CAPACITY ANALYSIS AND CONGESTION CONTROL IN DELAY TOLERANT NETWORK

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Abstract -*In this quick evolving time, data or information sharing is one of the key necessity of human and machines. Systems are planned to give this office of information sharing to the people or machines. The systems which work under the antagonistic conditions (i.e. irregular availability) are named as Delay Tolerant Networks. In the Delay Tolerant Networks, Congestion is the key territory which should be tended to by the scientist and the network. In this paper we have proposed a novel method for support administration to keep away from/evacuate the Congestion in Delay Tolerant Networks. This methodology for buffer administration examines the span of message and whatever is left of the TTL of message for support administration and for comfort of new moving toward message at each node. Through the simulative outcomes got in this examination we discovered that the methodology proposed and assessed in this work is giving better conveyance probability of the messages.*

Keywords: *Delay Tolerant Network; Time to Live; Delivery Probability; Overhead Ratio; Congestion Avoidance.*

1. Introduction

A system can be characterized as a couple of (at least two) PC frameworks which are connected together by means of link/or potentially remote and furthermore has the ability to share programming and equipment assets among a number or clients. TCP/IP convention is the principle correspondence dialect or convention of the web. A wonder such as this may likewise be utilized as a correspondence convention in a private system (either web or extranet). It likewise makes utilization of the client-server model of the correspondence in which the solicitations are made by PC front and clients (customer) the administrations are given by another PC (server) from the network[1]. This correspondence is principally point-to-point, which means have hub is associated with another host hub of another PC in the system. It likewise gives dependability of message amid transmission process. TCP/IP convention offers basic naming and tending to conspire.

The upsides of the TCP/IP convention are [2] (I) It works freely of working framework (OS). (ii) It depends on customer/server engineering. (iii) It can be utilized to set up association between at least

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two PCs. Though the burdens of TCP/IP convention are (I) It is extremely intricate to setup and oversee as it has expansive number of PC/ways/switches. (ii) It just permits to send/get information inside its system.

The TCP/IP convention isn't working tastefully with existing and recently rising remote systems as utilized in military wars, profound sea, profound space, surges, storms and so forth the consequence of this is intemperate postponement, data transfer capacity hub, limitations versatility and lack of power. On account of such condition, there is no closure to end way between the source and its goal which makes network impractical. Numerous systems which have been irregularly associated are as of now under research precedent include: Wireless Sensor Networks (WSNs) [3], Exotic Media Network (EMNs), Mobile Ad-hoc Networks (MANETs) and so on [4]. As the time passed the ere stimulated the need of the death of data between the different sorts of ICNs like Wireless sensor networks (WSNs) and Internet [2]. For making this correspondence conceivable the utilization of entryways were made. These portals make the trading of convention parameters between various ICNs by changing over the convention parameters into the frame worthy by the objective ICN

1.1 Delay Tolerant Network

A piece of systems administration managing issues in withdrew or disseminated particularly without end to end association is known as Delay tolerant network (DTN). The current TCP/IP- based Internet Protocol work in light of a rule of giving end-to-end intervene communication utilizing a connection of potentially divergent link-layer topologies[5] . These Internet protocols don't function very well for a few situations enduring long delays and predictably interrupted communication over long distance because of the few basic assumptions incorporated with the Internet architecture.

- There is node to node path between the source and goal throughout a communication session.
- Constants and well-timed feedback from information collections known as retransmission is essential to repair error for practical communication.
- The node-to-node packet drop chance is less.
- The TCP/IP protocols are help up by or routers and ending stations.
- Communication execution is not a problem of applications.

In any case, in DTN there isn't a confirmation of end to end way, so web switches discard any message in light of the fact that an association is down. That result in data hardship. In DTN, switches can be displaced with DTN hub, which has capacity confine and in the later stage they send groups of data. In case the association is down DTN hub will hold the data until the point that the association comes up. DTN uses store-convey forward (SCF) framework to send the data [6]. The structure of DTN is wanted to contain organize association disturbance by methods for a strategy to manage heterogeneity. The engineering handles the thoughts of irregularly associated systems that may encounter the evil impacts of ordinary portions and that may be engaged with at least one distinctive course of action of protocols or protocol families. Beneath the applications but above the transport layers of the networks on which it is hosted, there exists a bundle layer as shown in the below figure no. 1, known as end to end message overlay.

		Application
Application		Bundle
Transport		Transport
Network		Network
Link		Link
Physical		Physical
Original Five Layer Internet Protocol Stack		DTN Protocol Stack Including Bundle Layer

Figure 1: Protocol Stack of Internet and Delay Tolerant Networks

2. CONGESTION CONTROL IN DELAY TOLERANT NETWORK (DTN)

However, in DTN congestion control is a trying task in light of the fact that in DTN end to end route among source and objective cannot be guaranteed constantly and correspondence latencies can be discretionarily long. Due to this it makes high inducing deferral. It stores the message in its buffer for a long time. It may be in hours or days. Congestion can be controlled by reducing the sending rate in a framework. Congested node drops the groups to oversee blockage. In case dropping rate is speedier than the sending rate then gigantic proportion of groups can be dropped. These messages may have been sent through various past jumps and devour broad framework resources before finally being dropped. That results data can be retransmit which can decrease framework execution.

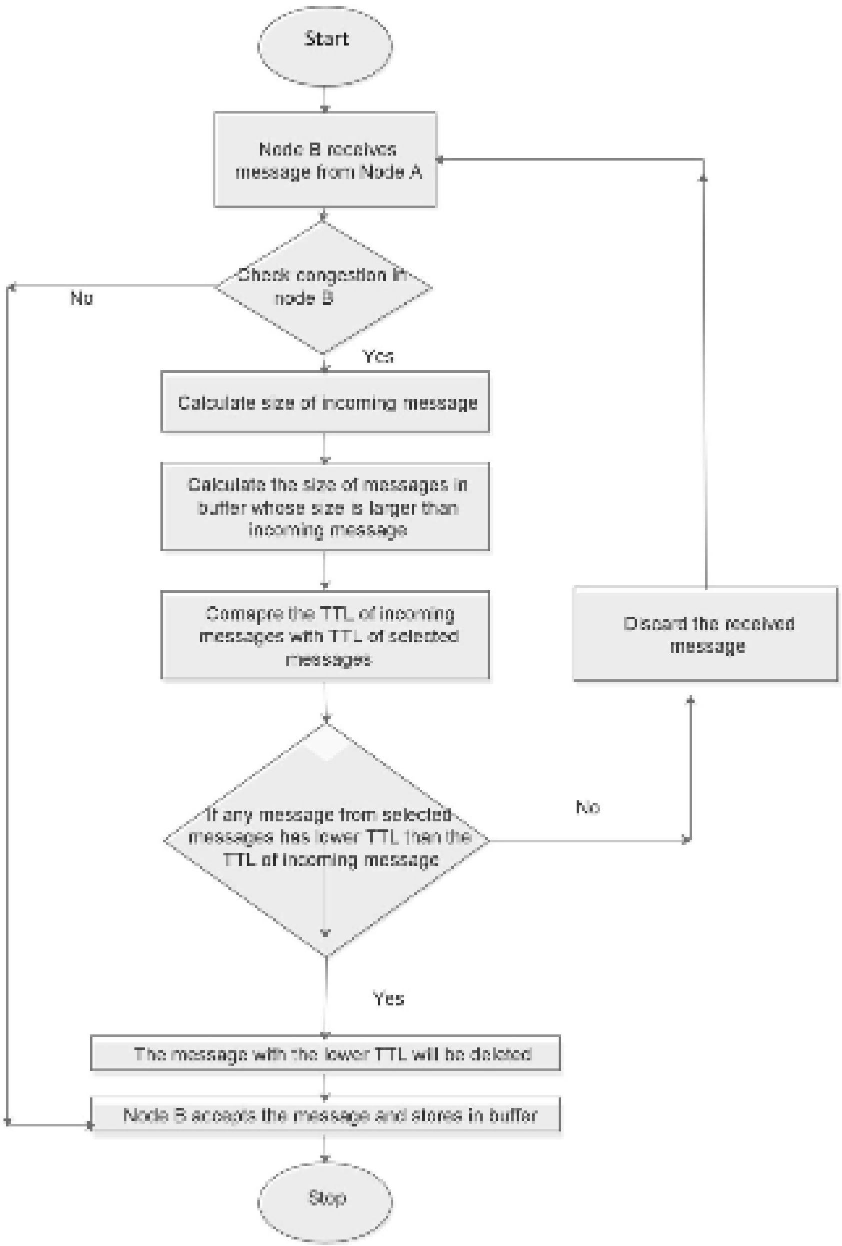
3. RELATED STUDIES

In Delay Tolerant Network, Hua et. al. (2010) [7]proposed a technique dependant on path avoidance. In Storage Management this method separates the stockpiling of custody nodes into three parts such as temporary stockpiling, custody stockpiling and direct transmission stockpiling. Direct transmission stockpiling is used to give guide sending administration to the bundles and it does not give stockpiling administration, so therefore when the congestion problem occurs it can be utilized to trade control data to determine the trouble. Every stockpiling has a least value and change can't surpass the base value. In DTN custody node, the congestion event is a bit by bit technique. To overcome congestion problem, the node state has three states for nodes such as normal state, congestion adjacent state and congestion state. When congestion occurs the nodes change its state from normal state to congestion adjacent state, then again change into congestion state. In Path Avoidance Mechanism, when any node (A) comes into congestion adjacent state, then node (A) disseminate data to its neighboring nodes to report that node (A) has fallen into congestion adjacent state and so that the neighboring nodes avoid path linked to node(A). The researcher found in his PA mechanism that the size of the bundle does not matter for successful delivery rate. APEA stands for Adaptive Parameter Estimation based congestion Avoidance strategy[8] and this strategy deals with buffer management and packet receiving policy. Delay Tolerant Networks (DTNs) are portrayed by discontinuous availability, long delays and frequently limited bandwidth. DTNs regularly utilize multi-copy routing plans for message transmission. Multi-copy routing plans, for example, Epidemic Routing , as a rule prompt congestion issues. So congestion control methodologies can essentially enhance the general working of DTNs. The buffer management strategy more often can't recognizably decrease the network overhead, so researchers built up the packet receiving policy for diminishing most futile transmission in the network. Packets with additional hops and bigger latency, which compare to littler priority weights, will be gotten in lower probability. In this manner, the packet receiving strategy specifically diminishes the network load. The simulation comes about demonstrate that the APEA policy essentially enhances the delivery ratio and diminishes the network load. The average hop number execution of APEA is great as well. Opportunistic Network Based Congestion Control Strategy was proposed by Zhang [9]. In opportunistic system, the moving of nodes isn't subjective yet obliged by existence. nodes can travel more than once in a couple of zones. Hence we can state that in a specific node if the experience likelihood is high with the objective then its neighboring hub experience likelihood will be high as well. For a specific node, both experience likelihood node its neighbor experience likelihood node are high. The message preparing in the astute system grasps the redundancy methodology in the clogged node. In this convention, there is less likelihood that message is sent to the blocked node. There can be abuse of the messages at the neighboring node. The neighboring node will get the traded message presumably, when the likely of the moved neighboring node is high. Exploratory results exhibit that strategy called DATM is utilized to upgrade the rate of message section and abatement the conclusion to-end deferral to some extent. Patil and Penurkar proposed an algorithm such as Congestion Avoiding Strategic Epidemic Routing Algorithm which is used to control the congestion problem in a node. In the DTN there is the basic issue of the congestion, for example, there is the loss of the bundles and there is no affirmation of end to end association. After the congestion there is shot of most elevated need messages will be dropped and it isn't satisfying in a DTN to drop high need messages .Therefore we will utilize some sort of proposition with the goal that need message drop ought to be less by bringing more achievable component of congestion rendering. In touchy applications high need messages ought not be dropped in light of the fact that they are imperative but rather and still, at the end of the day they are disposed of when the node is congested. To conquer this issue scientist proposed a CASE steering calculation.

4. PROPOSED FRAMEWORK

In any system, scattering bundles amid correspondence is an indispensable issue that needs consideration, in like manner in DTN the issue of congestion, relating to parcel falls or messages getting erased, is as fundamental worry as, making the association among nodes where end to end association isn't guaranteed. In DTN the normal latency of the system and hop jump count are similarly settled and every has some fix value. Our proposed system for system blockage depends on congestion avoidance approach (proactive). Our research essentially centers around buffer management strategy. The buffer management strategy regularly can't discernibly diminish the system overhead so we build up the new dropping arrangement which depends on size of the message and TTL of the message. According to our proposed system an edge an incentive for support inhabitance is build up and all the approaching message are obliged in the nodes buffer typically until the point when the edge value is accomplished. At the point when the space of the buffer draws close to the limit value our proposed system winds up dynamic. According to our proposed structure when another message comes, size of the approaching message is ascertained. Messages having biggest size from the approaching bundle in the buffer node are perceived and chosen. After that the Time to Live (TTL) value is acquired for chosen messages. An examination of the TTL estimation of the approaching message and chosen message is performed. On the off chance that any message in chosen message has bring down TTL value than the TTL estimation of the approaching message, the message with lower TTL will be dropped generally the approaching message can't be obliged in the nodes buffer.

Flowchart of the proposed framework



5. EXPERIMENTAL RESULTS

In order to executive the proposed idea there are some system prerequisites. The system should support Java based integrated opportunistic network environment (ONE) simulator, which is a extremely recommended for performing DTN related research simulation and monitor the enviable results. We are using Java Net Beans with ONE Simulator setup. There are few classic performance metrics for examining the work of DTN protocols such as delivery probability, over head ratio, buffer average time, hop count average.

Table 1: Simulation Parameter

btInterface.transmitSpeed = 250k
btInterface.transmitRange = 30
Group.movementModel = ShortestPathMapBasedMovement
Group.router = EpidemicRouter
Group.bufferSize = 4M; 8M; 12M; 16M; 20M; 24M;30M
Group.waitTime = 300, 900
Group.speed = 0.5,1.5
Group.nrofHosts = 100
Events1.interval = 15,30
Events1.size = 125k, 1M
Events1.hosts = 0,99
World Speed = 4500, 3400
MovementModel.warmup = 1000

The results obtained from the above mentioned **scenario** of our experiment with different parameters are summarized below in the Table Nos. 2 to 5 and figure nos. 2 to 5

Table 2: Delivery Probability in comparison to normal and proposed technique

	Delivery Probability		
Buffer size	**Normal**	**Proposed**	**Percentage**
4MB	0.1564	0.1656	5.88
8 MB	0.2544	0.2851	12.07
12 MB	0.3267	0.3779	15.67

16 MB	0.4067	0.4410	8.43
20 MB	0.4590	0.4769	3.90
24 MB	0.5133	0.5277	2.81
30 MB	0.5692	0.5728	0.63

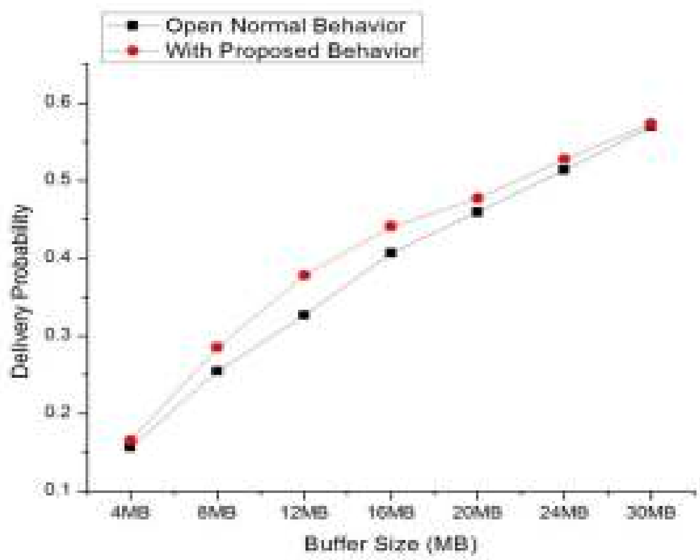


Figure 2: Delivery Probability in comparison to normal and proposed technique

From the data of Table 2 it is concludes that the delivery probability of the nodes increases from 0.6% to 16% (approximate) with different buffer size ranges from 4 Mb to 30 Mb when our proposed buffer management mechanism is implemented. The results in table also shows that the proposed mechanism gives improvement at various buffer sizes but the maximum percentage increase in the delivery probability is observed at 12 Mb buffer size and this increase is about 16%. The results of the above table are also depicted in the above line graph (Figure 2).

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Table 3: Overhead Ratio in comparison to normal and proposed technique

	Overhead Ratio		
Buffer size	**Normal**	**Proposed**	**Percentage**
4 MB	115.1082	172.1455	49.55
8 MB	121.3488	172.2860	41.98
12 MB	114.4694	143.5183	25.38
16 MB	99.8008	123.8198	24.07
20 MB	91.6257	109.9473	19.99
24 MB	83.5834	95.0826	13.76
30 MB	78.2622	83.9150	7.22

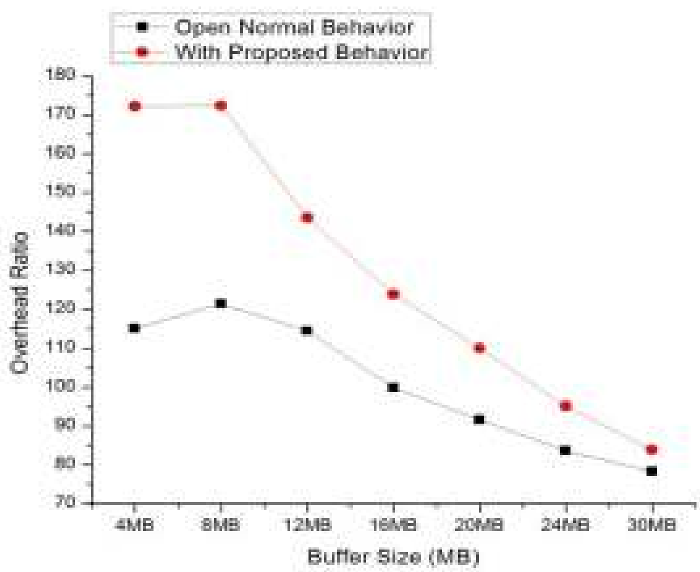

Figure 3: Overhead Ratio in comparison to normal and proposed technique

From the facts and figures mentioned in Table 3, is can be analyzed that the overhead ratio of the proposed mechanism is high as compared to the Normal behavior. But this increase in the overhead ratio is at the cost of increased delivery probability in case of our proposed mechanism. There is increase in overhead ratio as our mechanism removes the messages with larger size and less

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probability/time to get delivered and make space for the new incoming message which has higher chances of being delivered. The results in table also shows that the proposed mechanism gives improvement at various buffer sizes but the maximum percentage increase in the overhead ratio is observed at 4 Mb buffer size and this increase is about 50%. The results of the above table are also depicted in the above line graph (figure 3).

Table 4: Hop Count Average in comparison to normal and proposed technique

	Hop count Avg.		
Buffer size	**Normal**	**Proposed**	**Percentage**
4 MB	4.6459	5.0186	- 8.02
8 MB	5.0827	4.3004	15.39
12 MB	5.1429	3.9118	23.94
16 MB	4.6444	3.7174	19.96
20 MB	4.3162	3.6172	16.19
24 MB	3.9660	3.4509	12.99
30 MB	3.7541	3.2945	12.24

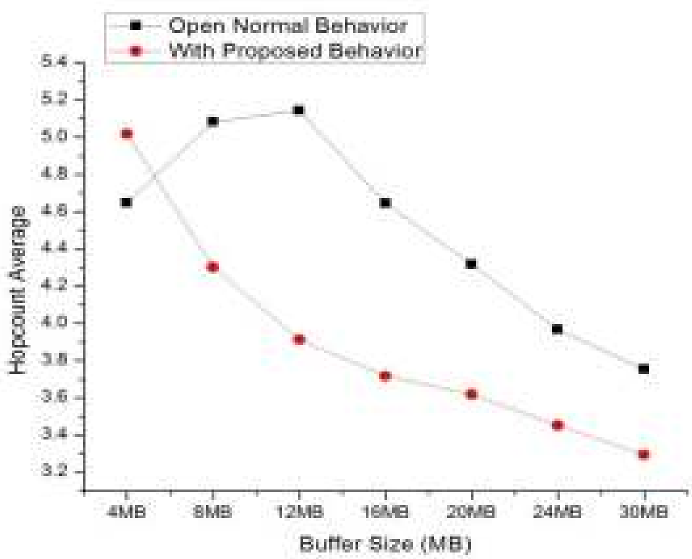

Figure 4: Hop Count Average in comparison to normal and proposed technique

From the facts and figures mentioned in Table 4, it can be analyzed that the hop count average of the proposed mechanism has improved as compared to the Normal behavior. The results in table shows that the proposed mechanism gives improvement at various buffer sizes but the maximum percentage enhanced in the hop count average is observed at 12 Mb buffer size and this increase is about 24%. At the smallest buffer size value i.e. 4 mb, the proposed mechanism negatively impacted the hop count average i.e. about 8% as compared to normal behavior. The results of the above table are also depicted in the above line graph (figure 4).

Table 5: Buffer Time Average in comparison to normal and proposed technique

	Buffer time Avg.		
Buffer size	**Normal**	**Proposed**	**Percentage**
4 MB	872.1414	579.8245	33.52
8 MB	925.1948	709.1013	23.36
12 MB	1048.0384	911.4895	13.03
16 MB	1202.0508	1081.4895	10.03
20 MB	1375.0491	1249.1182	9.16
24 MB	1531.7079	1385.8144	9.52
30 MB	1747.6875	1572.6636	10.01

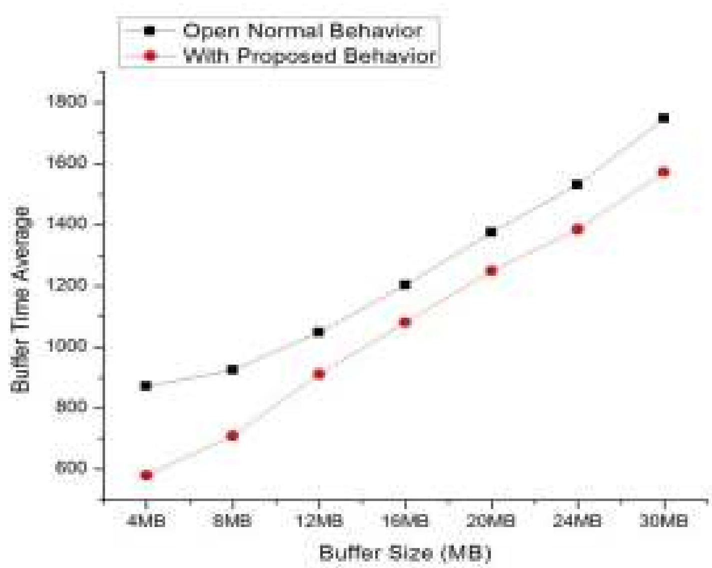

Figure 5: Buffer Time Average in comparison to normal and proposed technique

From the results obtained and shown in Table 5, it is evident that with the new proposed buffer management mechanism, the messages are now being delivered more quickly and staying for less time in buffer of the nodes. The results in table also shows that the proposed mechanism gives improvement at various buffer sizes but the maximum percentage increase in the buffer time average is observed at 4 Mb buffer size and this increase is about 34%. This means that the buffer is being now relaxed for accommodating the new incoming messages and hence contributes in higher delivery probability. The results of the above table are also depicted in the above line graph (figure 5).

8. CONCLUSION

In this paper we proposed another blockage shirking structure to forestall clog in the nodes buffer. In this strategy to take care of the issue of congestion we utilized the size and TTL of the message. We have led an analysis by utilizing the ONE Simulator with pestilence convention and most brief way outline development display. Reenactment results demonstrate that conveyance probability has made strides. The upgrade in conveyance probability has been seen up to 16 percent. The reenactment results additionally demonstrate that to suit another message when an old message is dropped the overhead ratio expanded which is common. Buffer time average has back tumbled off when the proposed structure wound up dynamic. In future we will extend our proposed structure on various directing conventions and furthermore on various development models to keep away from the clog in hub's support.

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