Two Hop Based Method for Progressive Packet Arrival in Delay Tolerant Networks

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Abstract— Delay-tolerant networking (DTN) is an approach to computer network architecture that seeks to address the technical issues in heterogeneous networks that may lack continuous network connectivity. Generally in networks the ability to transport, or route, data from a source to a destination is a fundamental ability all communication networks must have. Delay and disruption-tolerant networks (DTNs) are characterized by their lack of connectivity, resulting in a lack of instantaneous end-to-end paths. In this challenging environment we are able to effectively forward the packets from source to destination. When we need to transfer a large file from source to destination then here we are making all these packets available at source and then transfer as small packets. We are analyzing the performance of packets arriving at the source and then considering the linear blocks and rate less random linear coding to efficiently generate the redundancy as well as the energy constraint in the optimization. And then these small packets of large file are forward through the multiple paths to destination by using optimal user centric allocation and scheduling the packets at receiver side. We determine the conditions for optimality in terms of probability of successful delivery and mean delay and we devise optimal policies, so-called piecewise-threshold policies.

Key words: Delay Tolerant Networks, Spray and Wait Routing Protocol, Optimal Scheduling, Transmission Policy, Network Coding

I. INTRODUCTION

Delay Tolerant Networks (DTNs), also called as intermittently connected mobile networks, are wireless networks in which a fully connected path from source to destination is unlikely to exist. However, effective forwarding based on a limited knowledge of contact behavior of nodes is challenging. When large files need to be transferred from source to destination make all the packets available at the source and transfer the file as small packets. Study of the packets arrival at source and analysis of their performance is done. It is considered that the linear blocks and rate less linear coding to generate redundancy and also for energy constraint. Scheduling the large file into small packets and delivering through multipath to destination, for this we use optimal user centric allocation and scheduling the packets in the receiver side.

Delay or Disruption Tolerant Networks (DTNs) are characterized by long delays and intermittent connectivity. Moreover, they may have power constraints, low and asymmetric bandwidth, and high bit-error rates.

For the transmission of packet, we use spray and wait routing protocol. Wasteful resource consumption in the epidemic routing, could be significantly reduced if the level of distribution is somehow controlled. The spray and wait mechanism is used to control the level of spreading of messages throughout the network. Similar to the epidemic routing, the spray and wait protocol assumes no knowledge of network topology and nodes mobility patterns and simply forwards multiple copies of received messages using flooding technique.

The difference between this protocol and the epidemic routing scheme is that it only spreads L copies of the message. The spray and wait method consists of two phases, spray and wait phase. In the spray phase the source node after forwarding L copies of message to the first L encountered nodes, goes to wait phase, waiting for delivery confirmation. In the wait phase all nodes that received a copy of the message wait to meet the destination node directly to deliver data to it. Once data is delivered confirmation is sent back using the same principle.

II. EXISTING SYSTEM

In Delay Tolerant Networks, there is an intermittent connectivity between the DTN nodes. In such a scenario, links among DTN nodes may be unusual, for example due to low densities of active nodes, so that the plan of routing strategies is the most important phase to authorize timely delivery of packets to a intended end user destination with high probability. When mobility is unsystematic, i.e., cannot be known in advance, this is achieved at the cost of many duplications of the data, a method which consumes high power and memory resources. Because a lot of relay nodes may be involved in guarantying delivery, it becomes critical to design competent resource allotment and data storage rules and regulations.

A. Drawbacks of Existing System:

The basic problem is to deal with lack of constant connectivity and nevertheless be proficient to transmit data from source to destination.

The routing methods that influence relays' memory and mobility are a normal solution in order to improve message delivery delay.

As and when bulky files need to be transmitted from source to destination, not all packets may be available at the source prior to the first transmission.

III. PROPOSED SYSTEM

This paper focuses on general packet arrivals at the source and two-hop routing. We distinguish two cases: when the source can overwrite its own packets in the relay nodes, and when it cannot. The contributions are fourfold:

- For work-conserving policies (i.e., the source sends systematically before stopping completely), we derive the conditions for optimality in terms of probability of successful delivery and mean delay.
- In the case of non-overwriting, we prove that the best policies, in terms of delivery probability, are

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piecewisethreshold. For the overwriting case, work-conserving policies are the best without energy constraint, but are outperformed by piecewise-threshold policies when there is an energy constraint.

- We extend the above analysis to the case where copies are coded packets, generated both with linear blockcodes and rateless coding. We also account for an energy constraint in the optimization.
- We illustrate numerically, in the non-overwriting case, the higher efficiency of piecewise-threshold policies compared with work-conserving policies by developing a heuristic optimization of the thresholds for all flavors of coding considered. As well, in the overwriting case, we show that work-conserving policies are the best without any energy constraint.

IV. MODEL OF DTN

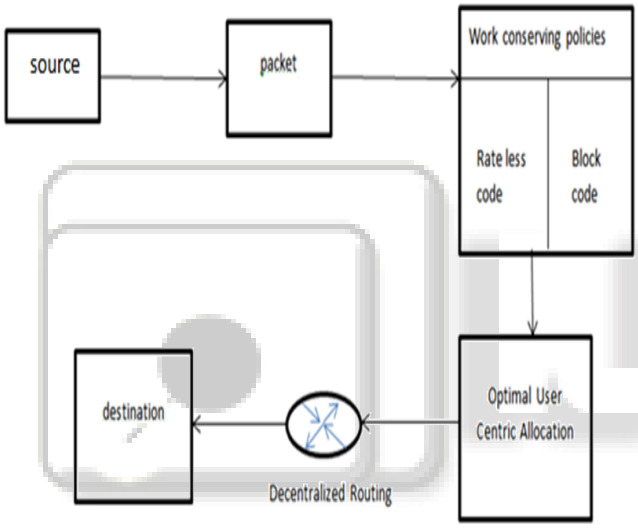

Fig. 1: Model of DTN

Consider a network that contains N + 1 mobile node. Two nodes are able to communicate when they come within reciprocal radio range and communications are bidirectional. We assume that the duration of such contacts is sufficient to exchange all frames: this allows to consider nodes meeting times only, i.e., time instants when a pair of not connected nodes falls within reciprocal radio range.

Times between contacts of pairs of nodes are exponentially distributed with given inter-meeting intensity. A file contains K frames. The source of the file receives the frames at some times t1 ≤ t2 ≤ ...≤ tK.ti are called the arrival times. The transmitted file is relevant during some time τ.By that it is meant that all frames should arrive at the destination by time t1+τ. Do not assume any feedback that allows the source or other mobiles to know whether the file has made it successfully to the destination within time τ.If at time t the source encounters a mobile which does not have any frame, it gives it frame i with probability ui(t).

Consider two-hop routing in this we used two concept are used, overwrite case and non-overwriting case. In the existing concept non-overwriting case are highly efficient but overwriting cases without constraints are not efficient, so in this work we use rate less code and block code for removing the overwriting case due to the transmission of packet. Rateless code and block code is used to share the information sequence to the receiver without data loss, overwriting and delay. In this work due to the data transmission the multi path can be create using optimal user centric algorithm in the source side.

Using the multi path the data can split into packet and assign packet to each node due to the transmission then packet are schedule using decentralized routing process based on the integer linear programming in the receiver side In the scheduling packet the packet can schedule and receive to the client side. We use erasure coding technique to increase the reliability and to further decrease the cost of routing. For a given desired delivery rate and deadline for delivery, we find that optimum parameters to obtain the smallest cost both in single period and two period erasure coding based routing. We also analyze the effects of message distribution algorithms on the cost of routing both in replication based (i.e. spray and wait) and erasure coding based algorithms. We analyze real DTN traces and detect the correlations between the movements of different nodes using a new metric called conditional intermeeting time. We then use the correlations between the meetings of a node with other nodes for making the existing single-copy based routing algorithms more cost efficient.

A. Merits of Proposed System:

In DTNs the framework is different since the challenge is to overcome frequent disconnections. We proposed a technique to erasure code a file and distribute the generated code-blocks over a large number of relays in DTNs, so as to increase the efficiency of DTNs under uncertain mobility patterns.

The performance gain of the coding scheme is compared with simple replication. The benefit of coding is assessed by extensive simulations and for different routing protocols, including two hop routing.

In this work we tried to provide a solution by the design of stateless routing protocols based on network coding, under intermittent end-to-end connectivity, and the advantage over simple probabilistic routing is established.

B. Routing Protocols in DTN:

Wasteful resource consumption in the epidemic routing, could be significantly reduced if the level of distribution is somehow controlled. The spray and wait mechanism is used to control the level of spreading of messages throughout the network. Similar to the epidemic routing, the spray and wait protocol assumes no knowledge of network topology and nodes mobility patterns and simply forwards multiple copies of received messages using flooding technique.

The difference between spray and wait routing protocol and the epidemic routing scheme is that it only spreads L copies of the message. The spray and wait method consists of two phases, spray and wait phase. In the spray phase the source node after forwarding L copies of message to the first L encountered nodes, goes to wait phase, waiting for delivery confirmation. In the wait phase all nodes that received a copy of the message wait to meet the destination node directly to deliver data to it. Once data is delivered confirmation is sent back using the same principle.

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C. Comparison Chart of Packet Delivery Probability:

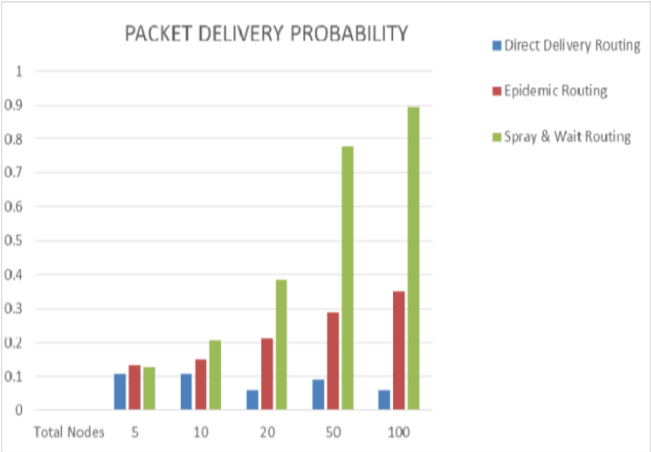

Fig. 2: Comparison chart of Packet Delivery Probability

Figure,shows the comparison chart of packet delivery probability for Direct Delivery Routing, Epidemic Routing and Spray and Wait Routing. From the chart it can be noticed that when 5 nodes are there at that time packet delivery probability given by all the three routing protocols are almost equal. Whereas in the case when total number of nodes are 10, 20, 50 and 100, the Epidemic Routing and Spray and Wait routing shows increment in packet delivery probability but at the same time packet delivery probability of Direct Delivery routing decreases. It is just because the Direct Delivery routing uses hand-to-hand packet delivery strategy. So, as the total number of nodes increase the possibilities to meet with the destination node in the Direct Delivery routing decreases.

If we only concentrate Epidemic routing and Spray And Wait routing then from the graph it is clearly noticed that still performance of Epidemic routing is not up to mark whereas Spray and Wait routing shows excellent performance in terms of packet delivery probability.

D. Algorithms Used:

*Algorithm 1:*Constructing an optimal Work-Conserving policy

(1) Use $p_t = e_1$ at time t ∈ $[t_1, t_2]$.
(2) Use $p_t = e_2$ from time t_2 till s(1,2) = min(s(2,{1,2}),t_3). If s(1,2) < t_3 then switch to p_t= $\frac{1}{2}(e_1 + e_2)$ till time t_3.
(3) Define $t_{k+1} = \tau$.Repeat the following for i = 3,…..k:
(4) Set j = i, Set s(i , j) = t_i
(5) Use $p_t = \frac{1}{i+1-j}\sum_{k=j}^{i} e_k$ from time s(i,j) till s(i,j-1) := min(s(j,{1,2,…i}),t_{i+1}). If j=1 then end.
(6) If s(i , j-1) < t_{i+1} then take j = min(j : j ∈ j(t , {1,….,i})) and go to step (5)

*Algorithm 2:*Rateless coding after tK

(1) Use $p_t = e_1$ at time t ∈ $[t_1, t_2]$.
(2) Use $p_t = e_2$ from time t_2 till s(1,2) = min(s(2,{1,2}),t_3). If s(1,2) < t_3 then switch to p_t= $\frac{1}{2}(e_1 + e_2)$ till time t_3.
(3) Repeat the following for i = 3,…..k - 1:
(4) Set j = i, Set s(i , j) = t_i
(5) Use $p_t = \frac{1}{i+1-j}\sum_{k=j}^{i} e_k$ from time s(i,j) till s(i,j-1) := min(s(j,{1,2,…i}),t_{i+1}). If j=1 then end.
(6) If s(i , j-1) < t_{i+1} then take j = min(j : j ∈ j(t , {1,….,i})) and go to step (5)
(7) From t = t_k to t = τ ,use all transmission opportunities to send a random linear combination of information frames, with coefficients picked uniformly at random in Fq.

V. SIMULATION STRATEGY

A. The ONE Simulator:

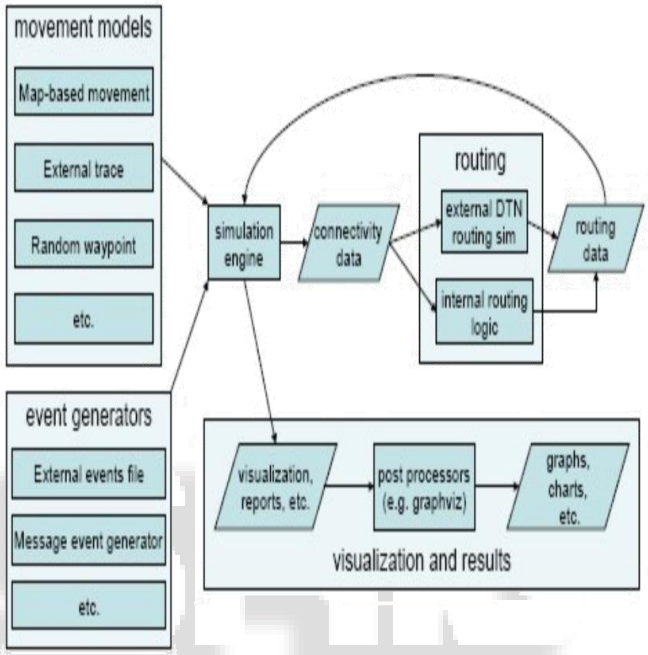

Fig. 3: Overview of the ONE simulation environment

Node movement is implemented by movement models. Connectivity between the nodes is based on their location, communication range and the bit-rate. The routing function is implemented by routing modules that decide which messages to forward over existing contacts. Finally, the messages themselves are generated through event generators. The messages are always unicast, having a single source and destination host inside the simulation world.

Simulation results are collected primarily through reports generated by report modules during the simulation run. Report modules receive events (e.g., message or connectivity events) from the simulation engine and generate results based on them. The results generated may be logs of events that are then further processed by the external post-processing tools, or they may be aggregate statistics calculated in the simulator. Secondarily, the graphical user interface (GUI) displays a visualization of the simulation state showing the locations, active contacts and messages carried by the nodes.

VI. CONCLUSION

Information is send to the destination after available of entire data at the source side. We use two concepts overwriting and non-overwriting cases non-overwriting case are highly efficient but overwriting case without constraints

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are not efficient, so we use rateless code and block code for removing the overwriting case for the transmission of packet.

Rateless code and block code is used for share the information sequence to the receiver without data loss, overwriting and delay. For data transmission the multi path is created using optimal user centric algorithm in the source side. Using the multi path the data can split into packet and assign packet to each node for the transmission, then packet are schedule using decentralized routing process based on the integer linear programming in the receiver side. In the scheduling packet the packet can schedule and receive to the client side. For this we have used spray and wait routing protocol for high packet delivery probability. This process can use to efficiently send the data from source side to the destination side using delay tolerant network.

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