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Abstract

TODO ABSTRACT

Preface

TODO MOTIVATION FOR RESEARCH TOPIC

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Chapter 1

Introduction

Interaction among user in the Internet community can be expressed in various fashion. Peer-to-peer (P2P) is one of the major interaction existed in the net. Many applications and protocols run on top of P2P system, online gaming, computing, and the most popular one, file sharing. BitTorrent is by far the most popular system used in file-sharing community with it's unique *tit-for-tat* mechanism to discourage freeriding [1].

p2p owned the internet

In higher abstraction level, it is common to see P2P system, specifically in BitTorrent, as social networking. Many social challenges addressed in this kind of network such as incentives mechanism, economical value to survive in the community, reputation identification, and user anonymity. All of those challenges involves peer behavior whether to help each other for the greater goods, selfishly consume all the resource without giving back, or inconsistently act between these two. Based on , lots of P2P peers are always show self-interest and rationality. It can be interpreted as maximizing their benefits and giving as little as possible. *Freeriding* is the term given to this kind of behavior. It is often to describe this peer as *freeriders*.

cite here and there about those study

cite, peer behavior

In BitTorrent system, cooperation between peers is very important to keep a file available in the network. With more user provides the file, the download speed gained for other user will be increased as well. However, this needs user enthusiasm for providing the file regardless of its needs. For both public and private communities, the number of seeder become an issue that made a swarm unhealthy [2, 3]. With freeriders join the swarm, naturally it will reduce the overall performance. Furthermore, when freeriders become majority, the swarm is as good as dead .

cite this, I read this somewhere

Several researches already provide solution to prevent uncooperative peer behavior, all to produce higher downloading throughput on downloader. Most of them focused their work on the incentives for peer or alteration of the currency system itself. Tribler for example, working on a MultiChain [4] as a secure and accountable currency in P2P system. This thesis work is more general and applicable as an another spectrum hoping to solve this problem.

cite here and there

another client address freeriding, incentive, etc

In this thesis, we introduce "Credit mining system (CMS)", an automatic investment framework on swarm with multidimensional gain. The first phase of the framework was conducted by Capotă et al., mainly to operate CMS without any restriction or coordination with any client. With CMS, locally, a user can gain credit with internal limited bandwidth allocation without any intervention needed. The credit can be in many forms such as share ratio (upload-to-download ratio), uploaded amount, effort based credit, and many other. From higher perpective, CMS will help a swarm to keep alive by providing integral pieces to peer who need it. Although CMS will be implemented in Tribler system, it is possible to implement this feature to any system on top of BitTorrent network.

Tribler is one of the P2P file sharing software developed in Delft University of Technology that addressing social issues in BitTorrent network[6]. With Tribler downloaded from official repository on the latest stable release (6.5.2) reaching 78440[1] times, it is desired to observe the usage of CMS with adequate user base. We believe our work will be able to increase the overall swarm throughput by donating unused bandwidth on peer upstream.

1.1 Document Structure

This thesis is structured as follows. Chapter 2 provides problem description and answer to tackle this issue. Chapter 3 discusses related work to the problem and solution proposed. Chapter 4 presents the design of credit mining system integrated with Tribler. Implementation of the mechanism and it's experiment will be elaborated in chapter 5. Chapter 6 shows performance of credit mining system. At the end, chapter 7 concludes the work mentioning possible future work.

[1] `http://www.somsubhra.com/github-release-stats/?username=tribler&repository=tribler` (Accessed 3 September 2016)

Chapter 2

Problem Description

Credit (share ratio or upload rate) is needed especially in private tracker. In this case, BitTorrent tit-for-tat is irrelevant [2]

2.1 Peer-to-peer networks

In this section we will discuss several aspects of peer-to-peer (P2P) networks.
P2p in social aspect freeriding prisoner dilemma -¿ reduce througput
private tracker/community solve lack of initiative -¿ incentivize
different p2p app (file transfer, vod, game), have different requirement
flashcrowd -¿ sudden increase in net -¿ unstable peer. supply demand misalignments -¿ non heavy tail
smart cloud seeding -¿ mix download from cloud and p2p. Analysis on which swarm/file to help
reputation, credit

2.2 Economics in distributed system

Demand and supply [5]

Public tracker generally slow. Why? find citation
private ¿ public oversupply, undersupply -¿ not all necessary to be mined [7] investment in swarm (decision) motivation in priv and public
incentive -¿ various, centralized, decentralized. Complicated or not. modifying bittorrent protocol? -¿ not standard

2.3 Optimizing network cost

Anonymous Relaying performance in Tribler [8]
Significant portion when seeding million torrents [9]

2.4 Research Question

2.5 Main Contributions

Chapter 3

Related Work

3.1 BitTorrent

BitTorrent [1] is a file distributed system on top of peer-to-peer network. Static `.torrent` file, which contains information such as tracker addresses and unique hash value of this swarm, is created by peer who want to publish their files. *Tracker* responsible for monitors the distribution and progress of file and peers in a swarm. Peer uses information in `.torrent` file to connect each other.

In BitTorrent, it is desirable to have many peers upload piece of file to the swarm. This way, swarm can be *healthier* and overall download speed can increase. However, many peers become a *leecher*, which quits the swarm when his download finished. BitTorrent uses *tit-for-tat* mechanism to reward good behavior and punish bad behavior. To force cooperation of other peer, BitTorrent implement *choking algorithm*. Choking algorithm is an algorithm to temporarily refuse uploading piece of file to a particular peer. Usually, an uploader has limited number of unchoked slots. By observing other peers, choking algorithm decide which peer a particular piece will be sent or not sent to. If we unchoke a peer, it means we consider to upload a piece to that peer. For starters, it is usually useful to execute *optimistic unchoking*. Optimistic unchoking is an algorithm to unchoke a peer regardless of its activity in a swarm. This gives a peer chance to increase his upload rate by providing more content.

cite cheating peers/freeloader/hit-n-run behavior

cite choke/unchoke algorithm

3.1.1 Peer Discovery

One of the integral part in BitTorrent protocol is peer discovery. With a large number of known peers, the algorithm will have more option on which peer to unchoke. State of the swarm itself often represented by the peer belong to that swarm. In BitTorrent, there are four method to discover new or update peer.

LSD? (bep_0014.html)

Tracker Peer Announce

In original design of BitTorrent, it uses tracker to allow peer discover each other [1]. Tracker tend to use random and limited list of peers. Peer contact tracker periodically to expand their peer dictionary. This act of requesting peer to tracker is called *announce*. Usually, most tracker has a policy about recommended interval when to recontact for getting new peers. Violate this policy can result a particular peer blocked.

Distributed Hash Table (DHT)

DHT performance?

Originally, peer need to contact tracker to fetch new peer address and file information. This makes BitTorrent very dependent on centralized system which vulnerable to single point of failure. In 2008, Distributed Hash Table (DHT) is proposed [10]. Towards a "trackerless" BitTorrent system, DHT allow each peer to become a tracker. DHT stores peer contact information with defined key-space as "node ID". Each peer stored other peer's node ID and its address in their own routing table. A "distance" is measured on two node ID to define how close those two. "Distance" also can be measured between infohash of a torrent and node ID.

To enrich its peer dictionary, a node can compare a torrent's infohash and node ID in its routing table. If the distance under the threshold, it contacts that node to ask the information of the swarm, which includes the peer list. If contacted node do not know this torrent, it will respond with another node in its table which closest to the provided infohash.

Peer Exchange (PEX)

To increase the chance of getting higher downloading speed, having up to date peer is desired. This can be achieved by contacting tracker or using DHT. Reducing the interval of contacting tracker can result in getting a number of updated peer sooner, however, it will put a burden in the tracker itself. Peer Exchange (PEX)[11] is proposed to tackle this problem. PEX used list of peers that bootstrapped from another mechanism. This mechanism allow contact known peer directly to get and give up to date information on swarm. Theoretically, it can keep this swarm together if trackers are down. Specification mentioned in [11] stated a restriction such as number of request per minute and number of peer added or removed in a PEX message.

3.2 Tribler

Tribler[1] is peer-to-peer file sharing application that compatible with BitTorrent protocol [6]. Tribler focused on security, fully decentralized system, and anonymity. Starts with ABC (Another BitTorrent Client), Tribler currently provides content

[1] https://www.tribler.org/

Table 3.1: Overview of implemented Dispersy community in Tribler [12].

Community Name	Purpose
AllChannel	Used to discover new channels and to perform remote channel search operations.
BarterCast4	While currently disabled, this community was used to spread statistics about the upload and download rates of peers inside the network and has originally been created as a mechanism to prevent free-riding in Tribler.
Channel	This community represents a single channel and is responsible for managing torrents and playlists inside that channel.
Multichain	This community utilizes the blockchain technology and can be regarded as the accounting mechanism that keeps track of shared and used bandwidth.
Search	This community contains functionalities to perform remote keyword searches for torrents and torrent collecting operations.
(Hidden)Tunnel	This community contains the implementation of the Tor-like protocol that enables anonymity when downloading content and contains the foundations of the hidden seeder services protocol, used for anonymous seeding.

discovery, channels concept, and reputation management in fully distributed manner.

What information to include?
-anonymous
-end2end encryption

3.2.1 Dispersy Community

See table 3.1. sdfasjfklasdfj lakdsfj aldfadsf alflas kdfjalk sdfaklf alsdfa.ds falkdsf alsdf.

Various community

Relation on peers

3.3 Libtorrent

3.3.1 Share Mode

3.4 Credit Mining Framework

Credit mining base [13].
Investment strategy in regression model [14].
Use libtorrent as helper. Multiple helper and its effect to swarm with actual downloading on the other side [15]. actual improvement! shift bottleneck and seed efficiently. Use trace to

Inter swarm resource allocation [16].

3.5 P2P Currency

Current currency used in Tribler (Multichain)[4].
Demand and supply in bittorrent environment [5].

Chapter 4

System Design

How to measure swarm by looking at Swarm evolution [17]. Helper in swarm without need of human intervention [15]. Aligning supply and demand of bandwidth

Chapter 5

Implementation and Experiment

Chapter 6

Performance Evaluation

Chapter 7

Conclusions and Future Work

7.1 Conclusions

TODO CONCLUSIONS

7.2 Future Work

TODO FUTURE WORK

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