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Composite portable data off-load through interruption compassionate Networks

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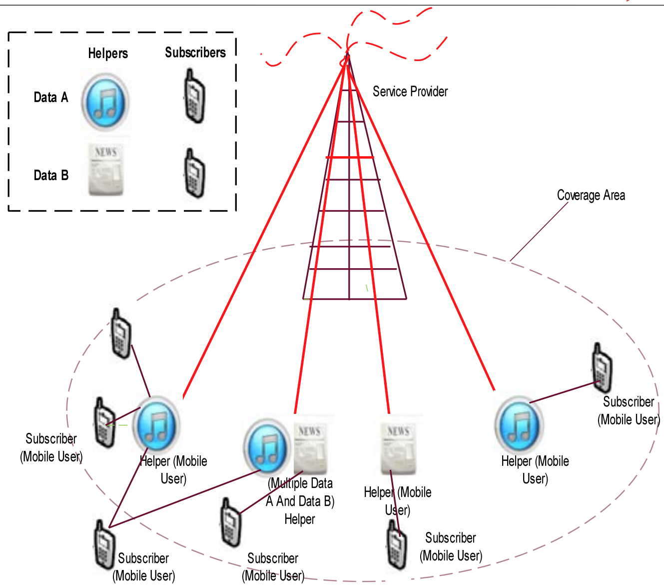
Abstract : Carry out to increase the storage of offloading helpers and to group the related data and data lifetime can be increased so that the mobile users can receive data from helpers alone not from service providers traffic totally reduced. In our DTN-based mobile data offloading system, some chosen users, named helpers, will participate in the offloading. Incentives for these users can be achieved by using some micro-payment scheme, or the operator can offer the participants a reduced cost for the service or better quality of service. The service provider chooses some users that are willing to participate in the data offloading, and transmits the mobile data to the chosen users through cellular network, and then these users further propagate the data to other users that are interested in it by short range device-to-device communication. If any users still have not received the data from the helpers after a tolerable duration which is related to the data lifetime, they directly receive data from the cellular network.

Key words - Mobile data offloading, storage allocation, Disruption Tolerant Networking.

I. INTRODUCTION

New generation of mobile devices have seen their computation power, storage and communications capabilities enhanced significantly. Up-to-date mobile phones all have multiple network interfaces, such as 3G, Wi-Fi and Bluetooth. These advanced devices help to create an enabling environment, where the network potential bandwidth and communication opportunity can be effectively utilized to enhance users' experience. For example, 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, users' demands and interests to mobile data are very different, and this must be considered in the design of any offloading scheme. Thirdly, a DTN has very limited network resources in practice, e.g. storage and battery capacity of mobile devices are limited, and communication contacts in a DTN are opportunistic by nature. How to efficiently exploit the limited resources to improve the overall system performance is a very challenging problem. Although several store-carry-and-forwarding schemes have been proposed for DTNs, most of them are end-to-end routing solutions and do not take into account the crucial fact that users' interests are different.



II. RELATED WORKS

Mobile traffic is growing today, with the increase of the mobile services and user demands, current cellular networks will, very likely, be overloaded and congested. Explosive traffic demands on current cellular networks of limited capacity. Especially during peak time and in urban area, users face extreme performance hits in terms of low network bandwidth, missed voice calls, and unreliable coverage. Limited spectrum and over-the-air bandwidth constrain multimedia applications, such as mobile TV, streaming music or video downloads. 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. Note that mobile data may include multimedia content like movies that are very large in size, and even the 32 GB of storage available on the current state-of- the-art devices becomes limited in comparison. Also it is unrealistic to ask a helper to contribute all its storage solely for offloading. Thus, we should consider the storage that each helper is willing to share as the constraint, which determines the number of data items that can be stored. Taking this realistic condition into consideration, we assume that helper s, $s \in H$, can at most buffer Ls size of data items. Since we use device-to-device communication to offload the data to subscribers, nodes can only communicate when they move into transmission range of each other. However, such short-range communications can often provide comparatively high data transmission rates, and nodes may complete very large mobile data transmission during one contact. We assume that the contacts between any two nodes occur at Poisson rates.

III. PROPOSED SYSTEM

In our DTN-based mobile data offloading system, some chosen users, named helpers, will participate in the offloading. Incentives for these users can be achieved by using some micro-payment scheme, or the operator can offer the participants a reduced cost for the service or better quality of service. The service provider chooses some users that are willing to participate in the data offloading, and transmits the mobile data to the chosen users through cellular network, and then these users further propagate the data to other users that are interested in it by short range device-to-device communication. If any users still have not received the data from the helpers after a tolerable duration which is related to the data lifetime, they directly receive data from the cellular network. Carry out to increase the storage of offloading helpers and to group the related data and data lifetime can be increased so that the mobile users can receive data from helpers alone not from service providers traffic totally reduced.+

1. Subscribers that are interested in the data by short range device-to-device communication. The subscribers after obtaining the data will not propagate the data further to others that are interested in them. Subscribers are users in the network.

2. Offloading Helpers, 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.

3. 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.

4. User (device) want 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.

5. **Algorithms:**
6. **Greedy Algorithm:**
7. Greedy Algorithm (GA) for generic multiple mobile data offloading.

8.
9. 1: Initialise $m = 0$ and $\mathbf{A}0 = \emptyset$;
10. 2: **while** $m = 0$ or $U(\mathbf{A}m) - U(\mathbf{A}m{-}1) > 0$ **do**
11. 3: $m = m + 1$
12. 4: (sm, km)=argmax $(s,k)\in\mathbf{P}$ $(U(\mathbf{A}m{-}1 \cup \{(s, k)\}) - U(\mathbf{A}m{-}1))$
13. 5: $\mathbf{A}m = \mathbf{A}m{-}1 \cup \{(sm, km)\}$
14. 6: **end while**
15. 7: Initialise $j = 0$ and $\mathbf{B}0 = \emptyset$;
16. 8: **while** $j = 0$ or $U(\mathbf{B}j) - U(\mathbf{B}j{-}1) > 0$ **do**
17. 9: $j = j + 1$
18. 10: (sj, kj) = arg max $(s,k)\in\mathbf{P}$ $U(\mathbf{B}j{-}1\cup\{(s,k)\}){-}U(\mathbf{B}j{-}1)$ lk
19. 11: $\mathbf{B}j = \mathbf{B}j{-}1 \cup \{(sj, kj)\}$
20. 12: **end while**
21. 13: **if** $U(\mathbf{A}m) > U(\mathbf{B}j)$ **then**
22. 14: $\mathbf{OPT}* = \mathbf{A}m$;
23. 15: **else**
24. 16: $\mathbf{OPT}* = \mathbf{B}j$
25. 17: **end if**
26. 18: Return $\mathbf{OPT}*$ and $U(\mathbf{OPT}*)$
27.
28. **Approximation Algorithm:**
29. Approximation Algorithm (AA) for multiple mobile data offloading under the scenario of short lifetimes.

30.
31. 1: Initialize $\mathbf{OPT}* = \emptyset, U(\mathbf{OPT}*) = 0$. Initialize the approximation parameter ε as required.
32. 2: **for** every helper s that $s \in H$ **do**

3: Compute the weight for each data item, denoted by pk, pk = lkTk _ i∈N _γs,iwi,k_, ∀k ∈ C4: Compute the quantisation precision r = _log_ ε · max k∈C {pk} C __

5: Update the weights for all data items, denoted by $p\_ k = \_pk\ 10r\ \_, \forall k \in C$
6: Initialize $\mathbf{T} = \emptyset$, $P0 = 0$, $\mathbf{Q}0 = \{(\mathbf{T}, P0)\}$
7: **for** $\forall k \in C$, $i = 1{:}C$ **do**
8: Obtain $\mathbf{Q}i = \mathbf{Q}i{-}1 \cup \{(\mathbf{T} \cup \{k\}, Pi{-}1 + p\_ k)|\_j\in\mathbf{T}\ lj + lk \le Ls$ and $(\mathbf{T}, Pi{-}1) \in \mathbf{Q}i{-}1\}$
9: **if** $\exists$ $\_\mathbf{T}1, P1\_ , \_\mathbf{T}2, P2\_ \in \mathbf{Q}i$, satisfies $P1 = P2$ and $\_j\in\mathbf{T}1\ lj > \_j\in\mathbf{T}2\ lj$ **then**
10: Update $\mathbf{Q}i = \mathbf{Q}i\backslash \_\_\mathbf{T}1, P1\_\_$
11: **end if**

12: **end for**
13: Select $\{(\mathbf{T}*, P*)\} \in \mathbf{Q}C$, where $P* = \max P \in \{(\mathbf{T}, P)\} \in \mathbf{Q}C$
14: Update $xs,k = 1, \forall k \in \mathbf{T}*$
15: $\mathbf{OPT}* = \mathbf{OPT}* \cup \{(s, k)|xs,k = 1, \forall k \in C\}$
16: **end for**
17: Return **OPT**∗ and $U(\mathbf{OPT}*)$

Homogeneous Algorithm:

Homogeneous Algorithm (HA) for multiple mobile data offloading under the homogeneous scenario.

1: Set $xs,k = 0$, $uk = 0$, $\_Fk = 0$, $k \in C$, $s \in H$;
2: Initialize set $IC = \{1, 2, \cdot \cdot \cdot ,C\}$ and sum = 0;
3: **for** every data item k that $k \in IC$ **do**
4: $\_Fk \leftarrow l (Fk (uk + 1) - Fk (uk))$;
5: **end for**
6: **while** sum $\leq s \in HLs/l\_$ and $IC \_= \emptyset$ **do**
7: Select $i = \text{argmax}k\{\_Fk|k \in C\}$;
8: Select $q = \text{argmax}s\_\_Ls/l\_ - \_k \in Cxs,k|xs,i = 1, s \in H\_$;
9: Set $xq,i = 1$;
10: Update $ui \leftarrow ui + 1$, sum $\leftarrow$ sum + 1;
11: Update $\_Fi \leftarrow l (Fi (ui + 1) - Fi (ui))$;
12: **if** $ui = H$ **then**
13: $IC \leftarrow IC\backslash\{i\}$;
14: **end if**
15: **end while**

Storage Algorithm: The storages of offloading helpers are limited to increase the storage of offloading helpers storage algorithm is used. In this according to data rate we calculate data storage.

Segmentation Algorithm: Mobile data are heterogeneous in terms of size and lifetime and mobile user's interests are different. So we are dividing data into groups according to their similar properties.eg Education, Music, segmentations algorithm is used. Many enterprises have accumulated a large amount of data over time. To achieve competitive advantages, enterprises need to find effective ways to analyze and understand the vast amounts of raw data they have. Different methods and techniques have been used to reduce the data volume to a manageable level and to help enterprises identify the business value from the data sets. In particular, segmentation methods have been widely used in the area of data mining. We present a new algorithm for data segmentation which can be used to build time- dependent customer behavior models. The proposed model has the potential to solve the optimization problem in data segmentation.

IV. Performance Evaluation

To demonstrate the efficiency of our proposed GA and AA schemes in realistic mobility environments, we used the synthetic mobility model, Random Waypoint (RWP), and real-world MAP-driven DTN model (MAP) with pedestrians and transportation systems, in the Opportunistic Network Environment (ONE) simulator. RWP is a mobility model while MAP in the ONE simulator represents the realistic DTN environments, where the contact rate is not governed by Poisson process.

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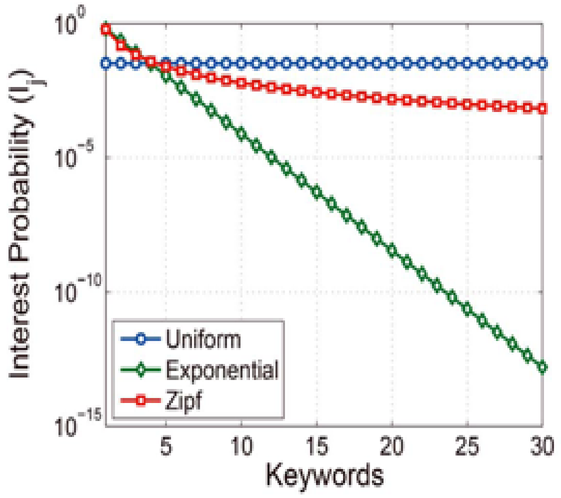
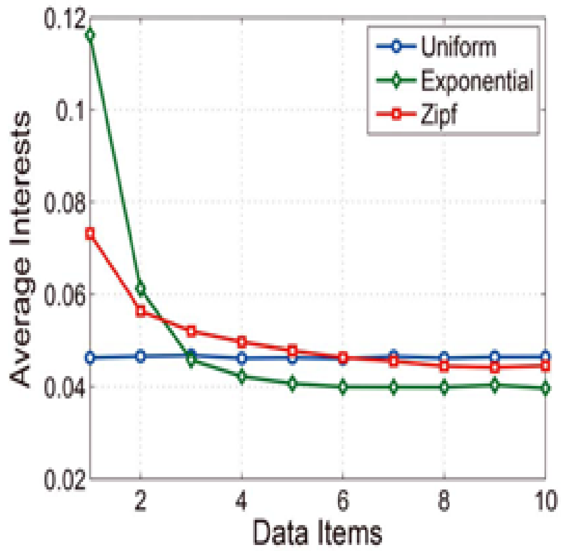


(a)



(b)

V. CONCLUSION

All the helpers cooperate in the offloading scheme. However, in practice, helpers may act strategically to offload data for others. For example, some helpers may be more willing to offload certain contents to certain other users. Therefore, designing appropriate and efficient incentive mechanisms has a crucial role in enhancing offloading performance. In our current framework, we consider the opportunistic contacts as atomics, in which the mobile data can be transferred from one mobile user to another during a single contact. However, when the size of a data item is very large, the transmission of the data may not complete in single contact, owing to the limited contact time. Therefore, considering the limited contact duration for the current offloading framework is also needed. Our future work will investigate how to integrate appropriate incentive schemes with our mobile data offloading framework with the consideration of limited contact time.

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