Introducing Heterogeneity in Mobile Communication Through Disruption Tolerant Network

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***Abstract*— An unprecedented increase in the mobile data traffic volume has been recently reported due to the extensive use of smart phones, tablets and laptops. Moreover, predictions say that this increase is going to be yet more pronounced in the next 3-4 years. This is a major concern for mobile network operators, who are forced to often operate very close to their capacity limits. Smart mobile devices are generating a tremendous amount of data traffic that is putting stress on even the most advanced cellular networks. Delayed offloading has recently been proposed as an efficient mechanism to substantially all stress .A mobile device to delay transmission of data packets for a certain amount of time, while it searches Wi-Fi networks to offload the data during the time. When the time expires it completes the remaining portion of the delayed transmission through the cellular network that is available at the moment. In this paper we propose a Greedy Algorithm with the analytical framework using an embedded Markov process for the delayed offloading system that can be used to understand the performance improvements achievable by Wi-Fi-based data offloading, as a function of Wi-Fi availability and performance, and user mobility and traffic load.**

Keywords- Mobile data offloading, storage allocation, Disruption Tolerant Networking

INTRODUCTION

Recent advances in mobile devices are fueling the dramatic growth of mobile data traffic all over the world. In order to support ubiquitous connectivity from such mobile devices to the Internet, cellular network providers are struggling to increase the capacity of their cellular networks by reducing cell sizes, widening the wireless channel bandwidth and upgrading the communication standards. This continued growth of mobile data traffic is creating challenges to the business model of cellular network providers who need to incur prohibitively large expenses for upgrading their networks, while the earnings from their subscribers remain relatively stagnant. Service interruption literally means unwilling discontinuity of service in the queue, and this models connection and disconnection periods of a mobile device to Wi-Fi networks in the system. Given these heavy-tail distributions of connection and disconnection periods, mathematical challenges arise in deriving a closed-form equation from the queuing process (which is obviously non-Markovian) on how much mobile data can be offloaded to Wi-Fi networks for a chosen deadline. We propose a general analytical framework that handles such challenges.

Our queuing system is characterized by three factors:
(i) Server vacation with non-exhaustive service,
(ii) Heavy-tailed vacation and non-vacation periods
(iii) Impatient customers with deterministic reneging times.

Direct device-to-device communications can be leveraged to transmit large amounts of data by using the unused bandwidth between mobile devices that are in proximity, over Bluetooth or Wi-Fi, which offloads data from the cellular network. Indeed, many researchers have actively studies offloading mobile data from the overloaded. A mathematical framework to study the DTN based mobile traffic offloading of multiple mobile data items in a realistic mobile environment. This problem is challenging for several reasons. Firstly, mobile data provided by service providers are not single uniform type. Because mobile data have different delay-sensitivities, content sizes, etc, it is difficult for providers to decide how to offload these heterogeneous mobile data. Secondly, user's demands and interests to mobile data are very different, and this must be considered in the design of any offloading scheme.

The service provider only selects some of the mobile users that currently are not retrieving mobile data for themselves as the helpers to participate in the offloading to help the data transmission to the relevant subscribers via the DTN communication. We point out that our proposed algorithms can be applied directly to the more generic mobile data offloading problem where a mobile user can be both a subscriber and a helper. For the helpers, the system requires their storages to buffer some data items. There are two types of nodes in the system, known as offloading helper and mobile data subscriber, respectively. The service provider first chooses some users that are willing to participate in data offloading. Therefore, they may be selected as the offloading helpers. Mobile data are heterogeneous in terms of size and lifetime, Mobile users have different data subscribing interests; and the storages of offloading helpers are limited. When it has a set of mobile data items to deliver, the storage allocation decision is made, and it then transmits the mobile data to these chosen helpers through the cellular network properties that some nodes may play a globally important role in the network, which can help offloading a very large amount of the mobile data. Service provider select heterogeneous data make storage, carry, and transmit data to helpers. User (device) wants to communicate and get information from helpers are also user i.e., a device means device to device communication. To cope with explosive traffic demands on current cellular networks of limited capacity, Disruption Tolerant Networking (DTN) is used to offload traffic from cellular networks to high capacity and free device-to-device networks. Direct device-to-device communications can be leveraged to transmit large amounts of data.

II RELATED WORK

Offloading mobile data from overloaded cellular networks to other networks in order to provide better service. These works can be divided into three types according to their offloading destination networks. Broadcast offloading utilizes mobile broadcasting network to offload the cellular traffic, and the work proposes an architecture called UNAP. Another popular offloading method utilizes freely available Wi-Fi networks which may be referred to as Wi-Fi offloading. Specifically, the work proposes a mechanism for using network diversity to improve the application-level aggregate bandwidth, which is termed Intentional Networking. Networking. By using the measurements obtained in a Wi-Fi and cellular 3G network coverage area, it shows that the system latency is enhanced significantly. The problem of augmenting mobile 3G using Wi-Fi in a moving vehicular environment is studied, in which designs a system called Wiffler to augment the mobile 3G capacity by leveraging delay-tolerance and fast switching. It shows that, for a delay tolerance of 60 seconds, 45% of the traffic can be offloaded to Wi-Fi. The study investigates daily mobility patterns of humans, and finds that Wi-Fi can offload about 65% of the total mobile data traffic from mobile 3G networks and save 55% of battery power without using any delayed transmission. In our work, we also study the problem of Wi-Fi offloading but we focus on another type of mobile social network offloading, which transmits the traffic by opportunistic communications between users. The work exploits the opportunistic communications among devices to facilitate offloading by peer-to-peer sharing after one user has obtained the content. Specifically, the heuristic algorithm designed is shown to be capable of offloading cellular traffic by up to 73.66% for the traces studied. But multi-hop opportunistic forwarding is employed in which a set of targeted users are selected to disseminate the traffic to all other users. This multi-hop forwarding needs all the users to cooperate in the traffic offloading by using their own resources, which can be unrealistic, and it is unsuitable to mobile data offloading. In our solution, we rely on crucially a small set of users who are willing to participate in the offloading. By contrast, we focus on how to efficiency allocate the buffer resource of the helpers after they are selected by the system.

III PROPOSED WORK

We use an architecture which combines Proxy based system and Peer to Peer system to reduce the load on the Helper Nodes. We have used the Markov-Chaining for the transmission of data in the mobile nodes. The problem in this architecture is that nodes are unreliable which may frequently break the chain during the transmission of data between the nodes. Hence we propose a new data replication technique on peers for improving the reliability of the data transmission.

For the generic offloading scenario, we have a Greedy Algorithm (GA). When one or more copy of a certain item is stored in a helper which satisfies the constraints, the objective function will be enhanced. The gain in the objective function is generally different for different choices of item and helper. Thus, we can choose the data item and helper that maximizes the gain on the objective function among all the legitimate choices at each step, as our first strategy.

Data replication is defined as the more number of copies of the same data are stored in different requested nodes. In this paper we have followed four major steps for the overall optimality of the data streams. Firstly the check the data is where replicated into number of replicas and these replicas must be stored in which nodes. Secondly it requires a data placement policy, which decides, how many number of replicas should be placed on the nodes.
Thirdly a selection policy is required to select a node that contains a replica of the data for optimal streaming and finally, we have used a Time Markov Chain model to analyze the system performance of the replication in case of node failures.

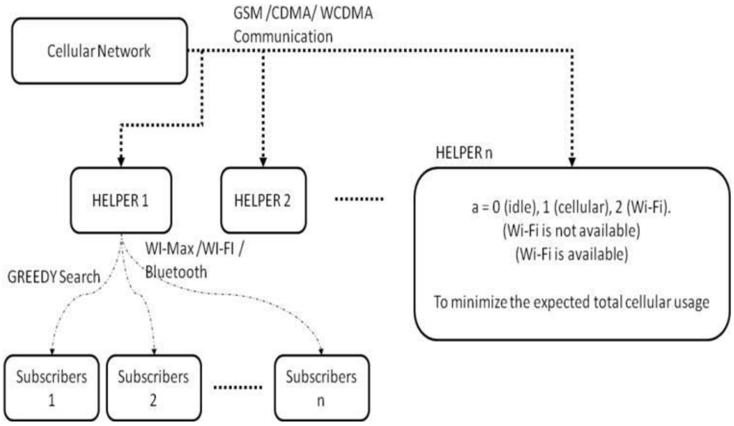

Fig.1.System Architecture

We divide the entire task into six subtasks as

1. Node creation.
2. Network formation.
3. Greedy algorithm implementation.
4. Markovian analysis for Proxy Selection
5. Path selection.
6. Analysis

(a) Node Creation

This mainly to create a node with specific kind of information such as Node Name, IP address, Port Number and those information's are stored in the database. The wireless communication established between the Nodes created on. Each and every node must be requesting to its server connected to the database.

(b) Network Formation

The simulation is done in ns2. In the simulation model, there are 50 sensor nodes deployed in a 800x600 m2 field. All the nodes are set as static nodes. The type of the wireless propagation model is Two Ray Ground. Routing protocol which is used in this simulation is AODV

(c) Greedy Algorithm Implementation

Greedy algorithm can be employed as an approximate solution to the problem. When one more copy of a certain item is stored in a helper which satisfies the constraints, the objective function will be enhanced.

Thus, we can choose the data item and helper that maximizes the gain on the objective function among all the legitimate choices at each step, as our first strategy.

(d) Markovian Analysis For Proxy Selection

Whenever a new node makes a request for a data with its existing resource information to the Helper then proxy node replies to this new node with the list of all active serving peers which contains the requested movie in it. Now the non serving peer should make a decision in selecting a serving peer from the list.

(e) Path Selection

The mechanisms for path selection when the energy of the sensors in original primary path has dropped below a certain level. This allows us to distribute energy consumption more evenly among the sensor nodes in the network. Numbers of hop counts are also identified by using this method. The Energy Efficiency of the individual node is increased by this path selection method.

(f) Analysis

Analysis is done using following parameters

Packet Delivery ratio
Residual Energy
Delivery Latency

IV EXPERIMENTAL RESULT

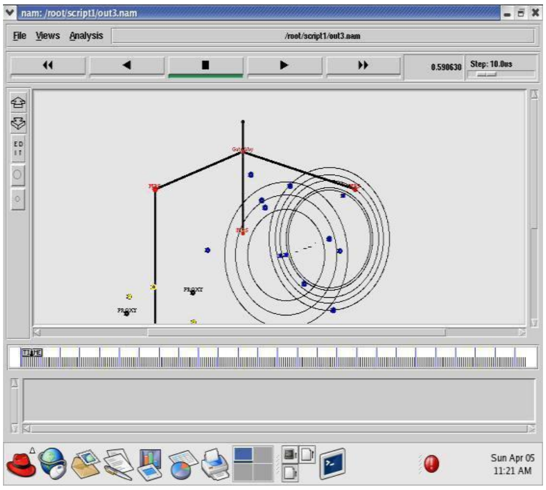

Fig.2.Data Transfer

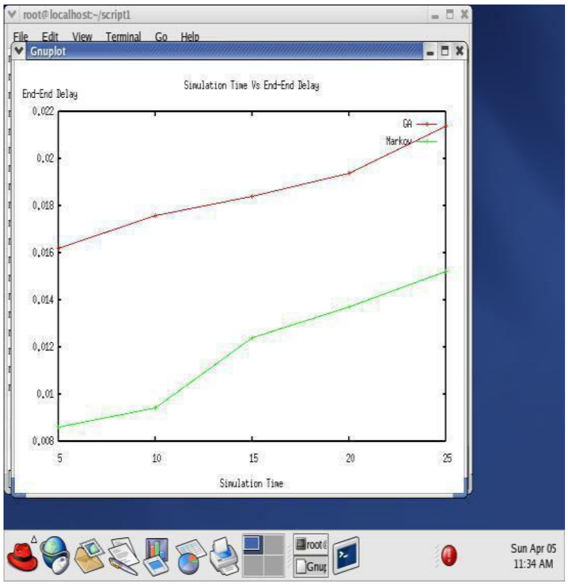

Fig.3. Simulation Time Vs End-to-end Delay

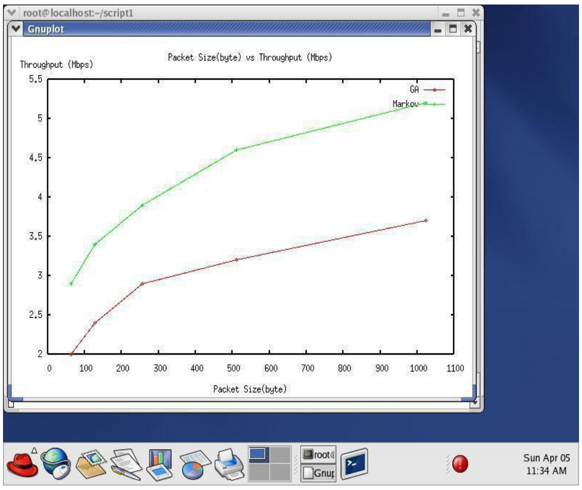

Fig.4.Packet Size (Bytes) Vs Throughput (Mbps)

V FURTURE WORK

For future work, to improve the accuracy of data delivers to the user by reducing the mobile data traffic with the help of Fem-to-cells and mobile data offloading in efficient manner. Based upon the comparative analysis it can be said that a typical customer who don't want to pay for a dual mode smart phone or iphone, is a little technical savvy, want to get good coverage of network at home, Fem-to-cell is a good solution.

VI CONCLUSION

We have studied the problem of how to offload multiple mobile data traffics from overloaded cellular networks in a realistic heterogeneous DTN-based network environment, where offloaded data consist of multiple contents with different delay tolerances and sizes, and the storage resources of helpers are limited. The Markov process, achieves the best performance under the generic heterogeneous DTN-based offloading scenario.

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