Various Issues in Ad-hoc Social Networks (ASN)

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I. INTRODUCTION

Social networking has been provided as an online service that focuses on building relations among people. Social networking services are web based and use a centralized infrastructure e.g. Internet connection and a website (e.g. Facebook, LinkedIn, or twitter) for providing communication among users interested in making social network. Each user has to maintain a profile on a webpage of the website and uses this page to connect with other members. Users can share audio, video, messages, and other interests within their individual networks. A person uses social networking service to connect old friends, make new friends, or people with similar interests.

Along with other advantages, online social networking has several limitations with regard to needed infrastructure. Online social networking is dependent on a centralized infrastructure. If the website is blocked due to some reasons, social network will not be available. Another reason could be the Internet. Users access social networking service only if they have an Internet connection working on their devices. However, the Internet connection may not be completely available (as you are not connected to wireless router) or may be partially available (as you are connected but blocked to access these sites). Another limitation of present social network is suggesting friends based on their profile and not based on their dynamic interests. These social networks do not suggest friends based on present interest, context, and proximity. The interests of users may be attending a conference or sharing taxi. ASN help users to connect with other nearby users interested in similar objective.

So, there is a need for network-on-the-move that can also provide social network facilities anytime anywhere based on the dynamic interests of the users without using any infrastructure.

Ad-hoc Social Network (ASN) [1] has been proposed to form social network that is not dependent on any other centralized infrastructure or Internet. ASN is combination of Ad-hoc network and social network. ASN can connect users which are in proximate location to each other and have common interests. ASN uses routing protocols of ad-hoc network in order to facilitate communication among interested users. Out of many nodes that form an ad-hoc network, some of the nodes may have social network among them as shown in Figure 1.
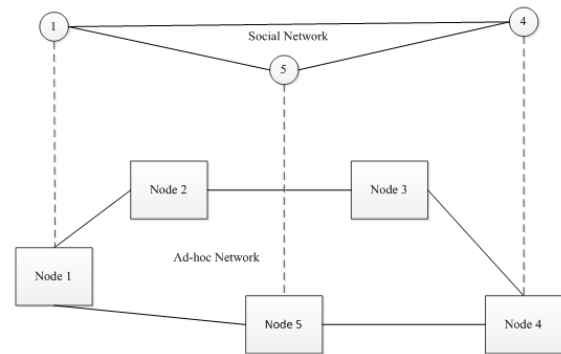

Fig. 1: ASN Supporting Social Network Layer over the Ad-hoc Network Layer

Various frameworks have been proposed for ASNs. Authors [2] proposed a software platform for ASN which supports social web application running on local browser connected to lightpd server which directs control to Ad-hoc directory service to support applications like gaming, setting up video chat etc. as shown in Figure 2.
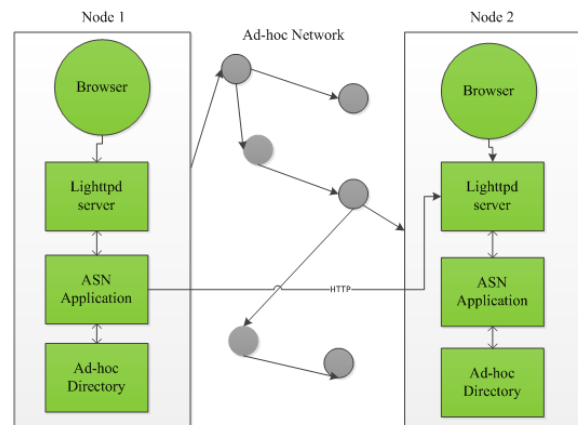

Fig. 2: ASN Platform over Ad hoc Network

Routing protocol in an ad-hoc network allows wireless devices to directly (without using any access point i.e. broadband wireless router) communicate with each other. The routing protocol allows all wireless devices within the range of each other to discover and communicate in a peer-to-peer fashion without using

any centralized access point. The nodes in the ad-hoc network move freely and form an arbitrary topology. There is no master-slave relationship and nodes rely on each other for communication, thus each node acts as router. Packets either travel directly or through intermediate nodes.

Current research in ASN uses existing ad-hoc routing protocols to form social network but lacks optimization of routing protocol in adapt the protocols for ASN. Social network has different characteristics like proximity, meeting pattern, privacy concerns, density of mobile devices, and others that are different than general ad-hoc network. Therefore, there is a need to optimize routing protocols of ad-hoc network to make the protocols suitable for ad-hoc network. Due to differences in characteristics and features there is a need to study the protocols whether routing protocols of traditional ad-hoc network cannot used in ASN. The routing protocols can be optimized based on the criteria comprising packet delivery ratio, stability of path, priority of service, transit delay, loss ratio, privacy issue, and others.

Rather than focusing on traditional ad-hoc networks applications such as military battlefield or emergency rescue operations, ad-hoc social network (ASN) is small scale network established to provide social applications, for instance, to play a game with friends on the train, to make connection with people, or to share photos and documents in office or household environment without using any infrastructure.

II. AD-HOC SOCIAL NETWORK (ASN)

Ad-hoc social network has a different set of characteristics than ad-hoc network and social network. Ad-hoc social network is infrastructure-less and self-configured i.e. no need to have central infrastructure. In order to connect users which are in nearby location, pattern matching algorithm compares profile of users and suggests possible friends. Devices in ad-hoc social network are low battery powered so the routing protocols or pattern matching algorithm are to be designed to consider this aspect. Ad-hoc social network has been proposed to support social network in short distance. So Ad-hoc social network is based on proximity of the nodes. ASN can search friends [1] or other persons with similar interests in nearby locations. There is no cost associated with establishing social network and service is available without any disruption.

ASN creates social network for a small number of people that have similar dynamic interests and are in proximity. The dynamic interests can be users interested in sharing a common cab from a common source to a common destination. People may be in making new connections for their professional benefits. People may be interested in spending idle time with persons having common interests while sitting on trains or waiting for

their flights at airport or at any location. Users may be interested in knowing whether there is someone they already know is at nearby location. People meet many other friends in a conference but due to shortage of time available it is not possible to meet every individual present there and to have their contact information for future contacts. Ad-hoc social network can provide us information about other persons present there having similar interests in order to contact at that time and in future.

III. RELATED WORK

Seada [1] presented social networks as a killer application for wireless ad-hoc networks. Kawarabayashi [3] discussed problem of message duplication in dissemination of dynamic content over a dense mobile social networks (MSNs). Sarigol [4] presented a tuple space system for social networking on ad-hoc networks. Podobnik [5] proposed that ad-hoc social networking as a platform in comparison to social networking as a service based on benefits, applications, and ease of building ad-hoc social network. Podobnik [6] presented model, architecture for platform and possible services for ad-hoc social networks platform. Podobnik [7] also proposed to extend social network model to ad-hoc social network to capture the interest of users physically located in a limited geographical area with common goal or similar dynamic interests.

Sarigol [2] presented an AdSocial, a software platform supporting social network applications for mobile devices in multi-hop ad-hoc networks. Gurecki [8] proposed in his project proposal to develop software for Android phone which would enable a phone to connect with other android phones in its proximity using ad-hoc mode. Bottazzi [9] presented a middleware called Socially Aware and Mobile Architecture (SAMOA) for management of location and user profile dependent social networks. He [10] addressed the problem of message propagation in ad-hoc-based proximity mobile social networks (PMSNs). Stuedi [11] proposed MAND (Mobile Ad-hoc Network Directory) a distributed system built on the top of network layer for the storing and the information in MANETs.

Musolesi [12] represented a social network using a weighted graph where weight of an edge represents the measure of the likelihood of geographic colocation individuals. Lee [13] presented a method for locating a friend in ad-hoc social network based on user's interest. Algorithm to suggest friends is based on the concept that users having similar browsing history have common interests. Chen [14] discussed a file-sharing algorithm for an ad-hoc network consisting of 'n' fixed nodes. In [15] and [16] authors presented a framework for reputation management and generation system in ASNs. Using this framework (AdChat) a user can see

the local reputation of other users during chatting. In [17] authors proposed MobiClique as an architecture to enable mobile ad hoc social network on windows mobile phones. The Junction protocol proposed by [18] is an application-level communication protocol for ASNs on which applications of ASN can be developed. Yiu [19] presented an application which locates friends in proximity based on given threshold Euclidean distance. Dobson [20] presented an algorithm for synchronization of nodes in ASNs while exchanging data for routing. Kohno [21] discussed an application of ASNs for sharing photos which have been clicked in an ad hoc network. Mattila [22] proposed proximity based TWIN system for establishing an ASN for content sharing.

Nazir [23] presented an algorithm for prediction of contact duration using people predictable social patterns to deliver the time critical content. Rahnama [24] worked on problem of efficient friend locating mechanism in ASN and extended the work on semantic based pattern matching via adding the context based adapitiby. Campbell [25] proposed to add sensing capability into social networking applications. They presented a system called CenceMe which collects the information about the neighboring users and concise the facts which can be used in many applications.

IV. RESEARCH ISSUES AND CHALLENGES IN ASN

Current research in ad-hoc networks is focused on ad-hoc networks to support emergency or defense applications. Supporting social network depending on dynamic interests using routing protocols of ad-hoc network is a new field and emerging application of ad-hoc networks. This application of building social network over ad-hoc networks provides many new research challenges that have still not been addressed.

Current research lacks in optimization of routing protocols of ad-hoc networks which can be used for ad-hoc social networks and there is a need for optimization of routing protocols that can exploit nature of ASN and provide efficient results. Moreover once optimized path is established, stability of the path is important due to mobile nature of devices. Users will not be able to share large files if route is not stable. Therefore, there is a need a routing protocol that provides a stable path.

There may be different type of communication e.g. regular communication or emergency communication. There is further need for a routing protocol that adapts according to the nature of desired service. The routing protocol should prioritize data packets accounting to characteristics. In order to make ASN reliable and feasible, a routing protocol is needed that links some economic incentives to co-operating nodes to motivate them for delivering data packets. The routing protocol should provide a mechanism to provide incentives to intermediate nodes.

Ad-hoc social network depends on cooperation of intermediate nodes in order to deliver packets to destination. There may be privacy concerns at intermediate nodes. to the routing protocol is needed to handle privacy concerns for users. Users of ASN may like to see if any of his connection/friend of on-line social network [26] is present in proximity of the user. There is a need to integrate on-line social network with ad-hoc social network. There is also a need for better matching algorithm to suggest friends based on profile and/or dynamic interests. The matching algorithm should be based on semantics and not based on key words as different users may have different vocabularies. Currently, pattern matching algorithms are based on infrastructure and distributed systems. However, devices in ad-hoc social network are mobile and low battery powered so there is a need for a pattern matching algorithm for these devices. Determining and recommending friends based on similar interests in proximity is another area that needs to be improved.

Security and privacy is another serious issue, which needs to be discussed in ASNs. In web based social networks security is handled by site servers. In Ad-hoc networks also there are various distributed authentication mechanisms to handle security but those may not work while locating and detecting the friends in ASNs since these involve communication without pre knowledge of nodes in network. On privacy aspect in ASN, preventing intermediate nodes from knowing about user's friend is also an issue.

V. FUTURE WORK

Future work should optimize ad-hoc routing protocols by using location information, prioritizing packets, solving privacy concerns, and providing economic incentives to intermediate nodes along with an efficient matching algorithm to determine common interests.

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