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Social Network Device-to-Device Communication in Wireless Networks

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ABSTRACT

Device-to-device (D2D) communication is seen as a major technology to overcome the looming wireless capacity trouble and to enable new application services. In this paper, a novel social network approach for optimizing D2D communication by exploiting two layers, namely the physical wireless network layer and the social network layer, is proposed. In particular, the physical layer D2D network is captured via the users encounter histories. Subsequently, an approach, based on the model the distribution of con tents in the users' online social networks, a algorithm for optimizing the traffic offloading process in D2D communications is developed based on the given the social relations collected by the base station. In addition, the Chernoff bound and approximated cumulative distribution function (cdf) of the offloaded traffic is derived and the validity of the bound and cdf is proven. Simulation results based on real traces demonstrate the effectiveness of our model and show that the proposed approach can offload the network's traffic successfully.

Keywords: Device-To-Device Communication, Social Network, Indian Buffet Process.

I. INTRODUCTION

The recent proliferation of smart phones and tablets has led to the introduction of truly pervasive, anytime; anywhere wireless communications [1], [2]. The rise of online services, such as Facebook and YouTube, has significantly increased the frequency of the users' online activities. Due to this continuously increasing demand for wireless access, a tremendous amount of data is circulating over today's wireless networks. This increase in demand is straining current cellular systems, thus requiring novel approaches for network design [3].

In order to cope with this wireless capacity crunch, device-to- device (D2D) communication under laid over cellular systems has recently emerged as a promising technique that can significantly boost the performance of wireless networks [4].In D2D communication, user equipment (UEs) transmit data signals to each other over a direct link instead of through the wireless infrastructure, i.e., the cellular network's base stations (BSs).The key idea is to allow direct D2D communication over the licensed band and under the control of the cellular system's operator [5].Recent studies have shown that the majority of the traffic in cellular pertains to the download of popular content such as videos or mobile applications [6], [7]. Given the commonality of such downloads, offloading it to the D2D tier can reduce the load on the cellular network's infrastructure. In practice, popular contents, such as certain YouTube videos, are requested much more frequently than others. As a result, the BSs often end up serving different mobile users with the same contents using multiple duplicate transmissions. Cellular UEs' resource blocks (RBs) can be shared with others.

Newly arriving users that are within the transmission distance can receive the "old" contents directly from those users through D2D communication. Here, the BS needs to only serve those users that request "new" content, which has never been downloaded before or not currently available from other users. Through this D2D communication, one can reduce considerable redundant requests to the BS thus alleviating its traffic load.

Social ties can be utilized to achieve a stable transmission link via D2D communication. This social relation assisted data transmission wireless network is referred to as the offline social network (OffSN). The probability that a certain content is requested, which can

be used to assess the amount of traffic that will eventually be offloaded via the D2D network. This probability is affected by both external (external influence from media or friends) and internal (user's own interests) factors. While the users' interests are difficult to predict appropriate, the external influence which is based on users' selections can be easily estimated. To this end, for the users within a considered OffSN, we define an online social network (OnSN) which reflects the users' online social ties and influence to one another.

II. METHODS AND MATERIAL

A. Related Works

The demand for video content is continuously increasing as video sharing on the Internet is becoming enormously popular recently. This demand, with its high bandwidth requirements, has a considerable impact on the load of the network infrastructure. As more users access videos from their mobile devices, the load on the current wireless infrastructure (which has limited capacity) will be even more significant. Based on observations from many local video sharing scenarios, in this paper, we study the trade-offs of using Wi-Fi ad-hoc mode versus infrastructure mode for video streaming between adjacent devices. We thus show the potential of direct device-to-device communication as a way to reduce the load on the wireless infrastructure and to improve user experiences. Setting up experiments for Wi-Fi devices connected in ad-hoc mode, we collect measurements for various video streaming scenarios and compare them to the case where the devices are connected through access points. The results show the improvements in latency, jitter and loss rate [7].

This paper addresses two fundamental and interrelated issues in device-to-device (D2D) enhanced cellular networks. The first issue is how D2D users should access spectrum, and we consider two choices: overlay (orthogonal spectrum between D2D and cellular UEs) and underlay (non-orthogonal). The second issue is how D2D users should choose between communicating directly or via the base station, a choice that depends on distance between the potential D2D transmitter and receiver. We propose a tractable hybrid network model where the positions of mobiles are modelled by random spatial Poisson point process, with which we present a general analytical approach that allows a unified performance evaluation for these questions. Then, we derive analytical rate expressions and apply them to optimize the two D2D spectrum sharing scenarios under a weighted proportional fair utility function. [8]

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B. Proposed System

We propose a Online/Offline Social Networking application which utilizes the P2P communication, when the requested content is available with neighborhood by leveraging the locations of all users and establishes a secure data connection using Bluetooth for local access.

OSN users can post their Text, Image and Video to public or friends. If user needs to view the post, it should be downloaded from OSN Server or receive from the nearby device if available.

Server continuously maintains all users download history and current **GPS** of all OSN users.

If a request arises to the server, it looks up for the nearby devices and if available it searches for the user requested content. If the content is available server triggers the both the neighboring devices and initiate a peer to peer mode of communication, here we use Bluetooth as P2P communication and the requested content will be delivered to the destination device in offline mode.

C. System Model

Consider a cellular network with one BS and multiple users. The UEs can receive signals from the BS via the cellular network, or from the other UEs via D2D pairs using licensed spectrum resources. In this system, two network layers exist over which information is disseminated. The first layer is the OnSN. The OnSN is the platform over which users acquire the links of contents from other users. Once a link is accessed, the data packet of contents must be transmitted to the UEs over the actual physical network. Taking advantage of the social ties, the OffSN represents the physical layer network in which the requested contents to transmit.

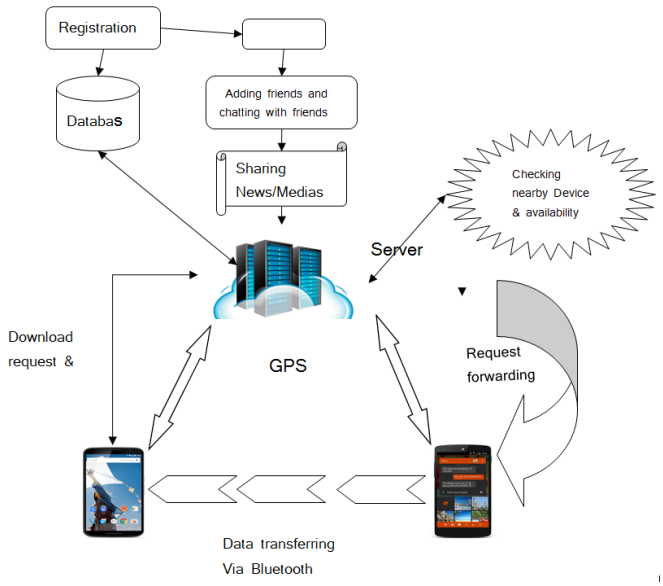

Figure 1. Architecture Diagram

4.1 Social Networking Web Application:

In this module, the OSN web application is built as social networking application in which new user can register for the services. The registration fields are validated user is able to login with his credentials. The users can set Cover picture, Profile photos and can add friends. The friend request will be dispatched to end user account and will be readily available once he logged in. He can accept/reject the friend request. The friend list is shown in the right panel and can be able to chat with the recipient private manner.

4.2 Sharing Posts with Access Control:

In this Module, The users can post some News, Images and Video and some other information. These posts can be shared with friends with access control. The shared posts can be viewed by friends if they have proper access control once they login. Friends can reply to the posts with some comments and like/dislike the posts.

4.3 Reviews/Likes, Posts/Views through Android Application:

In this Module, users first need to install the OSN app in their Android phone and user need to login with their valid account. After login server can able to maintain their **gps** position Of the user and Bluetooth MAC address and IMEI. The Server keeps track of all the users gps coordinates and the downloaded file contents if a download request rises from the user. A service thread will be run in android application which regularly updates the gps coordinates to the server if any change occurs. The gps position is intimated only if there a change notified which reduces the communication overhead between the client and server. The server will be in a push mode whenever a post is triggered to the android mobile device. Our Image compression technique enables the user to view compressed image without blur and reduce the data usage. All the post can be viewed in android and web application.

4.4 Downloading/Transferring of Data via P2P:

If any of the user need to view the post eg:(Video/Image) the request is sent OSN Server which will look up for the nearby devices. If there is one or more devices in close proximity, the server will check for the historical download requests of each nearby user for content. If the content is available with any of the user, server triggers both the nearby devices (Content requester, Content dispatcher) in back end Service Thread that already running in the mobile devices to initiate a Bluetooth communication. Here we handled both paired as well as unpaired devices and this is through pre sharing of Bluetooth ids by server to neighbouring devices. After successful Bluetooth initialization the contents will be transferred from source mobile to destination mobile. The privacy of the entire user is retained by having pseudo identities for all the communications. The users are not aware of peer to peer communication that is happening in the back end, hence ensuring the security.

5. ALGORITHMS/TECHNIQUES USED:

- Nearest Neighbour Search (NNS).
- Distributed and Privacy Preserving.
- Huffman Compression Algorithm

III. CONCLUSION

In our work, P2P communication reduces the Bandwidth usage, Network traffic and Server load and improved the data utility by neighbourhood sharing, maintaining the security, battery usage and privacy concerns are achieved.

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