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Mobile Networking (CISE 6930, Helmy, Spring 2012)
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Title: BEHAVIOR AWARE SEARCH ENGINE (BASE)

I. Abstract

Analyzing user behavior through mobile traces allows us to effectively group users in terms of their mobility preferences. We propose that this data can be used to route specific and subjective user queries dealing with local information (i.e. pertaining to places of interests or POI(s) in a university or a small town) to knowledgeable users who frequent such POI(s). In addition to this, our system would allow places of interests to be tagged dynamically as more questions are answered to build a richer metadata for improving future results (i.e. routing to a more specific group of users and recommending “more accurate” places of interests).

All the mobile users using this service will first agree upon a set of locations that are used as references to keep track of their mobility profile. Whenever a user is in one of these designated locations; it will send nearby users (hop count < 4) a data packet containing his unique id (hash function applied on his mac address) and the current location. These nearby users can be thought of as witnesses. Users belonging to the same mobility group (i.e. having a certain degree of similarity in their mobility profile; measured by applying a similarity metric on their association matrices) will also exchange tags (i.e. subjective keywords describing that particular location or place of interest) between themselves and thereby maintain a rich set of dynamic tags.
Our service will contain 4 phases.
a) Query Creation and Forwarding:
An incoming (new) mobile user will create a query tagged with one (or more) keywords (e.g. ‘fees’ or ‘soccer’). He will then use expanding ring search to forward the query to nearby users and then passively wait for a reply.
b) Expert Identification:
Each user who receives the packet will check its local list of tags, if incoming tag is a match; the user can identify himself as an expert. We are working on a reputation system where users will maintain a reputation count for every user based on the number of correct answers he has given in the past. This rank can be used to identify the experts for future queries.
c) Dynamic Tagging:
New tags can be added to the system if more than 1 user identifies himself as an expert to answer the query and these expert(s) have similar mobility preferences (belong to the same mobility group). This matching will be done by comparing association matrices at the destination (i.e. by the asker)
d) Reply Forwarding:
The answer will be relayed back to the user using random transmission on the Delay Tolerant Network.

The application is deployed over an ad hoc network topology where each device is free to move

independently in any direction. A mobile ad hoc network being a self-configuring infrastructure-less network, the system is completely decentralized and therefore, there is no existence of a centralized server or data repository. The network size is assumed to scale to a range as large as the university campus.

We are developing a prototype mobile application to display the effectiveness of our search service in real world scenarios. This application uses Bluetooth APIs to enable user discovery, send messages asynchronously and store persistent service-orientation information (such as tag lists, association matrices of other users etc).

We are also developing a simulation environment using mobile trace data for 1 month in University Of Florida by building an indexed database [using flat files] that stores the queries in a specific format. Our primary technique for building simulations is to imagine the network of university users as a set of vertices V in Graph G = (V, E) such that any edge Eij is assigned a value 0 if there is no encounter between user i and j at timestamp t, or 1 if there is an encounter between user i and j at timestamp t.

II. References

[1] W. Hsu, D. Dutta, A. Helmy, "Mining Behavioral Groups in Large Wireless LANs", IEEE Transactions on Mobile Computing (TMC).
[2] W. Hsu, D. Dutta, A. Helmy, "CSI: A Paradigm for Behavior-oriented Profile-cast Services in Mobile Networks, Ad Hoc Networks Journal - Elsevier.
[3] K. Fall. “A Delay-Tolerant Network Architecture for Challenged Internets.” ACM SIGCOMM Aug 2003.
[4] Tao Jiang and John S. Baras “Autonomous trust establishment”, In Proceedings of 2nd International Network Optimization Conference, March 2005.
[6] Sepandar D. Kamvar, Mario T. Schlosser, and Hector Garcia-Molina. The eigen trust algorithm for reputation management in p2p networks . In Proceedings of the Twelfth International World Wide Web Conference, pages 640–651, Budapest, Hungary, 2003
[7] Evaluating Similarity-based Trace Reduction Techniques for Scalable Performance Analysis by Kathryn Mohror and Karen L. Karavanic, Portland State University, 2009.
[8] U.Kumar & A.Helmy. “iTrust: Encounter Based Trust Recommendation System”