EOCC: Energy-Efficient Ordered congestion control using cross layer support in Mobile Ad Hoc Network routing

T.Suryaprakash Reddy, Dr. P. Chenna Reddy

ABSTRACT - In the recent times many accessible congestion control procedures have no capability to differentiate involving two major problems like packet loss by link crash and packet loss by congestion due to buffer overflow. Consequently these resolutions effect in form of wastage of possessions because they target only on the packet drop by link crash that has the unnecessary importance. Consumption of energy and possessions in order to make the basis node attendance regarding the congestion occurring in routing path is the supplementary drawback in most of the available models. This method of intent mainly on regulating the outlet load at the basis node stage is the boundary to the present available models. It is by now aware that as a motive of link crumple and congestion packet loss in the network routing largely occurs. Hence in our earlier research we proposed routing strategy called Ordered congestion control using cross layer support in Manets in short OCC [19]. In this article we refined the OCC to gain the ability of energy conservation in congestion discovery. In this effort we attempt to limit the role of MAC layer to detect link failure and developed a new strategy to detect the congestion at a relay node level and path level. In this new congestion detection approach we consider the channel loading, packet loss and buffer utilization as parameters to detect the congestion state. These parameters together we referred as congestion detection activity parameter set in short C-daps. The produced tentative results illustrate energy efficiency over OCC [19].

Keywords - Manet; routing protocol; congestion control; zone; occ; cross layer.

1. INTRODUCTION:

Mobile ad hoc network is recognized for their influence on protocols and protocol stacks of managing methods and they are naturally unsuited for customary TCP [17]. As a result ordinary TCP congestion management that applies to the internet is not pertinent method. In MANETs the nodes budge primarily through a dissimilar way that is not recognized which generally is an outcome of public wireless multi hop channel and it does not get construed as the congestion is gone. As a consequence the packet deliverance delay and collision. “a hop level node can be transmitted in its intrusion series” is the principal policy of the wireless channel with multi hops. Concern to the MANET, the total region in the medium is crammed and congested as it is general region, but coming to the internet the crowd is on the main path [17]. The significant character of the MANETs is that the region may be packed full but not the nodes [17].

The contrast between ordinary TCP and MANETs is due to the verity that crash and losing by packets is constantly not due to the congestion in the network and the transfer periods (along with round trip periods) diversify creating complexity in identifying the missing packets. Dissimilar consumer is capable to turn out a congestion ensuing in a relatively lesser bandwidth of Manet, owed to which it is the intricate source of congestion in the wireless network.

Author name is T.Suryaprakash Reddy, working as Professor, Department of CSE, Krishna Chaitanya Institute of Technology & Sciences Markapuram, Prakasam(Dist),A.P,INDIA.
Email: surya.prakash12@rediffmail.com
The Co author name is Dr. P. Chenna Reddy, working as Associate Professor and HOD, Department of CSE, JNTU College of Engineering Pulivendula,Kadapa(dist),A.P, INDIA

A rational congestion manages method ought to be in use effected to be firm and for greater functionality [17] of the wireless system as a reason of vulnerability towards congestion troubles in contrast with conventional wired systems. The wireless networks are not capable to attain a distinct and integrated procedure for the trouble in the congestion as they are heterogeneous character of utility protocols. As a substitute proper model of congestion control should be intended that mainly concentrates on the characteristics that are associated with the network [17]. Eventually these schemes serve as a division of the procedures for the troubles that are recognized instead of an absolute immediate employed procedure. They generate themselves as the head of the customized application protocol stacks. But there are only less characters that work with a huge series of functions [17] and these are rare cases.

Congestion managing techniques focused mainly on the representation, study, algorithm improvement of the congested loop control system (e.g. TCP) have been observed in more recent times preparing them to get customized to the mobile ad-hoc networks with stipulating constraints concerned with routing path and bandwidth algorithms that hold the capability to unite and improve functions are urbanized. There is one more principal part that ought to be taken in the view in the field of wireless ad hoc network is by reason of the MAC layer [17]. That condition is that maximum wireless MACs consist a time restraint which allows the customer to utilize the physical medium but in the provided time period.

This article is structured in the method as given: The section 2 looks at the mainly quoted works in the field of literature. The discussions of the predictable functions are featured in section 3 and section 4 exposes the replications and the corresponding outputs that are tagged by end conclusion and references.

2. RELATED WORK

The device for QOS centric congestion managing is presented in [1]. Et al, [2] initiated metrics to assess data-rate, MAC operating cost along with buffer disruption, that aid in recognizing and manage the congestion conflicted region in network system. Hongqiang Zhai et al, [3] put ahead a method conflicting that congestion and severe means divergence is interrelated. Metrics supported elucidation on congestion aware routing was commenced in [4]. Hop level congestion managing design was anticipated by Yung Yi et al, [4]. Tom Goff, Nael et al, [5] bestowed a collection of algorithms that bring about substitute pathway exploitation in case of vagueness in the value of a pathway that is being used. Xuyang et al, [6] attained a cross-layer hop-by-hop congestion control scheme which was formed for the TCP functioning in multi-hop wireless networks. Dzmitry et al [7] bring in the crash congestion at the transport layer that reduces the functioning of the system. Duc et al [8] has exposed that the models that exist in current days cannot be atoned for the jamming.

Determining the congestion unfurnished in routing pathway is the main goal of current strategies. The packet crash is the cause for the link crumple. The well-organized way is to work on the technique to control the packet loss, which is the cause for the link crumple. Regulating the way out close to every node connecting in routing is one more expensive method. The administration of congestion is in the neighborhood of hop stage [4] [15] in most of the situations. As a result the regulating way out method at every node in the network includes the usage of the expensive possessions. This article demonstrates the effectiveness in discovering the collision of the packets which are frequent as a reason of divergence or by buffer filled up or by malicious failure. So the method of administrating the congestion through regulating the way out can be prevaricated in the conditions like the link collapse and in bitter situations this is handled by using substitute pathway restoration. We can also advocate that circumstances may arise where the hop stages cannot normalize themselves for which only hop level congestion supervision is not adequate. The way of administrating the passage energy that is gone after in the source stage consistent design, can also be followed as well in the management of the congestion by using the similar possessions.

In this piece of writing introduction to a new power competent congestion detection form has been made which is a advanced approach of our earlier proposed routing protocol called ordered congestion control using cross layer support in Manets in short OCC [19]. The extension proposed involves:

- The node competence and possession's heterogeneity.
- Congestion correlated packet crash being established by C-daps.

3. OCC: ORDERED CONGESTION CONTROL BY CROSS LAYER SUPPORT IN MANET ROUTING [19]

We know that in MANETs crashing of the packets happen frequently. The main causes for this to happen are as follows:

- Link collapses during transfer.
- Minimizing the packet entrance power by utilizing conditional Transfer with overwhelming Ingress. This is also named as packet sinking because of congestion near routing strategy.
- Medium usability conflict.
- Malevolent sinking near the recipient.

A concise explanation on introducing OCC is as given: The congestion control methodology that was put forward is attained in stratified way.

In our methodology, at first reduce channel current near the pathway node pn_p antecedent to pathway node pn_c that is affected by congestion. This step is voluntary and probable delay threshold at pn_p and functional part of buffer capability. If there is any situation of error or crash in the functioning of the primary step, then automatically this gives rise to the functioning of the secondary step of the methodology. Coming to the secondary step the MAC layer makes the adjacent nodes pn_p attentive that are also present in that particular region. As a result the outcome of all the other adjacent nodes pn_p will be reduced at a time, so that there will be no delay in the group of the threshold value.

Even if the affected node has not improved after the commencement of the first steps of the methodology then the third step gets instigated. The procedure in this step is that the MAC checks the inward rush of the nodes I near the particular pathway pn_p in a given period of the time span τ , then the nodes that are present in that particular cell c_c of the routing path will be intimated about the affected node pn_v by the MAC. Now all the rest of the nodes have reduced their outward rush in order to make the delay of the threshold group gets decreased. When the MAC checks the inward rush of the nodes I near the particular pathway pn_p in a given period of the time span τ , if $I' \geq I$ and the affected node is not improved then the pathway is re-established by making a link between the nodes pn_p and rpn_c , where rpn_c is the pathway node that is held back, which is a consideration node for pn_c. As a result the routing information avoids the affected node pn_v, that is pn_c.

3.1 Dividing the network into zones

Mohammad M. Qabajeh et al [8] explained a methodology, which was chosen by us. By thoughtful the before now current nodes, the total area is alienated into divisions. In general the

delineate of the cell is preferred as a hexagon. By taking into account the hexagon the benefit is that they delineate touches the larger area and along with it the association with adjacent nodes is also easier as the outline is similar to that of the transmitter. The point-based is pertinent in the MANETs due to the ease of access of convincingly cheap and portable less fragile GPS receiver. The sequence of the transport for the node is signified using R and the length of the hexagon by using the L. For the correspondence of the zones amongst them a relation between R and L is generated as L=R/2.
All the zones have their identification as (cid). The zones are provided with a couple of alternate measures. They are:

1. If a node is concerned with the routing and its cell is present in the routing path, if that node has entered in the specified sequence of region then it is referred as pathway node.
2. If the node rpn of the pathway node pn is recognized as the substitute node for the node pn by the transport layer then that node is named as the reversed pathway node.

If the placement of the node originates, that is at which position it is there then, nodes can carry out our self-mapping algorithm of the substantial site for present cell and compute the cid with no snag. Figure 1 illustrates the general delineate of the Cell divisions in the network.
Pathway nodes and their respective reserved pathway nodes are present in every cell.

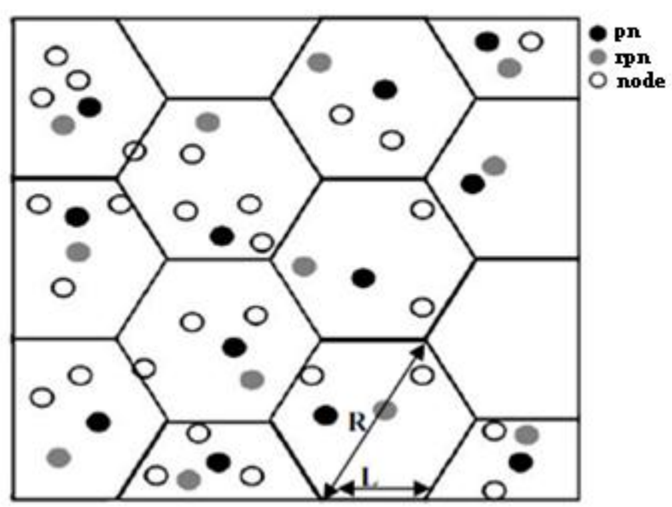


Figure 1[8]: Common outline of the Cell divisions in network

3.2 Path discovery:

This practical methodology is termed as a DSR policy for Path discovery. A disseminated technique is used in order to decide the path to the end node n_d by the source node n_s. The appealed packet $rreq$ that is being transmitted will take the node related data like the involvement in the routing path and its id value cid of that node that is conversing. While the packets are transporting the transport layer ensures the cell stage nodes of every node that is corresponding and holds the data with the packet $rreq$ .After the final end node gets this packet $rreq$ from the source then it gets ready to send the reply packet $rrep$ which incorporates the record of all the pathway nodes and their corresponding nodes in the region of the cell. At the time when the reply packet is approved then all the communicating nodes made the essential changes in their routing table and amend it with the ancestor and successor node data. It also corrects with the other corresponding nodes of that scrupulous node and its successor node in the pathway.

When the reply packet $rrep$ finally reaches the origin node n_s , then the most preferred path will be chosen. Then the origin node n_s delivers an acknowledgement $ack(pn)_i$ for every path node for the routing desired path. After the acknowledgement packet $ack(pn)_i$ is delivered then ahead the pathway node pn_i determines the desirable paths among the node pn_i and the both hop stage descendant node pn_{i+2}. In this step the main path node pn_i delivers an appeal $rreq$ to pn_{i+2}. This appeal $rreq$ communicates by using only the communicating nodes of the main node pn_i and the node pn_{i+1}. When this appeal is delivered to pn_i, then pn_{i+2} acknowledges it by using the packet $rrep$ and transfers it to the pn_i on the same path that used by the $rreq$. When the acknowledgement $rrep$ is delivered then pn_i chooses the desired path among the nodes pn_i and pn_{i+2}, lastly is accumulating it into the routing tables. The preferred path that was selected is used for the re-establishment among the nodes pn_i *and* pn_{i+2}, on the basis of a condition that the congestion is obvious at the adjacent descendant node pn_{i+1} of the main node pn_i .

Path detection algorithm

1. n_s generates $rreq$ and broadcast it to adjacent units.
2. When $rreq_i$ is distributed, hop level node n_i verifies that whether retransmitting of $rreq_i$ is earlier finished on their own or not.
3. If retransmitting is earlier finished then discards the $rreq_i$, or else n_i collects the details of the corresponding nodes from the transport layer and along with that it includes its own recognition and particulars of its corresponding nodes to $rreq_i$, then retransmits . This procedure continues until $rreq$ is delivered to the end node n_d
4. Then end node n_d creates acknowledgement packet $rrep_i$ that includes the particulars of the nodes that are present in the pathway. By utilizing this acknowledgement $rreq_i$ navigated to arrive at n_d and its corresponding nodes. The acknowledgement packet $rrep_i$ transfers in reverse to the origin node n_s on the same desired path of the packet $rreq_i$.
5. Every transitional node pn_i in the path which utilized the packet $rrep_i$ gathers the particulars of its antecedent node pn_{i-1} in pathway, descendant node

pn_{i+1} and corresponding nodes of main path node pn_i and descendant path node pn_{i+1}

6. Main path node pn_i revises its routing table by the particulars attained in earlier steps.
7. The methods 6 and 7 frequently continue until the acknowledgement packet is delivered to origin node n_s
8. Origin node n_s derives the desired path which includes zones with crowded nodes.
9. For every pathway node 1 to n of the path chosen, n_s replies $ack(pn)_i$ for $i = 1..n$.
10. On gaining the $ack(pn)_i$, pn_i begins deriving the substitute path among pn_i and pn_{i+2} , so that the substitute path can utilize corresponding nodes of the pn_i with pn_{i+1} merely.
11. pn_i then records substitute path between the nodes pn_i *and* pn_{i+2} at routing collection.

4 CONGESTION DETECTION WITH MINIMAL ENERGY UTILIZATION

The aim of the extension proposed for our earlier congestion control mechanism OCC [19] is to capture the degree of congestion at relay hop level node with maximal accuracy with low energy usage. The proposed congestion detection model is decoupled from other activities of the MAC layer such as link reliability analysis and buffer size analysis. The detection model extended to detect the congestion at traffic level, which is based on the degree of congestion measurement of relay hop level nodes.

4.1 Measuring degree of congestion at the Relay hop level node

The significant dissimilarity in hardware and software configurations between nodes in ad hoc is common, which is unusual in traditional networks. The results of these dissimilarities can emerge as dissimilar radio ranges, maximum retransmissions and unmanageable buffer sizes. In this context it is clear that the status of congestion can be found with the parameters listed below:

- Channel Loading state
- Degree of packet loss
- Using state of the Buffer

Hence the detection congestion state using these three parameters clearly indicating the sign of possibility to suspend the process of congestion state detection from the MAC layer responsibilities. Hereafter these three parameters referred as Congestion detection activity parameter set(C-Daps)

The congestion caused by the inverse ratio of collision due to contention and the count of retransmissions can be observed by the C-daps scope. If the degree of the collision rate appropriately not balanced by the number of retransmissions then the proportional increase in egress delay at the relay hop node is clear evidence that leads to congestion and reflected as congestion due to buffer capacity run over.

4.2 Measuring degree of congestion at path level traffic

The aggregation of congestion state degree csd determined by C-daps at each relay node in the path indicates the ‘ csd ’ of the routing path between source and destination nodes. The ‘ csd ’ of each relay node n_i can be measured by its ingress initiator n_{i-1} .

A collision detection strategy cds will initiate periodically to find the collision state degree csd at the path $n_{i-1} \rightarrow n_i$, then verifies against the retransmission count rc . The appropriate action listed below will be taken based on the difference between ‘ csd ’ and ‘ rc ’.

$condition : (csd - rc) \cong 0$ Action: no action will be initiated

$condition : (csd - rc) > 0$ Action: Congestion found and alerts n_i about the congestion state if it is greater than node level congestion state threshold $dc(\tau)$.

$condition : (csd - rc) < 0$ Action: unnecessary retransmissions found that causes contention, which shall be minimized.

Each node of a selected routing path including destination node receives the degree of congestion dc from its ingress initiator. Since the destination node not having any successor to find the degree of congestion state dc initiates to measure the degree of congestion at routing path level by cumulating the degree of congestion at each relay node. The periodic updates on the congestion status of each relay hop level node to its successor in routing path are significant energy consuming activity. Hence to conserve the energy, the congestion update strategy must be conditional such that

1. Degree of congestion $dc(n_i)$ at relay hop level node h_i will be sent by descendants n_{i-1} iff the ‘ $dc(n_i)$ ’ is greater than the node level congestion threshold $dc(\tau)$. Hence the energy saves due to conditional transmissions.

If the degree of congestion at path level traffic $d_c(rp)$ that measured by destination node will be transmitted to source in the form of response if and only if the path level degree of congestion $dc(p)$ is greater than the path level degree of the congestion threshold $dc(\tau_p)$, hence energy conserves due to avoidance of $dc(p)$ transmission.

5 ADMINISTERING CONGESTION

When the packet is crashed and that is determined that it crashed at the node pn_i then MAC layer checks the conflict position near pn_i , if that point is found then it makes the antecedent node pn_{i-1} of main node pn_i aware regarding the need of the transferring again in the given span τ as conflict alert con_+. If the span id maximizing the delay near pn_{i-1} so that the packet is crashing at the node pn_{i-1} and its values is higher than the tolerable threshold value, then the node depends on the substitute path among the nodes pn_{i-1} and pn_{i+1} which is present in the routing collection. This substitute path will be on use until the MAC layer sends the acknowledgement $con\_$ of conflict removed at the main path node pn_i by the node pn_{n-1}. When the node pn_{i-1} receives the acknowledgement $mac\_$ sent from the MAC layer then it returns the path back to the pn_{i+1}. The MAC layer again validates and if it derives that the congestion is not because of the conflict then MAC checks the buffer during the inward rush at the main node and if it is full then delivers bof_+ regarding the crowd in the buffer. When the node pn_{i-1} takes delivery of bof_+, then it tries to reduce the inward rush so that the delay that is incrementing may not make the packet collided at the main node pn_{i-1}. If this process fails to reduce the inward rush at the node pn_{i-1}, then the network layer makes the all the remaining nodes of the cell c_c in which the node pn_{i-1} is presently aware, so that the rest will reduce their inward rush because of which the increment in the delay may not make the packet colloid at those nodes. Even if this case fails then the network layer makes the successor cell of the present cell c_c aware of this circumstance. This procedure will be continued frequently until the congestion that is caused due to the rush in the buffer gets prohibited or it is delivered to the cell c_s in which origin node n_s is present. If the result is failed to come then in order to continue the information transfer among the nodes pn_{i-1} and pn_{i+1}, that was troubled because of the congestion bear the main node pn_i, the node pn_{i-1} depends on the substitute path that is accessible in the route compilation. If the MAC concludes that the congestion is occurring due to the link crumple between the node n_i and its descendant n_{i+1} then the main node pn_i chooses the substitute path in order bond up with the pn_{i+2} that is stored in the routing collection of the main node pn_i.

Algorithm for congestion management and working information transport in opposition to congestion

1. Let us presume a case of packet colliding at pn_i
2. MAC ensures the level of the conflict:
3. If congestion rouses for the reason that of conflict near pn_i
   a. Then MAC distinguishes the conflict near pn_i and make pn_{i-1} conscious by conveying information in con_+,
   b. Then pn_{i-1} acts on the congestion caused by the conflict: move to step 6.
4. else if congestion is reasoned because of the rush in buffer near pn_i
   a. Then MAC recognizes the rush in buffer near pn_i and make pn_{i-1} aware of it by transferring information in bof_+
   b. then pn_{i-1} acts on the congestion due to the rush in buffer: move to step 7
5. else if congestion is caused because of the link collapse among pn_i and pn_{i+1} near pn_i
   a. then MAC recognizes the link collapse among pn_i and pn_{i+1}, and make aware by sending a link collapse information in LF_+.
   b. then path node pn_i acts on the congestion caused by the link collapse: move to step 8
6. ***Managing Congestion caused by conflict:***
   i. When con_+ is taken the delivery from MAC, path node pn_{i-1} acts
      a. Evaluate the con_+, that includes a particulars regarding whether retransmission is needed and span τ for retransmission.
      b. Checks the weight of the τ on inward rush delay time Δ
         - If $\Delta \geq \delta$ (inward rush delay threshold) [consequences are packet termination because of surpassing delay] For span τ, choosing to alternate path among path node pn_{i-1} and pn_{i+1} to avoid the affected node pn_i, which was caused by congestion by conflict.
   ii. Past the span τ path node pn_{i-1} is taken the delivery of either con_+ or $con\_$ from MAC. MAC delivers mac_+ if the conflict is still present in the affected node pn_i else intimates to pn_{i-1} regarding the situation of no conflict at affected node pn_i through $con\_$.
   iii. If con_+ is delivered from MAC then pn_{i-1} executes steps 1 and 2.
   iv. else if $con\_$ is taken delivery by pn_{i-1} then it re-establishes the original path among pn_{i-1} and $pn_{i+!}$
7. ***Managing Congestion caused by the rush in the Buffer***
   v. When bof_+ is taken the delivery from MAC, path node pn_{i-1} acts
      Evaluate the bof_+, that includes a particulars regarding congestion because of rush in the buffer near pn_i.
   vi. Executes the procedure of inward rush reducing so that delay Δ does not cross delay threshold δ limit.
   vii. If inward rush not reasonable as needed to manage the congestion near pn_i then
      a. Network layer makes every path node that is located in the similar cell c_c to which pn_{i-1} is part of, aware regarding congestion position near pn_i.
      b. As a result every path node of cell c_c tries to reduce their inward rush so that that delay Δ does not cross delay threshold δ limit of individual path nodes.
   viii. If inward rush near individual nodes not reasonable as needed to manage the congestion near pn_i then
      a. Network layer makes path nodes in the cell c_p aware, that is antecedent to the c_c.
      b. As a result every path node of cell c_c tries to reduce

their inward rush so that that delay Δ does not cross delay threshold δ limit of individual path nodes.

c. If $n_s \notin c_p$ then $c_p \to c_c$: move to step viii.

d. Else if inward rush at individual not reasonable as needed to manage the congestion near pn_i then pn_{i-1} chooses the substitute path that bonds pn_{n-1} and pn_{n+1} to make the information transport, which avoids the congestion affected node pn_i.

8. ***Managing congestion caused by link collapse***

ix. When LF_+ is taken the delivery from MAC then path node pn_i chooses the substitute path alp that bonds n_i and n_{i+2} to make the information transport.
In view of the fact that the alp is being utilized the path node pn_i tries to derive a desired path among pn_i and pn_{i+2} and this substitute path gets constructed by considering corresponding nodes of pn_i and pn_{i+1}.

6 SIMULATIONS AND RESULTS DISCUSSION

The tool that was utilized in accomplishing the experiment was NS 2. Reflecting on the mobility and node volume ranging from 50 to 200, a simulation model network has been created. The features and the values of the simulation are clarified in the underneath table 1. If the packet that was sent is authorized then it authenticates that buffer is allocated productively. The main aim of this model is to distinguish the congestion and contention control protocol [11] and OCC. The functional test for the two protocols by means of the metrics given as follow:

Amount of nodes Range	50 to 200
Dimensions of space	1500 m × 300 m
Nominal radio range	250 m
Source–destination pairs	20
Source data pattern (each)	4 packets/second
Application data payload size	512 bytes/packet
Total application data load range	128 to 512 kbps
Raw physical link bandwidth	2 Mbps
Initial PATH REQUEST timeout	2 seconds
Maximum PATH REQUEST timeout	40 seconds
Cache size	32 Paths
Cache replacement policy	FIFO
Hash length	80 bits
certificate life time	2 sec

Table1: Simulation features taken for the experiment

There are few metrics in order to examine the working of the approached methodology. They are as follows:

- PDR (Packet Delivery Ratio): The ratio is consequential by calculating the division between the volume of information packets delivered from source and the amount of the information packets acknowledged by the sink.

- PDF (Packet Delivery Fraction): The ratio between the information packets that are transmitted to target area and the packets that were formed from the source. This results discussion gives the information on the operation of the model showing the impact in transmitting the packets to the target. As the rate of performance increases it produces the more precise outputs.

- END-TO-END DELAY AVERAGE: This is distinct as the regular node and node delay of the information packets. Some of the causes for this issue are stacked at the time of packet recognition, LIFO near the interface queue, retransmission delays stocking up at the MAC and the transport layer. By this the demarcation of the time periods when the packet was sent and arrived is determined. After this time period is consequent, separating the whole time period discriminated value on the overall amount of CBR packets arrived delivers the end-to-end delay for the packets that were reached. As the delay reduces the functioning, the performance of the model is enhanced when the delay period is a small amount.

- LOSS OF PACKETS: This proportion is consequent by subtracting the volume of packets that were dispatched at the source and the volume of packets that received at the sink. There were malfunctioned packets in the output received by us at Network and the MAC layers. This method propels the packet to the target until the path is derived, or else it searches if not a path is figured out. There are also circumstances when the buffer foliage the packet, couple of them are: Packet is prepared for the search of the path, but no room at buffer, which is filled. The second one is the hunt of the path crossed the time bound. From this, it is consequent that as much less is the loosing of the packets, more will be the functioning of the model.

- ROUTING OVERHEAD: This is the fraction of the on the whole amount of the routing packets and the information packets. This fraction is determined at the MAC layer.

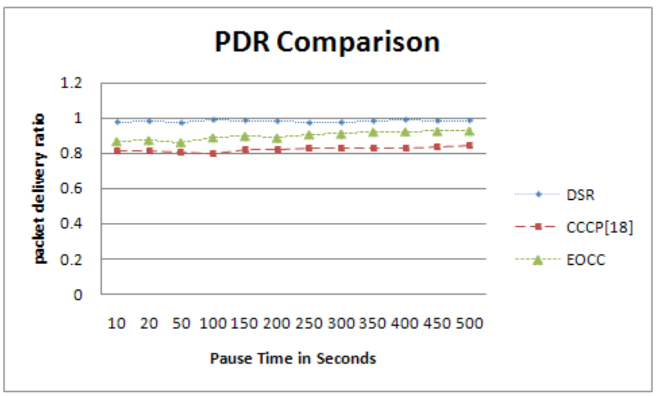
Figure 2(a) exemplifies Packet Delivery Ratio (PDR) for Protocol [11] meant for Congestion and Contention Control and EOCC. By taking into account this output it is sufficient to establish that EOCC deals with the utmost failure of PDR than that of [11] in the context of DSR. Fairly correct malfunction volume of the PDR that is restored by the EOCC than [11] is 1.5%. This is balanced amount among the pauses. The smallest amount of restoring examined is 0.18% and the highest id 2.5%. The next Figure 3(b) specifies OCC benefit than that of [11] in case of Path optimality. [11] utilized nearly 0.019 hops more when compared to OCC as the reason of dual distribution of the [11].

The packet delivery fraction (PDF) can be measured as:

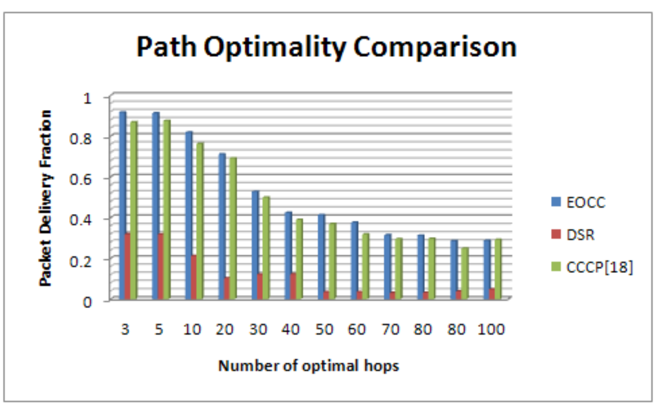
$$P' = \sum_{f=1}^{e} \frac{R_f}{N_f}$$

$$P = \frac{1}{c} * P'$$

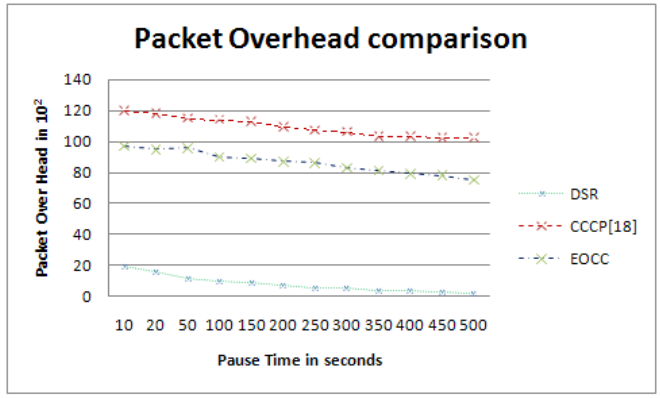
- P is the division of efficiently delivered packets,
- c is the total quantity of flow or associations,
- f is the unique flow id allocated as index,
- R_f is the quantity of packets recognized from flow f
- N_f is the quantity of packets transmitted to flow f



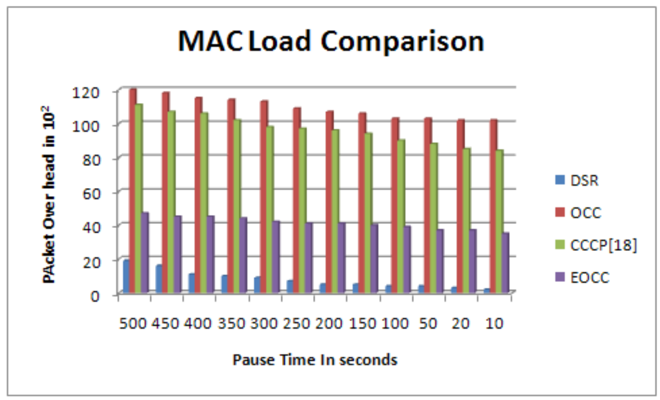
(a) Packet delivery ratio assessment for DSR, CCCP and EOCC



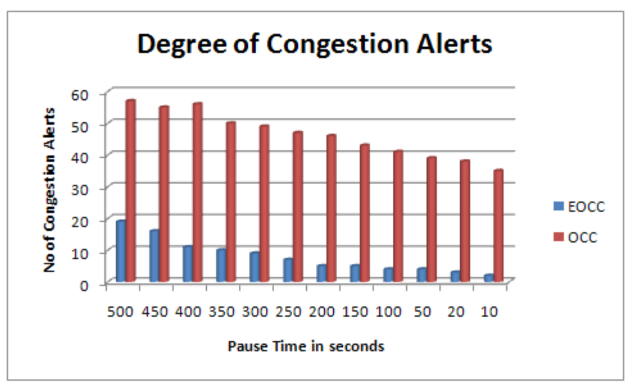
(b) Path optimality ratio between CCCP, EOCC and DSR



(c) The packet transparency assessment ratio between CCCP, EOCC and DSR



(d) Mac load assessment for OCC, CCCP, EOCC and DSR



(e)Congestion alerts in OCC and EOCC

Figure 2: Assessment details for EOCC functioning than CCCP [11]

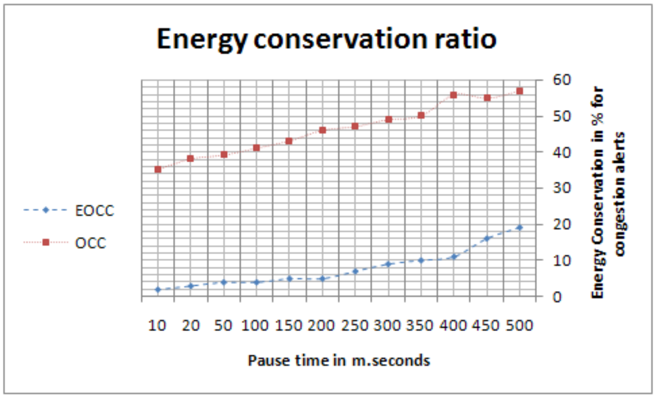


Figure 3: Energy conservation ratio for congestion alerts between OCC and EOCC

Figure 2(c) proves that EOCC is has less packets than that of [11]. This benefit of the NCTS could be feasible as a reason of availability of constant paths without negotiation or offended nodes and having cross-layer congestion control and effective routing procedure. The Packet transparency derived in [11] is nearly 5.29% larger than packet transparency derived in OCC. The minimum and maximum packet transparency in [11] than EOCC derived is 3.61% and 7.29% likewise.

MAC load transparency is higher in EOCC[19] than [11] to some extent. This is viewed in figure 2(d). This occurs due to the control packet swap in EOCC. The common MAC load transparency in EOCC than [11] 1.64%. The minimum and maximum MAC load transparency derived is 0.81 and 3.24% correspondingly. But in the case of EOCC the MAC load overhead drastically minimized (see fig 2(d)) due to suspending the congestion detection process from MAC activities, which saves energy due to avoidance of congestion alerts by the MAC layer to relay nodes. Fig 2(e) reveals the energy efficiency due conditional updates about degree of congestion at node level as well as path level. Fig 3 Indicates the significant advantage of EOCC over OCC[19] in energy saving.

Interesting outputs have been determined for DSR when all the estimation procedures are considered. Distance from path optimality DSR carried out fine as a consequence of not taking security apprehensions into account as a routing feature, and it is delivering enhanced QOS without menace in routing theory. But factually it is false in actuality. In path optimality confirmation DSR place at the end as a reason of not taking security fetters into account, between three considered events, finally this made to distinguish rough paths.

7 CONCLUSION

This paper explored the routing algorithm named as "Energy-Efficient Ordered congestion control using cross layer support in Manet routing". EOCC is a development to the OCC, which is our previous routing protocol. OCC is resultant of two algorithms for Path discovery and congestion management likewise. Conventional proactive routing protocol DSR was used to originate a Path find algorithm. The congestion managing procedure has been divided into three units. Primary one handles the congestion occurred because of the divergences, secondary unit is to manage the congestion occurring due to overflow in the buffer and the final unit is to handle the congestion due to link crumple. Against to the congestion due to overflow in the buffer, our model handles it near the antecedent path node level and error in this situation solves it by considering first to the cell stage and next to the network stage. This ordered procedure reduces the effort and cost for the resource usage. The path recovering at the node stage that was chosen in managing the congestion ease the possibility of information transport contrasting the meticulous congestion caused because of conflict and link crumple.
In this article we refined the OCC and gained the ability of energy conservation in congestion discovery. In this effort EOCC attempted to limit the role of MAC layer to detect link failure and developed a new strategy to detect the congestion at a relay node level and path level. This approach considered the channel loading, packet loss and buffer utilization as parameters to detect the congestion state. These parameters together referred as congestion detection activity parameter set in short C-daps. The tentative outputs that obtained were efficient and notable, such that we can expand the limits of the application in plummeting the delay and advancing the cross layer device for unforced potential in the future.

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