RESEARCH CHALLENGES IN AD-HOC SOCIAL NETWORK (ASN)

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ABSTRACT

Today mobile social networking is gaining high attention. Most of the mobile devices are equipped with ad-hoc mode of communication like Bluetooth, WI-FI, or cellular radio. Ad-hoc mode of communication can be used to build an ad-hoc Social network (ASN) between mobile users. ASN is used to form a small network between nearby users having same interest. In this paper, work done for implementation of ASN is described along with various research challenges and issues of ASN.

Keywords: Ad-Hoc Social Network, Profile Matching, GPS, Tuple Space, Routing, Semantic Similarity

I. INTRODUCTION

These days social networking is becoming very popular among people of every age group. It has also gained tremendous popularity on mobile devices to communicate with people. But, online social networking has some limitations. In online social networking, centralized infrastructure is prerequisite. If for some reason, website is blocked, then social network will not be available [1]. Secondly, the location of user is not considered in online social networking. Thirdly, it suggests friends on the basis of user's profile and ignores the dynamic interest of user. To connect with new people, usually all the users publish their complete profile for others to search. However, users profile may contain some sensitive or personal information that they do not want to make public [2].

There is a need of network-on-move to connect with people of same interest who are in physical proximity of him\her.ASN is a social network which uses ad-hoc mode of communication to develop relations with different people who are in proximity. ASN has its advantages over online social network, since it is decentralized and uses infrastructure-less network. It helps user to connect with nearby users who matches their interest at any instant of time. For example, user has different browsing pattern at different location meaning at office search terms are different and when at home or some location for holidays key terms are different. ASN is used as anytime anywhere social network.

ASN can be used to send text messages, photos, videos, or any other file to nearby user with similar interest. Nearby users can be found by wireless mobile protocols like Bluetooth, or GPS (Global Positioning System)

II. RELATED WORK

Sarigol [3] presented AdSocial, a Software and middleware platform for social networking using ad hoc networks. It has been deployed on Nokia N810 internet tablets. AdSocial targets small scale networks such as

friends playing game on train, to make social connection with people in a institution or conference or share documents and photos in office. AdSocial uses data piggybacking mechanism and share data using ad hoc routing protocols without any modification. Using AdSocial, buddies can chat, play games, can do video conferencing etc. Here buddies are the users in proximity which are detected by AdSocial. Users can retrieve profile of a nearby buddy which contains Session Initiation protocol (SIP) address and interest along with some basic information. AdSocial is implemented on a regular web browser (e.g. Firefox) that connects to lighttpd web server to redirect the call to AdSocial via FastCGI interface. To locate a buddy and to determine the address of buddy's webserver, AdSocial uses MAND(Mobile ad hoc network dictionary), a distributed dictionary service for ad hoc networks.

Sarigol [4] proposed a distributed tuple space for social networking on mobile phones. They presented an approach for storing and sharing the underlying network as the common memory space in which nodes can store and lookup key/ value pairs. A tuple consists of six fields. Key is tuple identifier and value is its content. Owner identifies the node generating the tuple. Version specifies replacement schema among tuples with the same key. Scope tells the number of hops and lifetime field specifies for how long a tuple is stored locally at a node.

```
Tuple-presence = {
  Key= "adsocial-presence"
  Value="15.10.5.2.80:/Patrick/busy"
  Version= 32
  Owner= "15.10.5.2"
  Scope= 4
  Lifetime= 30
}
```

Authors uniquely identified the tuple by pair <key, version>. Tuple space can perform tuple insertion, deletion and lookup of tuples. Insertion of tuple is done by *put(table)* operation. *Get(query)* and *scan(query)* operations are used for lookup of tuples stored in network. Deletion of tuple is done either when lifetime is expired or by incrementing the update of same tuple. Authors implemented buddy presence using tuple space that allows users to view all buddies with specific interest. Buddy's presence status and interest are periodically updated in network. Such an application may be used in a conference venue to allow people to set up discussion group.

Chayant[5] propsed optimized based approach for community identification in dynamic social networks. They assumed social networks as the graphs where a vertex represents individuals and an edge represents social interactions. They also assumed that time is discrete and in each time step, social interaction is in the form of several complete subgraphs of individuals. Authors showed that problem of inferring community structure in dynamic networks is NP hard and thus presented heuristic algorithms (e.g. greedy heuristic, Bipartite heuristic) to find the near optimal solution.

Seada [6] considered social network as the killer app for wireless ad hoc networks. They proposed proximity local networks using existing device base and wireless interfaces like WI-FI and Bluetooth. They also considered ad hoc network technology as the best way to provide proximity factor for following reasons:

i. Without any infrastructure, users can connect other peers in the same range.
ii. Users can detect and verify the proximity of their peers and can find their approximate location.
iii. Avoiding centralized approach for crowded locations, distributed approach is likely to offer viable alternatives.

They proposed several components required in ad hoc network that can support social network application like joining a social network by detecting physical neighbors that are part of same network, locating friends with same interests in proximity, finding locations using GPS, providing proper authentication and encryption of messages transmitted between two friends and lastly to allow nodes to form a social network without the need for internet access.

Lee and Hong [7] proposed an algorithm to create a user profile and infer user's interest in real-time. The data is extracted from the URLs which are accessed by users. The mobile web browser stores the browsing history to analyze user's interest. Authors presented a hierarchical model to infer user's interest from web pages. A node hierarchical mode consists of a keyword and a value. Keyword is the extracted word from URL and value is its interest level. Authors recorded the keyword and corresponding values. If extracted word from URL exists in hierarchical model, then its interest level is increased else it is added in hierarchical model and interest level is initialized. To build a ad hoc social network, a mobile device A broadcasts a neighbor discovery message with its own profile. Mobile device B on receiving this message calculates similarity between two profiles. If similarity is high then B sends its profile to A and forms a virtual link between two else it discards the neighbor discovery message. Using virtual link, the mobile devices can interact with each other in transmission range.

Aneja and Gambhir [8] presented a geo social profile matching algorithm that constructs user profiles dynamically based on their interests. They considered GPS location of users to create user's profile. GPS location of users is stored in data structure list. Each GPS Location has a corresponding hierarchical structure where extracted keywords from URL are stored. Current GPS location of users is compared with the GPS location stored in data structure list. If GPS location is found, then corresponding hierarchical structure is extracted. Keywords are compared with all children nodes of this hierarchical structure. If it is found then its interest level is increased else it is added to the structure and its interest level is initialized. If GPS location is not present, then a new tree with root node as that GPS location is added in forest along with its corresponding hierarchical structure.

Kaisa[9] designed a software called MobiClique for mobile social networking for windows phone that uses store-carry-forward technique. It does not rely on any infrastructure or on a centralized server. It creates a virtual world between users bads on their proximity, interest level and social compatibility. In order to connect with other users Mobi Clique uses three steps:

i. Neighborhood discovery
ii. User identification
iii. Data exchange

Neighborhood discovery is done by radio technology being used like Bluetooth or wifi. After discovery, in user identification phase, the user exchange their full profiles which are stored by MobiClique along with other contact statistics. In data exchange phase, users exchange messages which are stored on the device and can be forwarded to other devices in the proximity. MobiClique can be used to address both to the group of users or to a specific user. Messages stored on a device can be removed when TTL(time to live) expires. This exchange of messages between multiple hops in infrastructure-less environment creates a temporal communication network as in pocket switched network(PSN). Along with mobile social networking and asynchronous messages, MobiClique can also be used for epidemic newsgroups whereby multiple disconnected users can share their specific interest.

Li[2] proposed FindU, the first distributed privacy preserving personal profile matching in mobile social networks. In FindU, users can find best matching profile from group of users. For privacy purpose only minimal information about participant users is exchanged. FindU is secure under HBC (honest but curious) mode and prevents active attacks.

Aneja and Gambhir[1] presented various research issues in ASN. The authors presented the need of optimized routing protocols for better and efficient results of ASN and to provide stable path between users. They also presented the issue of privacy and security in ASN to prevent intermediate nodes from knowing about other user's friend. They focused on prioritizing data packets to make ASN reliable and feasible.

III. RESEARCH CHALLENGES IN ASN

- Current research on ASN is focused on similarity matching by extracting keywords from URLs or browsing history of user and finding similarity based on those keywords. They do not determine if keyword being matched within a profile or different profile is synonymous. E.g. one user may search for club and other user may search for disco. Thus there is a need of semantic similarity..
- Privacy of user is another issue in ASN. Authentication of users is difficult since ad hoc social network is not based on pre knowledge of other users. Encryption technique is required to send messages over a network.
- Ad hoc social network as per now works on routing protocols of ad hoc networks. They need to be optimized for ASN to include prioritizing of messages. Network is dynamic and thus topology can be changed at any instant of time. So, routing protocols must be designed so that a stable path can be maintained for message passing.
- In ASN, friend suggestions are shown on the basis of proximity and dynamic interest of users. There must be some similarity aspect on the basis of which it can be predicted that which profile is better to build a social network. Therefore, a profile matching algorithm is needed

IV. CONCLUSION

In this paper we discussed the research issues in ASN. Profile matching in ASN with several security parameters is a serious issue. In this paper only the survey on various profile matching schemes and security is presented.

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