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Scheduling and Dropping Policies in Delay Tolerant Network

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Abstract: Sometimes end to end connectivity may not exist between the nodes, sometimes it is too expensive to connect all the networks and sometimes due to some catastrophic effect, exchanging of messaging are difficult, so it can cause delays from hours to days, hence networking of this type of situation is called as Delay Tolerant Network. As no end to end connectivity between the nodes so it require buffer at each node to store incoming messages. The network uses a store-carry-forward mechanism, while sending a message from one node to another node. Messages which are stored at each node carry along with him until it reaches to the next node and then forward. Here two scheduling policies are named as PRIORITY+ algorithm and FACTOR algorithm. PRIORITY+ algorithm considers a priority of message with different routing algorithm. FACTOR algorithm considers the TTL value with priority of that particular message. Algorithms can achieve better delivery ratios with less overhead and latency ratio.

Keywords: Include at least 4 keywords or phrases.

I. INTRODUCTION

A delay tolerant network is a wireless network where nodes are mobile but there is no end-to-end connectivity between nodes [1] [3]. This type of communication environments subject to delay and disruptions. The difference between traditional network and delay tolerant network is shown in table 1.

	Traditional network	**Delay Tolerant network**
E2E connectivity	Continues	Frequent disconnection
Propagation Delay	Short	Long
Transmission reliability	High	Low
Link data rate	Symmetric	Asymmetric

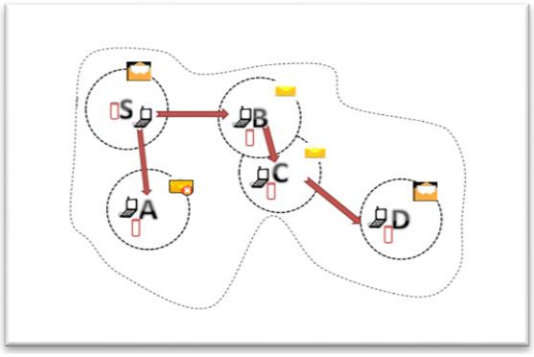

Fig 1: General DTN architecture

When source node is in contact with any intermediate node (the node which is close to destination node) then message(s) stored at source node is forwarded to that node and carry along it till it reaches to the destination node. This process is continued until it reaches to the destination node hop by hop. This mechanism is called "store-carry-forward" mechanism. This type of architecture is called as Delay Tolerant Network Architecture, shown in Fig.1. In order to increase delivery probability we propagated multiple replicas of messages [2].

Delay Tolerant Networking Research group (DTNRG) [4] is very useful while understanding DTN related standards. In DTN architecture, we have a bundle layer. Bundle layer is between the transport layer and application layer. The bundle is nothing but messages or we can say that collection of messages. For keeping a collection at each node we require buffer with efficient management technique which are scheduling policies and dropping policies shown in fig.2. Efficient scheduling decides which messages should be sent first and efficient drop policies will decide which message should be discarded first.

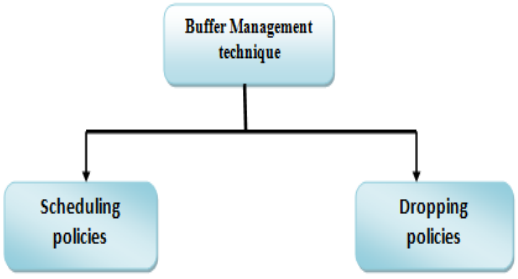

Fig.2.Buffer Management Technique.

In this Paper, a Delay Tolerant Network is used to analyze different scheduling policy on different scenarios and introduces a new scheduling policy which gives a better result than already implemented scheduling policy. All the work is done on ONE(opportunistic Network Environment) simulator.

The remainder of the paper is organized as follows. Section II elaborates on the background about scheduling

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and dropping policies for DTNs. Section III presents our DTN laboratory tested, while Section IV focuses on the performance analysis of the proposed approaches. Finally, Section V concludes the paper and points some directions for future work.

II. SCHEDULING AND DROP POLICIES

To support different type of application with different type of scenario we have to schedule messages with their priority to destination node or intermediate nodes. First step, we are dividing that messages into three different classes which are ExpMsg (Expidted messages), NorMsg (Normal Messages), BulkMsg (Bulk messages). Then we send messages having different priorities with different routing algorithm, this technique is called as Priority+ scheduling policy. The flow of the priority+ scheduling algorithm is shown in following flowchart figure 3. Another algorithm is about considering TTL and Prioirty of that particular message, The message which having high priority and high TTL value will schedule first. The flow of this algorithm is shown in figure 4.

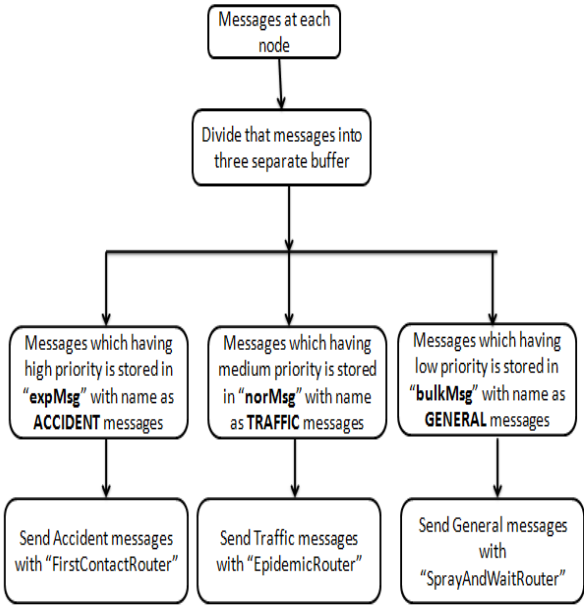


Fig 3: flow chart of PRIORITY+ scheduling policy

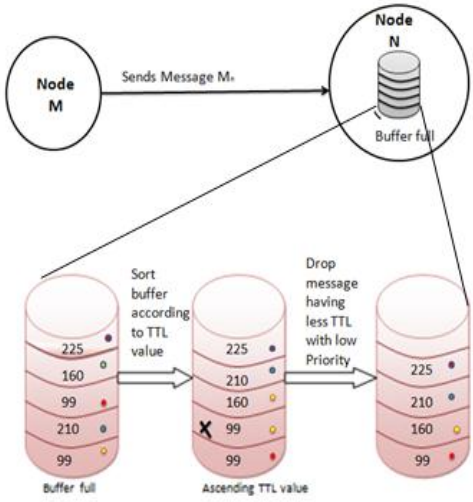


Fig4: FACTOR scheduling policy

III.PERFORMANCE EVALUATION

This section evaluates the impact of the above-described scheduling and drop policies on the performance of a previous define scheduling policy in DTN. For this purpose, a simulation study using the Opportunistic Network Environment (ONE) Simulator [10] has been executed. Next subsections present the simulation setup and results analysis.

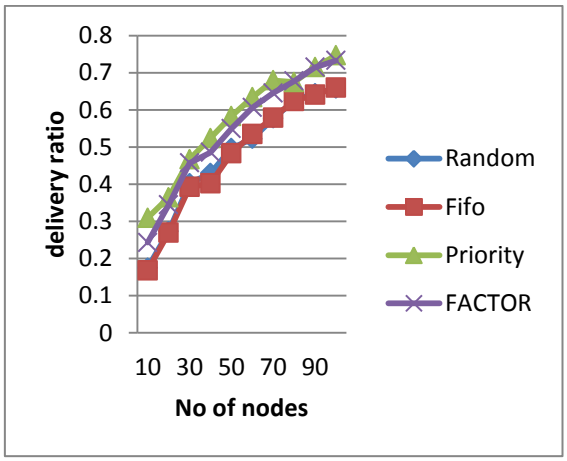
Simualtion setup

In order to evaluate scenarios close to the reality, we use a real world map-based model of part of the Helsinki downtown area, with a dimension of 4500×3400 meters (Figure 3).

Simulation time	43200(12 Hrs)
Interface Type	Bluetooth Interface
Transmission speed	2 Mbps = 250kBps
Transmission range	10 Meters
Mobile Node Speed	2.5 to 4.0 m/s
SendQueueMode	FIFO/RANDOM/ PRIORITY+/FACTOR

Result Analysis:

Delivery probability defined as the number of packets sent from the sender and its successful reception at the destination.



The overhead ratio is calculated using the following equation:

$$\text{Overhead ratio} = \frac{(\text{Number of relaying messages} - \text{Number of delivered messages})}{\text{Number of delivered messages}}$$

The latency measured here is the time that elapses between the creation of a message and its delivery at its destination. The average of the latency of the packets over the entire simulation time is considered.

This is the time as calculated for the delivered packets only.

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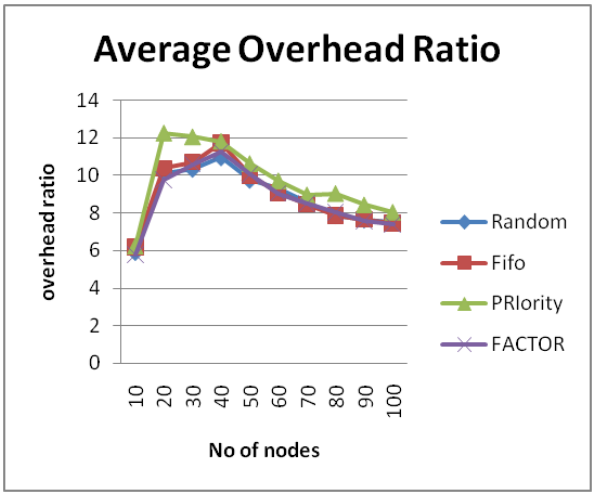

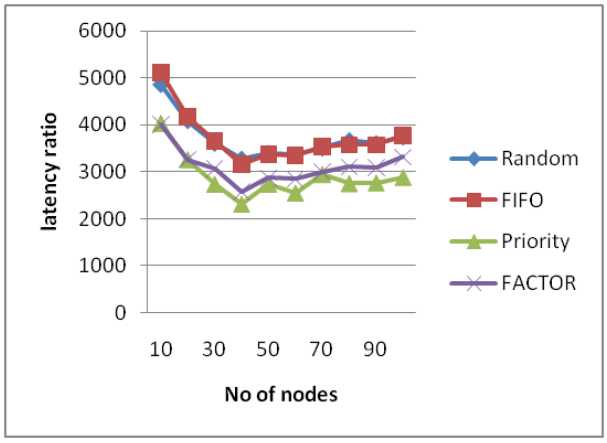

IV. CONCLUSION

In this paper, we investigated the problems of scheduling and buffer management in DTNs. We have proposed Priority+ and Factor scheduling technique using the ttl value of particular messages and their respective priorities. This gives around 10-15% more efficient result as compared to FIFO and random scheduling policies. We can send higher priority messages with higher ttl value first.

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