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Throughput Optimization of Data-Driven Peer-to-Peer Streaming

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ABSTRACT: *We consider a peer-to-peer scheduling for a network with compound wireless devices. Now a day's much attention has been focused on data driven peer –to-peer streaming systems due to its fast growth over the internet. In these streaming system each node randomly select their neighbors and exchanges block of data with neighbors. To improve the performance of the streaming data over the network the block scheduling method for improving the throughput of a constructed overlay is used. In this paper we provide the survey on the existing P2P solutions for live and on-demand video streaming. In general streaming system includes tree, multi-tree and mesh based systems. The block scheduling problem for a network is modeled as a classical min-cost energy network approach. We then propose a distributed heuristic algorithm approach to optimize the system throughput. To improve the quality of reception further, a video coding technique is aimed. This technique will augment the block scheduling and distributed heuristic algorithm. The results of simulation demonstrate that the proposed method significantly outperforms conventional ad hoc scheduling strategies especially in stringent buffer and bandwidth constraints.*

Keyword: *peer-to-peer network, video streaming, block scheduling, throughput*

I. INTRODUCTION

Nowadays, Peer-to-Peer (P2P) streaming system has become a popular service in the Internet. P2P streaming systems are sometimes Peer-to-peer (P2P) applications are widely used to distribute media files over the Internet and are sometimes referred to as "file sharing" applications. P2P content delivery systems work on the premise that peers will share resources in order to increase the total service capacity of the P2P system. The data driven peer to peer streaming protocol contains two steps. In the first step, each node independently selects its neighbors and forms an unstructured overlay network. This network is called as gossip-style overlay construction or membership management. The second step is named as block scheduling. The information is divided into blocks or segments (or packets) and each node announces what blocks it has to its neighbors according to their announcement.[1]i.e., the resource in the upstream bandwidth each peer contributes to distribute content to other peers by exchanging parts of the stream (or blocks) amongst each other.

The scheduling method (with data-driven and swarming based streaming) used in most of the existing system is somewhat adhoc and the conventional scheduling method used in the data driven protocol include Pure random way strategy[2] greedy local rarest first(LRF) strategy [3]and round-robin strategy [4]. In reality, a design of optimal block scheduling to maximize the data-driven streaming under a constructed overlay network is a tedious process.

In this paper, the scheduling problem is modeled as a classical min-cost network flow problem and to improve the throughput a global optimal solution is proposed in theory and then a heuristic algorithm is proposed which is fully distributed and asynchronous with only local information exchange. Furthermore, we address the problem of efficient layered video streaming over peer-to-peer networks and we propose a new receiver-driven streaming mechanism. The main design goal of our new layered video requesting policy is to optimize the overall distribution of video streams in terms of reliability and overhead. Since the layered peer-to-peer streaming problem is NP-Hard, we show that the classic approaches widely used in layered P2P streaming systems have some limitations and we propose an optimization technique based on harmony search which aims at increasing the rate of successful data transmissions for the most important video layers, while reducing the protocol overhead and ensuring load balancing among the participating peers. Analytical results have demonstrated that our new requesting policy enhances the streaming of layered video over mesh-based peer-to-peer networks and outperforms classic approaches.

In this paper we explain how P2P solves scalability issues by exploiting its ability to distribute information. In the first part of this paper we survey available technologies for the support of throughput optimization of data driven streaming. In the second part, we describe measurements and analysis based on an operational streaming system.

II. BACKGROUND

There has been considerable work in the area of peer-to-peer live video streaming. We refer to only a small subset of the application layer work here omitting interesting approaches involving media encoding (e.g. [2]) and various network layer techniques (e.g. [3]). P2P streaming systems strive to optimize three important metrics: SETUP delay (i.e. the time from when the user first uses on the channel to when the video is visible), END TO END delay (i.e. delay between the content originator and the receiver, also known as playback delay) and PLAYBACK continuity (i.e. percentage of received data packets).

Most of the systems may be classified based on the type of distribution graph they implement.

Tree-based overlays implement a tree distribution graph, rooted at the source of content. In principle, each node receives data from a parent node, which may be the source or a peer. If peers do not change too often, such systems require little overhead, since packets are forwarded from node to node without the need for extra messages. However, in high churn environments (i.e. fast turnover of peers in the tree), the tree must be continuously destroyed and rebuilt, a process that requires considerable control message overhead. As a side effect, nodes must buffer data for at least the time required to repair the tree, in order to avoid packet loss.

Mesh-based overlays implement a mesh distribution graph, where each node contacts a subset of peers to obtain a number of chunks. Every node needs to know which chunks are owned by its peers and explicitly “pulls” the chunks it needs. This type of scheme involves overhead, due in part to the exchange of buffer maps between nodes (i.e. nodes advertise the set of chunks they own) and in part to the “pull” process (i.e. each node sends a request in order to receive the chunks). In the following we will present what we observed during our experiments on a simple network.

III. EXPERIMENTS

At first we observe how packets are exchanged the very first time our client logs on the p2p network. This process involves an encrypted communication between the client and a server, where the client at first connects to a well known host to enter the network. This is typically performed in most p2p systems. Differently from other systems, where after a first login things may change, we here observe no changes in the pattern of exchanged packets. We then infer there is no attempt to delegate to peers successive logins and this process is always managed in a pure client/server fashion. After the login phase, we are able to look at the data packets.UDP packets are received by our host during a video session. In each UDP data packet, the first two bytes represent an easily recognizable packet counter, while data, instead, is encrypted.

By observing that data is not pulled from peers or servers but pushed to our client, we infer this may be a tree-based system. In order to be sure, we should be able to observe the whole network and derive its topology. We are anyway able to see that the most relevant peers involved in the streaming phase range from four to six. We should also emphasize that the most considerable part of the downloaded data, about 50 to 60%, mainly arrives from two sub networks. This type of behavior suggests there is a two-tier hierarchy in the analyzed p2p system. The dimension of this file, about one gigabyte, is considerable. This is a different approach from what we typically observe in p2p streaming systems, it is evident that since content is on-demand, the system doesn’t care about strongly caching and introducing high delays in the view of content.

The following shows the experimental output obtained from J_Sim simulator. The throughput of the mesh network is optimized by using scheduling algorithm. The Fig.1 and Fig.2.. shows how the throughput is improved constantly as the data stream is continuously transmitted.

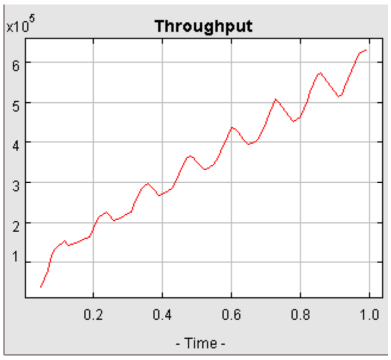

Fig.1.Throughput optimized output

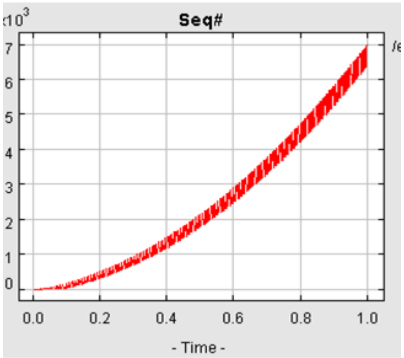

Fig.2. Improved throughput output

IV. CONCLUSION

The aim of this work is to understand which are the most successful approaches to optimize the throughput of p2p network and, with a few basic experiments, what is the behavior of a popular p2p streaming system. In the p2p system under test we find a very static and stable structure with a strong use of system's proprietary network. In addition, user's hosts are also relied on with a strong use of caching on the host's hard disk. Although this is mainly based on speculation, thus requiring a more extensive set of tests to better understand. we study the scheduling problem in the data driven/swarming based protocol in peer-to-peer streaming. The contributions of this project are twofold. First, to the best of our knowledge, we are the first to theoretically address the scheduling problem in data-driven protocol. Second, we give the optimal scheduling algorithm under different bandwidth constraints, as well as a distributed heuristic algorithm, which can be practically applied in real system and outperforms conventional ad
hoc strategies by about 10 percent-70 percent in both single rate and multi rate scenario. In particular, since this system will probably become the reference system on the Internet, due to its popularity, it is worth to investigate it with a more complete test operation.

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