ISSN:0975-9646

K.Thamaraiselvi et al, / (IJCSIT) International Journal of Computer Science and Information Technologies, Vol. 3 (2) , 2012,3821-3824

Performance Analysis of Homogeneous and Heterogeneous Systems Using BitTorrent in Compeer Networks

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Abstract—**We study about homogeneous and heterogeneous systems, where all peers have to share available resource between their own and other peer's needs. A system of peers who use their capacity-limited access links both for their upstream and downstream connections. In the selfish approach, each peer would like to exploit use his full capacity only for his downloads. However, if all peers acted selfishly, so the entire system would be collapse. In order to motivate peers to cooperate, we propose a heterogeneous along with bittorrent used to exploit his full capacity for his both upstream and downstream. Since the differentiation is based on nodes prior contributions, the nodes are encouraged to share large information/services with each other. So all peers act as rationally, trying to achieve their maximum tradeoff capacity**.

Keywords— ***homogeneous, heterogeneous, resource, upstream, downstream, bittorrent, tradeoff***

I. INTRODUCTION

P2P model is a communication model in which each party may act as a client and a server. Both parties have the same capabilities and both can initiate connection. Homogeneous system performs sharing the available resource between every node, each node can have same characteristics, but heterogeneous system can have different characteristic of every node. It is the opposite of client/server model in the sense that there is no central entity that the other parties contact but every single entity is able to initiate connection directly with all other entities.[2]

This paradigm has proved to be a promising approach to the problem of delivering a large file from an origin server to large audiences in a scalable manner. Since peers not only download content from the server but also serve it to other peers, the serving capacity of the system grows with the number of nodes, making the system potentially self-scaling. [4]Pure P2P communication doesn't need any kind of central server or database to make a connection. In addition to pure P2P there are a lot of solutions that are neither pure P2P nor client/server. They combine characteristics from both models. What makes them more P2P than client/server solutions are that the communication channel that is established will be directly between communicating parties rather than through some central server. Our choice is motivated by the observation that BitTorrent is composed of several interesting mechanisms that interact in many complex ways depending on the workload offered. BitTorrent has recently emerged as a very popular and scalable P2P content distribution tool. Using a simulator provides the flexibility of carefully controlling the input parameters of these mechanisms or even selectively turning off certain mechanisms and replacing them with alternatives.

Consider ad-hoc construction of the BitTorrent network and its decentralized operation. It is unclear at the outset how well the system can utilize the "perpendicular" bandwidth between peers. It is a situation that involves losing one quality or aspect of something in return for gaining another quality or aspect. It implies a decision to be made with full comprehension of both the upside and downside of a particular choice.[5]

II. RESOURCE ALLOCATION

A reputation-based, differentiated admission control, that allows a node to receive a level of service based on its service and usage reputations in the past. Network of N peers, who provide and consume bandwidth for large content sharing. Peers act both as servers and clients simultaneously. [1] Because it act as centralized database. We consider that the access technology does not provide strict separation between upstream and downstream flows. Therefore, peers have to share their link capacity between their uplink and downlink connections. [4]

Examples of such access technologies include WiFi, WiMAX, Ehternet LANs, etc. There are implementation tools which can be used to appropriately adjust the uplink and downlink bandwidth for each connected user without modifications in the access protocol, but these issues are out of the scope of this paper. But proposed approach needs to done by the .torrent contains information about the file, its length, name, and hashing information. And avoid free riding problem effectively. Download rate be equal to the total upload rate. Since Peer's download rate be proportional to their upload rate. [3]

Peers collect statistics about other peers and form opinions about them (reputation rating)

0 <= Reputation Rating <= 1

Peers can share reputation ratings

Example: 100 node transaction

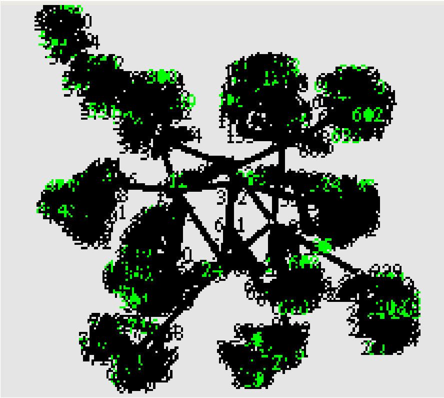

Fig.1. Bittorrent Protocol Performance

Although RA policy is fairly suitable in cases where all Peers' request generation profiles are almost the same, it fails to be fair when there are peers who produce many More requests than other peers in the system in order to exploit the network. [5]

Table 1. List of abbrevations

Name	Description
BS	Basic request Strategy
RA	Reputation-based Allocation policy
SA	Simple Allocation Policy
NS	No Strategy
AS	Adaptive Strategy
GS	Greedy Strategy
NAT	Network Address Translation

III. SYSTEM PERFORMANCE

BitTorrent nowadays is one of the most popular peer-to-peer (P2P) applications on the Internet; on the other hand, network address translation (NAT) has become pervasive in almost all networking scenarios. Despite the effort of NAT traversal, it is still very likely that P2P applications cannot receive incoming connection requests properly if they are behind NAT. Although this phenomenon has been widely observed, so far there is no quantitative study in the literature examining the impact of NAT on P2P applications. In this paper, we build analytical models to capture the performance of BitTorrent-like P2P systems with the presence of homogeneous and heterogeneous NAT peers. [8]

A. Homogeneous System

In this section, we consider a homogeneous system of peers who have the same capacity C and request generation rate g and they send their requests to each one of the other peers of the system with equal probability. In Fig.2.we can see the performance (average bandwidth per request) of different combination of strategies and policies for different peers' capacities. [10]

The BS/RA scenario stands for the combination of the basic request strategy (BS) and the reputation-based allocation policy (RA).

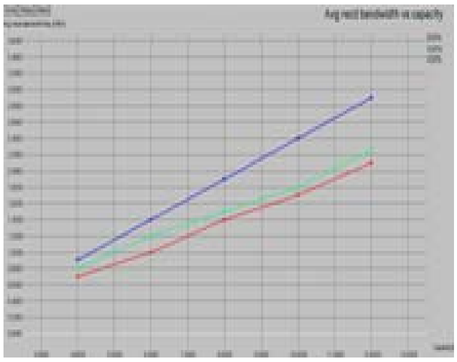

Fig.2. Average received bandwidth per request for different capacity peers

In the same way, all possible scenarios are named. As we can see from the results of *Fig.2.*the higher the capacity of all peers in the system, the higher the average bandwidth they receive per request. It is obvious that our proposed policies lead to the cooperation among peers and significantly improve the performance (average received bandwidth per request) of the system compared to a system of peers who do not follow any strategies and reputation based policies (e.g., NS/SA scheme). AS/RA scheme provides the best results in terms of average received bandwidth per request, followed by GS/RA and BS/RA. Next, we would like to delve into the fairness issues of the different aforementioned schemes. We, thus, examine the average received and offered resources from peers and would like to see whether they are correlated.

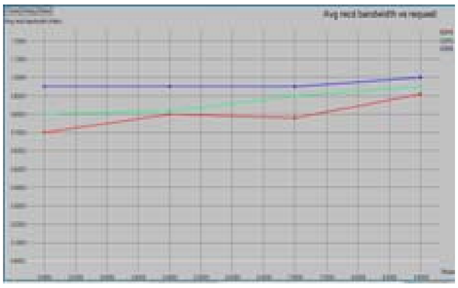

Fig.3. Average received bandwidth per request for different request peers

Fig.3. we examine a smaller community of 10 peers and we see the average received bandwidth per request for different values of the request generation rate of all peers. For each generation rate that we study we consider such capacities of peers as to satisfy C=2g (Mb/s). In this way, each peer should receive 1 Mb/sec on average per request in the optimal steady state. The average received bandwidth for the NS/SA scheme converges to zero. This was expected, as the higher the g, the bigger the sum of peer's demands and hence the less the capacity that is left for the needs of the other peers. All reputation-based schemes' performance is slightly below the optimal one. This may be due to the heterogeneity of the load on servers. Some peers may have too many requests to serve in a given period and some may have none. [9]

The performance of peers is almost the optimal one in the case of g = 9 and C =18 Mb/s, under which each peer has to serve nine other peers every period and thus the load is stable and the same for all peers.

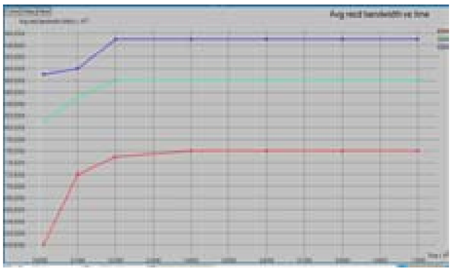

Fig .4. Average received bandwidth per request for different time peers.

*Fig.4.*we sees the evolution of the average received bandwidth per request through time for the aforementioned p2p system. In the early steps of the system, the average received bandwidth differentiates from peer to peer but as the system evolves, the average rate with which peers receive bandwidth converges to the same value for all the peers of the homogeneous system. [11]

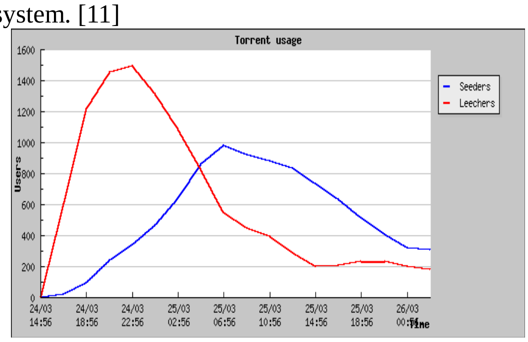

Fig.5. Performance of Torrent usage-No of Complete and incomplete downloaders

Once a peer is done downloading, it no longer has useful download rates to decide which peers to upload to. The current implementation then switches to preferring peers which it has better upload rates to, which does a decent job of utilizing all available upload capacity and preferring peers which non else happens to be uploading to at the moment.[12]

B. Heterogeneous System

We investigate a network of cooperative peers with different capabilities/link capacities. Some of the peers are more powerful than others. In particular, we study a network of 100 peers, where 20 percent of them have a total capacity of 8 Mb/s, 20 percent have one of 7 Mb/s, 20 percent have one of 6 Mb/s, 20 percent have one of 5 Mb/s, and 20 percent have one of 4 Mb/s. [9]

All peers have a request generation profile of two requests per period. We can see the average received bandwidth per request and global reputations of each category peer for the various schemes, respectively.[10]

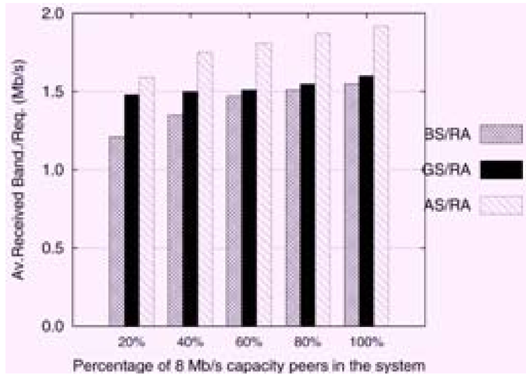

Fig.6. Performance of 8 Mb/s capacity peers for different portions of capacity peers.

From *Fig.6.* We see that by using the reputation-based schemes the higher capacity peers succeed in receiving more resources from the network as they are the ones who contribute more resources in it.[13] Actually for BS/RA and AS/RA schemes, peers' average received and provided bandwidth is the same in the steady state (this is not exhibited in *Fig.6.)*

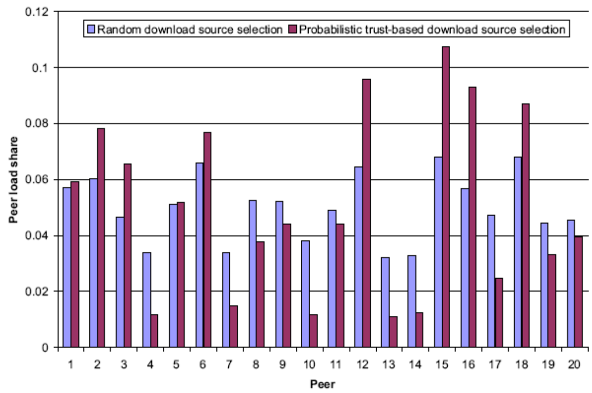

Fig.7. Unexploited capacity of 8 Mb/s capacity peers for different portions of capacity peers.Random downloads

Higher capacity peers' resources are not exploited in this case study because of the inability of the other peers to offer and receive resources at the rate that high capacity ones can accept and provide, respectively. If more high capacity peers existed in the heterogeneous network, their performance could be improved and the unexploited capacity would be decreased (see in the sequel the discussion on *Fig.7.* [14]Under BS/SA scheme all peers receive almost the same bandwidth irrespective of their contributions, as no reputation system is regarded.

C. Newcomer Performance

In this section, we exhibit the behavior of the system under the case of new peers periodically entering and leaving the network. As in the previous section, we consider a network of 100 peers where peers are categorized according to their total physical capacity; there are five equal-sized categories of peers with 8, 7, 6, 5, and 4 Mb/s capacities. However, we consider that 50 percent of each category peers are permanent in the system (stable), while the remaining 50 percent of each category (capacity) peers stay in the network only for 100 periods and are replaced by new identity peers of the same capacity with those who left every 100 periods. We use this case in order to keep the same analogy of capacity peers in the system and better investigate the performance of the system compared to the static one where no arrivals or departures occur. In Fig 8, we can see the performance of the stable and newcomers of 8 and 4 Mb/s capacity peers, when the BS/RA-SS scenario is used. [9]

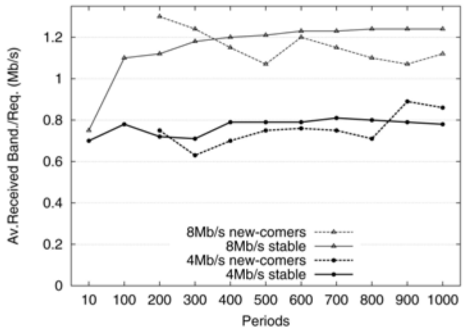

Fig 8: Performance of stable peers and newcomers

The scenario of this performance of the other capacity peers and when the GS/RA-SS or AS/RA-SS strategies are used. What we see from Fig 8 is that the performance of the stable peers is not much influenced by the presence of the newcomers, and on the other hand, newcomers' behavior is very close to the one of the stable peers of the same capacity, despite their short life in the network. We present our experiments on mitigating message traffic using the Friends-First technique.

Friends-First takes advantage of the Friend-Cache to try and locate a positive query response among the known reputable nodes, before querying the entire system. As we will see, in a flood-based querying system, this can result in85% less message traffic. This scenario, which is also supported by many different scenarios that we run, shows that newcomers adapt quickly to the network and do not really affect the performance of the long-lived peers in the system.

IV. CONCLUSION

In this paper, we implemented homo&heterogeneous system and main scope of bittorrent.Bittorrent mainly improving trade-off capacity. In the homogeneous scenario where all peers have the same capacity and request generation rate, rational peers fast reach a cooperative operating point under which they offer half of their capacity for their download and half for their upload. In heterogeneous systems, utilization of all resources is not always possible since some of the higher capacity peers resources may not be exploited fully, because of the inability of other peers to offer and receive resources at the rate that powerful peers can accept and provide, respectively.

ACKNOWLEDGMENT

We also express our thanks to our institution, parents, and friends, well wishers for their encouragement and best wishes in the successful completion of this dissertation.

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