Survey on Incentive Mechanism

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Abstract

P2P network have dramatically gain popularity for the past few years. However, these networks suffer from problem like free-riding, Tragedy of Common which degrades the performance of the network. Here, the authors present several approaches to overcome the problem of free-riding. They have categorized the approaches and have described each category?s important features and implementations.

Index terms— P2P network, free-riding.

1 Introduction

2P network have dramatically gain popularity for the past few years. P2P are overlay network since P2P network runs on top of internet. In a P2P network, the peers are computer systems which are connected to each other via internet. Files can be shared directly between systems on the network without the need of a central server. In other words, each computer on a P2P network becomes a file server as well as a client .The only requirement for a computer to join a peer-to-peer network are an internet connection and P2P software ??1]. Each node can join or leave the network at anytime.

P2P systems are usually designed on the assumption that all peers can share their resources consciously. P2P is currently receiving considerable interest but still there are threats like free riding and tragedy of common which are degrading the performance of P2P system. Free Riding is not a new problem, it has existed in community -sharing based fields of human endeavour for centuries. Economist have done comprehensive studies on the twin problem of free riding and tragedy of Common [2].Hardin [3] proved that common resources without any exclusive ownership will be consume without limit. He named this phenomenon Tragedy of Common.

A Free rider is a peer that uses the P2P services but does not contribute to the network at an acceptable level. In [4] authors reported that 70% of peers did not share any files at all, and 25% provide 99% of all query hits in the network. Self interest of the peer is the main cause of free riding. Causes of free-riding are as follows. 1) Sharing of resources requires usage of bandwidth, hard disk space, CPU cycles etc. Therefore a peer does not share in order to avoid the usage of these things. 2) Usually peers does not get benefit for sharing others, therefore they are not interested in sharing.

3) To facilitate digital contents to be downloadable by other peers, the computer is required to open several ports for such activities. This also opens the computer for attacks and viruses [6]. 4) If peers, start sharing popular files. All the download request will be directed to those peers. This causes overloading the machine and congestion in network. According to [5] there are two kinds of free riding 1) The peers who shared little or no files.

2) The peers who tend to share fake or unpopular files instead of popular to decrease their load. Some free riders act in different way than others, they don't contribute to the network as well as they don't forward the query. These types of free riders are called Droppers.

2   II.

3   Impact of Free Riding

1) Large number of free riders and their queries will generate a large amount of P2P network traffic, which may lead to the degradation of P2P service. 2) The system will not have a large and growing number of interesting files. Therefore system will fail to attract users.

4   3) High level of Free Riding activity increases load on

the contributor nodes which is not a positive sign for P2P network. 4) Quality of search is degraded due to the increase in traffic.

III.

5   Free Riding Solutions

Researchers have come up with several approaches to combat free riding in P2P network. Solutions are used to encourage peers to contribute more to the network in order to improve the utility of the network. These free riding solutions are further classified into the following: a) Monetary/Micropayment Based Approach In this approach peers are charge for the services they receive. Peers have to buy virtual currency in order to avail the services. Any monetary -based system require two key mechanisms [7].

6   i. Accounting Module

It is used to securely store each peer's virtual currency.

ii. Settlement Module It is used to fairly exchange virtual currency for services. A single authority is used to manage each peer's balance and transaction. PKI is used to provide(D D D D D D D)

security against fraud and error. In this approach a peer is charged for initiating a query and a peer is rewarded for every referral. If Peer A initiates a query and Peer B does not has the answer then it will forward the query to Peer C. Monetary fund deducted for peer A , Peer B and peer C will be Peer A =T-Q-R Peer B = T+R Peer C= T+Q Where R is incremented for referral a query monetary approach can be implemented in two ways [7].

Online Approach: Exchange of virtual currency takes place at the same time as peer receives services. A central authority must be present (online) at the time of transaction.

7   Offline Approach:

If Central Authority (CA) is not present at the time of transaction then exchange of service is done and payment of virtual currency is executed when the CA is available.

8   b) Reciprocity-Based Approach

In reciprocity-based approach [8] [9], a peer monitors other peer's behavior and evaluates their contribution level [7]. The quality of service receive by a peer depend upon its contribution level. This approach usually measure other peer's contribution only for current session, which means a peer judged as contributor in one session can be judged as free rider in another session. Reciprocity-based approach is further classified into two parts [10].

9   i. Non Real Time Approach

A node collects information about the other nodes from their neighbours, trusted third party, local information etc. A reputation value of each and every node is calculated to determine their performance in the past.

10   ii. Real-Time Reciprocity Approach

In this approach, transaction partners evaluate each other only at the time of transaction. If a peer is consuming a resources from other then it is compulsory for a peer to make sources available for other peer. This approach is like a barter system.

Reciprocity-based approaches face several implementation issues. 1) Peers publish fake services so that they can gain higher levels of contribution. 2) Peers are identified by their values. However, if newcomers are assigned a higher standard utility value than free riders, a free rider can try to get rid of its degraded value by constantly getting a new identity.

11   c) Reputation Based Approach

Reputations of the peers are evaluated on the basis of feedback receive from the peer who have already interacted with that peer. Data is exchanged among the peer depending upon their reputation. It is assumed that the peers report their interaction honestly. Reputations can be positive, negative or both. Services are provided to the peer depending upon their reputations value. A peer with positive reputation will be offered with better service as compared to the peer with negative reputations. In this approach, it is not easy to convert a bad reputation to good reputation and vice versa. Reputations approach is further classified into two parts.

12 i. Autonomous Reputation Approach

It stores the reputation information of only those peers's to whom they have interacted with.

13 ii. Global Reputation Approach

In this approach, average of reputation information is obtained from several peers or all peers. Average reputation is stored at central location or is stored with a set of peers in the network. This approach provides long term reputation information about peers In P2P network some peers are likely to manipulate reputation value by forging transaction history. There are three main type of such behaviour [11].

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Volume XIII Issue V Version I a. Collude Inflating A set of peers rates one another with satisfactory values for some download that never existed or download of fake files. Peers misbehave in this manner in order to increase their reputation value.

15 b. Deflating

A set of peers rates one peer with unsatisfactory values in order to increase their own reputation value. c. Faker A peer of low reputation value pretend to act as a peer of high reputation value in order to gain the profit from the network.

16 d) Fixed Contribution

This approach follows a simple rule: if a node wants to join a network, it has to contribute to the network. Direct Connect [12] is the example of fixed contribution. Contribution to the network consist of sharing of files and minimum upload bandwidth available. If a user does not upload the requires amount of data then it is not allowed to join the network. Fixed contribution approach discourages free-riding since in this approach it is compulsory to share data and if every node is sharing something in network then there is no scope of free riders in network. This approach attracts many other users since there are many contributors in this network.

The main problem with this approach is that it does not check the data which is shared by the joining nodes. The user can enter the system by sharing some useless files or by sharing the same old file again and again. There is no such mechanism to stop such kind of activities.

IV.

17 Conclusion

In order to deal with free-riding in P2P system, different incentive mechanisms are presented in this paper that are currently being used. In this paper we have presented a survey of free riding solutions while at the same time laying down the problems of existing mechanism that need to be kept in mind while designing such scheme.

As the research on incentive mechanism in P2P networks are being done on wide basis, it is not possible to present the work of each and every researcher in this field of study. [1]
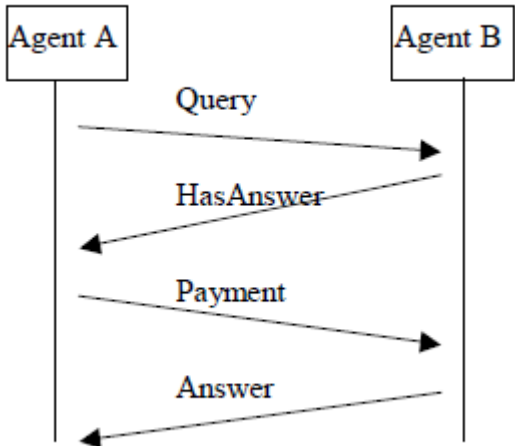

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Figure 1: Figure 1 : 2 :

Figure 2:

124 [Anagostakis and Greenwald] *Exchange Based Incentive Mechanism for P2P File Sharing*, K Anagostakis , M
125   Greenwald .

126 [Free Riding in P2P network Murat Karakaya, Ibrahim Korpeoglu and Ozgur Ulusoy] 'Free Riding in P2P net-
127   work'. *Murat Karakaya, Ibrahim Korpeoglu and Ozgur Ulusoy*,

128 [Adar et al. ()] *Free Riding of Gnutella*, Eytan Adar , A Bernarclo , Huberman . `www.firstmonday.dk/`
129   `issue/issue5` 2000.

130 [Adar and Huberman ()] 'free Riding on Gnutella'. E Adar , B A Huberman . *First Monday* 2000. 5.

131 [Glance and Huberman] N S Glance , B A Huberman . *Dynamics of social dilemmas*,

132 [Guan et al.] Zhitao Guan , Muhammad Hanif Durad , Yuanda Liehuang Zhu . *An efficient hybrid P2P Incentive*
133   *Scheme*,

134 [Dc++ et al.] *Incentive Mechanisms for Peer-to peer system*, Dc++ , Munindar P Yu , Singh . `http:`
135   `//dc++.sourceforge.net13`

136 [Lui et al.] S Lui , Karl R Lang , S Kwok . *Participation Incentive Mechanism in P2P Subscription Sysytem*,

137 [Feldman and Chuang ()] 'Overcoming free riding behaviour in p2p system'. M Feldman , J Chuang . *SI Geocom*
138   *Exchange* 2005. 5 p. .

139 [Hardin ()] *The tragedy Of Common Sceinces*, Hardin . 1968. p. .

140 [Tang et al.] *Trust Based Incentive Mechanism in P2P network*, Yangbin Tang , Min Huai , Wandou Wang .