

Social Networks

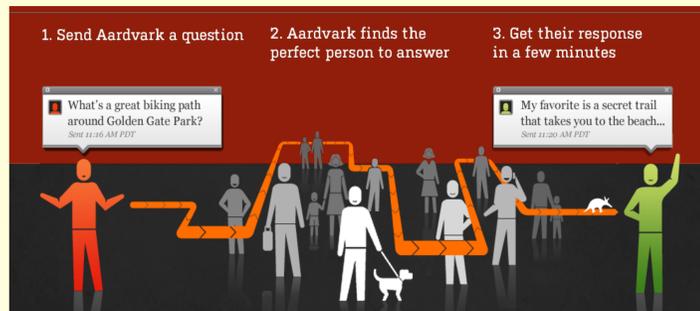


Social Networking has become a new culture and spawned several social networking systems. Social networking sites offer a virtual medium for people to come together and socialize by allowing them to share their profiles, photos, play games and make connections.

Social Search is another emerging area in the world of social networking sites. The concept is to perform a search from people's circle of friends and their friends. Sometimes questions are complicated and subjective and it is hard to find answers to some questions by googling for the answers. So you really need a person or an expert who you can have a short exchange with. And the results will be more relevant when they come from people closer to you in the social network.

Aardvark¹

- Aardvark is a new kind of tool that lets you tap into the knowledge and experience of friends and friends-of-friends.
- People join Aardvark from the web, IM, email, Twitter, Facebook, or iPhone.



Problems

1. All social networking sites are centrally managed thus risking the privacy of users' information.
2. These sites do little to protect the anonymity and privacy of individual users. Some questions/answers may be sensitive and in such cases, users' privacy should be maintained.

Contributions

- Designing a decentralized peer-to-peer social search system which has all features of centralized Aardvark using peer-to-peer architecture and social networks.
- leveraging the presence of "trusted" friends to shield users from being observed by passive attackers[2].
- Providing privacy and anonymity for both messages and users.
- Using Aardvark engine as our design goal to find the experts in the social network that can give the best possible answer for any question but in a peer-to-peer architecture.

System Model and Design

We design an algorithm to effectively route questions and answers in social networks. Our Algorithm has two parts:

1. Algorithm for creating hook group that forwards the question on behalf of querier. The idea is similar to Crowds.
2. Routing algorithm to pass the question through the social network and to find experts.

Assumptions

- A user has access list of his/her friends in the social network and members in his/her hook.
- No one knows interests of others.

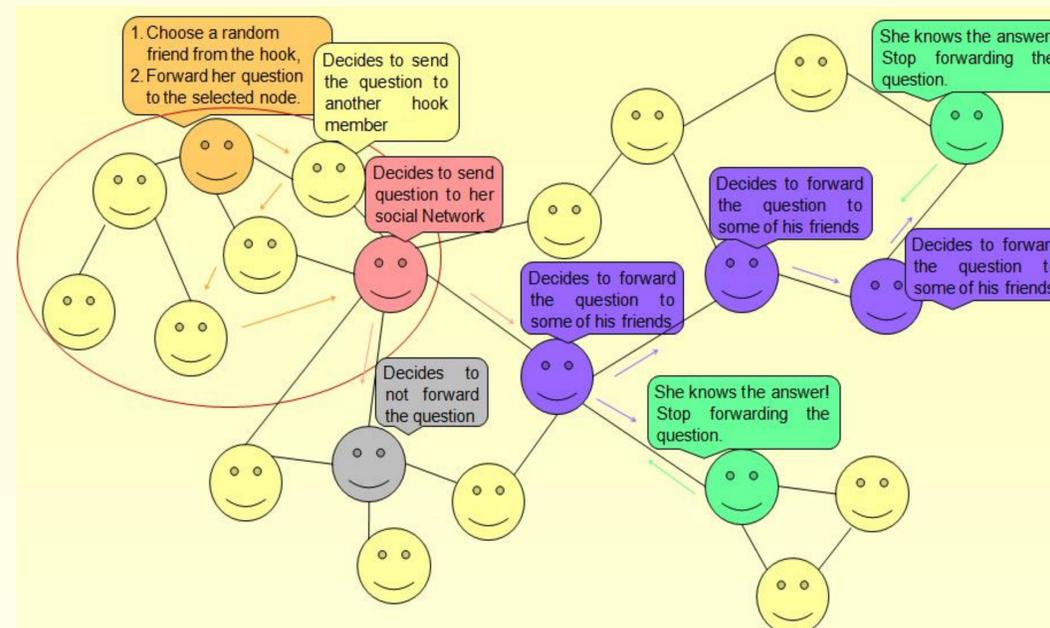
Peer-to-Peer Aardvark

Routing messages and Finding Experts

1. The question is initially forwarded within the hook for a random number of times.
2. One hook member randomly decides to pass the question to his/her social network.
3. Using probabilistic algorithm avoids flooding the network by a question.
4. Each node makes a decision to forward a question by flipping a coin.
5. Each node knows the predecessor node and the successor nodes but not the querier and responder.
6. The answer will be routed backward using the same path that was used for forwarding the messages.

Privacy and Anonymity:

- Ideas is similar to the Crowds[3] in providing anonymity to senders and receivers.
- Since the querier does not directly pass the question into the network, but to one hook member, k -anonymity[4], where k is the number of hook members, is provided.
- Because each node only knows that its predecessor forwarded a question, he has no idea about the source.
- Similarly, within the social network, the question is forwarded amongst the nodes in the social network.

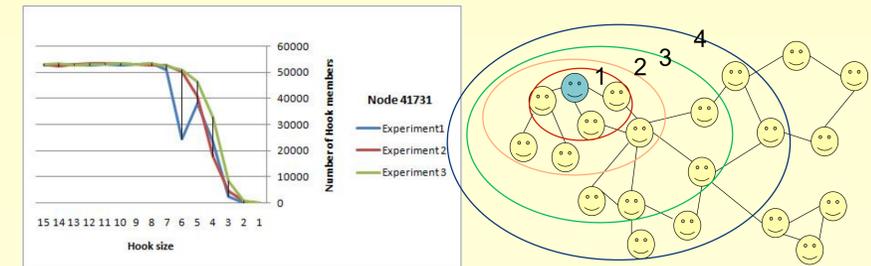


Implementation and Evaluation

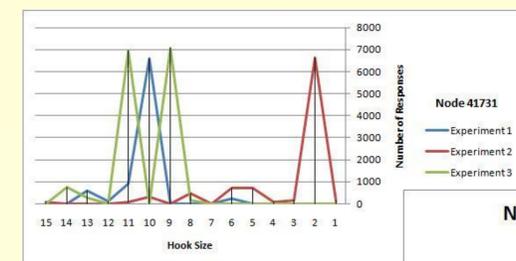
- Using a data set from the Facebook New Orleans networks[5].
- Includes 63,731 nodes and 1,545,686 links among the nodes.
- Interests are assigned random integers between 1 and 20.

Hook Size ~ Anonymity Set

- Size of the hook is the security parameter.
- By increasing the hook size, the size of anonymity set increases.
- After six- seven hops, the anonymity set is equal to the social network set.

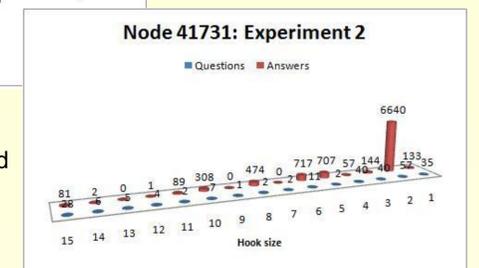


One goal is searching and finding enough answers for questions.



- Each node receives different number of answers for different hook sizes.
- In some cases answers are more than enough.

- In three experiments for one node, the ratio is 31 unanswered vs 520 answered.



Future Directions

- Applying all the proposed attacks to Crowds and social networks such as the predecessor and the intersection attacks.
- Implementing key distribution amongst the nodes of the peer-to-peer Aardvark to maintain message integrity.
- Optimizing the routing algorithm so that questions are routed to the people that are Experts by implementing a reputation system.
- Taking a semantic view of the questions asked and relating topics according to the question asked and not just the topic.

References

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2. M. Wright, M. Adler, B. N. Levine, and C. Shields, Defending anonymous communications against passive logging attacks. Proceedings of IEEE Symposium on Security and Privacy, 2003.
3. M. K. Reiter and A. D. Rubin, Crowds: Anonymity for Web transactions. Proceedings of ACM Transactions on Information and System Security, p 66-92, 1998.
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5. B. Viswanath, A. Mislove, M. Cha, and K. P. Gummadi, On the Evolution of User Interaction in Facebook. Proceedings of the 2nd ACM SIGCOMM Workshop on Social Networks (WOSN' 09), 2009.

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