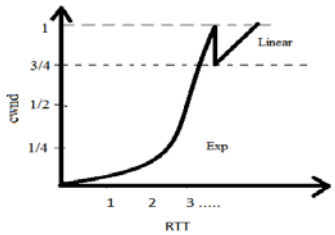
In proposed model, we are using dual level marking concept. That is the entire buffer size of the intermediate node is divided into the two levels as level-1 & level-2. If the buffer size of the node is beyond the limit of first level, it will start to mark ecn_1 field & if the current buffer size is of the node is beyond the second level, then the node will mark ecn_2 field. ecn_1 & ecn_2 fields are added in the flag headers.

If the ecn marking is received by the sink, It will mark ecnecho flag to the ack. If ecn_1 is received, sender will make ecnecho_1 and if the ecn_2 is received, sender will make the ecnecho_2. The ecnecho_1 and ecnecho_2 fields are added in the header to notify back the congestion to the sender. In the sender size, if ecn_1 is received, the sending rate is reduced to three quarters of the sending rate as shown in Fig. 7. This is because the intermediate nodes faces the very small amount of congestion.



If the sender received the ecn_2 , then the sending rate is reduced to one fourth of its actual level and increase exponentially upto three quarters of its actual value and further the value increases linearly as shown in Fig. 8. This will increase the throughput in low sending rate and maintain the throughput in high sending rate.





5. SIMULATION ANALYSIS

The proposed method is designed and implemented using the NS-2 and the performance of the proposed model with is compared with the existing model. Performance is the term that involves in number of factors like Throughput, Goodput and delay in the transmission of data in wireless communication in a particular area with some specific functional details. The specific parameters that are used for experimentation in this model is

- Area = 850 * 850 Sq. m
- Channel= Wireless Channel
- Propagation= shadowing
- MAC layer= IEEE 802.11 b
- Simulation time = 500.0 seconds.
- No. of nodes = 50, 100, 150, 200.
- Traffic connections involved = 2, 4, 6, 8.

The result of proposed method compared with the existing method in two different categories

1. Number of nodes vs. performance
2. Traffic rate vs. performance

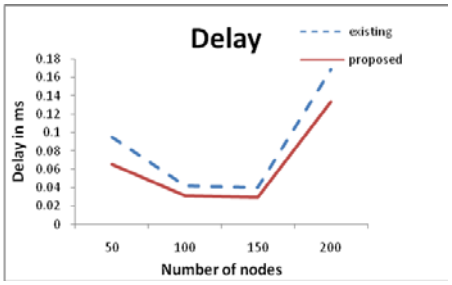
1. Number of nodes vs. performance

In this, the number of nodes are varied from minimum to maximum so that the performance of proposed method is analyzed under dense and rare conditions as shown in Table. 1.

The simulation analysis for the performance which includes the throughput, goodput and the end to end delay when the different numbers of nodes were used in given area has been plotted. The number of nodes used was 50, 100, 150 and 200 respectively.

Table.1 Number of nodes vs. performance

	nodes	throughput	goodput	Delay	Drop rate
Exsiting	50	35576.39	32998.39	0.094708	12
Propose	50	11573.58	10734.92	0.065172	0
existing	100	313216.6	290519.7	0.042137	10
propose	100	387013.5	358969	0.030676	0
existing	150	107637.3	99837.47	0.039998	4
propose	150	168016.8	155841.7	0.029052	0
existing	200	803159.3	744959.4	0.168972	35
propose	200	848527.1	787039	0.1339	0



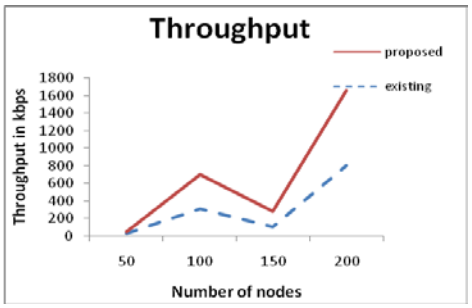
The total tabulation has shown that the throughput and goodput of the proposed model has enhanced 20.96% than the existing method as shown in Fig. 9 & 10 and the delay reduced 71% than the existing model with respect to the different number of nodes as shown in in Fig. 11.

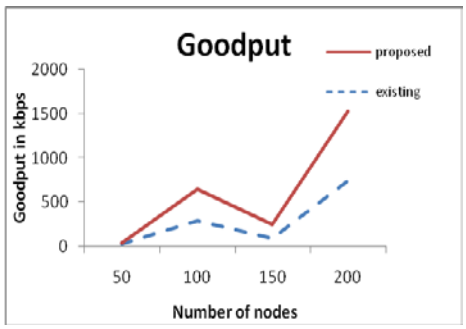
2. Traffic rate vs. performance

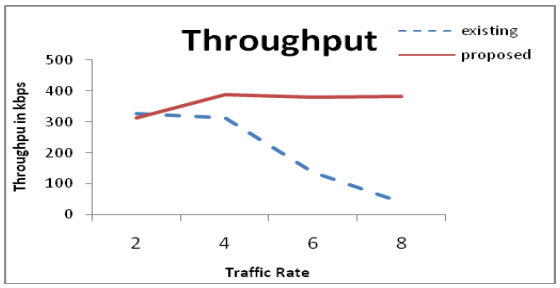
The number of simultaneous traffic connections varied from min to max that is 2, 4, 6, 8 and the performance including throughput, goodput and delay is calculated with existing model as shown in Table 2.

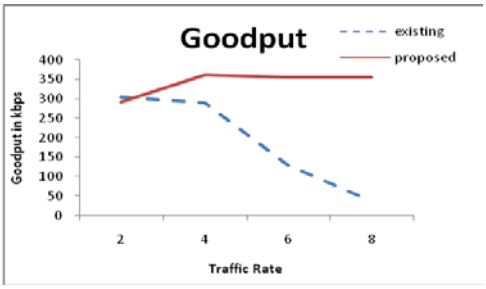
Table 2. Traffic rate vs. performance

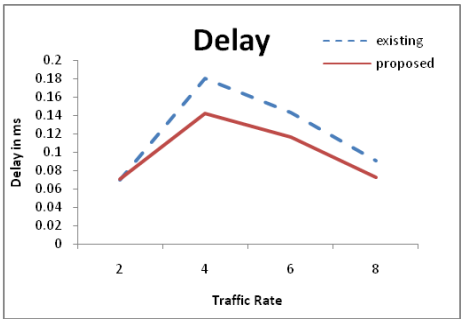
	traffic rate	throughput	goodput	Delay	Drop rate
exsiting	2	328239.9	304454.4	0.070002	4
propose	2	314424.2	291639.8	0.070408	0
exsiting	4	313212.7	290516.2	0.18054	10
propose	4	389460.7	361239	0.14273	0
exsiting	6	139043.2	128967.6	0.14304	5
propose	6	381695.2	354036.2	0.11624	0
exsiting	8	39989.26	37091.49	0.090786	9
propose	8	383066.6	355308.1	0.0723	0











The throughput and good put get enhanced to 45.2% than the existing model as shown in Fig. 12 and 13. The delay of the proposed model has reduced 82.3% than existing model with respect to traffic rate as shown in Fig. 14.

The comparison of existing model with proposed model was shown on above shown graph that the performance hikes of the proposed method.

The reason behind the enhancement of the proposed model than the existing model with high performance is the multiple level marking of ECN, this made the optimistic congestion notification to use the optimum sending rate in the proposed model.

6. CONCLUSION

From the analysis of proposed multi level marking is compared with single level marking. The simulation analysis shows that the 33% improvement in the proposed method throughput and goodput than the existing single level marking and the 75.65% decrement in the end to end delay than the existing model. The proposed method has assured that the zero packet drop. In future the proposed method can be implemented in wireless networks like VANET, MANET, wireless sensor network etc… by varying the buffer size according to our need and increment of performance by dual level marking can be further be increased to n- level marking.

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BIOGRAPHY

R.Mohan completed his M.E Applied Electronics in Karunya Institute of Technology, Coimbatore, Anna University, Chennai, Completed his B.E Electrical and Electronics Engineering, Bharathiyar University, Coimbatore. Now, He is working as a Associate Professor and Head in ECE department in M.P.Nachimuthu M.Jaganathan Engineering College, Erode, India and have 14 years of teaching experience. He has published more than 15 research papers in various national and international conference proceedings. His area of interest includes VLSI Design, Embedded and Low power design.

K.Manoj has pursuing B.E Electronics and Communication Engineering in the M. P Nachimuthu M. Jaganathan engineering college, Erode, Anna University, Chennai. He has pursuing B.E Internet of Things (virtual) in Indian Institute of Information Technology, Allahabad. He has published a paper in a national conference and secured the best paper award. His area of interest is Networks and Internet of Things and image processing

V. Gokul has pursuing B.E Electronics and Communication Engineering in the M. P. Nachimuthu M.Jaganathan engineering college, Erode, has completed diploma in electronics and communication engineering in Muthayammal polytechnic college, Rasipuram. He has published a paper in a national conference.

P. Ajay kumar has pursuing B.E Electronics and Communication Engineering in the M. P. Nachimuthu M.Jaganathan engineering college, Erode. His area of interest is java.

D. Venkatesh has pursuing B.E Electronics and Communication Engineering in M. P. Nachimuthu M.Jaganathan engineering college, Erode