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An Improvised Trust Management Strategy for File sharing in peer to peer systems

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***Abstract*—** Trust is an essential factor in file sharing peer-to-peer systems to achieve better interaction among peers and reduce malicious uploads. In trust and reputation-based P2P systems, trust and reputation values are used to build trust among peers based on their past transactions and feedbacks from other peers that are explicitly set by the users. Reputation systems are based on collecting information about peer's past transactions and computing a reputation value for these peers. The trust and reputation values form a basis for identifying trustworthy peers. The proposed system implements a reputation and recommender system for decentralized file sharing P2P systems. The proposed recommender system uses additional effort from the users since implicit rating and uses a graph based collaborative filtering and reputation calculation is done based on Eigenvector Centrality. The proposed scheme protects the system against free-riders and malicious peers and reduces issues related to file sharing.

***Keywords*—** peer to peer; Reputation; File sharing; Trust

I. INTRODUCTION

Peer to peer systems have recently gained an enormous influence in social, Academic and commercial communities. Peer to peer file sharing systems provides a pool of files for downloading. Traditional systems provide basic information regarding the peer selection i.e. list of peers with the requested files. So selecting the peer based on this information is not sufficient for successful interactions. There are certain security issues related with peer to peer file sharing like free riding, Malicious Peer interaction, Sybil attacks etc. In order to reduce the risk associated with file sharing each peers are labeled with trust value and a reputation system is used. Reputation system is based on feedbacks from past transaction and computing a value for the peers.

P2P file sharing systems can be centralized, completely decentralized or partially decentralized systems. Many Trust and reputation model has been implemented [11],[12],[13],[14],[15].Where feedback is calculated based on the previous transaction either explicitly or implicitly. Reputation systems will motivate users to exhibit good behavior, identify malicious peers, increase users' confidence and satisfaction

In this paper we propose a model for computing the reputation and trust value based on the previous history of transaction especially by collecting a network data set. We use partially decentralized system having a similar working strategy as that of Bit torrent with improved features. Our model aims to help the users to select the most reliable peer at the same time reduce the attacks by malicious peers. We concentrate on famous peer to peer to system as Bit torrent and source code of this model is available for experiment. Rest of the paper is organized as II related work, III proposed work, IV Experiment, V result analysis and VI as conclusion and future work.

A. Basic Description of Peer to peer

Since from the Arpanet era the main function is to share the confidential files between the various departments and later due to the increase in the requirement for file sharing client and server model has been used. While considering the overlay network and traffic generated a basic peer to peer model has been developed in many departments like education, commercial etc

Peer to peer networking is a distributed architecture that divides the workload or task among different peers .Peers are equally privileged. Peer to peer network can be classified as structured and unstructured network. Peer to peer file sharing system can be classified as centralized, completely decentralized and partially decentralized systems. Peers consume a less portion of their available resources such as power, storage and bandwidth.

It is designed based on the concept that peer nodes simultaneously function as both client and server to the other nodes in the network. This mode of working is different from basic client and server as the communication is from to and from a client server. Many trust and reputation model has been designed to increase the performance of peer to peer file sharing system. Figure 1 defines resource sharing among interconnected nodes in peer to peer system.

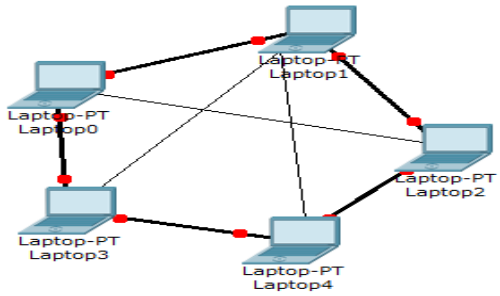

Fig. 1. peer to peer system in which interconnected node share resources

B. Basic Description of Bit torrent model

Bit Torrent is an internet based peer-to-peer file sharing protocol that works in decentralized manner. Bit Torrent is

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one of the most commonly used protocols for transferring very large files because it doesn't overload web servers that provide downloads, since everybody is sending and receiving, it's much more efficient than downloading from a single server. As per [10] peers have optimized the upload and download rates in order to improve efficiency.

An indexer compiles a list of torrents and their descriptions and is a place where users form a community around Bit Torrent content. When we want to share, download, or request files, indexer site has o be accessed. Usually they are accessed in the form of a forum and/or an IRC channel. A tracker is a server that assists in directing peers, initiated downloads, and maintains statistics. Trackers route little pieces of data, or packets, to downloader's and assist them in connecting to their respective peers.

Once we have done with downloading, we become seeders and continue to upload to other peers. If we stop uploading and we only download, we are referred to as a leecher and it can lead to being banned from the tracker. Generally it's a good practice to seed how much we download. Figure 2 explains the basic working of a Bit Torrent system.

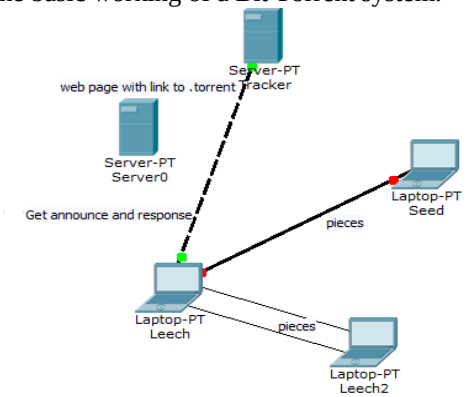

Fig. 2. depicts the basic description of Bit torrent model

C. Trust Management Approach

Trust is not a static value that keeps on changing based on the transactions. The transaction between the peers is based on trust values. This value acts as a basis for providing relationship between the peers.

Trust management is a mechanism that allows providing a mutual trust between peers and provide long term availability for other peers. Trust management can be classified as credential based, trust based and social network based trust systems. Trust values are calculated based on previous transactions prior to the feedback set by the users; this can be either direct or indirect. Trust values vary from one peer to another and it is very difficult to analyze the value by the new comer.

II. RELATED WORK

Various researches have been done in the field of p2p file share systems in the past few years basically on trust management. Peer to peer systems have proven a better alternative for traditional client-server in the field of resource sharing. Basically research is related to the performance, trust value, network, security etc. Different works have been done in this field to improve the system efficiency. [1] Model is based on Bayesian approach and trust values are calculated based on the self experience.

A distributed model was [2] developed on distributed recommendation and it lacks repeated updating by agents. Similarly various models were implemented based on binary trust [3], polling algorithm [4], XRep protocol [5], and Eigen Trust [6] etc.Our proposed system provides a mechanism for improving the performance and security related issues of p2p file sharing system

As per [15] trust and reputation calculation is done using Bayesian approach and exhibit the concept of power nodes. Another approach to calculate trust is by normalizing the rating on each transaction of peer and this model [11] uses pGird for data management. Fuzzy Trust [13] fuzzy interface is used to produce local trust values and aggregate them to find global values.

III. PROPOSED WORK

Many models like eBay, Amazon, [9],[4],[5],[6] uses users review as a credential for calculating the trust and reputation value. Our proposed model consists of four phases:-

Preparation Phase

First we collect the data set related to the user's previous transaction from the private Bay. This data set has been used to perform collaboration filtering using graph database. Finally feedback is set based on query process and the resultant information can be set as criteria for calculating the trust and reputation value.

Trust and Reputation Calculation Phase

Here the resultant feedback is used to calculate the trust and reputation value based on Eigen Centrality algorithm.

Transaction Phase

Based on the Trust and Reputed values we will select the peer for Transaction. On completion of interaction either it can be uploading or downloading we will update the values for future process.

Performance Analysis Phase

Here we try to compare the performance of the Bit torrent before and after applying the algorithm and compare related to upload rate, Download Rate and Speed.

Algorithm: Eigenvector Centrality

Eigenvector Centrality is the measure of participation of nodes in network. Assigns score to all nodes based on connecting High score node and provide equal connection to low scoring nodes. Google's page rank is an example of this approach.

Using Adjacency Matrix to find Eigenvector Centrality:-

For a given graph G :=(V, E)
|V|:= Number of vertices
Let A= ($a_{v,}$ t):= Adjacency Matrix i.e. $a_{v,}$ t=1
If vertex v is linked to vertex t then $a_{v,}$ t=0
Otherwise centrality score of vertex v is defined as:-

$$x_v = \frac{1}{\lambda} \sum_{t \in M_{(v)}} x_t = \frac{1}{\lambda} \sum_{t \in G} a_{v,t}\, x_t$$

Where M (V):= Neighbor's of v and λ =constant
Eigenvector Equation: =

$$Ax = \lambda x$$

v^{th} component of eigenvector gives centrality score and power iteration is used in this context.

IV. Experiment

Here experiments and analysis is done by using Bit torrent model were one system is set as a server and we will try to upload maximum files to the server and thereby try to plot the performance analysis of the same by comparing upload rate , download rate ,speed and peer exchange. Bit torrent does not provide any advanced criteria for searching the files and peers. Once we upload the file to the tracker we will share the respective location to other system for downloading.

TABLE 1. Sample dataset

Torrent ID	Dataset for trust and reputation value calculation			
	category	*Size*	*Seeders*	*Leechers*
4553138	101	67696064	0	0
4553064	101	66553120	4	7
4553131	199	52103740	1	1
4553128	101	54599352	0	0
4553058	199	42184212	1	1
4553041	101	4907336	1	2
4553019	101	68283272	0	0
4553103	101	73421288	2	8
4553097	101	98052344	0	0
4552895	101	86423632	34	21

During course of time we try to run the wire shark to capture the packets that are moving to and fro from the system. Once we end up the task analyze the packets observed to find the details of the peers involved in the transaction process. Analyze the performance by viewing the graph generated in the background and set the parameters for our system analysis. Once we get the information regarding the peer we will assign the trust and reputation values for respective peers and try to plot the graph for our system. Table 1 describes the sample dataset for calculating trust and reputation values

V. Result Analysis

Here the case scenarios are compared and analyzed for bit torrent before and after applying the algorithm. Observed nearly 10% improved in performance of our model while comparing with the basic Bit torrent.

Case 1: Efficiency

The efficiency of a trust model is measured as the overall satisfaction level of peer for its related feedback, when the percentage of malicious peers in the network varies from 0% to 60% .The comparison is depicted in Figure 3.

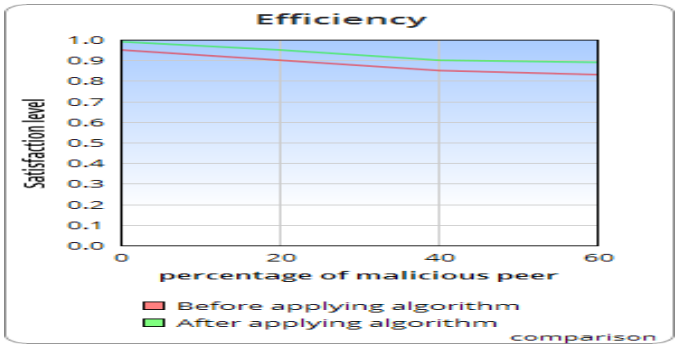

Fig. 3. Efficiency comparison

We can observe that the proposed model performs better than the existing Bit torrent model and causes the trust values of malicious peers to drop faster and increase slower, and hence minimizes the impact of dishonest behavior.

Case 2:Throughput

The Figure 4 depicts the average throughput in the network. Proposed model enables the nodes to increase the capability of suspecting a malicious node which drops or tampers the packets by updating the trust information.

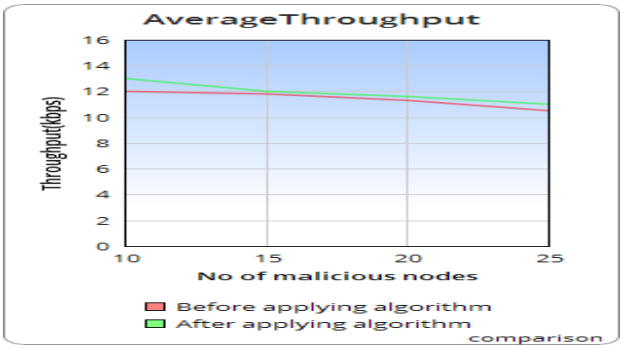

Fig. 4. Average Throughput

It initiates a node to send packet to next trusted nodes. This results in increasing throughput with respect to the malicious peer in the network

Case 3: Upload ratio

Figure 5 shows the Average upload of Bit Torrent before and after applying the algorithm. Depicts the peer participation in uploading the files to the network there by reducing the occurrence of free riders problem

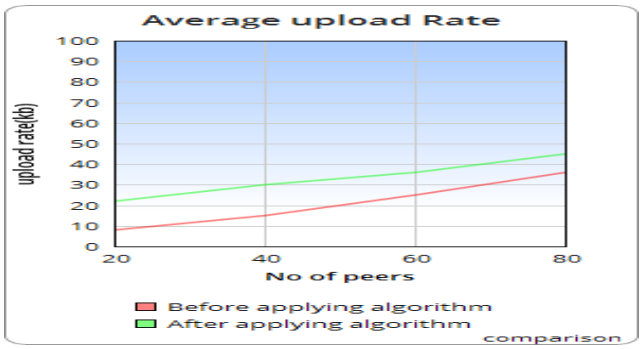

Fig. 5. Average Upload rate

Case 4: Download Ratio

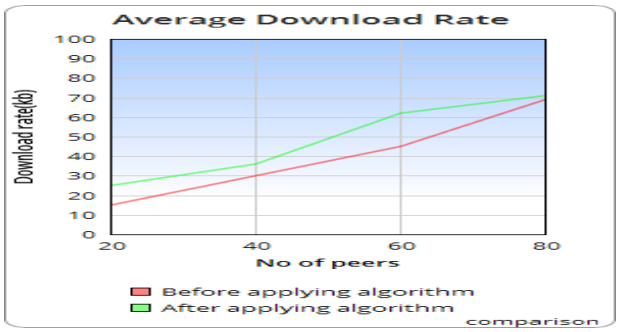

Fig. 6. Average Download rate

Fig 6 shows the Average download of Bit Torrent before and after applying the algorithm. Depicts the peer participation in downloading the files to the network and set criteria where all peers should be able to download their files without any problem of network overhead

Case 5: Malicious uploads

The Figure 7 depicts the average malicious uploads in the network.

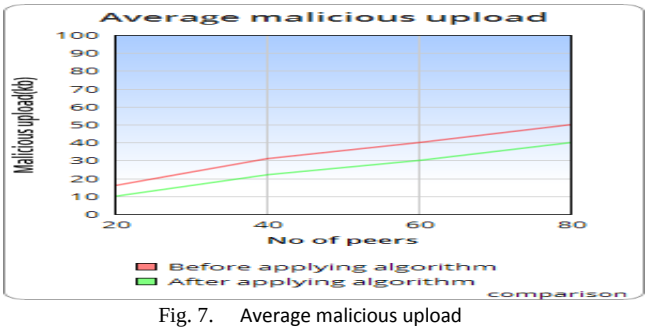

Fig. 7. Average malicious upload

Proposed model enables the nodes to increase the capability of suspecting a malicious node which drops or tampers the packets by updating the trust information. It initiates a node to send data packets to the next trusted node to increase best-of-effort delivery. While applying the Eigenvector Centrality, malicious uploads can be controlled to a minimal level.

Case 6: Peer Availability

Figure 8 shows the average peer availability for different categories of peers. At the beginning the availability of free riders is null since their probability of sharing files is null. As this probability of good free riders increases, their availability also increases. Hence, their contribution increases and also the amount of received services. However, the availability of malicious contributor peers decreases.

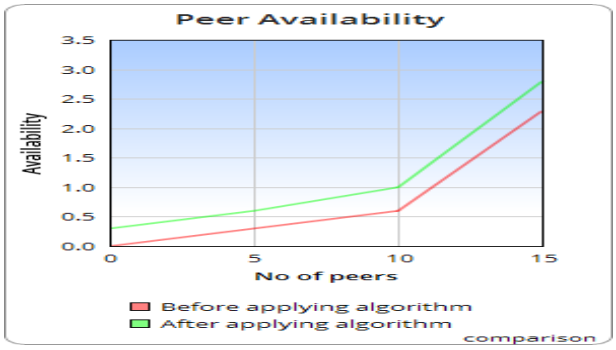

Fig. 8. Peer availability

Case 7: Trust relationship

Figure 9 show peer response to requests to provide trusted resources. The algorithm is based on peer perception to select the resources based on trust values and provide more reliability to the peer's requests and resources.

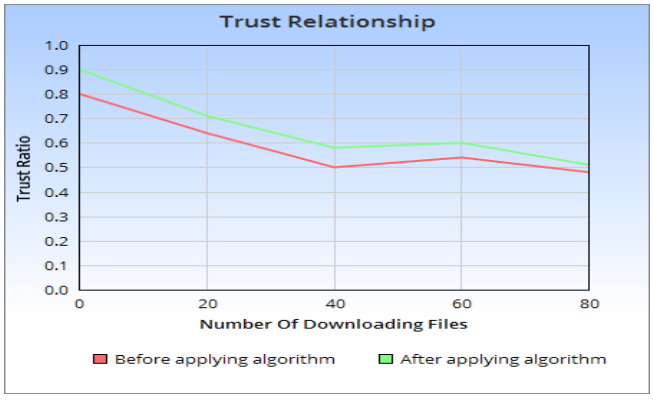

Fig. 9. Trust relationship

Case 8: Load share

Figure 10 depicts the contribution of peer and its involvement in sharing resources. Here resources shared by free riders will be null and only load will be supported by good peers.

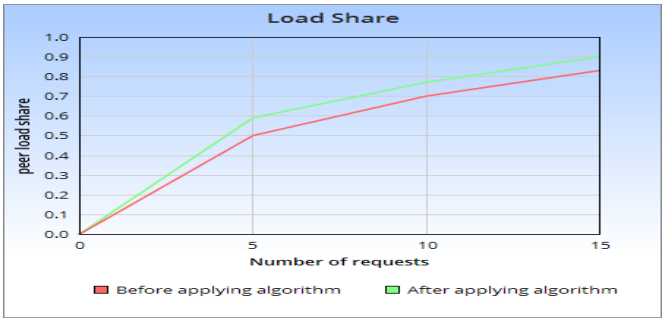

Fig. 10. Load share

VI. Conclusion and Future work

Many research works have been carried out in this field to improve the performance of the system. We proposed to enhance the existing Bit torrent model with Eigen Centrality algorithm to improve the credential and peer exchange property. Though the tracker acts as a central authority, its role is limited to the trust management of the peers. As the tracker

Decides upon the approvals from the reputed peers, the cooperation of the peers in the content sharing network is vital. The restriction in privileges and penalty imposed for non-cooperation makes the peers to share the content for longer time than in existing Bit Torrent networks.

The model enhances the performance of the system approximately up to 10% increase while comparing with the existing Bit torrent model. The model still supports Anonymous mode and free-riding as in the Bit Torrent-like systems but, they are limited to the old model. Our model can be easily deployed in the existing Bit Torrent-like networks with assured trust both on the network and shared contents.

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