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## Simulating BitTorrent

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### ABSTRACT

IP Telephony (IPTV) and other media distribution applications are expected to be one of the next Internet killer applications. One indication of this is the corporate backing that the IP Multimedia Subsystem (IMS) is getting. However, the bandwidth utilization of these applications is still an issue, as the volume of multimedia grows due to larger image resolution and higher bitrate audio. One way of managing this increase in bandwidth requirements is to use existing and fast bandwidth to decrease the load on the content server in a Peer-to-Peer (P2P) fashion. One of the most successful P2P applications is BitTorrent (BT), a streaming file transfer system. This paper presents an implementation of a BT simulator intended for future use in investigating modifications to the BT system to provide streaming media capabilities. The simulator is validated against real-world measurements and a brief performance analysis is provided.

### Categories and Subject Descriptors

C.2.2 [Computer-Communication Networks]: Network Protocols; Applications; C.2.4 [Computer-Communication Networks]: Distributed Systems—Distributed Applications

### Keywords

P2P simulation, BitTorrent, streaming, multimedia, video-on-demand

### 1. INTRODUCTION

The advent of P2P applications has motivated a significant amount of research into many aspects of these applications. A large number of measurement, analytical and simulation studies have been performed on a wide variety of P2P applications and protocols. P2P applications appear in a multitude of forms, but the most common is some form of file sharing or resource location application. These applications have shown to be very efficient in both decreasing

server load as well as providing a simple way of locating information. P2P applications improve their own routing and forwarding on top of the existing infrastructure by either forming overlay networks.

While P2P applications contribute to Internet of applications-oriented group consists of IPTV Demand (VoD) and others. In the context of wide multimedia stream application, indications that, e.g., the BT has been used for research put into mechanisms for congestion control, file allocation and related domains. Previous attempts to provide streaming services using BT Multicast (BTMC) have to a large extent been unsuccessful. This is due to a number of reasons: BTMC lacks buffering capabilities, a lack of applications using BTMC, poor deployment of BTMC and robustness of Internet Service Providers (ISPs) to allow BTMC forwarding across their networks. Another Multicast (MCAST) has been investigated as a possible solution to these issues. Systems such as End-system Multicast (ESMC) [8], PeerCast [9], dPAM [10], offstream [7] and others have been proposed to address the issues with BTMC in the context of media streaming.

One of the most popular P2P applications is BT [2], a streaming file distribution system. BT has shown to be very efficient in distributing large files without increasing the load on the original source of the files being distributed. While originally a file distribution system, research has been done on adapting the core BT algorithms to facilitate VoD. Solutions such as BTMC [3] and BTLib [4] have been proposed that modify the original BT algorithms to be able to handle streaming scenarios. Streaming media places significantly different demands on both the network and the distribution mechanism from those of non-streaming file transfers. The most obvious difference are the temporal demands, i.e., delay sensitivity and the associated timeliness of data packet arrival. In addition to packet timeliness, the ordering of the packets is important. The data of a video object is played back in a linear fashion, but in BT, data segments are downloaded in a random fashion. As for the other demands of VoD, it is very difficult to provide one true Quality of Service (QoS) for these demands, and the BT protocol does not provide any means for this. The work we present in this paper is part of the Streaming in Overlay Networks (SIOVEN) project at Baskage Institute of Technology (BIT) to verify

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