A Survey on Reputation Systems and Social Network Based Peer-to-Peer File Sharing Systems

Mohamed Rafeeque Theyyampattil and Micky James
PG Scholar, Assistant Professor,
Department of Information Technology,
Government Engineering College, Idukki, India
rafeequetheyyampattil@gmail.com,mickyjames43@gmail.com

Abstract: *Today Peer-to-Peer (P2P) applications are widely available and it has millions of users. Due to the open nature of the P2P environment, P2P file sharing systems are prone to have selfish and misbehaving nodes, it causes many attacks like free riding, he-said-she-said attack etc. The reputation systems can reduce these attacks due to its incentive behavior. This survey studied some traditional reputation management systems in P2P and also analyzes some social network based P2P systems. From the survey we concluded that every reputation systems have high reputation cost in the case of large-scale P2P. It causes some problems like service delay, reducing download rate etc. To overcome these drawbacks, there are some researchers proposes a SocialTrust, it is a social network based reputation management system. SocialTrust consider a social network to P2P file sharing. SocialTrust consist of a friendship network and partnership network, so a peer can select a reliable server from these networks directly, then it reduces reputation querying cost. Hence SocialTrust can provide efficient reputation management system for P2P file sharing.*

Keywords– *Peer-to-Peer networks, Social network, File sharing.*

1. Introduction

Peer-to-Peer networks are the group of computer nodes, each node can act as client and server. That is, the peers have dual functionality i.e. they are free to join the network and share their resources by functioning as clients when they need to download and they can function as a server when they need to serve resources to other users. In P2P network, each nodes have same privileges so it is called peers. Today's P2P applications are widely available with millions of users. P2P applications includes file sharing applications (Gnutella,BitTorrent,Maze etc.), Video streaming applications (PPLive,UUSee etc.) and other multimedia applications.

Due to the open nature of the P2P environment, P2P file sharing systems are prone to have selfish and misbehaving nodes. Selfish nodes are not cooperative in providing files, but still would like other nodes to comply to their requests. Misbehaving nodes can distribute tampered files, corrupted files or files with malicious code into the system, which could be further spread by unsuspecting users. These behavior may causes some attacks. Such attacks are introduce below,

- Deny of Service attackers attempt to cause the central authority to become overloaded (e.g. by sending many reputation value queries) to prevent the calculation or dissemination of reputation values and cause denial of services on the central authority.

International Journal of Computer Science and Engineering Communications,
Volume.5, Issue.3 (2017): Page.1619-1626
www.ijcsec.com

- Free Riding. Due to the influence of user watching and sharing behavior of P2P network, the numbers of uploaders and downloaders over each file are often in the imbalanced status. That is free riding nodes not have contribution to the network but it uses the resources of others in the network.

- Whitewashing. a low reputed user can simply discard its current ID and register a new ID to gain the initialization reputation.

Therefore, incentives are needed to encourage cooperation in P2P networks. Reputation system, as a cooperation incentive method, has been widely studied in recent years. In this paper, we studied some traditional reputation management systems in P2P [1][2][3][4][5][8].In a reputation system, a nodes reputation is built based on a collection of feedbacks from other nodes. The traditional reputation management systems are EigenTrust[1], PeerTrust[2], PowerTrust[3], GossipTrust[5], SFTrust[8] and a fine grained reputation system[4]. These works focus on how to aggregate reputation ratings and calculate the reputation efficiently and accurately.

In EigenTrust[1], the unique global trust value calculate based on peers trust values. In the calculation, it consider every satisfied and unsatisfied transactions in between the peers. So it can decrease the number of downloads inauthentic files. PeerTrust [2] includes a coherent adaptive trust model for quantifying and comparing the trust of peers based on a transaction based feedback system, which combines multiple parameters such as feedback a peer receives from other peers and the total number of transactions a peer performs. Zhou and Hwang [3] observed a power-law distribution in user feedbacks in eBay and proposed the PowerTrust reputation system that selects few most reputable nodes to aggregate reputation feedbacks in order to improve the global reputation accuracy and aggregation speed. GossipTrust [5] uses randomized gossiping and power nodes to enable fast aggregation and fast dissemination of global reputation. SFTrust [8] separates trust between the service providing and feedback in order to take full advantages of peers service abilities for high performance. Zhang and Fang [4] focus on reliable server selection for clients. It offers a theoretical basis for clients to predict the reliability of candidate servers based on self-experiences and feedbacks from peers. In these reputation systems, a node must query the reputation values of the server options to select suitable servers, which generates high cost. Then it affected to QoS to the system. To overcome the drawbacks, we propose social network reputation system, namely SocialTrust.

So we include some papers[9][10][6][7] based on social networks for reliable services to the survey. TRIBLER [9] is a social-based P2P file sharing system, which enables fast, trusted content discovery and recommendation by allowing nodes to retrieve files from taste groups, friends and friends-of-friends. MyNet [10] is a P2P middleware platform and user interaction tool that allows everyday users to easily and securely access and share their devices, services, and content in real time. In the F2F system [6], a node chooses its neighbors (the nodes with which it shares resources) based on existing social relationships. SocialP2P[7] to simultaneously achieve efficient and trustworthy P2P file sharing by leveraging social interests and relationships. In these works, there is no mentioned an efficient reputation management system, it may affect on the QoS in large-scale P2P applications. SocialTrust can also overcome the problem.

The reminder of the paper organized as second section includes literature survey, in which different reputation management systems in P2P and social network based in P2P systems. Third section includes a comparative study of these systems and forth section presents conclusion of the survey.

2. Literature Survey

2.1 Reputation Systems in P2P

1) EigenTrust: S.Kamvar and M.Schlosser [1] describe and algorithm to decrease number of downloads inauthentic files in P2P file sharing network that assigns each peer a unique global trust value, based on the peers history of downloads. Mean- while, the entire system's history with every node is considered to calculate reputation value. Peer selects another peer to download to their global trust value, hence EigenTrust [1] minimizes the influence of malicious nodes in a P2P network, it can isolate them. To calculate global trust value, it consider every transactions(satisfied and unsatisfied) on the node. Due to the fact that all nodes in the network compute global reputation values symmetrically, EigenTrust[1] is able to operate node computations in a scalable and distributed way with minimal overhead.

2) PeerTrust: L.Xiong and L.Liu proposes [2] a reputation based trust supporting framework, which include a coherent adaptive trust model for quantifying and comparing the trustworthiness of peers based on a transaction-based feedback system. PeerTrust [2] is a dynamic P2P reputation management system that quantifies and evaluates the trust of nodes in P2P e-commerce communities. In this system, five important factors are considered to evaluate the trust of a node: the feedback, the feedback scope, the credibility of the feedback source, the transaction context factor, and the community context factor. Feedback means feedback of a peer receives from other peers. Feedback scope means total number of transactions a peer performs. Credibility of feedback source is a qualitative measure and needs to be computed based on past behavior of peers who file feedback. Transaction context factor is another important factor when aggregating the feedback from each transactions as transaction may differ from one another. Community context factor can be used to address some of the community specific issues and vulnerabilities. Also it define a general trust metric to combine these parameters. And the metric meaningfully decreases common threats, such as man-in-the-middle attacks, compromised nodes, and the distribution of tampered-with information in a decentralized P2P environment.

3) PowerTrust: It is a robust and scalable P2P reputation management system that uses a trust overlay network (TON) to model the trust relationships among nodes. R.Zhou and K.Hwang [3] first examined eBay transaction data from over 10,000 users and discovered a power-law distribution in user feedback. Their mathematical analysis justified that a power law distribution effectively models any dynamically growing P2P feedback-based system, whether structured or unstructured. The authors then developed the PowerTrust system to leverage the power-law feedback characteristics of P2P networks. PowerTrust dynamically selects a small number of the most reputable nodes as determined by a distributed ranking mechanism, these nodes are termed as power nodes. Using a look-ahead random walk strategy and leveraging power nodes, PowerTrust significantly improves previous systems with respect to global reputation accuracy and aggregation speed. PowerTrust is adaptable to highly dynamic networks and robust to disturbances by malicious nodes.

4) GossipTrust: K.Hwang and M.Cai [5] proposes a scalable, robust, and secure reputation management system specifically designed for unstructured P2P networks. This system leverages a gossip-based protocol to aggregate global reputation scores; each peer randomly contacts others and exchanges reputation data periodically. So it can overcome the drawback of time consuming aggregation. Gossip-based protocol for aggregating global reputation scores rapidly and accurately. GossipTrust allow peers sharing weighted local trust scores with randomly selected neighbors until reaching some global consensus on peer reputations. In which each aggregation cycle consist of several gossip steps. In a gossip step, each node receives reputation vectors (node id, score) from others, selectively integrate the vectors with its current reputation vector and then sends the updated one to a random node in network. This gossiping process continues (converged gossiped scores) until a threshold. GossipTrust continues next aggregation cycle (converge global reputation vectors) until a threshold. GossipTrust is built on a fast reputation aggregation module with enhanced security support that strengthens the robustness of the gossip protocol under disturbances from malicious nodes.

5) SFTrust: Y.Zhang and S.Chen [8] separates trust between service providing and feedbacking. Above traditional trust models are single trust metric. According to single trust metric , trust value of peer would be decreased significantly, so service capacity of peer cant be effectively developed. Y.Zhang and S.Chen [8] propose SFTrust in unstructured P2P using service trust and feedback trust. It consist of three modules. Such as Trust storage, Trust computing and Trust update. Trust storage consist of service trust record and feedback trust record. These records includes peer IDs and trust values. Trust computing consist of direct trust computing and recommending trust computing, in which it aggregate weighted trust from its neighbor peers. Trust update module can update the feedback trust of recommending peers in its feedback trust record module. It can prevent the attacks like collusion, on-off attack, Free-riding and new comer attack.

6) A Fine grained reputation system: Zhang et. al [4] found three problems in previous trust systems: (1) a binary QoS differentiation method that classifies a service as either good or bad without any interim state, thus limiting the potential for use by P2P networks in which servers have diverse capabilities and clients have various QoS demands; (2) no strong incentives designed to stimulate honest participation in the trust system and (3) failure to protect the privacy of references, which is important for obtaining honest feedback. To address these problems, the authors proposed a fine-grained trust system to support reliable service selection in P2P networks. It offers clients to predict the reliability of candidate servers based on self-experience and feedback from others. It is application independent and can serve simultaneously unlimited P2P applications of different type. Mainly the system consist of a central server and distributed users. The central server consist of an account manager, query processor, feedback collector and reputation engine. So this system have high involvement of centralized server. In these reputation systems, a node must query the reputation values of the server options to select suitable servers, which generates high cost. It may cause high effect on QoS of the system. The proposed work can overcome the problem by leveraging the social network concepts applying to the P2P networks. So in this paper, we also studied some of works that leverage social networks for reliable services in P2P networks based on different properties of social networks, such works are discuss in next section.

2.2 Social Network Based Systems in P2P

Web sites such as Flickr , Facebook and Twitter are online social networks (OSNs), in which participating users communicate with their real-world acquaintances and online friends. OSNs are continually growing both in the number of communities and the overall population. Since a user's friends are usually trustworthy and share similar interests, online friendships are exploited to perform reputation estimation. Below, we introduce OSN-based approaches for encouraging node cooperation in P2P file sharing systems.

1) Tribler: Tribler [9], as a set of extensions to BitTorrent, utilizes social phenomena such as friendship and the existence of communities of users with similar tastes to increase the usability and performance of a P2P network. By maintaining social networks and using these relationships for content operation (i.e., file discovery, file recommendation, and downloading). A.Pouweise [9] present a social-based P2P filesharing paradigm that exploits social phenomena. This system would be fast, trusted content discovery and recommendation at low additional overhead and significant improvement in download performance.

2) MyNet: Z.Antonious and F.D. Reynolds propose MyNet [10] is a P2P platform of middleware with user interaction tools, which allows participating users to safely use and share their devices, services, and file resources with others without contacting any central control systems. MyNet allows distributed services and files to be accessed and shared in real time as they are generated from personal devices of users directly. It offers a straightforward replacement to existing web-based personal and social networks. The primary contributions of MyNet are intuitive user interface (UI) tools of user interaction, resource discovery, and security. It can enable non-expert users to easily organize and share their resources within social neighborhood.

3) F2F: J.Li and F.Dabek [6] focus on storage system with P2P. They discovered the frequently nodes fail in P2P, it hardly affects to the storage system. Hence they propose a way to structure P2P storage system that retains the benefits of an open system. In which the nodes restrict themselves to sharing storage and network resources only with neighbors, where expect friends are behaves cooperatively. This approach provides incentives for nodes to behave cooperatively and decreases the consumption of data, which also creates a more stable system that remains scale.

4) SocialP2P: Haiying Shen and Kang Chen propose Social-P2P [7] studied trace data from Facebook and BitTorrent. They proposed the Social-P2P, a social network based P2P file sharing system, based on their observations. It groups common-multi-interest nodes into a cluster and further connects socially close nodes within a cluster. It achieves highly efficient and trustworthy file sharing. Social-P2P has components of item interest/trust-based structure construction, interest/trust-based file searching, and trust relationship adjustment to simultaneously achieve both efficient and trustworthy file querying with low overhead in P2P file sharing systems. However, OSN-based approaches limit transactions merely between friends. Hence, such approaches violate the free and open environment of P2P networks. These methods mainly use the trust among social relationship directly for certain services. However, since the friends of a node only cover part of the whole nodes in the system, by constraining the options of servers to friends, the objective of widely sharing of individual resources, even between strangers, cannot be realized in P2P file sharing

International Journal of Computer Science and Engineering Communications,
Volume.5, Issue.3 (2017): Page.1619-1626
www.ijcsec.com

applications. SocialTrust solves this problem by considering both social networks and reputation system for reputation system, thereby supporting widely and freely P2P file sharing.

3. Comparative Study

From the literature survey we studied and compare different reputation systems used in P2P networks. That is shown in TABLE 3.1.

TABLE 3.1. Comparison table of different reputation systems in P2P

SYSTEM	KEY IDEA	ADVANTAGES	LIMITATIONS
EigenTrust [1]	Assign each peer has a unique global trust value based on peers local trust values.	Normalization used in local trust values. Decrease the download of inauthentic file	To find trust value, consider entire systems history with each single peer. Host cost if pre-trust peers leave
PeerTrust [2]	Based on a transaction based feedback system. Basic trust parameters used. Adaptive factors. Adaptive factors_ General trust metric to combine	More accuracy in calculation of trust. Partially scalable	Incorporating to some P2P applications
PowerTrust [3]	power law distribution in user feedback. Use TON	Improved accuracy in reputation. Fast aggregation. Adaptable to churn	Maintain a centralized authority
A Fine Grained System[4]	Central server(consist of account manager, query processor, feedback collector, reputation engine)	Application independent. More secure. Semi-distributed	Single point of failure
GossipTrust[5]	Gossip-based protocol	Scalable. Secure	Difficult to apply in structured P2P
SFTrust [8]	Service trust. Feedback trust	Prevents collusion, free riding	High reputation querying cost

Also we studied some number of works that leverages social networks for reliable services in P2P networks. That is shown in TABLE 3.2.

TABLE 3.2. Comparison table of different social network based P2P systems

SYSTEM	KEY IDEA	ADVANTAGES	LIMITATIONS
Tribler [9]	Friends Friends-of-Friends Taste groups	Extension to BitTorrent	Not consider multicast transfer
MyNet [10]	User interaction tool	Secure sharing Real time services	Incorporating to some P2P applications
F2F [6]	Restrict the sharing storage to neighbors	Reliable storage system Secure storage	Not use all resources for storage
SocialP2P [7]	Interest/trust-based structure construction Interest/trust-based file searching Trust relationship adjustment	High efficiency High trustworthiness	High cost in inter-cluster communication

4. Conclusion

Due to open and distributed nature of Peer-to-Peer networks, it prone to have selfish and misbehaving nodes, it causes many attacks in network. Therefore an incentive method is needed to encourage cooperation P2P network. Many researchers are studied it and they conclude the incentive method as to reputation system. In this paper, we studied and analyze the reputation management systems in Peer-to-Peer networks, have been widely studied in recent years. These works focus on how to aggregate reputation ratings and calculate reputation efficiently and accurately. But there have high reputation querying cost due to failed utilization of social network properties in P2P file sharing system. Hence we studied some works on social network based P2P system. These methods mainly use the trust among social relationship directly for certain services, so they does not use an accurate reputation management system. Results, it is not applicable to large scale P2P file sharing systems. To overcome these drawbacks, there are some researchers propose SocialTrust, it leverages social network connections and a reputation system to provide efficient reputation management for P2P file sharing.

REFERENCES

[1] S. Kamvar, M. Schlosser, and H. Garcia-Molina (2003) "The eigentrust algorithm for reputation management in p2p networks",in Proc.of WWW.

[2] L. Xiong and L. Liu , (2004) "PeerTrust: Supporting reputation-basedtrust for peer-to-peer electronic communities",IEEE TKDE.

[3] R. Zhou and K. Hwang, (2007) "PowerTrust: A robust and scalable reputation system for trusted peer-to-peer computing",IEEE TPDS.

[4] Y. Zhang and Y. Fang, (2007) "A fine-grained reputation system for reliable service selection in peer-to-peer networks,",IEEE TPDS.

[5] Zhou, K. Hwang, and M. Cai,(2008) "Gossiptrust for fast reputation aggregation in peer-to-peer networks,",IEEE TKDE.

[6] J. Li and F. Dabek (2006),"F2F: Reliable storage in open networks,",in Proc. O IPTPS,.

[7] Z. Li and H. Shen (2015)."Social-p2p: Social network-based p2p le sharing system.",In Proc. of Network Protocols (ICNP), 2012. Haiying Shen,Yuhua Lin and Jin Li ."A Social-Network-Aided Efficient Peer-to-Peer Live Streaming System"IEEE/ACM TRANSACTIONS ON NETWORKING, VOL.23, N0.3,JUNE.

[8] Y. Zhang, S. Chen, and G. Yang (2009),"SFTrust: A double trust metric based trust model in unstructured p2p system,",in Proc. of IPDPS,.

[9] J. A. Pouwelse, P. Garbacki, J.Wang, A. Bakker, J. Y. 0015, A. Iosup, D. H. J. Epema, M. J. T. Reinders, M. van Steen, and H. J. Sips (2006),"Tribler: A social-based peer-to-peer system,",in Proc. of IPTPS.

[10] D. N. Kalofonos, Z. Antonious, F. D. Reynolds, M. Van-Kleek, J. Strauss, and P. Wisner (2008),"MyNet: A platform for secure p2p personal and social networking services",in Proc. of PerCom.

Author(s) Biography

Mohamed Rafeeque Theyyampattil pursuing M.Tech in information technology at government college of engineering idukki and from APJ Abdul Kalam Technological (KTU) university, india on 2017. He is specialized in network engineering. He received B.Tech degree in computer science and engineering from Kannur university, india in 2015. His research interests include peer-to-peer networks, reputation systems, live streaming systems, trust and secure collaboration in peer-to-peer computing.

Micky James received in M.Tech in computer science and engineering from Mahatma Gandhi (MG) university, india in 2014. She is assistant professor in department of information technology at government college of engineering idukki. She received B.Tech degree in information technology from Mahatma Gandhi (MG) university, india in 2012. Her research interests include networking, Image processing, and data structure.