Measuring P2P IPTV Traffic on Both Sides of the World

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1. INTRODUCTION

P2P IPTV applications arise on the Internet and will be massively used in the future. It is expected that P2P IPTV will contribute to increase the overall Internet traffic. Moreover, these emerging applications are proprietary and their exact implementation details are still widely unknown. In this context, it is important to measure the traffic generated by these applications to understand their underlying mechanisms and to evaluate their impact on the network.
Nowadays, there have been several traffic measurement studies of P2P IPTV systems [1] [2]. Basically, these studies analyze the network traffic generated by controlled peers situated in the same network. The scope of these studies is limited to a local view of the P2P network and the observations can not be generalized to the overall P2P network. The study of the P2P network with a wider view is essential to get a complete understanding of these systems. The knowledge of the global properties of the P2P network will be useful to improve the architectures of these P2P systems and will also help to model or simulate them accurately.

In this ongoing work, we aim to get a better understanding of the P2P network built by the P2P IPTV applications to broadcast live streaming video to a large number of users. To this end, we perform an extensive measurement campaign by collecting traffic from several peers situated in different network environments: our campus network in France and in the WIDE network in Japan.

In this abstract, we firstly describe our measurements testbed to collect the network traffic in France and in Japan. Then we show some preliminary results and give our perspectives of future work.

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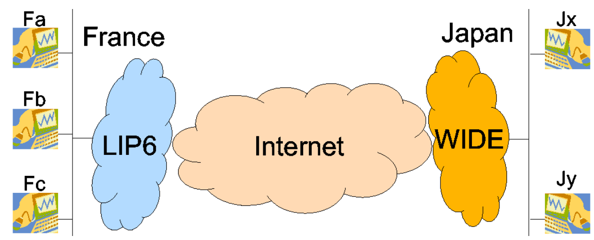

Figure 1: Measurement experiments testbed. Each PC is directly connected to the Internet within LIP6 or WIDE network.

2. MEASUREMENTS TESTBED

Our measurement experiments take place from July to the end of September 2007. We collected data while watching live sports as soccer, athletics or rugby. We collected a huge amount of data by using the most popular P2P IPTV applications (SOPCast, PPStream, TVAnts).
Our measurement experiment testbed is described on Fig. 1. To collect the data, we used personal computers (PCs) with 1.8GHz CPU and common graphic card capabilities. The operating system running on the PCs was `Windows XP`. The PCs were situated both in our campus network in France and in the WIDE network in Japan. All the nodes were directly connected to the Internet with 100Mbps Ethernet access. During a measured sport event, all nodes were running the same P2P IPTV applications and `Windump` to collect all the packets. In each distinct networks, we used from two to four PCs to collect the data depending on the availability of our PCs.
The key idea of these measurement experiments is to collect P2P IPTV traffic both in our campus network in France and in the WIDE network in Japan. In this way, our controlled peers will exchange data with other peers in the Internet but also among them. The study of the traffic exchanged among our controlled peers will be one of our main focus in our traffic analysis.

Table 1: Exchange of data between Jx and the other controlled peers

Jx	Fa	Fb	Fc	Jy
Japan	France	France	France	Japan
Upload (MB)	37.43	37.14	0.00	77.63
Download (MB)	31.99	25.54	0.00	70.95
Up/Down	1.17	1.45	0	1.10

3. PRELIMINARY RESULTS

In this abstract, we focus on a single measurement experiment while watching a soccer game by using PPStream on August 15. This soccer game has been measured by five controlled peers: three peers were situated in the LIP6 network in France (namely Fa, Fb and Fc) and two peers in the WIDE network in Japan (Jx and Jy). This experiment is illustrated in Fig 1. In the following, we will focus on the trace collected by our controlled peer Jx.

Table 1 shows the amount of data exchanged by Jx with the other controlled peers in both directions: upload and download. As an example, we observe that peer Jx uploads 77.63MB to peer Jy and downloads 70.95MB from peer Jy. Peers Jx exchanges 0MB in both upload and download directions with peer Fc. In fact, there have been a few packets exchanged in both directions among them and it counts only for a very low amount of data.

Whatever the traffic directions are, the amount of data exchanged by peer Jx with peer Jy situated in the same network is more important than with the other peers situated in another network (Fa, Fb and Fc). The PPStream application seems to take the locality of peers into account to exchange the data among peers. The amount of data exchanged with peers Fa, Fb and Jy shows that peer Jx uploads more data to them than it downloads. We compute the ratio of upload and download traffic exchanged by peer Jx to all the other controlled peers. These ratios are different for every peers: Jx uploads 1.10 times what it downloads from Jy situated in the same network and from 1.17 for Fa to 1.45 for Fb situated in a different network. PPStream does not seem to use any incentive mechanisms to control the amount of data exchanged between peers.

The incentive mechanisms are essential since they are the key mechanisms of P2P networks to force the peers to collaborate and to share fairly their resources among them. The locality of peers is also an important matter especially in the point of view of the Internet Service Providers. The increase of the traffic due to the use of these P2P applications increases the costs for the ISPs. These costs could be limited if the locality of peers where the data are duplicated is taken into account.

With the trace collected by Jx, we try to infer the

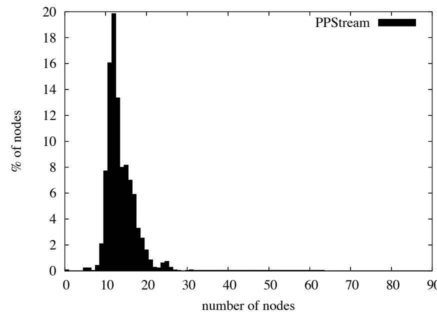

Figure 2: Distribution of the distance in number of hops between Jx and all the other peers in the Internet.

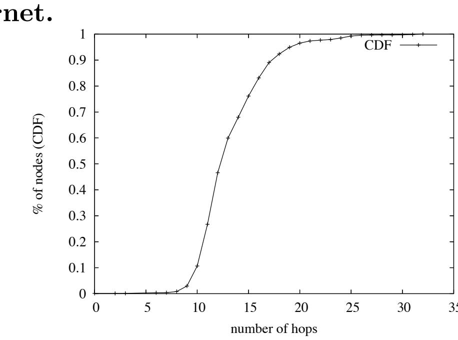

Figure 3: Cumulative Distributive Function of the distance in number of hops.

locality in number of hops to all the other peers by using the TTL fields of the received IP packets. The Fig. 2 gives the distribution of the number of hops observed in the trace. The major part of the peers are situated from 10 to 17 hops of our controlled peer Jx. The CDF plot on Fig. 3 shows that more than 90% of the remote peers are situated in less than 20 hops from Jx. We still have to compute the amount of data exchanged with the other peers according to their distance in number of hops.

4. FUTURE WORK

In this work, we measured the traffic of P2P IPTV applications in France and in Japan in order to get a global view of these P2P networks. This measurement study is still ongoing and we still have to analyze our other traces to generalize our first observations. The finer understanding of such P2P network will help to improve the design of these applications and to evaluate their impact on the network. It will also be useful to model or simulate P2P IPTV systems with realistic input parameters and assumptions.

5. REFERENCES

[1] X. Hei, C. Liang, J. Liang, Y. Liu, and K. W. Ross, “A Measurement Study of a Large-Scale P2P IPTV System,” in *IEEE Transactions on Multimedia*, 2007.

[2] T. Silverston and O. Fourmaux, “Measuring P2P IPTV Systems,” in *Proc. of ACM NOSSDAV*, 2007.