Authentication Algorithm for a Node in Peer-To-Peer Network

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ABSTARCT

Peer-to-Peer (P2P) network, an overlay network is a popular file sharing system, however, by default content pollution is a problem in these networks .Due to absence of server in this network a peer, including a malicious node, can enter or leave the network at any time without intimating other peers .At the same time an user in the P2P network needs the trust value of participating nodes in the network .Owing to decentralized structure of the network. trust plays an important role in content distribution, as trust based content distribution is needed between peers .The trust value of a node is measured in terms of its past behavior and satisfaction of other sharing nodes. However, there is an important issue of security in evaluating trust value of a peer ,since a malicious node can provide a negative feedback about a genuine peer .In this paper a robust trust evaluation algorithms is presented using Fuzzy logic. Using this technique the authenticity of a peer can be determined and simulation can be done for this purpose using the proposed algorithm.

I.   INTRODUCTION

Trust is a complex ,multifaceted and context based notion. Sloman [2004] defined trust in context of P2P networks as," The quantified belief by a trustee with respect to competence ,honesty ,security and dependability of trustee with a specific context" Trust can be evaluated by a number of methods .Reputation based trust management is a particular nature of trust .According to American Heritage Dictionary ,"Trust is firm reliance on the integrity, ability ,or character of a person or thing". Similarly reputation is defined," A measure derived from direct or indirect knowledge on earlier interaction of agents and is used to assess the level of trust an agent puts on other agent." .The very nature of trust and reputation suggest that these concepts are fuzzy concepts and a membership function can be defined as trustworthy or not trustworthy or somewhat trust worthy.

Networking in computer science is an excellent concept and has revolutionized the communication system. It has enabled the users at a large geographical distance to communicate and share data at an excellent speed .Peer-to-Peer network and overlay network provides many services and applications like file sharing and file distribution.

Through P2P network has many advantages like efficiency ,fault tolerance ,but at the same time it is vulnerable to pollution attacks ,spread by malicious nodes .So it is imperative to know the trust worthiness of a node and thus trust plays an important role in P2P system. A peer has to make trust decision before interacting with other nodes .Trust value of a node is, its reputation .Recently reputation-based trust models for P2P system have attracted the attention of many researchers .Reputation is determined as an estimation of reliability in the form of trust .Azzedin and Maheswaram [2002] have opined "Reputation systems offer a basis for developing trust through social control without trusting third parties ,by way of community –based responses about past experiences of entities ".

II.   RELATED WORK

Trust management models for P2P networks considered by Li,[2009],Peng et.al.[2009] and Peng [2010],have mainly focused on cooperation of peers in bandwidth sharing and punishment for content pollution. Since ,in most of the cases content pollution occurs without the knowledge of the providers and these providers are punished for no fault of them. The approach of these models dissuades the content providers   in sharing valuable contents .Kamvar et.al[2003]proposed Eigen Trust, "A method to compute global trust value for each peer in the network .Inspired by Page Rank it gathers the history of transactions and trust information of the entire system and provides global reputation score for each peer .Finally the trust value for each peer is calculated on the basis of eigenvector of a normalized local trust rating matrix."

Zhou and Hwang [2007] presented an improved version of Eigen Trust algorithm and termed it as Power Trust. The methodology of Power Trust is," Nodes calculate the trust values based on their own rating and neighbour's rating .The scheme gathers the peer feedback information locally and aggregates these scores to the global

reputation rating ".However, Power Trust system is developed for distributed Hash Table (DHT) based P2P structures only.

Xiong and Liu [2004]proposed Peer Trust ,which compares the trust worthiness of peers based on a transaction based feedback system .Peer trust is "A reputation based trust supporting framework in a distributed P2P network, which is based on transaction based feedback system. It uses five trust parameters to compute trust scores of peers and general trust metric parameter to compute global trust rating ".

Xi et al [2008] considered a P2P trust model based on dynamic fuzzy theory ,while Chen et al. [2009] made comparison of several fuzzy trust methods for P2P –based systems .In their works the trust is treated as a fuzzy variable and local trust scores and cumulative global reputation are obtained using fuzzy –logic inference rules .

Lin et al.[2010] considered multifactor trust evaluation using fuzzy logic inference for effective trustworthiness of a peer .Further they also considered various malicious behaviors of the peers .They concluded that their trust model considerably updates the efficiency of the network and the unauthentic files decreased in the network.

Liang and Shi [2005] proposed a P2P reputation system based on fuzzy logic inferences and termed it Fuzzy Trust .They experimented this system using e-Bay real transaction .Comparing it with Eigen Trust, they concluded that Fuzzy Trust is more efficient and robust .Gossip Trust, Zhou et .al.[2008] ,is based on gossip – based aggregation algorithm .Their trust scheme uses bloom filters to achieve efficient storage for the rank of global reputation .

Lee et.al.[2003] Considered NICE project ,a trust inference scheme in distributed P2P network .In this project NICE models the network as trust graph and uses the trust reference among the trust graph to infer indirect trust. Their major contribution is the concept of trust and the low overhead trust information search and inference algorithms."

In the related area of analyzing credibility of a reputation system ,Ruohomaa et.al[2007] analyzed the maturity of reputation system from the point of view, how these systems support credibility analysis of reputation information .Their analysis is based on recommendations, creation and content selection and use of recommenders ,and reasoning and interpretation of the result .Gaeta & Grangetto [2015] considered statistical inference technique for identification of malicious nodes in P2P file sharing .Naming the technique as belief Propagation they proposed, "The detection algorithm is run by a set of trusted monitor nodes that receive notification messages from peers whenever they obtain a chunk of data ;these messages contain the list of the chunks, uploaders and a flag to mark the chunk as polluted or clean .Peers are able to detect if the received chunk is polluted or not but, since multiparty download is employed ,they are not capable to identify the source of bogus blocks .Factor graph of peers and messages on which an incremental version of the belief propogation algorithm is run by the monitor nodes to infer the probability of each peer being malicious one ".

In the present paper the fuzzy logic based trust evaluation algorithm is presented. This trust model is based on two parameters (i) availability and (ii) response time .Simulation can be performed for is validation .The rest of the paper is arranged as following: Section 3 describes the proposed experimental model, Algorithm for its implementation is included in Section 4,Concluding remarks are given in Section 5.

III.   AUTHENTICATION EXPERIMENTAL MODEL

In order to evaluate the proposed approach simulation was done of a file sharing system in P2P network .To ach file in the system an ID was assigned .It is assumed that the file sharing system is transparent and ideal in the sense that any peer can approach for any file with the knowledge which peers (peers) is (are)holding that file. When a leecher (peer seeking a file) queries for a particular file then its query is propagated through broadcast all over the network .On receiving the response from the seeders the leecher scans the trust index of all these seeders and selects a seeder possessing the highest trust index and downloads the requested file.

To implement the trust model, two different types of parameters have been taken in consideration .These two parameters are availability and response time .The availability means the sum total of sessional time and life time assigned to a peer .The rate at which peers join and leave the network is termed as churn rate .In order to keep the churn rate low a limit is put on the availability of a peer ,which is related to lifetime and sessional time of a peer as defined above, for controlling the frequent joining and leaving a network by a peer a threshold value of availability is prescribed .The response time is the duration between the request time of the leecher and recieving the requested chunk of file by the sender .A threshold is put on the response time. If the response time exceeds the threshold value or no response is received from the seeder then it is presumed that the particular seeder is malicious or not a member of the network during this threshold value of the response time.

The time between two sessions attended by a peer is termed 'gap' and a threshold value is fixed for gap. Whenever any peer wishes to join the network then only those peers are allowed to join the network whose gap between leaving and joining the network in previous history is less than the prescribed threshold value .In case the gap exceeds the threshold value then the peer is either permitted to join the network as a stranger or is not permitted to enter the network.

A peer-to-peer network is considered which can be represented as a random graph on N nodes and having E edges .An edge between two nodes exists whenever two peers associated with these nodes communicate with each other .Let pc be probability of existing an edge e in the graph ,then each possible edge is assigned a random value in the interval (0,1).If the generated random value is less than *pe* then there will be an edge *e* between these two nodes else it will not .Thus a matrix of order N*N is generated and presently it is termed as transaction matrix .The elements in this matrix are 0 and 1, if there is an edge between two nodes i.e. there is transaction between these two associated peers ,then the value is 1 otherwise the entry is 0.

From the transaction matrix a feedback matrix of order N*N is generated .Whenever two peers transact there will some feedback, the feedback is assigned a value is assigned in the set [-1,0,1]. The inference rules of fuzzy logic are based on the feedback values .The inference rules are: For Positive feedback the value is 1; for Negative feedback the value is 0; for No feedback the value is -1.

IV.   PROPOSED ALGORITHM

Input: A static network of N nodes; Probability function P, P(e)=*pe* for being an edge e; Threshold values for the response time and gap.

The model can be executed in six steps.

Step 1: For each and every peer in the network calculate the availability.

Step 2: A peer in the networks starts activity.

If gap ≤ the threshold value, then the peer is allowed to join the network with previous history

If gap > the threshold value then the peer is not allowed to join the network and considered as a stranger.

Step 3: For each possible edge take a random value in the interval (0,1).

If random value ≤ *pe*=P(e), then an edge between two peers exists

else

No edge exists

If the edge exists then the input in the transaction matrix is 1 otherwise it is 0.

Thus a transaction matrix of order N*N, denoted by T(N,N) is obtained.

Step 4: create a N*N feedback matrix with the values -1, 0, and 1 based on feedback from the transaction matrix and denoted by F(N*N).

Step 5: for each and every communication record the response time

Step 6: for each and every peer in the network

If availability =1 and T(N,N)=F(N,N) and response time <threshold limit

Then peer is authentic

else

The peer is malicious or corrupted.

Output: The authenticity of each and every peer in the network .One is able to conclude whether a peer is trustful or not in the network.

This algorithm can be implemented using MATLAB fuzzy logic toolbox or in NS2 using simulink.

V.   CONCLUSION

In this paper an algorithm is presented for an authentication of a node in P2P network .Fuzzy logic has been used to determine the trust value of a node and it used to decide whether a node is reliable or malicious .This algorithm can be implemented.

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