CONGESTION CONTROL IN NOVEL ENERGY EFFICIENT CLUSTER BASED PROTOCOL FOR HIGHLY DENSE MANET

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Abstract : Due to highly dynamic nature of Mobile ad hoc networks (MANET), predictability and design of efficient protocols and methodology to handle congestion proves to be a tedious task. Since issues and architecture of mobile ad hoc networks are very much different from their counterparts, so are its congestion control strategies due to frequent changes in network's topology. A noted congestion control mechanism is to notify source for the congestion in the network so that either it may pacify the transmission rate or look for an alternative option. It must be noted down that all the existing methodologies are capable to tell the source about the congestion problem as they use TCP. But in case of MANET, the packet losses due to link failure (due to its dynamic nature) are misinterpreted as packet losses due to congestion, and in the snapshot of a timeout, backing-off its RTO. This results in needless reduction of transmission speed due to which throughput of the whole network degrades. In this paper we implemented hierarchical tree alternative path algorithm for congestion control in Fish-eye state routing algorithm , Order-One Manet Routing Protocol (OOMRP)and novel energy efficient cluster based protocol for highly dense MANET. The comparative results shows that congestion control is very good in proposed cluster based protocol. The throughput is high and packet loss is less and finally energy is saved.

Index Terms - MANET, Congestion control, OOMRP, Fish-eye state routing algorithm.

1. INTRODUCTION

MANET is a short-lived self-organizing network of cordless mobile nodes with no existing facilities. It enables various tools to form a network in the locations where no required facilities exists. Albeit, there are numerous problems and also difficulties that need to be resolved prior a large facility of a MANET, tiny and medium-sized MANETs can be easily established [1] In this paper the problem of congestion control in MANETs is considered. In a lot of cordless situations utilized, the tools connect via some networking foundation in the form of base stations. On the other hand, an ad-hoc network does not have any type of infrastructure. Mobile ad-hoc networks are used in circumstances where no framework is readily available, of which a very typical instance is, disaster alleviation circumstance much research initiative has actually been put into the ad-hoc network location. Various approaches have been suggested to carry out transmitting in MANETs. It has also been noticed that the functions of transportation layer needs to be adjusted to the specific buildings of MANETs. Specifically the congestion control approach applied in the transport protocol used nowadays, i. e., TCP; do not deal properly with the particular effects taking place in MANETs [2] Because of this, ideal Congestion control is taken into consideration to be a crucial concern for mobile ad-hoc networks. Several Congestion related problems determined, consists of drastic throughput failure and also other troubles. They have actually been shown to advance from the Tool Accessibility Control layer, network, as well as transport layers, as discussed, in [1], [2] and also [3] There is a big variety of ideas on just how to overcome the problems. In this survey paper, we give a short of existing attempts to address the congestion trouble in mobile multi-hop ad-hoc networks. There is no attention paid in the direction of methods focused on improvising congestion control or TCP performance. Congestion control works very well in TCP over Net. Yet impromptu network display some homes that very impacts the design of proper methods in general, and of specifically Congestion control device. As a result of the dynamic actions, mobile ad-hoc network is very troublesome for conventional TCP. Key amongst the varying homes of MANETs is the frequent mobility of nodes and a shared, cordless multi-hop channel. Route changes as a result of vibrant nature along with the inherently undependable medium lead to abrupt delay package shipment and packet losses. These delays and also losses need to not be misunderstood as Congestion losses [4] The usage of a cordless multi-hop channel permits just single information transmission each time within the range of one node. Thus close web links are not independent from each other. This influences the means network Congestion revealed itself. Routers are dedicated hosts linked by high data transfer networks. When Congestion takes place on the network, it is usually concentrated on a router. However, Congestion in ad-hoc networks influences a total area as a result of the shared medium. Although, it relies on the network, the very same occurred with various other reasons can cause false impression of TCP Congestion control. Besides, discovering packet losses is much hard, as transmission hold-up and thus also RTTs differ a lot more. The result of a web traffic flow on the network condition can create extreme unfairness in between circulations. Therefore cordless multi-hop networks are far more intended to overload troubles than typical wired networks like the Web. As a result a proper Congestion control is required for network satisfiable performance. In MANET, since there is no set facility, there are no routers, as well as therefore the mobile nodes themselves functioning as the routers. Congestion control approaches [5] can be released on routers or node. In existing methods, the source is told about the congestion to make sure that, either it may pacify the package transmission rate or discover a choice which may not essentially be an optimal route. TCP, one of the preferred transportation layer methods, utilizes congestion control approaches (break) to inform the resource about the Congestion control issue.

2. **BACKGROUND**

2.1. Congestion in MANETs

Congestion in MANETS is much difficult in contrast to traditional networks given that it might show up in various types and also diverse places. Worrying the cause of Congestion occurrence this might be classified in two kinds [6]:

2.1.1. Congestion of Type H1 :

In a specific location, lots of nodes within series of each other attempt to send instantaneously, resulting in losses as a result of interference and consequently decreasing all nodes' throughput in the location. We note that explicit neighborhood synchronization amongst bordering nodes might decrease this sort of loss, however can't remove it totally due to the fact that "non-neighboring nodes" could still disrupt transmission.

2.1.2. Congestion of Type H2 :

In a specific node the line (buffer) utilized to handle packets to be sent overflows. This is standard description of Congestion, commonly made use of in the wired networks. This is additionally the chief root cause of losses of the packet. Kind H2 thinks the presence of a reliable MAC method that is capable to transmit packages from dissimilar resources with no crashes.

Worrying where in the network issue occurs, 3 groups exist [7]:

2.1.3. Congestion of Type W1 – "hotspot near the source (transient)" – source congestion :

Largely deployed sensing units producing data occasions during a situation state is certainly create relentless hotspots near the resources. In this situation, local rapid time-scale systems proficient of offering backpressure from the points of Congestion back to resources would work. Likewise source's local de-synchronization would certainly be effective too.

2.1.4. Congestion of Type W2 – "hotspot near the sink (persistent)" – sink congestion :

Also sparsely released sensing units that create information at reduced information rates could potentially make transient hotspots throughout the sensing unit field, however more likely further from the resources and also adjacent sink. The "fast time-scale resolution of local hotspots" making use of a mix of local backpressure & also "packet-dropping methods" can be much efficient, in this instance. Resource nodes might not be associated with backpressure as a result of transient nature of the issue in this scenario. Additionally an efficient method of relieving sink Congestion is to release several sinks, which are evenly spread throughout the sensing unit area and then stabilize traffic among these sinks.

2.1.5. Congestion of Type W3 – "forwarder congestion" :

A “sensor network” will certainly have greater than one circulation, and these circulations will certainly interconnect with other. The location around the crossway will likely come to be a location. In a tree-like interaction pattern, every intermediate node in tree might struggle with forwarder Congestion. Compared to KEY IN W1 as well as W2, the “forwarder congestion” is even more challenging due to the fact that it is very problematic to anticipate the crossway factors because of network characteristics. In this situation also sparsely released sensors creating information will develop both transient as well as consistent hotspots dispersed through the field of sensor. A mixture of quick time scale activities to deal with local transient hotspots, and shut loophole rate law of all sources that add towards producing relentless hotspots appears to be efficient. The resource provisioning methods can be utilized when “traffic control approaches” can’t meet the needs of application.

2.2. Mitigation and Congestion control techniques in WSNs

Usually, the existence of Congestion indicates that the lots are (temporarily) greater than the sources could manage. To manage that scenario the complying with control methods might be utilized; lower tons, boost the sources, or use the MAC layer improvements. The MAC layer improvements can assist more towards Kind H1 Congestion. Whether the cost of packet generation is adequately small, instantaneous packet transmissions becomes independent of rate. Instead, it depends on the moment at which every node produces the package. A great way to decrease this sort of Congestion is to execute stage shifting, a monitoring made by the writers in [8] Small number of stage moving could be executed by introducing minor anxieties at the “data-link layer”. In [8] additionally the “application layer” itself introduces stage changes. Whereas jittering at the “data-link layer” intends to cause low transmission variants among surrounding nodes, we believe that “phase-shifting at a higher layer” might be attained on the “larger time scale”. To manage the congestion of Type H2 may utilize other 2 techniques, (a) lowering the tons or (b) boosting sources as these might help in clearing the buffers of “intermediate sensor nodes”. An examination of these 2 techniques is described below:

2.2.1. Traffic control technique :

By employing a “website traffic control approach”, affected nodes notify upstream nodes to lower the price with transmitting packages to them, since they will certainly soon end up being overloaded. To attain information price discount, impacted nodes, make use of “backpressure messages” that are communicated in reverse to the information sources till the “data rate” is managed.

While this approach might be effective in instances where the overall tons in network is hefty, or in particular circumstances like “Type W1 and Type W2”, it can’t be effective when it comes to Kind W3 Congestion. In “W3 congestion” it is probable for a variety of flows with reduced data prices to send data through a details intermediate node and also congest it. By acting upon every flow separately, circulations will be dedicated to decrease the currently low information price they transmit with the residual network is under-loaded. One more substantial drawback of this technique is the fact that in WSNs a heavy ton is frequently generated when an event is happening. Lowering the information price throughout that duration can adversely influence the objective of network. The traffic control is the technique employed by the bulk of “congestion control procedures in WSNs” [7-15].

2.2.2. Resource control technique :

In this approach, influenced resources take benefit of the repetitive deployment of nodes in the network and try to use nodes which are not associated with the present circulation for sending packages, to keep the rate with that information are flowing. The benefit of this technique is specifically apparent when congestion of Type W3 is experienced, considering that flows that are merging to a particular node are rerouted to utilize other courses to the sink. If various paths are selected for several of the connecting circulations, the information rate for the affected circulations will certainly not be decreased and the throughput of last network is enhanced. Obviously, in this technique it is not probable for every node to arbitrarily determine that moves to decline as well as for rejected circulations to arbitrarily select which nodes to sign up with. This circumstance is particular that it will certainly get worse the circumstance. Consequently, a count of specifications, containing the kind of congestion and also the sort of the application, should be considered before using a source control model. This model has actually not attracted as much focus on “web traffic control equivalent”.

The main demonstrative work that employs “source control method” in [6]. Additionally [16-19] employ in dissimilar methods a “source control scheme”. HTAP formula that is described in this manuscript is also a “source control formula”.

3. HTAP “(Hierarchical Tree Alternative Path)” algorithm

In this algorithm, we recommend and also review a Congestion control algorithm that based on its performance on the production of other paths from sources to sinks to stop congestion from taking place. The HTAP is a “vibrant congestion control algorithm” that bases its course switching choice on regional info, like the Congestion state of its neighbors.

HTAP contains of four diverse methods:

- Topology control.
- Hierarchical tree production.
- Alterative course creation.
- Handling of helpless nodes.

These 4 systems are defined listed below.

3.1. Topology control :

The “Topology control” is critical in WSNs given that it might control problem occur from the repetitive variety of nodes and also their dense implementation. Troubles such as optimum number of feasible routes, interference, and maximum power utilization to interact to remote nodes directly, and so on, are probable to develop. Because the HTAP is a formula that tries to use the additional assets of network, it is apparent that assuring a repetitive variety of paths is vital. To preserve the presentation features of network in the event of Congestion, these paths should be meticulously picked. Topology control is a initial plan used in “HTAP algorithm”. An efficient topology control formula need to have the ability to maintain connectivity with using marginal power, while maintaining a maximum variety of nodes as neighbors to every node. In this job we utilize, with a disparity, the “Local Minimum Spanning Tree algorithm (LMST)” [20] as the first geography control that operates on network.

The LMST is an algorithm with the ability of conserving the network connectivity making use of slight power, whereas the level of any kind of node in subsequent topology is controlled to 6 nodes. As it is systematically described in [20], this function “(6 neighbors per node)” is desirable since a tiny node level minimizes the contention of MAC-level as well as interference. In LMST, every node forms its neighborhood “minimum spanning tree” individually, making use of “Prim's algorithm” [21] and keeps on the tree only those surrounding nodes which are one hop away.

3.2. Hierarchical tree creation :

The ordered tree creation formula works over topology control formula and also only at after a node ends up being a resource. This formula contains 2 primary actions:

- Path Creation
- Flow establishment

3.3. Alternative path creation :

This algorithm works when congestion will happen at a details node in network. Capability of the used “geography control algorithm (LMST)” to maintain network connection with the utilization of very little probable power and the truth node level in topology derivative under the formula is little, aids in controlling accidents in medium. Additionally, it aids to reduce the popular concealed as well as unveiled incurable issues there will certainly not be numerous nodes that need to be silenced to make sure error-free interaction. Nevertheless, congestion is still feasible to occur when a node gets packets with a higher rate than it might send (buffer-based Congestion). In a wireless sensing unit network wherever all nodes, except sink, are accurately the very same, this could occur whether the nodes to transmit packages to can decline more packages.

3.4. Handling of powerless nodes :

Special care is taken in HTAP formula regarding the nodes which are power worn down. These nodes cause main troubles to network in case they function as relay or source nodes. Therefore, when a node will get power exhausted it must promptly be removed from network and also the tables of its next-door neighbor nodes must be upgraded. This treatment needs to be as easy as probable because of the fact that this might take place when network remains in a critical situation. When the power of a node reaches the “power termination limit”, the node promptly transmits this truth to nodes around it. The receiving nodes eliminate the associated ID of Node from their next-door neighbor list. Whether the “power exhausted node” belongs of an active path (a course that is passing on packages to sink), the upstream nodes will apply the different path formula as well as locate another course to onward packets to sink.

4. Evaluated algorithms tested under Congestion description

4.1 Fish Eye-State Routing algorithm :

The “fish eye state routing algorithm is an implied hierarchical routing protocol”. It utilizes the “fisheye” strategy recommended by Kleinrock as well as Stevens [22], where the method was utilized to decrease the dimension of info need to signify the graphical data. The fish’s eye captures with high detail the pixels near the centerpiece. In directing, the “fish eye method translates to maintaining precise path and distance high quality data concerning the immediate neighborhood of a node, with progressively less information” as the range rises. The functionality of FSR similar to the LS Directing because it preserves a topology map at every node. The main distinction is the method in which directing info is shared. In LS, “web link state packets” are produced and also flooded into network when a node identifies a geography modification. In FSR, “link state packets” are not swamped. Instead, nodes preserve a “link state table” depends upon the current data gotten from neighboring nodes, as well as periodically exchange it with their neighborhood neighbors only (no flooding). Via this exchange procedure, the table access with the higher series numbers change the ones with lower series numbers. The “FSR table of elements exchange resembles the vector exchange in Dispersed Bellman-Ford (DBF)” [23], where the distances are upgraded according to the moment stamp or series number appointed by “node originating update”. Nonetheless, in FSR web link states rather than range vectors are propagated. Furthermore, like in LS, a full geography map is maintained every node as well as fastest courses is calculated utilizing this map.detail diminishes as the range from the focal point rises.

4.2 Order One Manet Routing Algorithm :

The essential idea will certainly be that an organize itself under a tree. Nodes aid in the origin of the tree to create a beginning path. The path later leaves beginning with that origin by reducing edges, as ant-trails do. When there disappear edges on cut, an about optimal course exists. This path is continuously cared for. Each treatment could a chance to be carried out for constrained marginal interaction, and also thick, as little router tables. OORP requires concerning 200K regarding memory. A simulated connect with 500 centers send towards 200 bytes/second figured out it clinched together with over 20 secs [24]

4.3 Proposed Novel Cluster based routing protocol for highly dense MANET :

The novel collection depended approach is reliable and reliable by the ways of power effectiveness. The gathered depended approach is shown in this area.

In order to develop the mathematical version the adhering to lemmas are considered. The lemmas and also the succeeding concept will certainly develop the model by analysing the cluster head detection.

Lemma-- 1: Any type of formula has to change the cluster head randomly and time to time in order to enhance the life time of the network.

Where,

T(CH) denotes the cluster head determining feature and also returns the cluster go to any time circumstances

G is the set of clusters

N is the collection of nodes in any cluster

k is the rounded number

Proof: In order to prove the above lemma, this work demonstrates that,

$$\forall g \subset G \qquad \text{(Eq. 1)}$$

There exists a cluster g in the total network, such that,

$$\varnothing(g) \neq NULL \qquad \text{(Eq. 2)}$$

The numbers of non-dead or active nodes are not zero.

Further, the selected node, n

$$\forall n \subset N \quad \text{(Eq. 3)}$$

And the randomly selected node to be considered as the new cluster head, n'

$$\forall n(t) \subset N' \quad \text{(Eq. 4)}$$

Subsequently to be naturally understood that,

$$N \not\subset N' \ and \ N' \not\subset N \quad \text{(Eq. 5)}$$

So that the recently selected cluster head can be avoided to be similar from the last one.

Considering the R(k) is the percentage of the cluster head available in the N, then

$$1 - R(k)[\mathrm{k}.\bmod \frac{1}{R(k)}] \quad \text{(Eq. 6)}$$

The remaining percentage of the cluster heads, available in the collection N.

Henceforth, the cluster dead deciding the function can be formulated as

$$T(CH) = \frac{R(k)}{1 - R(k)[\mathrm{k}.\bmod \frac{1}{R(k)}]} \quad \text{(Eq. 7)}$$

As the Eq. 5 clearly stand the point of not repeating cluster heads in the subsequent times, thus the energy consumption is also evenly distributed.

Lemma – 2: Any algorithm must choose the cluster head based on the comparisons of effective energy available in order to increase the life span of the network.
Where,
Net_LSpan denotes the Life Span of the network
Net_Egydenotes the energy of the network
N_Egy denotes the energy of the node

Proof: In order to prove the above mentioned lemma, this work demonstrates that,

$$\int_{MAX(Net\_Egy)}^{MIN(Net\_Egy)} Net\_Egy \quad \text{(Eq. 8)}$$

Considering the Max and Min denotes the maximum and minimum energy of the network.

Subsequently,

$$\int_{MAX(N\_Egy)}^{MIN(N\_Egy)} N\_Egy \quad \text{(Eq. 9)}$$

Here choosing any node n to be the cluster head, will result in

$$\mathrm{Re}\,s(N\_\mathrm{Egy}) = \frac{N\_Egy(t)}{dx(N\_Egy_n)} \quad \text{(Eq. 10)}$$

Where, Res denotes the effective energy left in the node.

After the random selection of the any cluster head, the energy varies in the utilized and non-utilized node.

$$\mathrm{Re}\,s(N\_\mathrm{Egy})_{\mathrm{n}} < \mathrm{Re}\,s(N\_\mathrm{Egy})_{\mathrm{n+1}} \quad \text{(Eq. 11)}$$

Further selection of the same node n, will result in

$$\operatorname{Re}s(N\_\mathrm{Egy})_{\mathrm{n}} \rightarrow Min(N\_Egy)_{\mathrm{n}} \quad \text{(Eq. 12)}$$

Repeated selection of the same node, will result in

$$\operatorname{Re}s(N\_\mathrm{Egy})_{\mathrm{n}} \rightarrow 0 \quad \text{(Eq. 13)}$$

Thus having a random shutdown of the node and result in

$$\operatorname{Re}s(Net\_Egy)(t) \rightarrow \mathrm{Min}(Net\_Egy)(t) \quad \text{(Eq. 14)}$$

Naturally to be understood that, this will result in

$$Net\_LSpan \rightarrow 0 \quad \text{(Eq. 15)}$$

This effective will be visible in much lesser amount of time.

Henceforth in the light of the Lemma – 1 and Lemma – 2, this work demonstrates the novel algorithm,

Step-1. In the pre-installation step, the list of active nodes will be accumulated,

$$n \subset N \notin D \quad \text{(Eq. 16)}$$

Where n denotes the any available node belongs to the cluster set N and does not belongs to the D, the dead cluster set.
From the Lemma – 1, it is proven that the random selection of the cluster head will improve the life span of the network.

Step-2. In the next step, for the selected node, the energy status will be accumulated.

$$\operatorname{Re}s(n) \leftarrow \overline{Max(\mathrm{N\_Egy}(n))} \quad \text{(Eq. 17)}$$

From the Lemma -2, it is also proven that the consideration of the available energy will improve the life span of the network.

Step-3. Henceforth, the cluster head will be decided considering the weight function consisting of the available energy and selection of non-repeating nodes.
Where,
CH denotes the cluster head

From the Eq. 7, Eq. 14 and Eq. 15,

$$CH = \prod_{\operatorname{Re}s(N\_Egy(n))}^{Max(N\_Egy(n))} n \oplus [n \subset N \notin D] \quad \text{(Eq. 18)}$$

Step-4. The information captured for all the nodes in the network will be maintained in the routing table RTab with the following parameters.

$$RTab(\mathrm{N\_Egy}_{\mathrm{n}}, \mathrm{n}_{\mathrm{Source}}, \mathrm{n}_{\mathrm{Destination}}, \mathrm{n}_{\mathrm{Next}}) \quad \text{(Eq. 19)}$$

Step-5. In the next step, the nearing neighbour node to be decided repeating the step – 1 to 4.

Step-6. After the path is been decided, the data transfer is carried out.

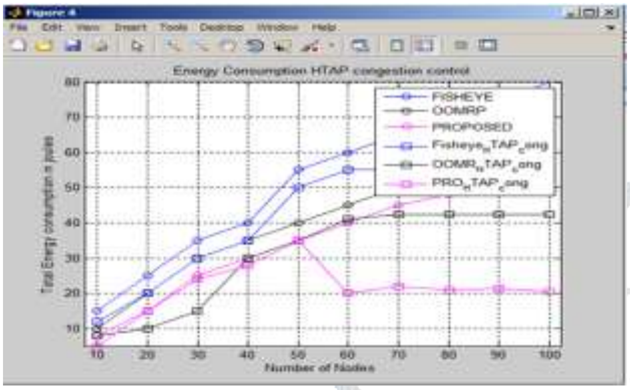
Step-7. In case of the network topology change repeat the step – 1 to 5.

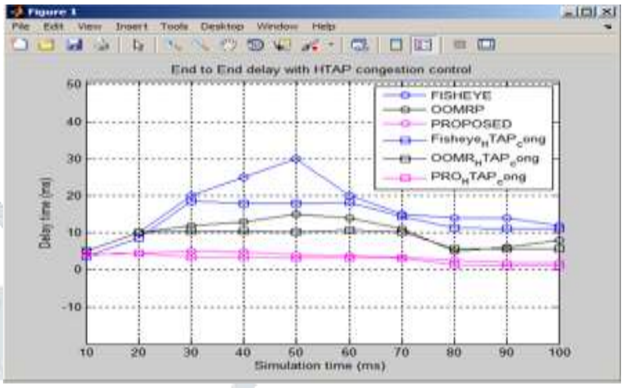
Henceforth the novel cluster based algorithm may show the higher latency, however the algorithm will demonstrate the higher energy awareness compared to the existing algorithms.
In order to prove, the improvements in the next section, this work furnishes the comparative study.

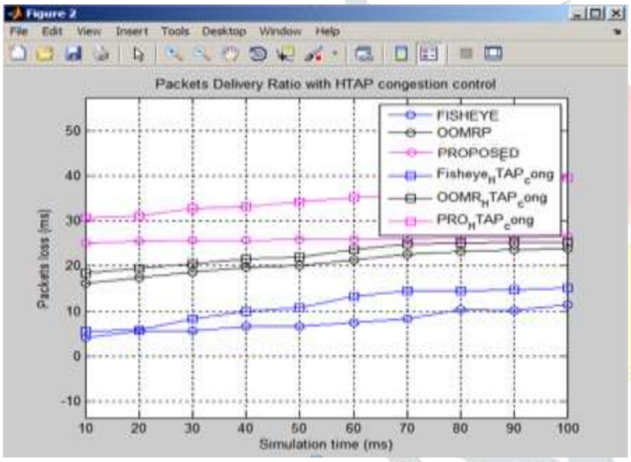
5. Results and discussion

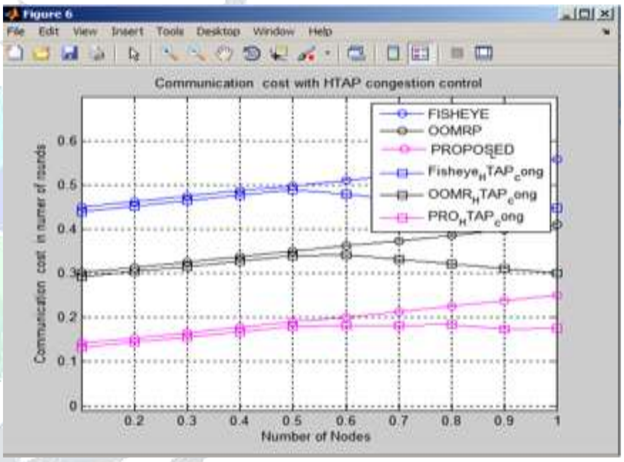
The figure1 to figure6 shows the results of Communication cost, Delay, Energy Consumption, Packet loss, Packet delivery ratio, and throughput when congestion control is implemented Table 1 to Table 6 shows the resulting values for 10 seconds to 100 seconds.

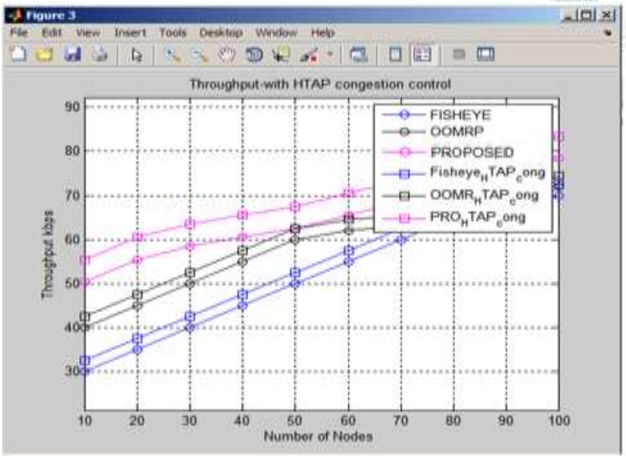
The simulation results proves that communication cost is decreased in proposed cluster based algorithm, delay is decreased, throughput increased, Energy consumption decreased, Packet loss decreased and packet delivery ratio is increased when compare with Order one manet protocol and fish eye state protocol. Overall Congestion control is very good in proposed cluster based routing protocol for highly dense MAENET, when compared to two other protocols.

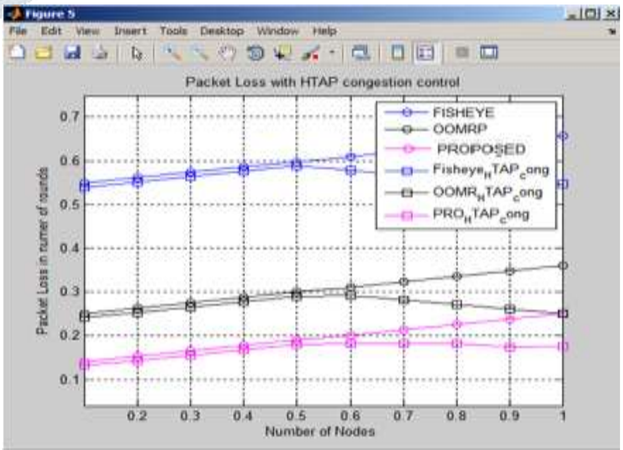












Delay	10	20	30	40	50	60	70	80	90	100
Fisheye	5	10	20	25	30	20	15	12	13	15
OOMR	5	10	12	13	15	14	11	5	6	8
Proposed Algorithm	4	4.5	5	4.8	3.2	2.5	2.3	2.32	2.36	2.56
Fisheye_HTC_cong	5	10	20	21	21.5	21.6	21.8	21.9	21.91	21.92
OOMR_HTC_cong	5	10	12	12.1	12.3	12.4	12.54	12.56	12.45	13.1
Proposed HTC_cong	4	4.5	5	4.8	4.81	4.823	4.842	4.851	4.853	4.528

Table 1. End to End delay

Packet Delivery Ratio	10	20	30	40	50	60	70	80	90	100
Fisheye	2	4	8	10	15	20	25	25	25	25
OOMR	1	2	4	5	8	7	6	4	3	2
Proposed Algorithm	0.8	1.8	3.5	4.6	6.7	5.8	4.8	3.6	2.9	1.9
Fisheye_HTC_cong	2	4	8	10	11	11.5	12	12.2	12.3	13
OOMR_HTC_cong	1	2	4	5	8	7.95	7.89	7.68	7.85	7.86
Proposed HTC_cong	0.8	1.8	3.5	4.6	6.7	6.56	6.54	6.53	6.53	6.531

Table2. Packet Delivery Ratio

Throughput	10	20	30	40	50	60	70	80	90	100
Fisheye	30	35	40	45	50	55	60	65	68	70
OOMR	40	45	50	55	60	62	63	64	65	72
Proposed Algorithm	50	55	58	60	62	65	68	70	75	78
Fisheye_HTC_cong	32.5	37.5	42.5	47.5	52.5	57.5	62.5	67.5	70.5	72.5
OOMR_HTC_cong	42.5	47.5	52.5	57.5	62.5	64.5	65.5	66.5	67.5	74.5
Proposed HTC_cong	55	60	63	65	67	70	73	75	80	83

Table 3. Throughput

Energy	10	20	30	40	50	60	70	80	90	100
Fisheye	15	25	35	40	55	60	65	70	75	80
OOMR	10	20	30	35	40	45	50	56	60	65
Proposed Algorithm	8	15	25	30	35	40	45	48	57	60
Fisheye_HTC_cong	12	20	30	35	50	55.1	55.2	55.3	55.4	55.6
OOMR_HTC_cong	8	10	15	30	35	41.1	42.3	42.41	42.41	42.42
Proposed HTC_cong	5	15	24	28	35	20	22	21	21.3	20.5

Table 4. Energy Consumption

Packet loss	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
Fisheye	0.25	0.262	0.274	0.286	0.298	0.31	0.322	0.334	0.346	0.358
OOMR	0.1515	0.1635	0.1755	0.1875	0.1995	0.2115	0.2235	0.2355	0.2475	0.2595
Proposed Algorithm	0.1415	0.1535	0.1655	0.1775	0.1895	0.2015	0.2135	0.2255	0.2375	0.2495
Fisheye_HTC_cong	0.25	0.262	0.274	0.286	0.298	0.299	0.3	0.31	0.32	0.33
OOMR_HTC_cong	0.1515	0.1635	0.1755	0.1875	0.1995	0.21	0.22	0.23	0.231	0.241
Proposed HTC_cong	0.1415	0.1535	0.1655	0.1775	0.1895	0.191	0.192	0.193	0.194	0.195

Table 5. Packet Loss

Communication cost	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1
Fisheye	0.263	0.113	0.123	0.133	0.128	0.129	0.139	0.149	0.135	0.151
OOMR	0.2373	0.0873	0.0973	0.1073	0.1023	0.1033	0.1133	0.1233	0.1093	0.1253
Proposed Algorithm	0.2042	0.1642	0.1742	0.1842	0.1792	0.1802	0.1902	0.2002	0.1862	0.2022
Fisheye_HTC_cong	0.263	0.113	0.123	0.133	0.128	0.211	0.212	0.213	0.214	0.216
OOMR_HTC_cong	0.2373	0.0873	0.0973	0.1073	0.1023	0.113	0.114	0.115	0.116	0.117
Proposed HTC_cong	0.2042	0.1642	0.1742	0.1842	0.1792	0.18	0.182	0.192	0.195	0.197

Table 6. Communication cost

6.CONCLUSION

Congestion control mechanisms discussed so far have their own pros and cons along with its complexities. Perspectives proposing improved transport layers for MANETs show two major trends, firstly, there are large numbers of protocols which try to improve, wide spread protocols, mainly with TCP. On the other hand many approaches willingly sacrifice compatibility to gain more freedom in protocol design and hence to even better fit the specific needs of MANETs. In this paper we presented a survey of, different approach as to handle congestion in MANET along with an approach presently deployed in MANETs using concept of HTAP. HTAP is implemented in three protocols, namely FSR, OOMRP, and Proposed Cluster based routing protocol of highly dense MANETs. The Proposed cluster based algorithm controls the congestion very well and performs in better way compare with two other approaches. Throughput is high, and packet loss is less in proposed one when congestion control is implemented.

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