Content Sharing Systems in Mobile Social Networks

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I. Introduction

Mobile shows its powerful influence on daily communication. Telephone and sms are the basic services provided by mobile for social interaction. Now the development of wireless technology, e.g. Wi-Fi and Bluetooth, promotes people's communication though mobile. Even in the scenarios that mobile has never shown his appearance before, we can deploy mobile in the activities to exert the effect of social interaction.

This paper explores the potential scenario in which mobile can be deployed to promote peoples' communication. When we visit to museums or places of interest, traditionally a guide is arranged if we want to make a better sense about the exhibits or the scenes. However, this costs extra expense and labors. In other case, the museums or the places of interest may deploy a screen, and keep on playing a video introducing the exhibits and scenes. The negativity lies that visitors arrive at different time slots. In most case, they have to start to watch from the middle of the video. Besides, they also have to watch the whole video before they find out the part they want mostly. That problem may be more serious when there are many people crowding in a certain exhibit.

To solve the problems, we propose the approach that visitors download the streaming media from the servers provided by the museums to their mobile. Then they can watch the certain part of the video at their will. However, the servers may be too busy to service all visitors. So the visitors are encouraged to share data they have gotten to other visitors. Then a p2p streaming like system is built.

One of the challenges of the system lies the formation of network infrastructure.Given the particular scenario, we choose Bluetooth as the wireless technology to from the network for several reasons. First, the area of the application is limited in a small range, typically about 10 meters around. Bluetooth is effective in t area with such size. Second, Bluetooth is more widely deployed in mobile compared to Wi-Fi. Third, the battery energy consuming of Bluetooth is much less than Wi-Fi. That ensures visitors able to run the application for a longer time. Sometimes, the advantage is quite significant to visitors. Next, the usage of Bluetooth requires a special infrastructure to distribute data to visitors.

Another challenge involves the social interaction between visitors. Since visitors share their data to others, the incentive of visitors should be taken into consideration. One factor influencing visitors' strategy is the capacity of the battery. Visitors whose mobiles have high degree of battery energy have higher probability to be willing to share data to strangers. On the other hand, visitors whose batteries are nearly run out of may only intent to share data to their friends. It is significant to combine users' strategies to the design of the network infrastructure.

This paper analyses the user requirement in museum content sharing system, and propose our novel design of the network infrastructure based on Bluetooth. We pay attention to the requirement and behavior of visitors, and form a scatternet network to satisfy the requirement. Besides, we implant our design of social network and users' strategies in the system. We present our model based on users' personal preference, which ensures that the system is practical and rational. Finally, we deploy a p2p streaming system in mobile platform. We foresee the potential of mobile based p2p system.

The rest of the paper is organized as follows: Section 2 discusses related works on mobile social network and Bluetooth architecture. Section 3 describes the system design. Section 4 present the simulation result and analysis. The rest talks about future work and conclusion.

II. Related Works

In this section, we review related works on mobile social networks and Bluetooth related background. Many works have presented their contribution on the application of mobile social network. Generally, such application can be divided into two categories. First can be called "centralized mobile social network". In this category, there is a server to provide service and store users' personal data. Users mainly share their profiles and data though Internet. Due to the characteristic of mobile, most of the applications in this category involve the location of users. Either do users share geotagged data to others or inquire the profiles of users in physical proximity.

Micro-Blog [1] is a typical example of the former. Micro-Blog talks about the scenario that people share the information they own to others though the Internet. Users generate geotagged multimedia by their mobile phones and update such data. Then others are allowed to query or browse them though either an Internet map service or in physical space as they move through a location.

On the other side, Social serendipity [3] contribute on the communication between users in physical proximity. Users' profiles are stored in a web server and mapped with the Bluetooth MAC address of users' mobiles. One user is able to retrieve another's profile by enquiring the Bluetooth MAC address. Applications in this category include PeopleTones [**?**], Just-for-Us [10], and so on.

The other category of mobile social network is distributed mobile social network. There is no central server in this case. Users' profiles are stored in mobiles of themselves. When

they move into the range of each other, they exchange the profiles directly and start the interconnection. Comparing to centralized mobile social networks, distributed mobile social networks have little demand on internet connection. There is also much less cost during communication compared to centralized mobile social networks. The connection is maintained only if related devices, e.g. WiFi, Bluetooth, are deployed. E-SmallTalker [2] is a typical example of this category. It discusses a solution to deal with the problem of social gap in physical proximity communication. Users exchange personal profiles without establishing a Bluetooth connection. PeopleNet [5] is another representative application based on distributed mobile social networks. It proposes an algorithm on multicasting messages to a group of devices in a mobile ad hoc network.

III. System Design

In this section, we present our design for the system. We first overview the basic concept of Bluetooth scatternet. Then we propose our protocol design on scatternet building up to implement the social relationship. We talk about the dynamic scenario in the system.

A. Bluetooth scatternet

When two Bluetooth devices come across, they will set up a *piconet* if they want to communicate with each other. In a piconet, the device sponsoring the connection takes the role of *master* while the other one becomes its *slave*. The max number of active slave devices in a piconet is limited to 7. Besides, the communication is performed only between master device and slave devices. Time-Division Duplex (TDD) is used for bi-directional communication.

A Bluetooth device can take part in different piconets meanwhile. The BT devices timesharing among different piconets are called "*bridging node*". Several piconets connecting though some bridge nodes form a *scatternet*. Bridging devices can act as different roles in different piconets. In particular, a device can be a master of one piconet while a slave in another piconet. Although Bluetooth Specification has described the concept of scatternet, the methods for the foramtion and optimization of scatternet are not indicated. Furthermore, based on the particular request of our application on the performance of scatternet and the behavior of the bluetooth nodes, we propose an original approach to form our scatternet.

B. Bluetooth scatternet design

To form the Bluetooth scattenet to distribute the video, we propose a new method based on social network. users will take into consider their social relationship with new discovered Bluetooth devices when their want to build connection between them. It is naturally that someone is willing to share his data source to strangers while others will select their friends in real society as the only ones having the right to get their data. In this system, we divide the users to three categories. The users in the first category will distribute their data only to their friends. The users in the second category are willing to provide their data to the users sharing the same attribute with them. At last, the users are so generous that they can distribute their data to all other users.

Based on the social relationship we have built, an original method to build up a scatternet is developed. The scatternet is built as a tree for several reasons. First, in the particular scenario, there is a server which provides the origin data source to the users. Second, when a new user joins the system, it is probably that he will connect with his friends, in the way that the friend he select to connect acts as the parent while the new user acts as a child. Such structure works like a tree.

It is necessary to check whether a node has the privilege to set a connection to and get the resource from another node. We define three scenarios in which a connection is allowed to be set based on the attribution and the preference of the node. The privilege is authorized if and only if the social relationship between the two node satisfies one of the conditions:

(1)one node is a friend of the other node;

(2)one node share the same attribution with the other node while the other node is willing to distribute his data to others with the same attribution;

(3)one node is a stranger of the other node, but the other node is willing to share his data to strangers.

In our design, the preference of a node is stored by a service record. If node A tends to connect to node B, node A searches the service record of node B first, and gets the preference of node B. Then node A judge whether his attribute matches the preference of node B, e.g. they satisfy one of the three conditions above.

We will describe the procedure for a new to join in the system. When a new Bluetooth user move to the range of the system, he first discoveries other users. After that, he can get the preferences and the attributions of them. He makes sense which users he has the privilege to get the resource from by check the social relationship between them and the preference of other users. After that, the new user can get a list of the users he can connect to. Since friends is the strongest social relationship comparing to attribution sharer and stranger, while stranger is the weakest one, we can get a priority sequence from highest to lowest as: friends, attribution sharer, stranger. When the new user chooses users to connect from the list, he will choose the one with the highest priority. Then a connection socket is sent and a connect is built to send data to the new user.

C. dynamic system design

Another characteristic of the system is the dynamic behavior of the nodes. Users join in at a random time, and leave off the system at their mind. So the system should adopt the dynamic model of users.

When a new user move into the range of the system, he first takes the discovery action. They he chooses the most suitable node to connect to. The mechanism has been presented above. When the parent node leaves off the system, the transfer is interrupted. Then the user have to set up another connection. He restart the action of discovery and find out the most

suitable node in current networks. After a new connection is built, the user sends a request to his new parent for the media blocks he misses. Then the transfer goes on until the media download is completed or the connection is broken again.

IV. Simulation Result

V. Conclusion

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