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A Novel Message Scheduling Framework for Epidemic and Two hop forwarding routing in homogeneous Delay Tolerance networks

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Abstract: Epidemic routing and two-hop forwarding routing are two routing schemes used in delay tolerant networks. That allows multiple message replicas to be received in order to increase message delivery ratio and to reduce message delivery delay. But this suffers from buffer space limitation. Thus, to achieve efficient utilization of network resources, it is important to come up with an new message scheduling strategy to determine which messages should be forwarded and which should be dropped in case of buffer is full. A novel message scheduling framework for epidemic and two-hop forwarding routing maintains the forwarding or dropping decision. It checks for the nodes priority for message delivery. This can be made at a node during each contact to achieve optimal message delivery ratio or message delivery delay and also buffer space is maintained.

Index terms: Routing, Buffer Management, message scheduling, DTN.

I. INTRODUCTION

One of the characteristics of a delay tolerant network is the lack of an end-to-end path for a given node pair for an extended period. To cope with frequent and long-lived disconnections due to node mobility, a node in a DTN is allowed to buffer a message and wait until it finds an available link to the next hop. The next node buffers and forwards the received message accordingly if it is not the destination of the message. This process continues until the message reaches its destination. Buffering and forwarding unlimited number of messages may also cause intolerable resources and nodal energy consumption, and it is not able to set up with buffer limitations at the DTN. With such buffer limitations at the DTN nodes, message drop or loss could happen due to buffer overflow. A newly proposed technique called novel message scheduling framework under epidemic and two-hop forwarding, aiming to enable effective decision process on which messages should be forwarded and which should be dropped when the buffer is full.

Thus it maintains the buffer space and also reduces message delivery delay as well as it increases the message delivery ratio. It deals with the message propagation prediction under epidemic forwarding and evaluates the delivery delay and or delivery ratio at any time instance during message lifetime.

This paper is organized as follows: Section II Presents Related Work. Section III presents proposed Techniques. The Experimental Results of the schemes are presented in section IV Section V presents conclusion of this paper.

II. RELATED WORK

Epidemic Routing for Partially Connected Ad Hoc Networks [A. Vahdat and D. Becker, Technical Report CS-200006, Duke Univ., Apr. 2000**]**.Mobile ad hoc routing protocols allow nodes with wireless adaptors to communicate with one another without any network infrastructure. Existing ad hoc routing protocols, while robust to rapidly changing network topology, assume the presence of a connected path from source to destination. Given power limitations, the advent of short-range wireless networks, and the wide physical conditions over which ad hoc networks must be deployed, in some scenarios it is likely that this assumption is invalid. Techniques to deliver messages in the case where there is never a connected path from source to destination or when a network partition exists at the time a message is originated. Finally epidemic routing is introduced, where random pair-wise exchanges of messages among mobile hosts ensure eventual message delivery. Efficient Routing in Intermittently Connected Mobile Networks: The Multiple-Copy Case [Spyropoulos, K. Psounis, and C.S. Raghavendra, IEEE Trans. Networking, vol. 16, no. 1, pp. 63-76, Feb. 2008**]** Intermittently connected mobile networks are wireless networks where most of the time there does not exit a complete path from the source to the destination. There are many real networks that follow this model, for example, wildlife tracking sensor networks, military networks, vehicular ad hoc networks, etc. Then propose a family of multi-copy protocols called Spray routing, which can achieve both good delays and low transmissions. Spray routing algorithms generate only a small, carefully chosen number of copies to ensure that the total number of transmissions is small and controlled. Then, an appropriate single-copy algorithm is used to route each of the copies independently. From the perspective of functionality, spray routing can be viewed as a tradeoff between single and multiple copy techniques. Despite this, theory and simulations show that spray routing:

1. Achieves an order of magnitude reduction in transmissions compared to flooding-based schemes, and even fewer transmissions than some single-copy schemes.
2. At the same time achieve better delays than all existing schemes in most scenarios, if carefully designed. It has very desirable scalability characteristics, with its relative performance improving as the network size increases.The Message Delay in Mobile Ad Hoc Networks [R.Groenevelt,p.Nain and G.Koole, July-2005**]**A stochastic model is introduced that accurately models the message delays in mobile ad hoc networks where nodes relay messages and the networks are sparsely populated. The model has only two input parameters:

1. The number of nodes. 2. Parameter of an exponential distribution which describes the time until two random mobiles come within communication range of one another. From this we derive both a closed-form expression and an asymptotic approximation of the expected message delay. As an additional result, the probability distribution function is obtained for the number of copies of the message at the time the message is delivered.

These calculations are carried out for two protocols: 1. The two-hop multi copy. 2. The unrestricted multi copy protocols. Routing protocols using relay nodes have been proposed that increase the message delivery ratio in mobile ad hoc networks. These protocols operate on a store-carry-forward mode to take advantage of node mobility to improve node connectivity, and ultimately the message throughput.

III. SYSTEM OVERVIEW

Buffer management using Novel Message Scheduling Framework technique to increase the message delivery ratio also reduces the message delivery delay.

1) Network Configuration Module

In network configuration module, a local network is constructed using sender node, intermediate nodes and Receiver node. Then connection establishment is made between them for file transformation over the network. Given power limitations, the advent of short-range wireless networks, and the wide physical conditions over which ad hoc networks must be deployed, in some scenarios it is likely that this assumption is invalid. In this it develop techniques to deliver messages in the case where there is never a connected path from source to destination or when a network partition exists at the time a message is originated. To this end introduce epidemic routing, where random pair-wise exchanges of messages among mobile hosts ensure eventual message delivery.

The goals of Epidemic Routing are to:
1. Maximize message delivery rate.
2. Minimize message latency.
3. Minimize the resource consumption.

2) Data Transfer Module

In this module the sender sends the file to its all neighbor nodes, which are said to be the intermediate nodes. All the intermediate nodes will receive the file from the sender. The intermediate nodes maintain the incoming data details such as file name, file size, file type and destination. There are two widely employed DTN routing schemes, namely; the epidemic and controlled flooding schemes. With the Epidemic scheme, whenever two nodes encounter each other, they exchange all messages they do not have in common. Therefore, the message copies are spread like an "epidemic" throughout the network to every node using the maximum amount of resources. With controlled flooding, a limited number of copies of each message are generated and disseminated throughout the network hop forwarding or source.

Average elapsed time for all the message data transfer between the nodes is T^=∑i=1toj*Ti / j.
Where j is the total number of messages that have been seen by the nodes. Ti is the time taken by the message to reach the destination.

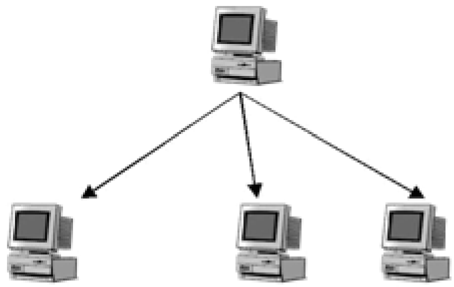


Fig.3.1 Data Transfer

1. Sender sends the file to its all intermediate nodes.

2. All the intermediate nodes will receive the file.

3. The intermediate nodes maintain incoming data details such as,
- File size.
- File name.
- File type and destination.

*3) **Buffer Management Module***

In this module the buffer details are maintained by the intermediate nodes. The buffer size will alter according to the arrival of the files. The buffer details include total buffer size, occupied size and available size. The neighbor node details are also maintained by the intermediate nodes.

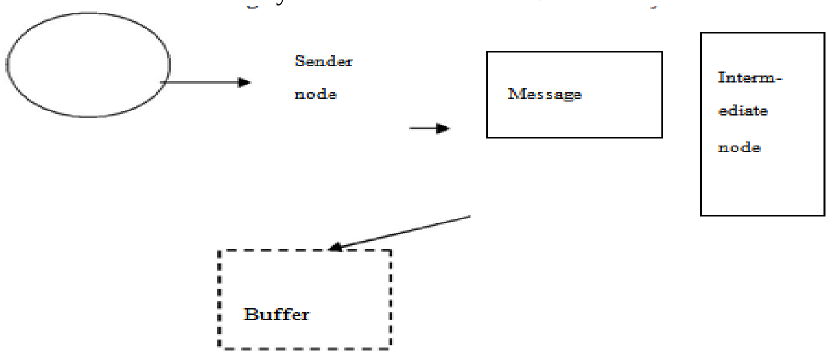


Fig.3.2 Buffer management

The buffer management scheme that divides the buffer into a number of queues different priorities. When the entire buffer is full, some of the messages in the lowest priority queue are dropped to give room for new messages. Specifically, their method estimates the number of copies of message i based on the number of buffered messages that were created before message i. Although interesting, the method may become inaccurate when the number of network nodes is getting larger, especially for newly generated message. Moreover, it is assumed that every node is aware of all messages that has encountered during contacts with other nodes, which raises practicability issue. Maintaining such message forwarding history is expected to cause very high overhead. It is clear that it leaves a large room to improve, where a solution for DTN message scheduling that can well estimate and manipulate the perceived nodal status is absent. The buffer size will alter according to the arrival of the files. The buffer details include total buffer size, occupied size and available size.

4) ***Message Scheduling***

This module is used for the purpose of message scheduling.The message scheduling framework consists of 4 processes.

1. Summary Vector Exchange Module (SVEM):

The network information summarized as a summary vector is exchanged between the sender and the intermediate nodes, which includes the following data:

1) Statistics of inter encounter time of every node pair maintained by the nodes.

2) Statistics regarding the buffered messages, including their IDs, remaining time to live (R_i), destinations for each incoming message.

2. Network State Estimation Module (NSEM): The NSEM is used to obtain the estimated m_i (T_i), n_i (T_i), and s_i (T_i) Where, m_i (T_i) – Number of nodes who have seen message i n_i (T_i) - Number of copies of the message i. s_i (T_i) – Number of nodes who have seen message i and their buffers were not full.

3. Utility Calculation Module (UCM):

UCM is used to optimize the average delivery ratio or delivery delay i.e., estimates per-message utility value.

4. Decision:

The decision of forwarding or dropping the buffered messages is made based on the buffer occupancy status and the utility value of the messages.

5) ***Data Retrieval***

In this Module the file which is transferred by the intermediate nodes will be received by the receiver nodes. The receiver can save the received file to the desired location. Thus the file is successfully reached the destination node.

A given message exchange and routing protocol can be evaluated along a number of different axes. Performance metrics include the average latency in delivering messages, the average amount of system storage and communication bandwidth consumed in delivering a message, and the amount of energy consumed in transmitting the message. save the received file to the desired location. Thus the file is successfully reached the destination node.

RAT E (%)	RATE AVG(S)	LATENCY	DELI-VERY
250m	94.0	98.2	100.0
100m	99.0	34.3	100.0
10m	99.0	82.0	97.0
25m	98.0	85.3	99.0

Moreover, it is assumed that every node is aware of all messages that has encountered during contacts with other nodes, which raises practicability issue. This can be resolved by a newly proposed technique, it will provide optimal message delivery ratio and also reduces the message delivery delay.

3.1techniques Used

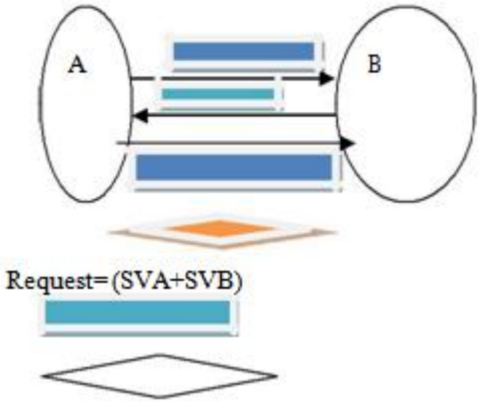
1. Background Of Fluid Flow Model:

The DTN message scheduling and dropping task under epidemic and two-hop forwarding routing follows a fluid-flow Markov chain process. The fluid flow model can then be used to formulate the rate of message propagation among nodes, analyze the expected time until a given node (destination) is infected, and then calculate the delivery ratio (delivery probability). Since solving the fluid flow model using a Markov chain-based approach is subject to extremely high-computation complexity, approximate the problem by using an ODE and derive a close-form solution of the problem. Note that the ODE-based approach for solving a Markov chain model has been used for similar networking problems yet with proven efficiency and correctness. ni(ti) denotes the number of nodes with message i in their buffers also referred to as "infected" at time t, where t is counted from the creation time of message i.

2. Epidemic And Two-Hop Routing:

There are two widely employed DTN routing schemes, namely, the epidemic and controlled flooding schemes. With the Epidemic scheme, whenever two nodes encounter each other, they exchange all messages they do not have in common.

Therefore, the message copies are spread like an "epidemic" throughout the network to every node using the maximum amount of resources. With controlled flooding, a limited number of copies of each message are generated and disseminated throughout the network.



Messages unknown to B

Fig.3.3 Epidemic and Two hop routing

An architecture description is a formal description and representation of a system, organized in a way that supports reasoning about the structure of the system which comprises system components, the externally visible properties of those components, the relationships between them and provides a plan from which products can be procured and systems developed that will work together to implement the overall system. This shows the message is send from source node. Source sends the message to intermediate nodes. Inside the buffer decision is taken. Finally the message reaches the destination.

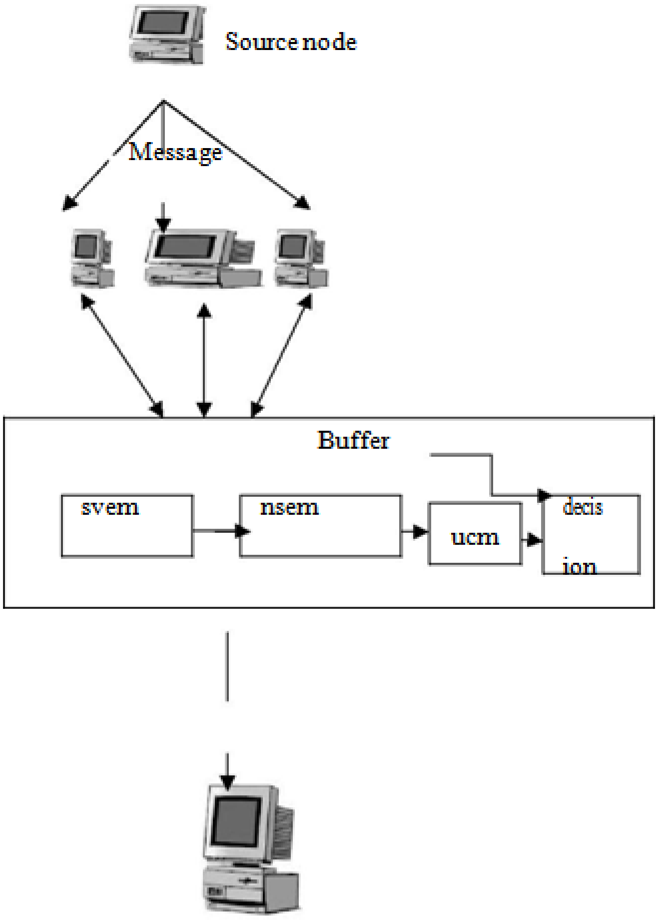
Summary Vector Exchange Module: The network information summarized as a summary vector is exchanged between the sender and the intermediate nodes, which includes the following data: Statistics of inter encounter time of every node pair maintained by the nodes Statistics regarding the buffered messages, including their IDs, remaining time to live (R_i),destinations for each incoming message.

Network State Estimation Module (NSEM):

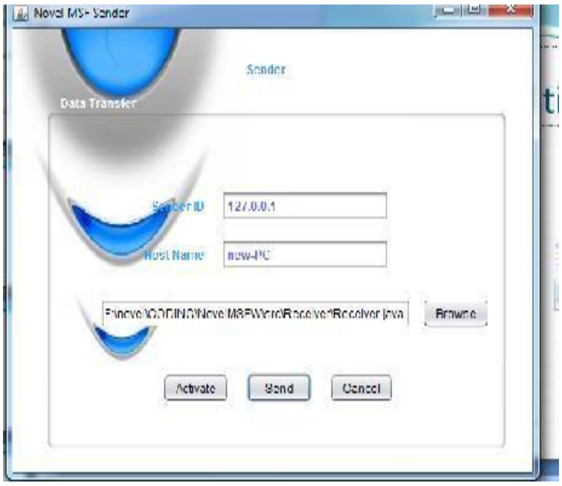
The NSEM is used to obtain the estimated m_i (T_i), n_i (T_i), and s_i (T_i) Where, m_i (T_i) – Number of nodes who have seen message i n_i (T_i) - Number of copies of the message

s_i (T_i) – Number of nodes who have seen message i and their buffers were not full.

Utility Calculation Module: UCM is used to optimize the average delivery ratio or delivery delay. *Decision*: The decision of forwarding or dropping the buffered messages is made.



NODE 1



NODE 2

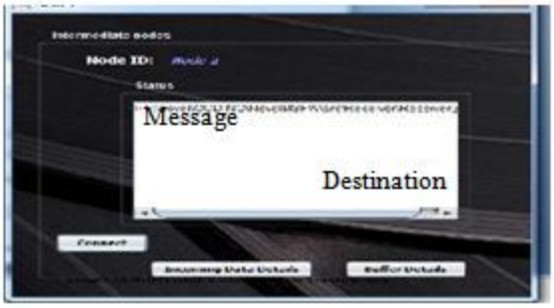


Fig.3.4 Message scheduling

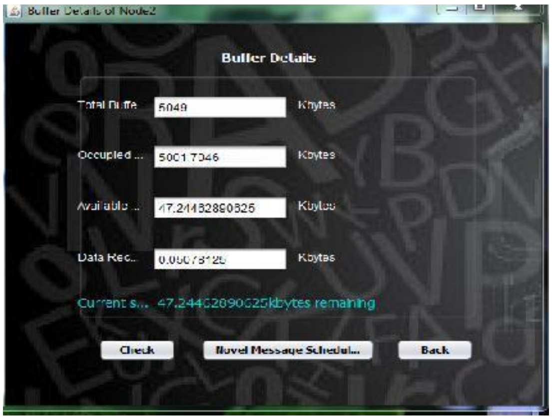


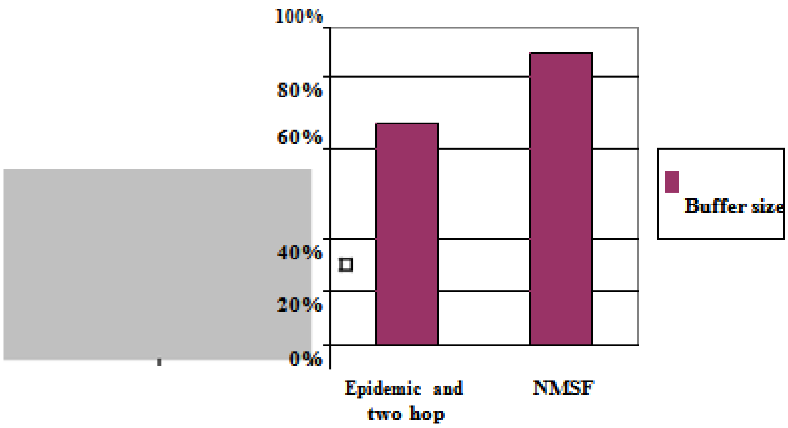
Fig.4.2 Data Transfer Module

IV. RESULTS AND ANALYSIS

Fig. 4.1-4.4 shows the experimental result of four modules. Fig 4.1 shows the Network Configuration module. Fig 4.2 shows the Data Transfer module. Fig 4.3 shows the Buffer Management module.

Fig.4.3 Buffer management

1) *Performance Evaluation:*



The performance graph shows the message delivery ratio comparison with routing protocols and NMSF. With the Epidemic scheme, whenever two nodes encounter each other, they exchange all messages they do not have in common. Therefore, the message copies are spread like an "epidemic" throughout the network to every node using the maximum amount of resources. With controlled flooding, a limited number of copies of each message are generated and disseminated throughout the network hop forwarding or source.

V. CONCLUSION AND FUTURE SCOPE

It is concluded that a novel message scheduling framework for epidemic and two-hop forwarding routing in homogeneous DTNs, aiming to optimize either the message delivery ratio or message delivery delay. The proposed framework incorporates a suite of novel mechanisms for network state estimation and utility derivation, such that a node can obtain the priority for dropping each message in case of full buffer. The future scope is to develop another type of routing schemes. Thus message delivery can be made faster better than the existing system. The packet delivery ratio can be estimated by using the routing schemes. Instead of using priority based method selection of node priority can be done with another scheduling scheme. Thus more delay can be reduced by using new techniques.

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