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Survey on Leveraging Social Networks for P2P Content-Based File Sharing in Disconnected MANETs

Authors
T.Ramesh[1], V.Umamaheswari[2]
[1]Assistant Professor, Department of Information Technology,
[2]Research Scholar, Department of Information Technology,
Bharathiar University, India, Coimbatore – 641046
Email: *trcsebu@gmail.com, maheavn@gmail.com*

ABSTRACT
3G technology has stimulated a wide variety of high band width applications on smart phones, such as video streaming and content-rich web browsing. Although having those applications mobile is quite appealing, high data rate transmission also poses huge demand for power. It has been revealed that the tail effect in 3G radio operation results in significant energy drain on smart phones. Recent fast dormancy technique can be utilized to remove tails but, without care, can degrade user experience. Implement Tail Theft in the Network Simulator with a model for calculating energy consumption that is based on parameters measured from mobile phones. When allowing for delays of a few seconds (acceptable for background applications), the energy savings increase to between 62% and 75% for 3G, and 71% for LTE. The increased delays reduce the number of state switches to be the same as in current networks with existing inactivity timers.
KEYWORDS: *Tail Theft, content-based file sharing, social networks.*

INTRODUCTION

Over a fifth of the 5.5 billion active mobile phones today have "broadband" data service, and this fraction is rapidly growing. Smart phones and tablets with wide-area cellular connectivity have become a significant, and in many cases, dominant, mode of network access. Improvements in the quality of such network connectivity suggest that mobile Internet access will soon overtake desktop access, especially with the continued proliferation of 3G networks and the emergence of LTE and 4G. Wide-area cellular wireless protocols need to balance a number of conflicting goals: high throughput, low latency, low signalling overhead (signalling is caused by mobility and changes in the mobile device's state), and low battery drain.

The 3GPP and 3GPP2 standards (used in 3G and LTE) provide some mechanisms for the cellular network operator and the mobile device to optimize these metrics but to date; deployed methods to minimize energy consumption have left a lot to be desired. The 3G/LTE radio consumes significant amounts of energy; on the iPhone 4, for example, the stated talk time is "up to 7 hours on 3G" (i.e., when the 3G radio is on and in "typical" use) and "up to 14 hours on 2G".1 On the Samsung Nexus S, the equivalent numbers are "up to 6 hours 40 minutes on 3G" and "up to 14 hours on 2G".2 That the 3G/LTE interface is a battery hog is well-known to most users anecdotally and from experience, and much advice on the web and on blogs is available on how to extend the battery life of your mobile device.3 Unfortunately, essentially all such advice says to "disable your 3G data radio" and "change your fetch data settings to reduce network usage". Such advice largely defeats the purpose of having

an "always on" broadband-speed wireless device, but appears to be the best one can do in current deployments.

Show the measured values of 3G energy consumption for multiple Android applications. This bar graph shows the percentage of energy consumed by different 3G radio states. For most of these applications (which are all background applications that can generate traffic without user input, except for Facebook), less than 30% of the energy consumed was during the actual transmission or reception of data. Previous research arrived at a similar conclusion about 60% of the energy consumed by the 3G interface is spent when the radio is not transmitting or receiving data. In principle, one might imagine that simply turning the radio off or switching it to a low-power idle state is all it takes to reduce energy consumption. This approach does not work for three reasons. First, switching between the active and the different idle states takes a few seconds because it involves communication with the base station, so it should be done only if there is good reason to believe that making the transition is useful for a reasonable duration of time in the future.

Second, switching states consumes energy, which means that if done without care, overall energy consumption will increase compared to not doing anything at all. Third, the switching incurs signaling overhead on the wireless network, which means that it should be done only if the benefits are substantial relative to the cost on the network. Tackles these challenges and develops a solution to reduce 3G/LTE energy consumption without appreciably degrading application performance or introducing a significant amount of signaling overhead on the network. Unlike currently deployed methods that simply switch between radio states after fixed time intervals an approach known to be rather crude and sub-optimal our approach is to observe network traffic activity on the mobile device and switch between the different radio states by adapting to the workload.

A traffic-aware design to control the state transitions of a 3G/LTE radio taking energy consumption, latency, and 4290ignaling overhead into consideration. The design incorporates two algorithms:

(a) Make Idle, which uses aggregate traffic activity to predict the end of an active session by building a conditional probability distribution of network activity.

(b) Make Active, which delays the start of a new session by a few seconds to allow multiple sessions to all become active at the same time and therefore reduce 4290ignaling overhead. This method is appropriate for non-interactive background applications that can tolerate some delay.

ARCHITECTURE OF P2P

A peer-to-peer network is designed around the notion of equal peer nodes simultaneously functioning as both "clients" and "servers" to the other nodes on the network. This model of network arrangement differs from the client–server model where communication is usually to and from a central server. A typical example of a file transfer that uses the client-server model is the File Transfer Protocol (FTP) service in which the client and server programs are distinct: the clients initiate the transfer, and the servers satisfy these requests.

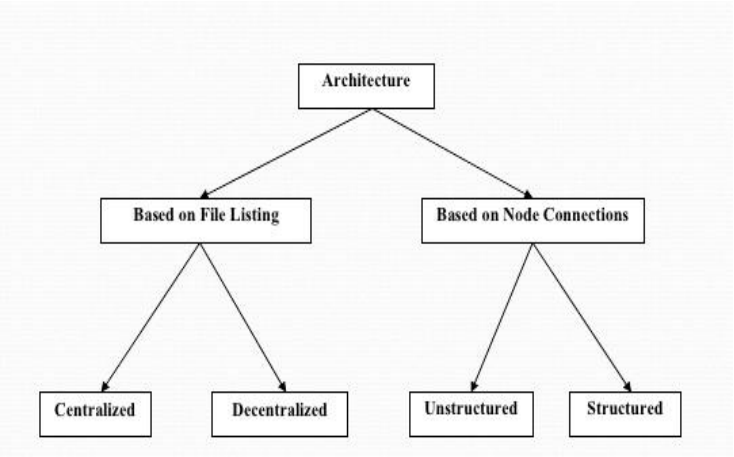

Figure-1 Architecture of P2P

Unstructured networks

Unstructured peer-to-peer networks do not impose a particular structure on the overlay network by design, but rather are formed by nodes that randomly form connections to each other. Unstructured networks are easy to build and allow for localized optimizations to different regions of the overlay. Unstructured networks are highly robust in the face of high rates of "churn", that is, when large numbers of peers are frequently joining and leaving the network.

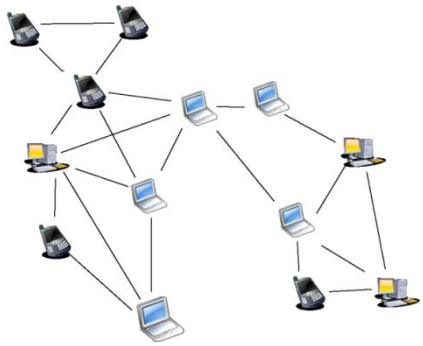

Figure-2 Unstructured Networks

Structured networks

In structured peer-to-peer networks the overlay is organized into a specific topology. The protocol ensures that any node can efficiently search the network for a file/resource, even if the resource is extremely rare. The most common type of structured P2P networks implement a Distributed Hash Table (DHT) This enables peers to search for resources on the network using a hash table: that is, (key, value) pairs are stored in the DHT, and any participating node can efficiently retrieve the value associated with a given key.

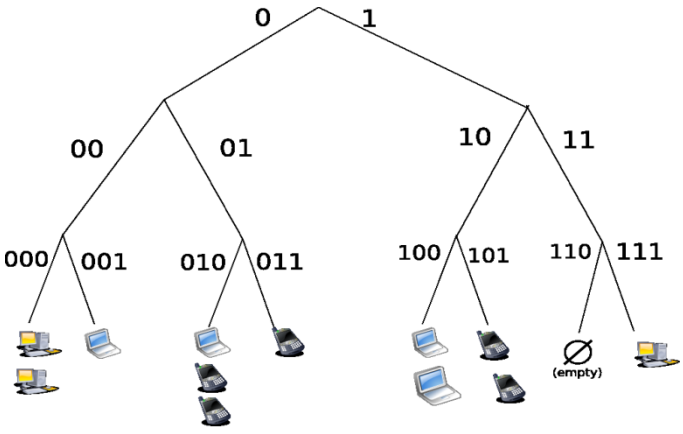

Figure-3 Structured Networks

FILE SHARING

In general, a P2P file sharing system mainly consists two parts: search algorithm and a file transfer protocol. File transfer protocol is responsible to downloading files by use of TCP connection. While search algorithm is responsible for transmitting query messages and searching results. And search algorithm, which has more relationship with efficiency, attracts more attention [4]. A lot of proposal discusses the P2P file sharing on MANETs and we classify them into four kinds according to their varying searching principle: DHT-based method, flooding-based method, advertisement-based method and social-based methods.

P2P over MANETs is the most popular used pattern of file sharing within MANETs. P2P file sharing network is very widely used in recent Internet. And within MANETs, P2P file sharing approach is also widely adopted.

DHT-Based Method

Most of approaches such as Pastry [12], Tapestry [1], Chord [7] in structured P2P network are mainly based on Distributed Hash Tables (DHT). DHT-based method use DHT to map objects with corresponding nodes in a distributed fashion using hash functions. DPSR [12] and Ekta [8] are the same as the essence of tightly integrating Pastry with DSR at the network layer. The different between them is that DPSR implements a distributed hash table (DHT) in MANETs, while Ekta does not use the DHT for unicast routing.

LocP2P (Location-assisted P2P) [5] adopts indexing algorithm and distributed hashed table (DHT). In LocP2P, a number of mobile content server nodes manage the information of all mobile nodes in a distributed manner through DHT. The mobile nodes location is set as the major key and object ID are selected as secondary key respectively in DHT. In LocP2P, the mobile nodes location is achieved during they are running other applications such as Facebook or Twitter. This method is effective to save up energy consumption.

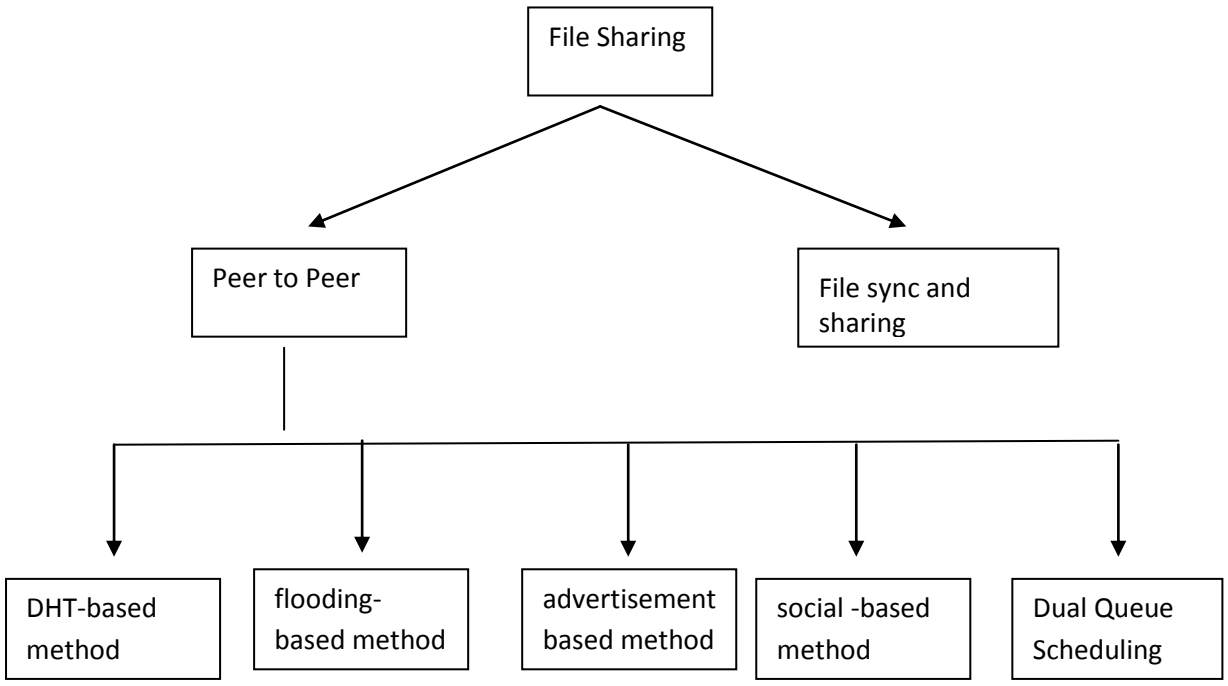

Figure-4 Various algorithms in File Sharing

DHT-based searching methods rely on DHT to record the content information of the neighbors. When a node wants to search some content, it firstly resorts to the DHT to achieve the relative information. From this point, DHT-based searching approach is very effective. However, the establishment and maintain of the DHT are not easy due to the dynamic topology. A lot of messages are needed to keep the DHTs renew and consistence, which leads to heavy traffic in the networks.

Flooding-Based Method

Flooding-based searching methods are based on broadcasting to implement the search process. When a node wants to search some content, it firstly broadcasts the requirement to its neighbors. Then from the response messages, it can obtain the information which relate to the content owner.

7DS [15] is a P2P data sharing system intending to provide an infrastructure to enable online Web-browsing without a direct connection to the Internet. It is one of the first approaches to port P2P technology to mobile environment and it uses local broadcast transmissions for implementing Web documents sharing among peers without connection to the Internet. Passive Distributed Indexing (PDI) [13] uses local broadcasting for content searching, and specially sets up content indexes on nodes along the reply path to guide subsequent searching. PDI is a general purpose distributed search service which enables resource-effective searching for file based on simple query. PDI utilizes Building blocks for local broadcast transmission of query, response messages, and caching of query results on every device participating in PDI. By use of building blocks, the need for flooding of query message to the entire network can be eliminated for most application.

The most default in flooding-based methods is the high overhead because of the high amount of duplicated messages. These overhead induces the high congestion due to a high volume of traffic, which is a significant problem in MANETs. In addition, local broadcasting used in some methods cannot guarantee file searching success.

Advertisement-Based Methods

Tchakarov and Vaidya present a content location service the Geography-based Content Location Protocol (GCLP), which takes physical location

information into consideration in order to provide an efficient content location service to nodes in an ad hoc network [2]. GCLP tries to allow each client to find a nearby server by use of the geographical distance as the distance metric (not number of hops). In GCLP, nodes make use of geographic information to advertise content periodically which are hosting to nodes along several geographical directions

Advertisement-based methods also lead to high overhead, and they have low search efficiency because of expired routes caused by transient network connections. Flooding-based methods and advertisement-based methods are fit for the relative stable MANETs. However, in more disconnected MANETs, the two kinds of method are failed due to the large overhead.

Social -Based Method

In recent works, Social Network theory has been utilized in routing or content sharing algorithms in MANETs and DTNs [8]. Since the node movement in a social network usually follows a certain pattern, social network based routing algorithms consider node contact frequency, predict future contact possibility, and choose the node with the highest possibility of successfully delivering a packet as the next forwarder in routing. However, these algorithms cannot be directly used for content-based file searching since the destinations are unknown in this service.

Qureshi et al. present an adaptive protocol to implement a Mobile Social Network based on P2P content driven communication when end-to-end connectivity is not possible [3]. The proposed protocol considers the information about user's interests, content based data storing and forwarding, and host mobility in a disconnected and delay tolerant MANETs.

SPOON [11] is novel Social network based P2P content file sharing in mobile ad-hoc Networks. It mainly rely on that it leverages social network properties of both node interest and movement pattern. SPOON consists of three parts: the first part is interest extraction algorithm which derives a node's interests from its files; the second part is community construction algorithm which enables users to efficiently retrieve files using intra- and inter-community communication; the third part is node role assignment algorithm which designates the community coordinator and ambassador.

Social-based methods consider the social relationship among the mobile devices users. In disconnected MANETs, the social-based methods implement file sharing according to the meet probability. The users with common interest often meet each other, so the file sharing is usually happened among them. So the social properties are very useful to find the file sources and share the files.

Dual Queue Scheduling Algorithm

Scheduling requests feasibly, Applications submit network requests by calling the API Defined as According to the parameter r_delay, requests can be divided into two categories: requests that must be scheduled instantaneously (r_delay is zero, including real-time and unsuccessfully prefetched requests) and requests that can be delayed (r_delay is positive or negative). Requests that can be delayed, referred to as TailTheft requests, include delay-tolerant requests and previous attempts. TailTheft employs a dual queue scheduling algorithm for scheduling these two categories of requests. TailTheft schedules requests by maintaining two queues:

- The real-time queue for requests that must be scheduled instantaneously
- The TailTheft queue for TailTheft requests

TailTheft schedules requests in the real-time queue if requests are present in this queue and schedules those in the TailTheft queue if the real-time queue is empty or if the deadline of the first request in the TailTheft queue approaches.

CONCLUSION

Inactivity timers in cellular networks are used to balance the trade-offs between resource efficiency for enhanced user experience and low management overhead. However, considerable

radio resources and battery energy are wasted in the tail time. Proposed TailTheft, which leverages the tail time for batching and prefetching. Our work is the first to consider using rather than eliminating the tail time for saving energy. To utilize the tail time, TailTheft uses a virtual tail time mechanism to determine the amount of tail time that can be used and a dual queue scheduling algorithm to schedule transmissions. Given that numerous transmissions are scheduled in the tail time, energy consumption is significantly decreased. TailTheft can benefit a number of common applications, including delay-tolerant applications (e.g., e-mail, RSS feeds, and software updates), and prefetchable applications (e.g., news, social networking, browsing, media and maps). We have simulated TailTheft in NS-2 and evaluated its performance under various conditions. The experimental results show that TailTheft achieves more significant savings on battery energy and radio resources than existing methods.

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