

Impact of Dynamic Social Relationship in a File Sharing System.

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Abstract—In this paper we discuss the impact of social networks (e.g. Facebook) on the improvement of data dissemination in Bittorrent. We compare a social disseminated swarm with a traditional disseminated swarm, discussing peers locality and inter-AS traffic. Our results show that social disseminated swarms may present up to 3 times more peers behaving to the same region. This pattern impacts on inter-AS traffic, which in turn, impacts the network traffic cost. Our characterization can be used to develop new incentive mechanisms that consider social relationship and geographic locality.

I. INTRODUCTION

The adoption of peer-to-peer (P2P) has grown since past decade and the traffic generated by this kind of application is dominant in the Internet. Estimations shows that, in 2012, more than 36% of traffic upload in North America was generated by *BitTorrent* [2]. The portion of BitTorrent in total peak traffic of North America is bigger than 10%¹.

The success of P2P systems is dependent from its peers' collaboration. However, the lack of cooperation in such applications imposes a big challenge in offering quality of service. There is many mechanisms that intend to incentive the peer cooperation in P2P systems. For example, the BitTorrent protocol present a decentralized mechanism called tit-for-tat. The peers monitor themselves mutually and the amount of resources offered is proportional to their contribution.

The proper working of tit-for-tat mechanism is strongly related to short-term contribution between peers. This mechanism do not favors relationship based on locality or long-term relationship. One could achieve better data dissemination in the case of considering theses factors [1].

In fact, BitTorrent file dissemination is improved when social network is used to announce a file. For example [4], [6] show that social announced torrents, mainly in *Twitter*, have more stable peers. These stable peers enter in a swarm (group of nodes sharing the same content) following predictable temporal patterns and keeps sharing for a time longer than in normal swarms, improving the content dissemination.

Furthermore, the peer locality, even in a single swarm, can be important for the global P2P system improvement. For example, Wang et al. [5] show that 85% of peers participate in multiple swarms and this characteristic can be used to increase the locality of the entire P2P network and reduce inter-AS traffic. In this case, one could correlate P2P peers with its

social profile could in order to create groups of peers that maintain the P2P traffic restricted to a given AS.

For example, Pietili et al. [3] define P2P groups as temporal communities where the casual opportunistic contact of peers can be explored to improve the data content dissemination. In this case, Pietili explores the social relations between conference participants, but other scenarios can be explored, as the interaction of social network users.

In this paper we present the preliminary results focusing at the discussion of impact of social network, mainly the Facebook, on the improvement of data dissemination in file sharing networks. We compare social announced swarms with normal swarms (announced in indexing sites) and discuss the preliminary impact in inter-AS traffic. Furthermore, is we characterize peer's locality in this social-P2P context.

We believe that our results can be useful for the development of new protocols and incentive mechanisms that consider social relationship and geographic locality.

II. TORRENT DISSEMINATION IN SOCIAL NETWORK

To analyze the role of social network in torrent dissemination we have collected 2 types of *torrents*: (i) regional torrent; (ii) global torrent. The regional torrent content is related to certain region/group. For example, the movies performed in *Bollywood* have more appeal in regions around India.

We have collected 60 swarms: 30 regional torrents and 30 global torrents. For each category, half of the sample was collected from an Indian Facebook group (namely *social swarm*) and the remainder half samples was collected from popular indexing torrent sites (non-social swarm). To map IP and locality we have used GeoLite database².

Our preliminary analysis of swarms evidence the correlation between the social network and a torrent swarm geographic locality. More precisely, torrents disseminated via Facebook tend to present better grouped peers (geographically) in its swarms. For example: Table I shows the top ten more representative countries in terms of number of peers. As observed, the social dissemination of swarms influences the clustering of nodes even in global swarms. It is evidence that social dissemination can even improve a swarm whose interest is not specific from a region of globe.

¹Global Internet Phenomena Report: 2H 2012, www.sandvine.com

²Maxmind GeoLite, www.dev.maxmind.com/geop/geolite/

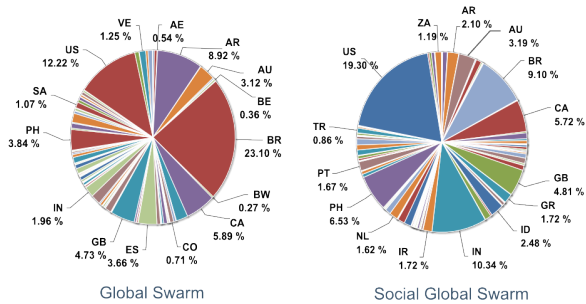


Fig. 1: Influence of social dissemination in global content.

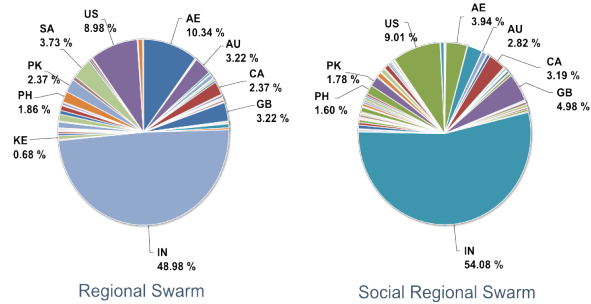


Fig. 2: Influence of social dissemination in regional content.

Reg. Social	Regional	Glob. Social	Global
U.S.A	India	U.S.A	France
U. K.	Pakistan	U. K.	Italy
India	U.A. Emirates	India	Netherlands
Canada	S. Arabia	Canada	Belgium
Brazil	U. K.	Pakistan	Algeria
Philippines	U.S.A	Australia	Canada
Australia	Bangladesh	Netherlands	Morocco
Netherlands	Qatar	S. Arabia	U.S.A
Malaysia	Australia	Philippines	S. Arabia
Greece	Canada	Greece	Switzerland

TABLE I. Top 10 countries by number of peers

Global Social Swarm			
total	%	Id AS	Country
147	13.8%	75741	India
28	2.6%	76780	India
21	1.9%	17921	India
15	1.4%	77677	India
13	1.2%	63986	United Arab Emirates
11	1.0%	77690	India
11	1.0%	101639	India
10	0.9%	74893	India
10	0.9%	17728	India
10	0.9%	101554	Pakistan
25.6% of peers (24.4% around India)			
Global Non-Social Swarm			
total	%	Id AS	Country
74	12.5%	75741	India
18	3%	63986	United Arab Emirates
17	2.8%	498	United Arab Emirates
16	2.7%	76780	India
15	2.5%	17921	India
9	1.5%	101639	India
9	1.5%	101554	Pakistan
9	1.5%	53316	United Arab Emirates
6	1%	49906	United Kingdom
5	0.8%	188581	United Arab Emirates
29.8% of peers (20.7% around India)			
Regional Social Swarm			
total	%	Id AS	Country
65	3.0%	75741	India
20	0.9%	69144	United States
14	0.66%	77074	Philippines
13	0.61%	73824	Philippines
11	0.52%	73822	Philippines
11	0.52%	53669	United Kingdom
10	0.47%	97400	Malaysia
9	0.42%	36309	United States
9	0.42%	68353	Canada
8	0.38%	53112	Portugal
7.89% of peers (5.26% around India)			
Regional Non-Social Swarm			
total	%	Id AS	Country
11	0.98%	108246	Argentina
10	0.89%	75741	India
9	0.80%	98420	Brazil
9	0.80%	107349	Argentina
8	0.71%	77074	Philippines
9	0.80%	98420	Brazil
7	0.62%	99150	Brazil
7	0.62%	103832	Uruguay
7	0.62%	108195	Argentina
7	0.62%	50612	Spain
7.37% of peers (1.6% around India)			

TABLE II. Peers by AS in Global and Regional Content

Figure 1 and 2 shows the distribution of peers according to type of content for the four bigger swarms in the distribution. It shows that the relation of interest has an important role in peer distribution. In regional swarms we have a major percentage of peers from the places around India (59% from social swarm

against 56% from traditional swarm). In global swarm we have an improvement of three times in peer concentration around India in social dissemination (24% against 8%).

We also analyze the distribution of peers by AS for the biggest swarms (table II). In regional content the social dissemination presents up to 25.6% of peers at 10 first AS against 29.8% from traditional dissemination. Considering an Indian group on Facebook, we have actually 24.4% against 20.7%. The global swarms present 7.89% in social dissemination against 7.37% in traditional dissemination. Again, considering the Indian group, we have actually 5.26% against 1,6%. These results show evidences that exploring social relationship improve the performance of a P2P file sharing systems, mainly in geographic localization.

III. CONCLUSIONS AND FUTURE WORK

In this paper we present our preliminary analysis of the impact of torrent dissemination on social networks. Our results show that exists node grouping based on social relationship and geographic localization. For example, our results show that social disseminated swarms may present up to 3 times more peers behaving to the same region/country. This grouping characteristic can be used to improve the content sharing.

As future work, we intend to further investigate how social relationship between peers can aid the development of new incentive mechanisms that discourage *freeriders*. For instance, we intend to elucidate the question if the incidence of *freeriders* is the same in social disseminated swarms as in traditional P2P systems. Finally, we intend to analyze the impact on system performance when using a modified version tit-for-tat mechanism that priorities the selection of nodes in the same AS or with similarities in social characteristics.

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