

# Energy Efficient Content Sharing in Smart Phones using Wi-Fi Networks

Nivedita S. Deshmukh

**Abstract:** - Because of increasing popularity of mobile devices their applications and infrastructure tends to advance quickly. The use of Smartphone's for the efficient content sharing among the wireless Delay Tolerant Networks (DTN) is growing worldwide. There are many methods recently presented by various researchers for efficient content sharing in DTN. However these methods are suffered from the various limitations. Hence this area of research is still challenging problem for researchers. Most of methods presented for content sharing are based on prediction of whether two nodes would encounter each other, regardless of considering the time and place of the encounter. But this method has many limitations which were later overcome by recently presented method. The recent method presented is based on discover-predict-deliver which is practically resulted as improved and efficient content sharing scheme for delay-tolerant Smartphone networks. However the limitation of this method is excessive battery power consumption which limits the lifetime of Smartphone. In this paper we have designed the method for android Smartphone in order to minimizing the batter power consumption. This method tries to use the idle times of Smartphone in order to stop applications like , Bluetooth and various other applications which are consuming the battery power during the idle condition. Also while sharing contents we will focus on file transfer rate, transmission cost and security.

**Index Terms**— Delay-Tolerant Networks; Hot Spot; Wi-Fi.

## I. INTRODUCTION

Now a days the problem of content sharing in DTN networks is challenging research problem. The numbers of Smartphone's are increasing now days. Peer-to-peer ad hoc content sharing is expected to occur more often. In traditional centralized server system, many tasks are required for content sharing among smart phones such as registration, uploading contents to central servers by content provider, and searching and downloading contents by consumer. In this method contents are spontaneously discovered and shared. This approach will improve the efficiency as compared to existing methods. Ad hoc networks can easily be constructed with Smartphone as they are prepared with various network interfaces, such as Wi-Fi or Bluetooth. The connectivity between Smartphone's is expected to be discontinuous due to the movement patterns of carriers and the signal propagation. To overcome this problem, researchers have proposed a variety of store carry-forward routing methods. In Store and forward networks information is sent to an intermediate station where it is kept and sent at a later time to the final destination or to another intermediate station. This technique is commonly used in networks with intermittent connectivity, mainly in the environments requiring high mobility. It may also be used in situations when there are high error rates and long delays in transmission. End-to-end connection is not available.

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Nivedita S. Deshmukh, Department of Computer Engineering, Pune Institute of Computer Echnology, Pune, India.

In the store-carry-forward routing schemes [2],[9],[10] a node stores a message and carries it for a certain period until a communication occurs. Utility functions are used for making local forwarding decisions. To increase the delivery possibility multiple copies of the same message are spread in parallel. Delay-Tolerant Network (DTN) routing protocols achieve better performance than traditional mobile ad hoc network (MANET) routing protocols. The absence of the requirement of a central server is the advantage of both DTN and MANET routing protocols. Hence contents are distributed and stored directly on the Smartphone's. A basic DTN routing solution is Epidemic routing [2]. Epidemic routing quickly distribute messages to hosts, within connected portions of ad hoc networks. At this point, the message spreads to large network of nodes. Due to this transitive transmission of data, probability of reaching messages to their destination increases. Existing methods are based on traditional mobile ad hoc network (MANET) routing protocols which delivers worst performance for content sharing. Some methods presented using the DTN, but deliver the less efficiency. New method introduced with more efficiency but resulted into more energy consumption. Existing system mainly focused on limiting search query propagation and proposed a number of query processing methods. It does not focus on the geographic search query propagation limit. Now days there are increasing demand for content sharing in wireless networks, hence we need to have efficient method in place. A hidden Markov model is used to predict an individual's future mobility information. We propose an energy efficient content sharing mechanism in DTNs. Today's Smartphone's have various characteristics (i.e., availability of various localization and communication technologies). So we are aiming to utilize them and appropriately designed the method. This approach will improve the efficiency as compared to existing methods. In this paper we are extending the recently presented method in [1], which practically efficient for content sharing in DTN. The extension of this method is required to enhance the lifetime of Smartphone's. The proposed method is basically based on fuzzy rules to stop the applications during the idle time. In next section II we are presenting the literature survey over the various methods presented. In section III, the proposed approach and its system block diagram is depicted. Finally conclusion and future work is predicted in section VI.

## II. LITERATURE SURVEY

This section focus on different methods presented for DTN based content sharing networks. In [3], Chaintreau et al. studied the effect of human mobility on opportunistic forwarding and suggested that the inter-contact time between two nodes can be approximated



by a power law. They did not study how mobility information can be used for estimating encounter opportunities among users. In [7], Entracked is location tracking system for GPS-enabled devices. The system is configurable to understand different tradeoffs between energy consumption and robustness. EnLoc[8] uses GPS, GSM, and Wi-Fi system for energy-efficient localization. The system takes advantage of human mobility patterns to predict a location of user to minimize the sampling count. Mobility prediction has been widely studied in and out of the delay-tolerant networking community. Markov-based schemes formulate the problem as a Hidden Markov or semi-Markov model and predict human mobility. Even though Bluetooth is a low-power radio, device discovery duration of it is much longer than Wi-Fi (approx. 10s for Bluetooth vs. 1s for Wi-Fi active scanning), it may cause more energy consumption on smart phones. In prediction-based schemes [9] [10] sophisticated utility functions are designed using the history of the mobility, the encounter rates and encounter times. Each node stores a utility value for all other nodes, and these values are updated using the time between contacts. While forwarding a message copy only those nodes are considered who are having higher utility for the message destination. Depending on the number of copies of a single message that may coexist in the network, one can define two major categories of mobility-assisted routing schemes. In single-copy schemes, there's only one node in the network that carries a copy of the message at any given time. This node is considered as the custodian of the message. When the current custodian forwards the copy to an appropriate next hop, this becomes the message's new custodian, and so on and so forth until the message reaches its destination. The multiple-copy routing schemes may generate multiple copies of the same message, which can be routed independently for increased robustness. Searching for Content in Mobile DTN by M. Pitkanen[5], explores various methods to limit query spread. The key differences in content detect are that we use a multicopy query distribution scheme, and our detect scheme efficiently uses location information to prevent the unnecessary propagation of queries. BeaconPrint[12] discovers meaningful places by continuously determining stable scans for a certain time period. Previous work has studied the power of Bluetooth/Wi-Fi devices which either focus on only Bluetooth [13], [14] or ignore the duration of device discovery [14], but without which it is hard to evaluate the energy consumption of these devices.

**III. PROPOSED APPROACH FRAMEWORK AND DESIGN**

Data flow of proposed method is described by following steps:

- Step 1: Input content request.
- Step 2: Search content in local storage.
- Step 3: Generate the query based on request if the contents are not found in local storage.
- Step 4: Detect the location where content sharing can be performed.
- Step 5: Trigger query in network based on distribution and termination technique.
- Step 6: Apply the Adaptive analysis Algorithm of

discovery content detection.

Step 7: Node matches the content in local storage and if match found select the subset of content.

Step 8: Send the content to the query originator.

1.1. Proposed Method

In the store-carry-forward networking the nodes communicate using DTN bundle architecture [10], all users are ready to cooperate and supply a limited amount of their resources, like bandwidth, storage, and processing power, to help others. This method allows users to issue queries for content stored on other smart phones anywhere in the network and to review the chances of obtaining the information needed. In the proposed method, contents are locally indexed and identified easily. Some of our assumptions are, unlimited content size, the contents are non-fragmented, or they are not coupled to locations. Localization devices should be equipped in Smart phones GPS, as well as various networking interfaces like Wi-Fi ,GSM/CDMA, and Bluetooth. Contents are shared using the mobility information of individuals. Let the maximum distance to exchange messages between two nodes be R. The distance between smart phones i and j at time t is denoted as  $D_{ij;t} = D_{ji;t}$ . Thus, nodes i and j can exchange messages if and only if  $D_{ij;t} \leq R$ . The content sharing process is classified into two parts. First is the efficient content detection and second is the content delivery. In the content detection, a user requests for content. The application initially searches for the content in local storage, and if not found, the application generate a query message based on the user's request. The query is then triggered in the network based on a particular forwarding decision and search-termination technique. eDiscovery for Content detection focuses on how to trigger query using Bluetooth [9]. The content delivery is initiated when the content is found. Using utility function the content is routed towards the query originator. The major principle of eDiscovery is to reduce smartphone energy consumption of device discovery, while not missing too many peers.

3.2. Mathematical Model

1. Mobility Information

$$MI_i = \{l_{i,t}, l_{i,t+\delta}, \dots, l_{i,t+k\delta}\}$$

$$L = \{l_1, l_2, \dots, l_m\}$$

$$m \geq 1$$

$$k = \lfloor M/\delta \rfloor$$

2. Query time

$$t_i = \{t_0, t_1\}$$

3.3 Definitions

1. Query time:

The time difference between query release time  $t_0$  and content usage time  $t_1$ ,

$$T = t_1 - t_0$$

Hence after the query lifetime, both query and content are no longer useful.

2. Mobility information:

A set of meaningful locations and paths between these locations. The mobility information of node i from time t for the interval of M is:



$$MI_i = \{l_{i,t}, l_{i,t+\delta}, \dots, l_{i,t+k\delta}\}$$

$$k = \lceil M/\delta \rceil$$

### 3. Utility function:

The utility function  $U_i(d)$  is for the effectiveness of node  $i$  when it delivers a message to destination  $d$ . In utility-based routing, node  $i$  forwards a message to node  $j$  which is intended for destination  $d$ , if

$$U_j(d) > U_i(d) \text{ and } \forall_m : U_d(d) \geq U_m(d)$$

### 3.4 Content detection

Content detection focuses on how to trigger query. Query should only be forwarded to neighbors that have matching contents or that are on the path to other nodes having matching contents. Nodes return non-overlapping response to the requester. Each node can make independent forwarding decisions. To limit the query triggering: a split query time limit and a query distance limit. We use a controlled replication-based [9] routing scheme because this scheme performs better than single-copy scheme. Our work splits the query lifetime for discovering and delivering contents. Also our work uses spatial constraint for query distribution. The details of the spatiotemporal constraint for query distribution are:

When a node needs some contents, it generates query information  $Q$ .

$Q$  contains: node identifier ID (e.g., IMEI number), the creation time of the query  $t_{qc}$ , the query time  $T$ , the replication size, and the  $q$  node's mobility information:

$$IM_q = \{l_{q,t_{qc}}, l_{q,t_{qc}+\delta}, \dots, l_{q,t_{qc}+k\delta} \mid k = \lceil T/\delta \rceil\}$$

When a query-carrying node encounters another node, the carrying node executes the following forwarding decision to spread the query:

forward(QI) = true

if  $(t - t_{qc} < (1 - \alpha) \cdot T)$

else

forward(QI) = false

Where,  $\alpha \in [0,1]$

is the ratio of the detect period to the delivery period. This indicates percentage of the query time used for detection and percentage used for delivery. When the query-carrying node finds that forwarding the query will not influence sharing performance due to the end of the query time, the node terminates distributing the query. In case the above forwarding decision function is true, the next forwarding decision is taken:

forward(QI) = true

if  $(|l_{f,t} - l_{q,t}| < H)$

else

forward(QI) = false

Where  $l_{f,t}$  is the location of the forwarding node  $f$  at time  $t$ ,  $l_{q,t}$

is the predicted location of the query originator node  $q$  at time  $t$ , and  $H$  is the threshold distance for query triggering. It is set by the user. This decision function is for not triggering the query in unnecessary area. A node may carry a query traveling long distance even the content can be found in the area where node is residing. In this case content delivery cost will be very high, or it happen that contents may not be delivered because of the query time expiration. Hence limiting the query trigger to a certain region is reasonable.

## IV. CONCLUSION

The main aim of this paper was to introduce the power efficient and performance efficient content sharing scheme for DTN. There are many ways or the applications which we have utilized here to stop during their idle time. The proposed method aims to utilize the advantages of today's smart phones (i.e., availability of various localization and communication technologies) and appropriately designed the method. This method shares the content by reducing the energy consumption.

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