Analysis of the network impact of P2P-TV applications

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With potentially hundreds of millions of users utilizing the P2P-TV, these applications plays an increasingly important role in the network communication. P2P-TV takes the tremendous pressure to the Internet backbone and access networks with traffic. So it is important to acquire an in-depth understanding of the associated network traffic. The user's role in these P2P systems, no longer a simple downloader, even became the content providers and the network communication sponsor. So the behavior of users of P2P-TV system, will give the network a new kind of impact. This is an important point of our experiment. In this work, we detailed analysis of the traffic characteristics when the user is watching a channel. On the basis of these, we have a detailed comparison and analysis of the data which is obtained by the user switch between multiple channels. And finally, we got some useful insights on the impact of the network.

Keywords: P2P-TV, Zapping, Channel switching behavior, Network measurement

1. INTRODUCTION

After the convergence support of voice and data networks, the Internet offers more and more services of broadcast audio / video (TV). These multimedia services were clearly confined to broadcast infrastructure (network television broadcasting by voice radio, satellite or hybrid fiber support / coax) . The transmission of qualitative television stream in standard definition or high (HDTV) requires the use of enormous resources in data networks. The development of technologies for the distribution of multimedia content is either local and limited to an residential operator (IPTV) , or is comprehensive and complex (CDN).

The alternative to these expensive technologies potentially lies in the peer-to-peer approaches (P2P). These have demonstrated their ability to leverage resources in the file transfer and distributed computing. As part of the TV, specific constraints require substantial changes to the P2P. A new class of application is trying to achieve this type of service: those of P2P-TV. Among the most popular, we can cite SOPCast, PPStream, PPLive, or UUsee.

One of the major problems with this application is that they are proprietary and closed. Their behavior is known only after analysis of network traffic they generate. And there were many analysis of these P2P-TV applications. But most of these experiments only studied the underlying mechanisms or architectures used by these proprietary applications. They did not study some coupling between the behavior of the user and the measured results.

In this paper, we seek to answer the following questions about the impact on the network applications of P2P-TV.

(1) How are the P2P-TV peer behaviors ? How many peers are there when users watch a channel or several channels? How are the peer arrival and departure progress and peer lifetime distribution both in the cases of one channel and several channels? What are the difference of the number of peers from the transient state to steady state? And what are the reasons of these changes?

(2) How traffic is divided into signaling and video, and into download and upload directions? And what are their characteristics ?

(3) What are the statistical differences between watching one channel and changing several channels ?

We attempt to answer these questions by using a standard P2P-TV application crawler and using packet sniffers deployed at high-speed campus access point. Quantitative results obtained in our study are as follows:

(1) The data in the steady state occupied about 20% of the total state.

(2) Switching channels according to different viewing time and times, will have different impacts to the users and the network.

The paper is structured as following parts : we describe the considered applications and the measurement setup in Section2. In Section3, we introduce the performance of one channel. For the two channels, we analyze the trace in Section4. And for the five channels, in Section5. We present related work in Section6, and discuss issues for further work and conclusion in Section7.

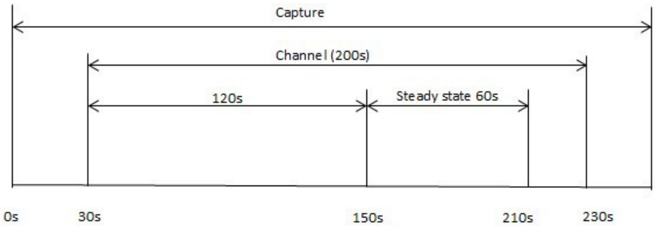
2. DESCRIPTION OF THE EXPERIMENTS

With the aim to have a better understanding about both traffic properties and peer behavior of a P2P-TV community, we focused on the most popular P2P-TV applications, namely SOPCast, PPSTream, PPlive and UUsee. And China has the world's largest users of P2P systems, and these four applications have a lot of the Chinese live-TV channels, so we chose them. For our experiments, we performed several 5 minutes long experiments during the end of June and throughout July 2011, where my partners watched the same channel at the same time and collected packet-level traces. Firstly, we watched one channel in order to observe the transient states and the steady states. Since P2P-TV application are mostly popular in China, we tuned each application to five different channels, in turn namely CCTV1, CCTV2, CCTV4, CCTV10 and CCTV13 during four different time periods, respectively, 14h-15h, 16h-17h, 17h-18h, 20h-21h (GTM+1). And secondly for the case of several channels, we set the same performing duration for each channel, and then manually switch channels in order to facilitate research. For the performing duration for each channel, we set five levels, namely, 5s, 10s 15s 20s and 25s. In this paper we focused on five packet traces for the one channel, two packet traces for the two channels and two packet traces for the five channels, collected on 30 June at 14h-16h (GTM+1) in the campus network of the UPMC Sorbonne University. From our collection, we selected these traces because the time period on that day was the China peak hours (Chinese time 20h-22h)[4], has a lot of P2P-TV users. We also analyzed the other collected traces and we obtained results similar to those mentions in this paper.

3. PERFORMANCE OF ONE CHANNEL

In this section we analyze traffic characteristics in detail for the one channel. Before preceding our analysis, in order to better understand the experiment as well as traffic characteristics, we will divide traffic activity into two different modes we will call zapping and viewing. The zapping mode indicates a period from the beginning of watching a channel to steady state in traffic. The viewing is a period steady state. To define these two modes, we make an assumption, and hope the analysis of the data to understand the two different states. For the assumption, we use a timing diagram (Figure 1) for illustration. First of all, we start to open P2P-TV application, and capture packets. After 30 seconds, we will select a channel to watch. Then, at the moment 120th second, we will assume that the trace will go to a steady state and keep observing more 60 seconds for this state. For this channel, we fix that all of the observing time is 200 seconds. After that, we will close the channel. However, we will intentionally wait for a more short period so that our observing duration will be longer than the period watching a channel (200sec) because all the effects of the live interest before and after the viewing duration could produce the behavior of peers.

Fig. 1. Timing diagram 1



Our analysis relies on four P2P-TV applications (SOPCast, PPSTream, PPlive and UUsee) with 300 collected traces. In this paper, instead of analyzing all of traces, we only focus on the data analysis of signification data for the SOPCast application.

Particularly, we describe some general traffic properties such as their size, dynamics of peers, download and upload traffic and then we discuss some issues related to the separation of video and signaling flows, and show the distinct results.

Firstly, we look at the number of peers, throughout five figures(Fig.2, Fig.3, Fig.4, Fig.5 and Fig.6); we consider that for one channel, the total number of peers varies between 50 and 70. And during the full duration, the local host continually changes its partners (i.e. remote peers). This is illustrated in Fig. Peers-active, in which the number of peers is sampled every 0.5 s. During each 0.5s period, typically some peers leave and some others arrive. Compared with the total number of peers, the average number of the changed peers in 0.5s is approximately equal to 33% of the total peers for the SOPCast. And in comparison with the graphics of steady state and the full trace, they are almost the same.

Secondly, in order to understand the download and upload policies, we plot the total of downloaded traffic and the aggregated traffic which are downloaded from the top-ten peers in the following figure. Each point of the figure represents a 0.5 s interval. With download, the top-ten peers contribute to almost the traffic in full duration. It is different about the download policies in [7]. And there is no top-ten peer which are concentrated at the steady state moment for the large amount of data transfer. For upload data, according to the figure, we see that before watching the channel (i.e. that from 0th to 30th second of time), it has been uploaded data. For the upload policy, SOPCast has two processes, the first process is whereas we are watching the channel, and we also share our downloaded data to others. The second process is when we did not watch any channel or even we did not open the application, SOPCast still uses our network for the upload service. In our current experiments, it is not easy to distinguish these two processes. So by this interference, we cannot summary the upload policies. In addition, we remark that the top-ten download peers and the top-ten upload peers have no intersection. This testifies peers did not reciprocate fairly when downloading the traffic.

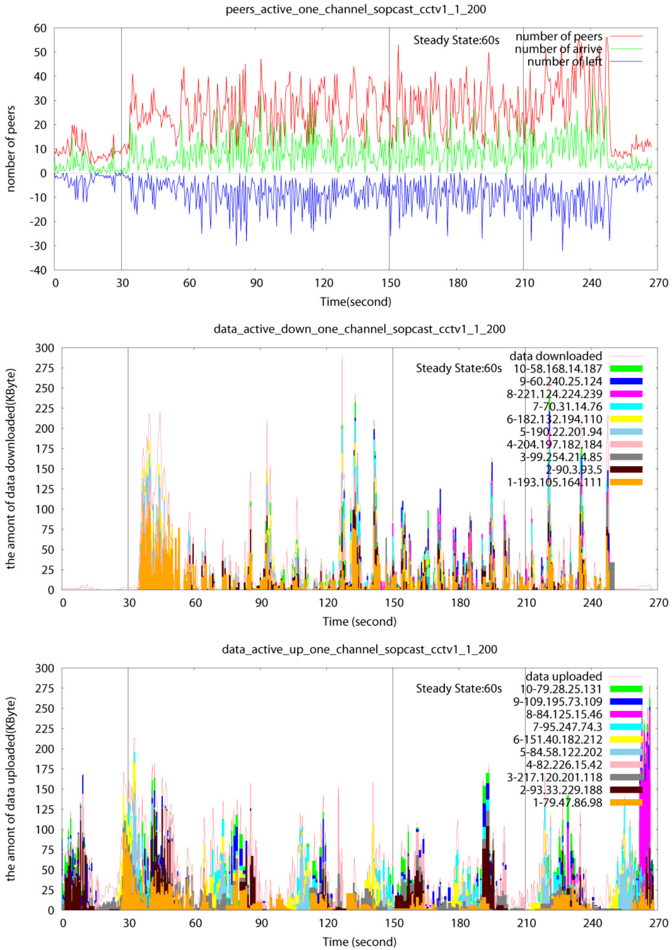
Thirdly, the following table contains the information regarding to the size of traces. We judge that there is much more traffic in the upload direction. This is because our nodes is situated in a university, and it is connected to the Internet with 100Mbps Ethernet NIC through a high-speed campus network. There we have symmetric upload and download capacity. Moreover, we also note that during 60 seconds of the steady state, we collected the data is about 20% of the full trace data. And the amount of downloaded data of the steady state is also about 20% of the full trace. But the percentage of uploaded data is slightly volatile, from 15 % to 40 % range. The percentage is changed because we cannot exclude the data of the second upload process. Hence the volatility is understandable.

Fourthly, the P2P-TV applications, we studied, generate 2 kinds of traffic: video and signaling. In order to separate two these kinds of traffic, I was inspired by the sentence in the [7], ”packet size property may be a good heuristic to discriminate between signaling and video sessions” . In this paper, we took a very simple heuristic. For each session, we count the size of packets, if the size is larger than or equal to 1200Bytes, then it is labeled as a video session. All the non-video sessions are supposed to carry signaling information. This heuristic is very simple to implement, but it is flawed, we will mention in detail later (Section 7). Acceptably, we use this heuristic to estimate the fraction of downstream and upstream signaling overhead for the SOPCast. From the table, it is notable that the downstream signaling overhead is generally from 10% to 16%. But the upstream signaling overhead is very high, even reaching in the 94% to 99% range. By comparing the data of the steady state and the full trace, we also discover an interesting phenomenon. That is, for download, whether it is the signaling traffic or the video traffic, the data of steady state are accounted about 20 % for the data of the full trace. In the other side, for upload, only the signaling traffic remains a 20% rate. For the video traffic, the ratio of steady state with respect to full traffic has undergone tremendous fluctuations; the smallest is only 5.0%, while the largest is 70.4%.

Finally, we focus on the smooth playback problem. Through the mention in [1], the bit-rate of these five live-TVs, they almost are 520 Kbps. Through the table we see that the downloaded average bandwidth is about 536.4 Kbps, so for smooth playback, is no problem. For the steady state, the downloaded average bandwidth is slightly lower than the full trace; it is about 464.1Kbps, the 86.5 % of the downloaded average bandwidth of the full trace.

3.1 cctv1

Fig. 2.



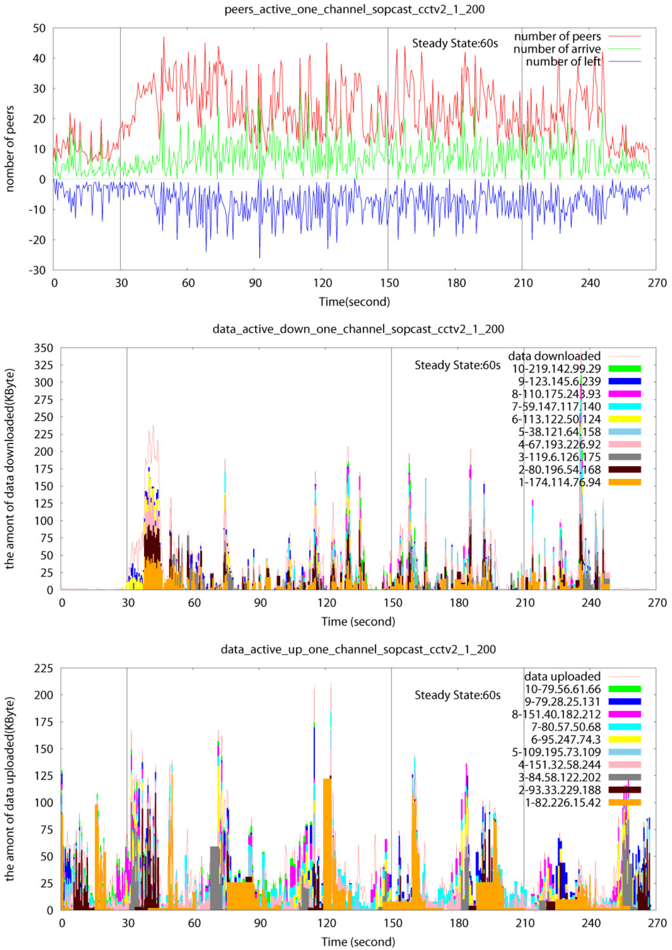
Trace	Total data(B)	Duration(sec)	Download(KB)	Upload(KB)
Full	41894625	238.0	18215.0	22697.0
60s	8073053	60.0	4042.0	3841.0

Trace	DOWNLOAD			UPLOAD		
	Sig.(KB)	Vid.(KB)	%	Sig.(KB)	Vid/(KB)	%
Full	2165.0	16049.0	11.89	22560.0	136.0	99.40
60s	419.0	3623.0	10.37	3832.0	9.0	99.77

Trace	Download average BW(Kbits/s)	Upload average BW(Kbits/s)
Full	612.2	762.9
60s	538.9	512.1

3.2 cctv2

Fig. 3.



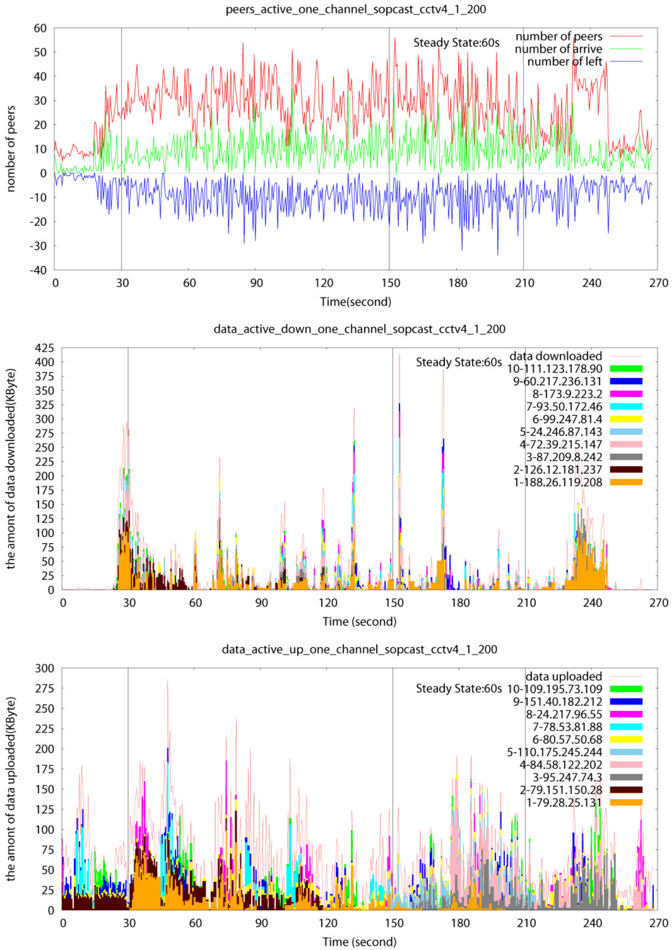
Trace	Total data(B)	Duration(sec)	Download(KB)	Upload(KB)
Full	33513578	237.5	17284.0	15443.0
60s	7824747	60.0	3951.0	3689.0

Trace	DOWNLOAD			UPLOAD		
	Sig.(KB)	Vid.(KB)	%	Sig.(KB)	Vid/(KB)	%
Full	2018.0	15265.0	11.68	14967.0	476.0	96.92
60s	430.0	3520.0	10.89	3587.0	101.0	97.26

Trace	Download average BW(Kbits/s)	Upload average BW(Kbits/s)
Full	582.2	520.0
60s	526.7	491.7

3.3 cctv4

Fig. 4.



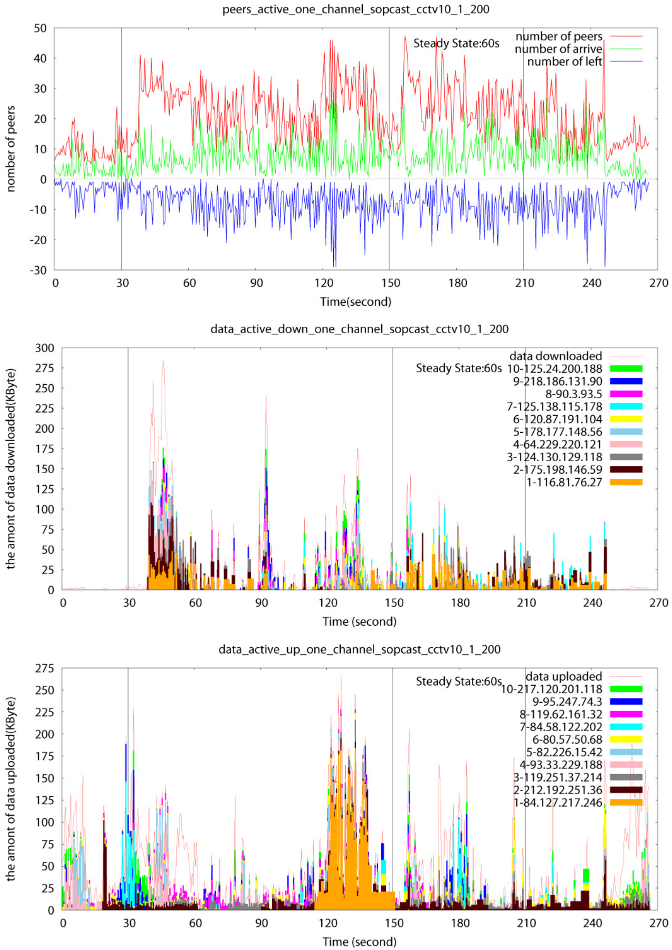
Trace	Total data(B)	Duration(sec)	Download(KB)	Upload(KB)
Full	46317255	238.0	28299.0	16932.0
60s	10520715	60.0	3326.0	6947.0

Trace	DOWNLOAD			UPLOAD		
	Sig.(KB)	Vid.(KB)	%	Sig.(KB)	Vid/(KB)	%
Full	2294.0	14638.0	13.55	27014.0	1284.0	95.46
60s	517.0	2809.0	15.54	6881.0	65.0	99.06

Trace	Download average BW(Kbits/s)	Upload average BW(Kbits/s)
Full	569.1	951.2
60s	443.5	926.1

3.4 cctv10

Fig. 5.



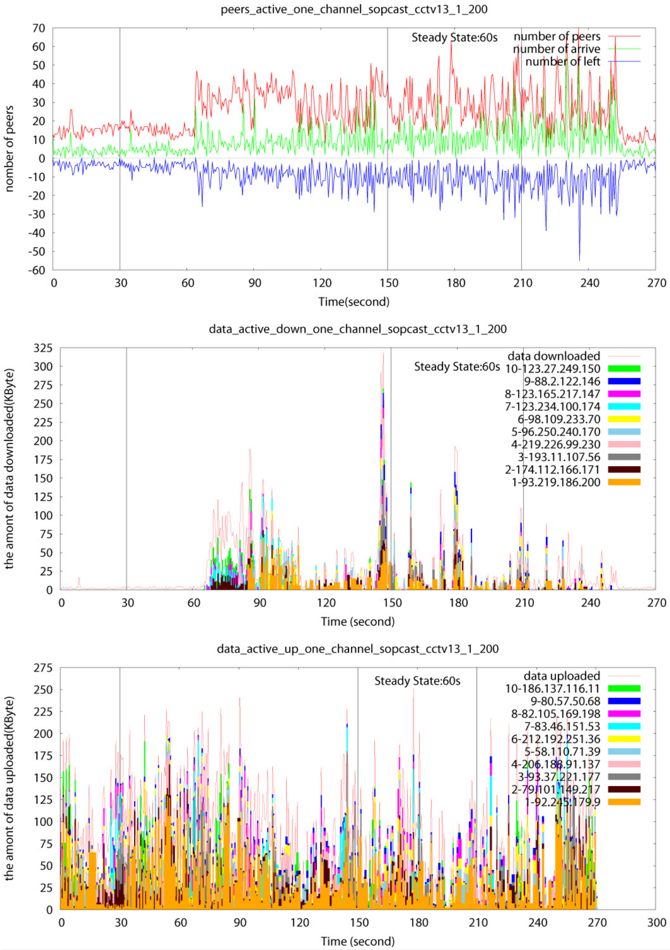
Trace	Total data(B)	Duration(sec)	Download(KB)	Upload(KB)
Full	36788473	236.5	14216.0	21709.0
60s	7619917	60.0	2939.0	4501.0

Trace	DOWNLOAD			UPLOAD		
	Sig.(KB)	Vid.(KB)	%	Sig.(KB)	Vid/(KB)	%
Full	1679.0	12537.0	11.81	20582.0	1127.0	94.81
60s	299.0	2640.0	10.17	4251.0	249.0	94.47

Trace	Download average BW(Kbits/s)	Upload average BW(Kbits/s)
Full	480.9	734.3
60s	391.9	600.0

3.5 cctv13

Fig. 6.



Trace	Total data(B)	Duration(sec)	Download(KB)	Upload(KB)
Full	53744159	240.5	13162.0	39321.0
60s	10461000	60.0	3147.0	7067.0

Trace	DOWNLOAD			UPLOAD		
	Sig.(KB)	Vid.(KB)	%	Sig.(KB)	Vid/(KB)	%
Full	2158.0	11003.0	16.40	39007.0	314.0	99.20
60s	465.0	2682.0	14.78	6846.0	221.0	96.87

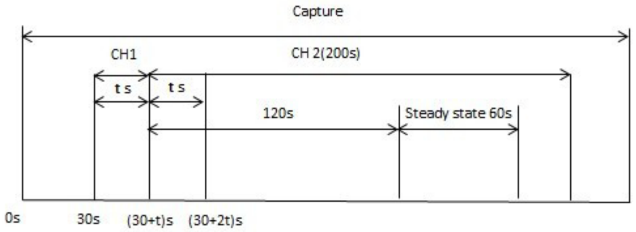
Trace	Download average BW(Kbits/s)	Upload average BW(Kbits/s)
Full	437.8	1308.0
60s	419.6	942.3

4. PERFORMANCE OF TWO CHANNELS

In case of multiple channel test, based on the content of the experiments, we divided the test into two parts. The first part is exactly the same experiments for one channel to collect the basic properties of traffic. Because of the limited space of this article, we don't go to much further in the details. We are more concerned about the second part, that is, the behavior of frequently switching channels will impact to the users and the network.

Here we use a timing diagram to explain in detail our experiments. In Fig. 7, it is similar to the experiment of one channel case. At the 30th second, we started to select the first channel. After a duration t (t belongs to a set of 5s, 10s, 15s, 20s, 25s), we immediately switched to a second channel. The 2nd channel duration was also the 200 seconds. After that, one after another, we repeated the test with many other options of duration t. To reflect on the impact of the second channel, we deliberately took a time interval namely T.I.2. The period of the T.I.2 was the same as the first one.

Fig. 7. Timing diagram 2



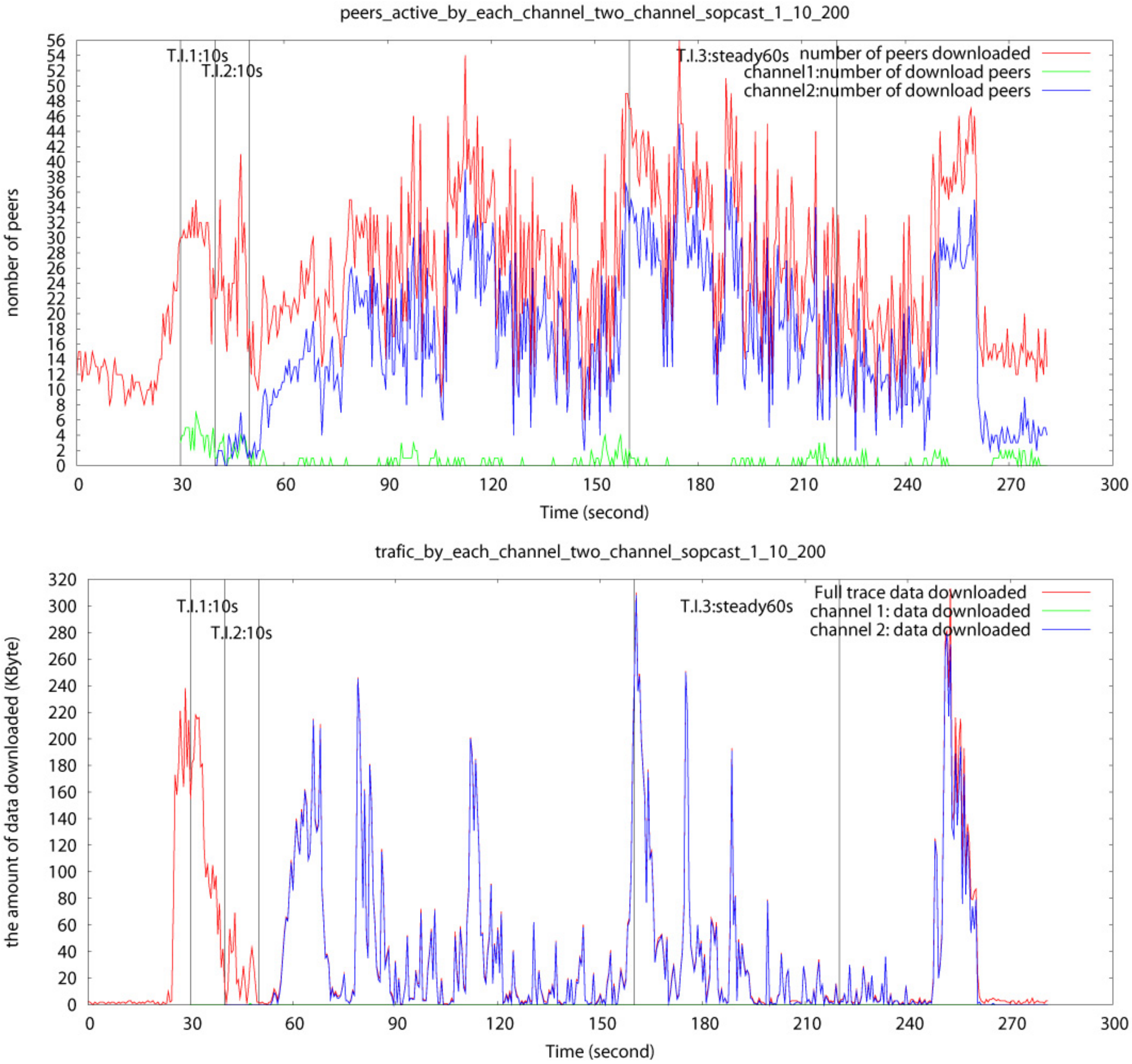
For the impact of users and the network, we focused on two properties made a detailed study: the first property is the peer, and the second is the traffic. We assumed that all the new peers for a channel, which we found in a slot, were linked to this channel and we want to understand how long they remained in the system. Therefore, we generated a figure of the peer lifetime for the each channel. With a simple algorithm, we firstly collected the peer list between the 0th to 30th seconds, called the useless peer list. Then we collected all the peers in the CH 1 time. If it was not belong to the useless peer list, then we determined it was the peer of the CH 1. So we got the peer list for CH 1. During the CH 2's performing period, we did the following determination for the each collected peer. If it was not part of the useless peer list, nor the peer of CH1, so it was the peer of the CH2. Since we distinguished the peer of each channel, calculated the detail traffic of each channel and then demonstrated them in the figure.

Now, we single out two examples for a detailed explanation.

4.1 10 s

We can see from the Fig 8, before selecting any channel, in the period from 0th to 30th seconds, there were some downloaded peers. Perhaps, these nodes were used to connect to the SOPCast server, or may be used to download the playbill, or they played some other roles. In the first time interval (T.I.1), we observed that only a small number of peers were part of CH1, the majority of peers were useless. In the second period (T.I.2), we turned off the CH1, started the CH2, but the number of the CH1 peers was almost as many as the number of the CH2. After the second period, CH2 began to gradually increase the number of peers; CH1 came to a rapid decline in the number of peers. However, the amount of CH1 peers had been continuing to the end of experiment. 240 seconds later, we no longer watched any channel, but interestingly, CH2 still kept increasing the number of peers. From this we can draw a conclusion that the peers exited the

Fig. 8.



Full	CH 1	CH 2
348	24	222

Trace	T.D.D(KB)	T.I.1(10s)	%	T.I.2(10s)	%	T.I.3(60s)	%
Full	21260.0	2518.0	11.8	482.0	2.3	5061.0	23.8
CH 1	13.0	4.0	30.8	3.0	23.1	2.0	15.4
CH 2	17279.0	0.0	0.0	2.0	0.1	4905.0	28.4

peer list after a very long time. One explanation is that a peer left only after it was disappeared from the peer list of all peers. A peer's sojourn time was longer than its actual value. This leads to three consequences. The first is it over-estimated the number of active peers. Secondly, it distorted the peer lifetime distribution. And for the last one, it generated useless traffic and brought some unnecessary overheads to the users and the network. How many of this useless traffic, as we can see the second graph of Fig.8. In the first time interval (T.I.1), CH1 won only 4.0KB of data, which can be seen, viewing time was too short, unable to obtain sufficient data. In the second period (T.I.2), the total download data had a very significant decline, from the original 2518KB down to 482KB, occupied 80 % decline. And the CH2 obtained data was very bad, only the poor 2KB. The irony is that the ended CH1 is still 3KB download data. The reason for this phenomenon we cannot determine whether it caused by a too short viewing time, or a result of switching channels. We assume that those are the 2 reasons, but which one is the main factor, we cannot determine in the present study. After the T.I.2, we can see the red line represented for the total download data and the blue line represented for the CH2 download data was coincident. Thus, although this period had some active peers of the CH1, but the traffic they generated was basically negligible.

4.2 25 s

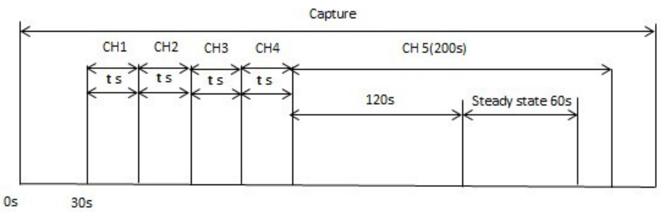
From the Fig.9, we can observe that the trend of activity peers was almost same with that of the 10 second. It is reasonable because the increase in viewing time, the proportion of the number of CH1 peers had significant growth, from the previous 5% -8% to 13% -14%. The proportion of the number of CH2 peers had a slight decline from the 60%-63% to 57% -59%. In the second interval, we consider that from 65th second to 80th seconds, CH2 had not any peer activity, it was not normal, which may be due to the problem of CH2. In the same 25 seconds of other experiments, CH2 gradually increased the number of peers, and the total number of CH2 peers in the T.I.2 was more than the number of CH1 peers.

Now we look at the case of the traffic. As the number of CH1 peers kept increasing, The traffic was also been increased significantly. However, we note that the traffic of CH1 was mainly in the T.I.1 and T.I.2, the specific data, the traffic of T.I.1 was 29.3%, the traffic of T.I.2 was 60.5%. This shows that nearly two-third of the traffic of CH1 was useless. However, after the T.I.2, once again, the red line and the blue line were overlapped, which explains, for the two channels, the increase in viewing time by switching channels (the t increase from 10s to 25s), the advantage is to increase the quality of the first channel to watch, but also the relative increase the overhead on the user and the network.

5. PERFORMANCE OF FIVE CHANNELS

In the last section, we have demonstrated switching channel will give users and network an unnecessary overhead. And this overhead is mainly present in the beginning second channel stage (i.e. T.I.2). Now we want to deeper study, frequent switching channels will bring what consequences, and these consequences have what kind of difference from the previous conclusions.

Fig. 10. Timing diagram 3



We still use a timing diagram to describe our experiments. The experiment for the 5 channels is similar to the experiment with the 2 channels, just increased from 2 to 5 channels. The first four channels, we fixed the viewing time of t seconds, at the end of t time, we immediately switch to the next channel. For the last channel, as usual, viewing time is also 200 seconds.

In order to compare the situation of the two channels, we still select the experiment results of the 10s and the 25s as an example.

5.1 10 s

From the Fig.11, we can observe that the trend of activity peers is much same with the situation of the 2 channels. Because there are four fast switching channels, so starting from the fifth channel, the number of the useless peer is also increased. The worth noting is that, the number of the CH5 peers, from the start to its first peak, it spent nearly 30 seconds. This time is nearly increasing twice from the time of 2 channels (15s). Now we observe the specific number of peers by each channel. The first four channels, respectively, the number of peers is in hovering at 3%-8%. And the number of four channels peers together account for 20%-22% or so. For the number of the fifth channel, it is accounted about 50 %. Comparing the number of peers for the case of 2 channels (the number of second channel is a 60%-63% rate), it has decreased.

Then, we see the situation of the traffic. From the figure, we observe that the first four channels, except the CH3, they are almost no traffic. Maybe the reason is the CH3 has the most number of peers. However, the number of CH2 peers is just a difference of 9 peers from the CH3, but their traffic is very different. Perhaps the CH3 has a super-peer. While the traffic of the CH3 has a little improvement, but in T.I.3, the CH3 is only 50 % of the valid data, the rest have become the useless overload. With the same case of the 2 channels, after the beginning of the last channel, that traffic generated by the useless node is also negligible. But the traffic of the CH5, from the beginning to the first peak, there are also nearly 30 seconds of delay. From this we can conclude that the frequent switching channels will impact the final channel.

5.2 25 s

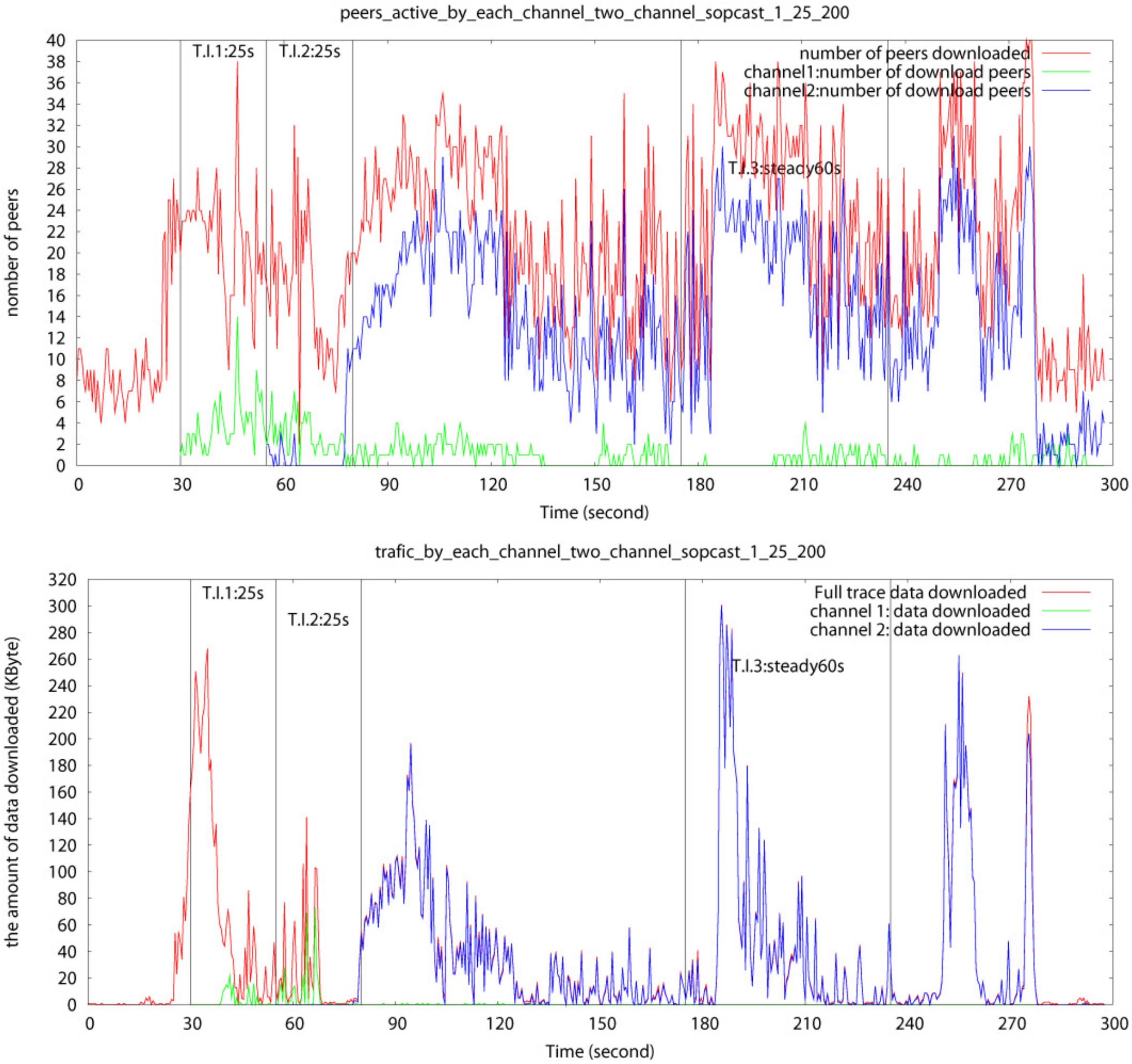
From the Fig.12, we obviously can see that because the viewing time of the first four channels is enough, the number of peers have increased significantly, from the previous 3%-7% to 6%-9%. And the proportion of the number of the CH2 peers had a decline from the 59% to 38%.

Now we observe the situation of the traffic. Although the traffic of the first four channels has improved, not many of them are valid data. CH1 has 38%, CH2 has 37.6%, CH3 has 59%, and CH4 has 11.8%. Moreover, we can see that the CH5 has been more serious impact. In its starting 25 seconds time, the useless data is in the majority, which led directly to the first peak of the CH5 delayed 25 seconds. And the traffic of the CH5 is unstable, the peak are always thin and small. The total traffic of the CH5 fell from 77.3% to 48.8%. From this we can conclude that frequent switching channels, will not only bring more useless overload, but also affect the final channel.

6. RELATED WORK

The P2P-TV applications from the beginning to the present have many revolutions. The technology of the P2P-TV is constantly updated; the system

Fig. 9.



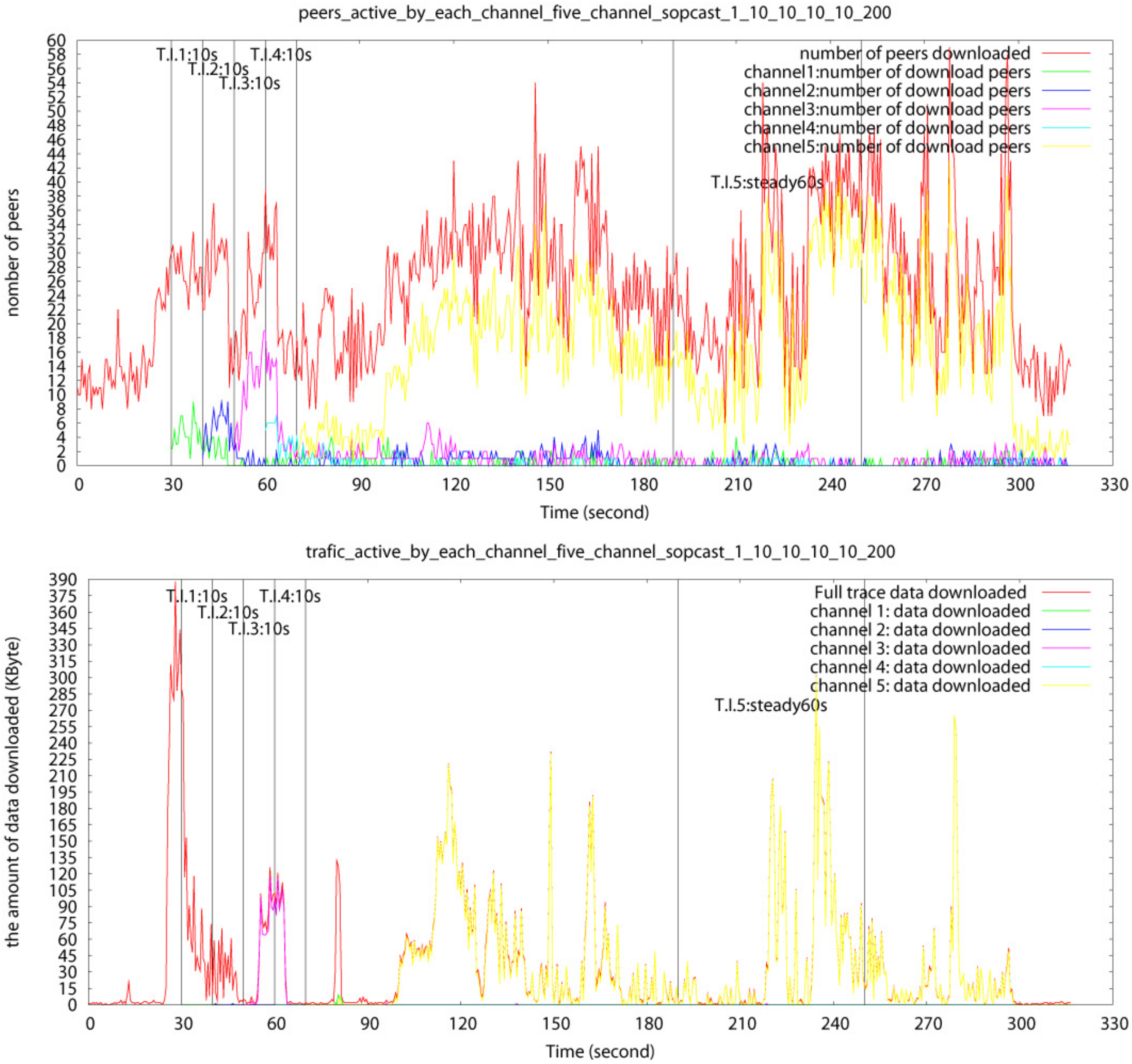
Full	CH 1	CH 2
353	48	201

Trace	T.D.D(KB)	T.I.1(25s)	%	T.I.2(25s)	%	T.I.3(60s)	%
Full	22115.0	4189.0	18.9	982.0	4.4	5526.0	25.0
CH 1	532.0	156.0	29.3	322.0	60.5	3.0	0.6
CH 2	16453.0	0.0	0.0	44.0	0.3	5418.0	32.9

is also continually improving. And the research for the P2P-TV is the same in constant progress with. The trend of the research of the P2P-TV system is more and more refined.

In [5], it only focuses on a single P2P-TV system: PPlive for a detailed study. In particular, the authors first use of 2 different measurement methods: active crawling and passive sniffing, for the campus and residential two different types of network nodes, they also carry out the corresponding analysis. And they provided useful insights on the users behaviors, the user geographic distribution, the playback delay and playback lags among peers, the characteristics of the connection and traffic. This article made two con-

Fig. 11.

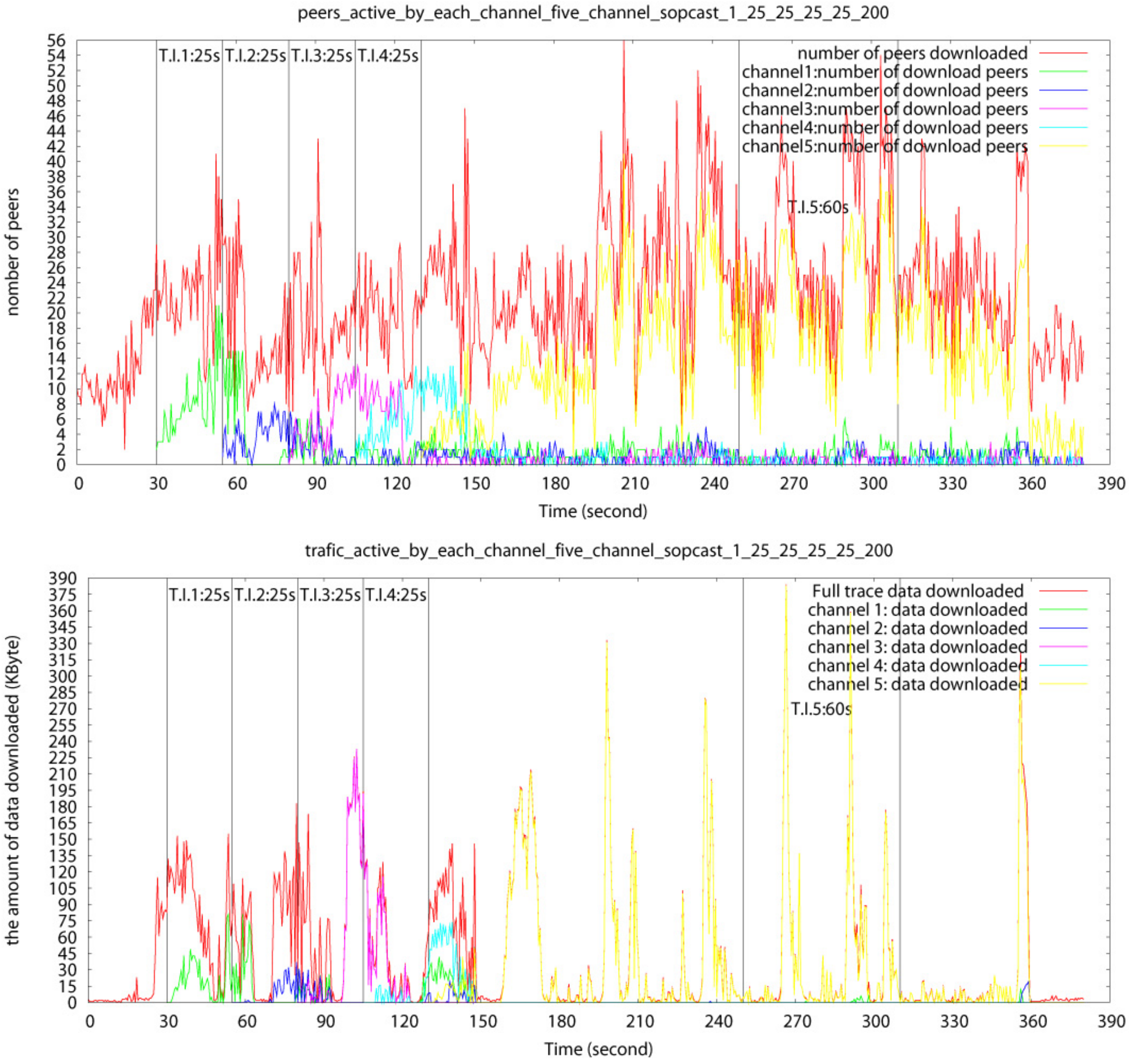


Full	CH 1	CH 2	CH 3	CH 4	CH 5
609	27	35	46	22	328

Trace	T.D.D(KB)	T.I.1(10s)	%	T.I.2(10s)	%	T.I.3(10s)	%	T.I.4(10s)	%	T.I.5(60s)	%
Full	21515.0	1660.0	7.7	533.0	2.5	893.0	4.2	762.0	3.5	5512.0	25.6
CH 1	45.0	5.0	11.1	2.0	4.4	0.0	0.0	0.0	0.0	3.0	6.7
CH 2	30.0	0.0	0.0	9.0	0.3	0.0	0.0	0.0	0.0	1.0	3.3
CH 3	1502.0	0.0	0.0	0.0	0.0	775.0	51.6	696.0	46.3	2.0	0.1
CH 4	9.0	0.0	0.0	0.0	0.0	0.0	0.0	5.0	55.6	1.0	11.1
CH 5	16622.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	5408.0	32.5

tributions on the research of the P2P-TV system. The one is providing a heuristic to distinct the signal and the data from the trace. Another one is the authors concluded the P2P-TV users have the similar viewing behaviors

Fig. 12.



Full	CH 1	CH 2	CH 3	CH 4	CH 5
601	74	48	50	50	228

Trace	T.D.D(KB)	T.I.1(25s)	%	T.I.2(25s)	%	T.I.3(25s)	%	T.I.4(25s)	%	T.I.5(60s)	%
Full	32290.0	4069.0	12.6	3146.0	9.7	3866.0	12.0	2073.0	6.4	4819.0	14.9
CH 1	2628.0	999.0	38.0	531.0	20.2	219.0	8.3	81.0	3.1	40.0	1.5
CH 2	898.0	0.0	0.0	338.0	37.6	265.0	29.5	12.0	1.3	3.0	0.3
CH 3	4153.0	0.0	0.0	0.0	0.0	2450.0	59.0	1689.0	40.7	3.0	0.1
CH 4	1775.0	0.0	0.0	0.0	0.0	0.0	0.0	210.0	11.8	2.0	0.1
CH 5	15752.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	4651.0	29.5

as regular TV users. On the basis of the [5], the [8] detailed study of the P2P-TV system's basic structure: mesh-pull architecture.

Then the research of the P2P-TV began to focus on the comparison of several different P2P-TV applications. Like [7], it focused on study the traffic generated by the four most used P2P-TV applications: PPLive, PPStream, Sopcast, TVants. The authors provide results on the (i) ports and protocols used; (ii) differences between signaling and video traffic; (iii) behavior of the traffic at different timescales; (iv) differences between TCP and UDP traffic; (v) traffic generated and received by peers; (vi) peers neighborhood and session duration. The special features of this article are 3 points: (i) they compute the energy spectrum of the traffic at different time scales for analyze the collected traffic. (ii) They find out the differences between TCP and UDP traffic.The TCP traffic exhibits periodic behavior, and the UDP traffic has long-range dependence which will affect the network conditions and the quality of the video stream. (iii) This is the first time to analyze the download policy of the different application. This finding can explain many peers' behaviors. And the article [6] to [7] is much wider comparisons. It analyzed almost all type of Internet P2P applications: the P2P file-sharing as BitTorrent and eMule, the VoIP telephony applications as Skype, the VoD as Joost, and the live-streaming P2P applications as TVAnts, SopCast and PPLive. The authors find out the many differences of these P2P applications.

Later the research of the P2P-TV is no longer satisfied with the comparison of different applications. They are also constantly expanding the scale of the experiment. And the point of view of the experiment not only from a simple analysis of the data of the P2P-TV system, but also increasingly concerned about the negative impact on the network. The [10] aim at assessing the level of network awareness has been embedded in the applications, i.e., the metric of selection peers. They definite a framework for directly and compactly comparing of different network properties and P2P systems. Here are the 5 metrics: BW Awareness, AS Awareness, Country Awareness, NET Awareness and HOP Awareness. And there are some relationships between these metrics. The CC preference is due to the AS preference. And the NET preference is also due to the AS preference. At the end, the author concluded that only BW-awareness is definitively embedded in all P2P-TV applications, i.e., these applications prefer to select the high-bandwidth peers. And another article [9] focused on the level of collaboration between peers, their location and the effect of the traffic on the networks. By analyzing the 4 popular P2P-TV applications, namely PPStream, TVUPlayer, Sopcast and TVantsm, from multiple points located in France and Japan, the authors find out that the P2P-TV application lacks the 2 mechanisms: a locality-aware mechanism and a new incentive mechanism which utilize for enforce peers to collaborate in the network.

Our work is also belongs to the range of analysis the impact to the network. But we are more focused on the behavior of users, such as frequent switching channels.

7. SUMMARY AND OUTLOOK

This paper studies a total of two issues. Firstly, we divide the watching process into two states. One is the Zapping state (i.e. the transient state), another one is the steady state. We found that, there are five experimental data in case of steady state occupied separately about 20% of the totality state: the total data, the downloaded signaling, the downloaded video and the uploaded signaling. Secondly, we focused on studying switching the channel will take what kind of the impact to the users and the network. For switching channels, we focus on the viewing time of each channel, and the times. If we increase the viewing time for each channel, although we have improved the viewing effect, we also bring a lot of unnecessary network overhead. If we increase the times of switching channels, then would bring the adverse effect to the last channel.

For the future work, first of all, I have to complete my heuristics. My heuristics is too simple, so it has some flaws. I only use the packet size to determine, making some video packet to be mistaken for the signaling packet. I think the heuristic in [7] is very good; it used two criteria to distinguish the traffic. One is the inter packet time; the other is the packet size. These two criteria were combined to make the distinction more accurate. So in the future work, I hope this heuristic can be achieved in the program.

Secondly, at the beginning, we mentioned that in order to reflect the impact to the network, we selected four different P2P applications. In this paper, we only analyzed the SOPCast. For the future, we continue to analyze the other three P2P applications. And we want to make some horizontal comparisons and find the difference between these results. For the direction of switching channels, we hope that our final results allow us to make some better strategies to further reduce the overhead on the network.

8. REFERENCES

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