



A Referral Social Network Model for Anti-Spam in a Large Scale VoIP System



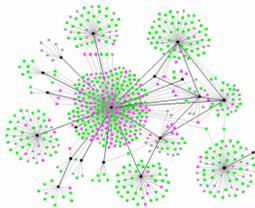
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Research Goal

- VoIP (Voice over IP) allows voice packets to be carried over commodity Internet
- Dramatic reduction in cost compared to PSTN (Plain Old Telephone System), a VoIP call could be as cheap as sending an email
- But mass migration of telephony to IP gives rise to the problem of SPIT (Spam over Internet Telephony)
- Unlike email SPAM, which can be prevented (to some extent) using content filtering, it is very challenging to perform content analysis of voice packets during call establishment. Also, there is a need to largely preserve the simple SIP when migrating residential telephony to IP.
- A whitelist (buddylist) could be used to maintain a list of users from whom calls can be accepted and a blacklist can be used to maintain a list of users from whom calls are never accepted
- However, we need a mechanism to classify calls coming from users who are in neither of the two lists
- Need a way to introduce first time caller to a callee

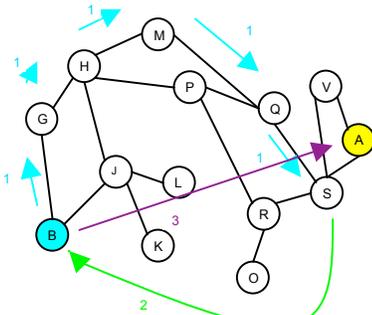
An Anti-Spam Framework

- Every user (peer) is connected to all other users in its whitelist (buddylist)



Ref: http://prblog.typepad.com/strategic_public_relation/images/2007/06/22/simple_social_network.png

- Connecting users to each other using their whitelist gives rise to a social network

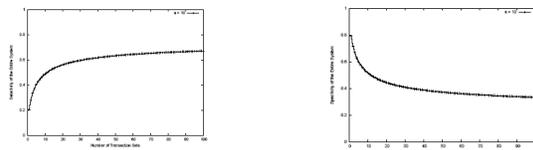


- A caller, say B , who is not in a callee's A buddylist can only call A with the help of a referral node, say I , who is a friend of A
- During call establishment, the caller sends a request message $\{msgid, B, A, rep, H\}$ to find I
- The request message is routed to I using techniques such as limited scope flooding, random walk/branching, and hybrid methods
- At each hop, while the request message is being forwarded, the reputation score, rep , and hop count, H , are modified
- Finally I replies with $\{msgid, B, I, \{timestamp, msgid, I, A, rep, H\}_{KAD}\}$ to B , who then forwards the message to A
- Depending on the values of rep and H , A decides whether to accept or reject the call

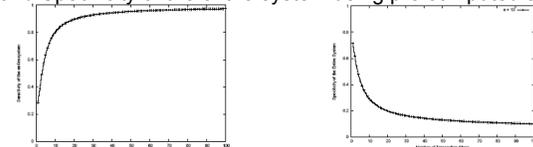
Referral System

- A user ranks all of its buddies using a normalized reputation score
- As the request message is propagated, every user modifies the reputation score, rep , in the message based on the reputation score of the neighbor to which it forwards the message
- A callee accepts or rejects a call based on a response function $g(a * R_{ij}(n))$, where a is some constant
- If the callee accepts a legitimate call, it increases the reputation score of the referring node by a small amount, c , and normalizes the reputation score of all its other neighbors
- If the callee accepts a spam call, it decreases the reputation score of the referring node by c , and normalizes the score of all its other neighbors
- If the callee does not accept the call, the reputation is not modified

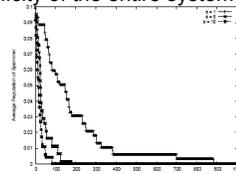
Performance Evaluation



Sensitivity and Specificity of the entire system using pre computed shortest paths



Sensitivity and specificity of the entire system using random walk



Average reputation assigned to a spammer

Conclusions

- Our approach correctly identifies 95% of spam calls while misclassifying less than 10% of legitimate calls
- Also spammers are identified while they are making spam calls and they are prevented from making additional calls