Conception and Evaluation for P2P Video Streaming

Video streaming relying on peer-to-peer architectures have become massively popular. The promising idea of P2P technology is to enable the cooperation between peers to share their resources, such as disk storage, processing power and network bandwidth. However, these systems still remain some practical issues to be overcome. This prevents a sustained development of P2P technology on video streaming applications. Our work focuses on the large-scale mesh-based P2P video streaming systems that include P2P live streaming, P2P VoD and P2P time-shifted IPTV. Due to different characteristics among these systems, each of them has specific challenges and opportunities. We make an in-depth study on problems of different application systems, and further propose the corresponding resolutions to improve system performance.

We first implemented measurement studies on PPlive live streaming to investigate the fundamental cause of long start-up delay for P2P video streaming systems. We observe that most of the initial video content is actually provided by the peers in the initial peerlist given by the tracker server. However, the ratio of peers effectively active in the initial peerlist is particularly low. According to this observation, we model the channel switching problem as the (δ, k)-configuration problem. We also present a distributed fast channel switching algorithm. The main idea of this algorithm is to improve the quality of the initial peerlist and further reduce the delay of getting the first video packets.

Second, to support time-shifted services in P2P IPTV, we propose two approaches aiming at resolving different issues. The first proposal, a peer-assisted catch-up streaming system that is modeled as the multiple-interval graph, requires each peer to maintain several intervals and each of them contains the consecutive chunks that the peer has already retrieved, and further serve other viewers requesting these content. This system can assist the server for the content delivery, alleviate the burden of the server, and simplify the task of the tracker. We further propose a turntable overlay to ensure the storage of every past chunks and guarantee a good quality of service with a large majority of requests that are fulfilled, and balance the load of storing and delivering the chunks to all the peers.

Finally, we explore a network-friendly P2P system, friendly P2P, to alleviate network congestion caused by P2P traffic and keep fairness between P2P traffic and traditional Internet traffic. We first designed and implemented a friendlyP2P file-sharing system, and further proposed a scalable network-friendly P2P video streaming system, namely SFP2P, which is still at the early stage of development. SFP2P, which integrates friendlyP2P and SVC technology on video streaming systems, is expected to keep fairness between P2P traffic and traditional Internet traffic and improve user experiences simultaneously.

We describe the different characteristics of various P2P video streaming systems, further present the main challenges in these systems. We also propose several solutions to improve the user experiences in these systems. Finally, we designed network-friendly approaches for current P2P applications. We believe that our studies could make a sustaining development of P2P video streaming systems and develop an all-win situation for P2P traffic, Internet traditional traffic and network operators.