

# LIVE STREAMING WITH RECEIVER-BASED ON PEER DIVISION MULTIPLEXING FOR NEXT GENERATION IPTV NETWORK

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## ABSTRACT

A number of commercial peer-to-peer systems for live streaming have been introduced in recent years. The behavior of these popular systems has been extensively studied in several measurement papers. Next generation broadcast network concentrates on IPTV (Internet Protocol Television). The main hurdle in IPTV is streaming of audio and video signals. A number of commercial systems are built to study and analyze the behavior of live streaming of audio and video signals. Peer to Peer multiplexing (P2P) provides a good solution for this problem. In this paper a variation of P2P multiplexing is proposed which is called as receiver based P2P multiplexing. To analyze the performance of the proposed multiplexing techniques the very famous European network "Zattoo" is considered. This paper also describes the network architecture of Zattoo and uses the data collected from the provider to evaluate the performance of the proposed variation in P2P multiplexing. To highlight, we found that even when the Zattoo system was heavily loaded with as high as 20,000 concurrent users on a single overlay, the median channel join delay remained less than 2 to 5 seconds, and that, for a majority of users, the streamed signal lags over-the-air broadcast signal by no more than 3 seconds.

## I INTRODUCTION

There is an emerging market for IPTV. Numerous commercial systems now offer services over the Internet that are similar to traditional over-the-air, cable, or satellite TV. Live television, time-shifted programming, and content on demand are all presently available over the Internet. Increased broadband speed, growth of broadband subscription base, and improved video compression technologies have contributed to the emergence of these IPTV services. Current generation broadcast network for TV is DTH which will be slowly replaced by the next generation Internet Protocol Television (IPTV) network. There is an emerging market for IPTV. Numerous commercial systems now offer services over the Internet that is similar to traditional over-the-air, cable, or satellite TV.

Live television, time-shifted programming, and content-on- demand are all presently available over the Internet. Increased broadband speed, growth of broadband subscription base, and improved video compression technologies have contributed to the emergence of these IPTV services [1][6]. IPTV systems deliver video and audio channels to viewing devices by switching a single channel to multiple sources. IP Television networks are primarily constructed



authorized to receive signal of the said TV channel, the Rendezvous Server returns to the user a list of peers currently joined to the P2P network carrying the channel, together with a signed channel ticket. If the user is the first peer to join a channel, the list of peers it receives contain only the Encoding Server. The user joins the channel by contacting the peers returned by the Rendezvous Server, presenting its channel ticket, and obtaining the live stream of the channel from them.

Each live stream is sent out by the Encoding Server as  $n$  logical sub-streams. The signal received from satellite is encoded into a variable-bit rate stream. During periods of source quiescence, no data is generated. During source busy periods, generated data is packetized into a packet stream, with each packet limited to a maximum size. The Encoding Server multiplexes this packet stream onto the Zattoo network as  $n$  logical sub-streams. Thus the first packet generated is considered part of the first sub-stream, the second packet that of the second sub-stream, the  $n$ -th packet that of the  $n$ th sub-stream. The  $n+1$ -th packet cycles back to the first sub-stream, etc. such that the  $i$ -th sub-stream carries the  $mn+i$ th packets, where  $m>0$ ,  $1<i<n$ , and  $n$  a user-defined constant.

### III RECEIVER BASED P2P MULTIPLEXING

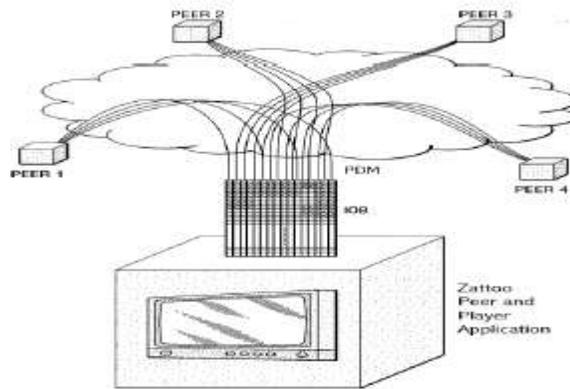
#### 3.1 P2P Multiplexing

When a new peer requests to join an existing peer, it specifies the sub-stream(s) it would like to receive from the existing peer [4]. These sub-streams do not have to be consecutive. Contingent upon availability of bandwidth at existing peers, the receiving peer decides how to multiplex a stream onto its set of neighboring peers, giving rise to our description of the Zattoo live streaming protocol as a receiver-based, peer-division multiplexing protocol.

To minimize per-packet processing time of a stream, the Zattoo protocol sets up a virtual circuit with multiple fan outs at each peer. When a peer joins a TV channel, it establishes a peer-division multiplexing (PDM) scheme among a set of neighboring peers by building a virtual circuit to each of the neighboring peers. Baring departure or performance degradation of a neighbor peer, the virtual circuits are maintained until the joining peer switches to another TV channel. With the virtual circuits set up, each packet is forwarded without further per-packet handshaking between peers.

The PDM establishment process consists of two phases: the *search* phase and the *join* phase. *Search Phase*: To obtain a list of potential neighbors, a joining peer sends out a SEARCH message to a random subset of the existing peers returned by the Rendezvous Server. The SEARCH message contains the sub-stream indices for which this joining peer is looking for peering relationships. The joining peer continues to wait for SEARCH replies until the set of potential neighbors contains at least a minimum number of peers, or until all SEARCH replies have been received.

*Join Phase*: Once the set of potential neighbors is established, the joining peer sends JOIN requests to each potential neighbor. The JOIN request lists the sub-streams for which the joining peer would like to construct virtual circuit with the potential neighbor.

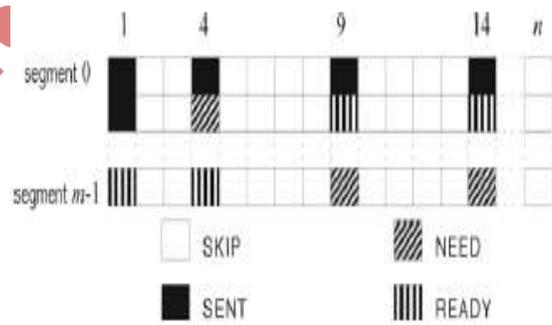


**Fig 2. Peer system with an IOB**

### 3.2 Stream Management

The IOB is referenced by an input pointer, a repair pointer, and one or more output pointers. The input pointer points to the slot in the IOB where the next incoming packet with sequence number higher than the highest sequence number received so far will be stored. The repair pointer always points one slot beyond the last packet received in order and is used to regulate packet retransmission and adaptive PDM [3] as described later. Different peers may request for different numbers of, possibly nonconsecutive, sub-streams. To accommodate the different forwarding rates and regimes required by the destinations, we associate a packet map and forwarding discipline with each output pointer.

Fig. 3 shows the packet map associated with an output peer pointer where the peer has requested sub-streams 1, 4, 9, and 14. Every time a peer pointer is repositioned to the beginning of a sub-buffer of the IOB, all the packet slots of the requested sub-streams are marked needed and all the slots of the sub-streams not requested by the peer are marked SKIP. When a Needed packet arrives and is stored in the IOB, its state in the packet map is changed to READY. As the peer pointer moves along its associated packet map, READY packets are forwarded to the peer and their states changed to SENT. A slot marked needed but not READY, such as slot  $n+4$ .



**Fig. 3 Packet Map Associated with peer map**

### 3.3 Adaptive PDM

Peers on the Zattoo network can redistribute a highly variable number of sub-streams, reflecting the high variability in uplink bandwidth of different access network technologies [7]. For a full-stream consisting of 16 *constant*-bit rate sub-streams, our prior study showed that based on realistic peer characteristics measured from the Zattoo network, half of the peers can support less than half of a stream, 82% of peers can support less than a full-stream, and the remainder can support up to 10 full streams (peers that can redistribute more than a full stream is conventionally known as super nodes in the literature) [5]. With variable-bit rate streams, the bandwidth carried by each substream is also variable. To increase peer bandwidth usage, without undue degradation of service, we instituted measurement-based admission control at each peer. In addition to controlling resource commitment, another goal of the measurement-based admission control module is to continually estimate the amount of available uplink bandwidth at a peer.

The amount of available uplink bandwidth at a peer is initially estimated by the peer sending a pair of probe packets to Zattoo's Bandwidth Estimation Server. Once a peer starts forwarding sub-streams to other peers, it will receive from those peers quality-of-service feedbacks that inform its update of available uplink bandwidth estimate. A peer sends quality-of-service feedback only if the quality of a sub-stream drops below a certain threshold [9]. Upon receiving quality feedback from multiple peers, a peer first determines if the identified sub-streams are arriving in low quality. If so, the low quality of service may not be caused by limit on its of available uplink bandwidth. If the new estimate is below the bandwidth needed to support existing number of virtual circuits, the peer closes a virtual circuit. To reduce the instability introduced into the network, a peer closes first the virtual circuit carrying the smallest number of sub streams.

Each peer on the Zattoo network is assumed to serve a user through a media player, which means that each peer must receive, and can potentially forward, all sub streams of the TV channel the user is watching. The limited redistribution capacity of peers on the Zattoo network means that a typical client can contribute only a fraction of the sub streams that make up a channel. This shortage of bandwidth leads to a global bandwidth deficit in the peer-to-peer network. In the Zattoo system, two separate centralized collector servers collect usage statistics and error reports, which we call the `—stats|` server and the `—user-feedback|` server respectively. The `—stats|` server periodically collects aggregated player statistics from individual peers, from which full session logs are constructed and entered into a session database. The session database gives a complete picture of all past and present sessions served by the Zattoo system. A given database entry contains statistics about a particular session, which includes join time, leave time, uplink bytes, download bytes, and channel name associated with the session.

## IV CONCLUSION

A receiver-based, peer-division multiplexing engine to deliver live streaming content on a peer-to-peer network. The same engine can be used to transparently build a hybrid P2P/CDN delivery network by adding Repeater nodes to the network. By analyzing a large amount of usage data collected on the network during one of the largest viewing events in Europe, we have shown that the resulting network can scale to a large number of users and can take good

advantage of available uplink bandwidth at peers. We have also shown that error-correcting code and packet retransmission can help improve network stability by isolating packet losses and preventing transient congestion from resulting in PDM reconfigurations. We have further shown that the PDM and adaptive PDM schemes presented have small enough overhead to make our system competitive to digital satellite TV in terms of channel switch time, stream synchronization, and signal lag.

## REFERENCES

- [1] R. auf der Maur, —Die Weiterverbreitung von TV- und Radioprogrammen über IP-basierte Netze,|| in Entertainment Law, F. d. Schweiz, Ed., 1st ed. Bern, Switzerland: Stämpfli Verlag, 2006.
- [2] Euro2008,|| UEFA [Online]. Available: <http://www1.uefa.com/> [3] S. Lin and D. J. Costello Jr., Error Control Coding, 2nd ed. Englewood Cliffs, NJ: Pearson Prentice-Hall, 2004.
- [3] S. Xie, B. Li, G. Y. Keung, and X. Zhang, —CoolStreaming: Design, theory, and practice,|| IEEE Trans. Multimedia, vol. 9, no. 8, pp. 1661–1671, Dec. 2007.
- [4] K. Shami et al., —Impacts of peer characteristics on P2PTV networks scalability,|| in Proc. IEEE INFOCOM, Apr. 2009, pp. 2736–2740.
- [5] Bandwidth test statistics across different countries,|| Bandwidth-Test.net [Online]. Available: <http://www.bandwidth-test.net/stats/country/>
- [6] X. Hei, C. Liang, J. Liang, Y. Liu, and K. W. Ross, —Insights into PPLive: A measurement study of a large-scale P2P IPTV system,|| in Proc. IPTV Workshop, Int. World Wide Web Conf., May 2006.
- [7] B. Li et al., —An empirical study of flash crowd dynamics in a P2Pbased live video streaming system,|| in Proc. IEEE GLOBECOM, 2008, pp. 1–5.
- [8] J. Rosenberg et al., —STUN—Simple traversal of User Datagram Protocol (UDP) through network address translators (NATs),|| RFC 3489, 1993.
- [9] A. Ali, A. Mathur, and H. Zhang, —Measurement of commercial peer-to-peer live video streaming,|| in Proc. Workshop Recent Adv. Peer-to-Peer Streaming, Aug. 2006.



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