Chapter 1- Introduction

In this first chapter, the study presents the definition of the problem and the motivation behind the research. Besides, it provides research objectives. Finally, the section gives various chapters in the study.

1.1 - Definition of the Problem

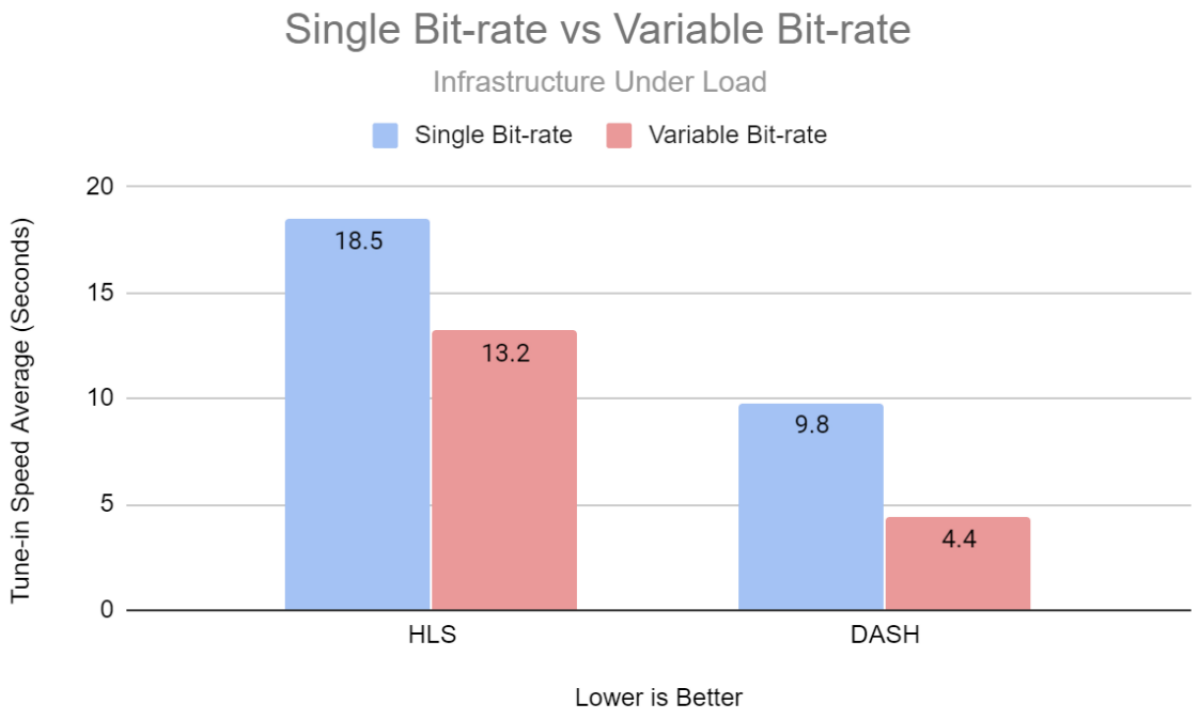
HTTP adaptive streaming technology is majorly adopted by different video producers and content delivery platforms that utilize it to adapt videos transmitted to certain conditions prevailing on the network, which enhances Quality of Experience (QoE) and improve stream quality. Despite the wide adoption of HTTP adaptive streaming (H.A.S) technology, HTTP Live Streaming bitrate adaptation methods with multi-tier caching servers still faces certain challenges because of the heterogeneous nature of networks, which poses a high demand among users as well as the dominance of high-quality live streams (Bentaleb *et al.,* 2018, p.567). The challenges comprise multi-client rivalry that results in stability lapses, QoE measurements, steady live streams quality, and optimization as well as inter-destination synchronization of content.

1.2 Research Motivation

Due to the growing demand for HTTP Live Streaming in the recent years among users, HAS solution has expanded to the most famous streaming technology since it has adapted well among various users in the internet video arena. The technology enables service providers to consume mobile-edge catches as well as traditional-stateless web servers to stream videos. In addition, it enables its consumers to access various media content through Network Address Translations (NATs) as well as behind different Firewalls. Despite the importance of the HTTP technology, scanty studies have been completed in this area to determine its efficiency. The technology is also consistently evolving. Therefore, it is imperative to analyse the quality of HTTP Live Streaming bitrate adaptation methods with multi-tier caching servers.

1.3 - Research Objectives

The objective of this study was to analyse the quality of HTTP Live Streaming bitrate adaptation methods with multi-tier caching servers. For this aim, the thesis used four approaches. Firstly, the study carried out the performance comparison of HLS & DASH packaging and delivery tests. Secondly, the study conducted a performance analysis of utilizing centralized storage with RAM, in comparison to the traditional hard-disk based storage. Thirdly, the researcher compared the utilization of non-variable bit rate streams with the variable multi bit-rate streams for HLS and DASH packaging outcomes as well as collected analytics as shown. Finally, the researcher analysed the performance benefit of the application of cache re-packagers as well as IP-based load balancing functionality for the region-based deployment of the cache server.



Single vs Variable Bit-rate

1.4 - Chapters in the Study

In chapter 1, the study focused on the definition of the problem, motivation behind the research, and definition of research objectives. Further, various chapters of the study have been presented. The chapter provides the foundation of the problem or background of the study. It

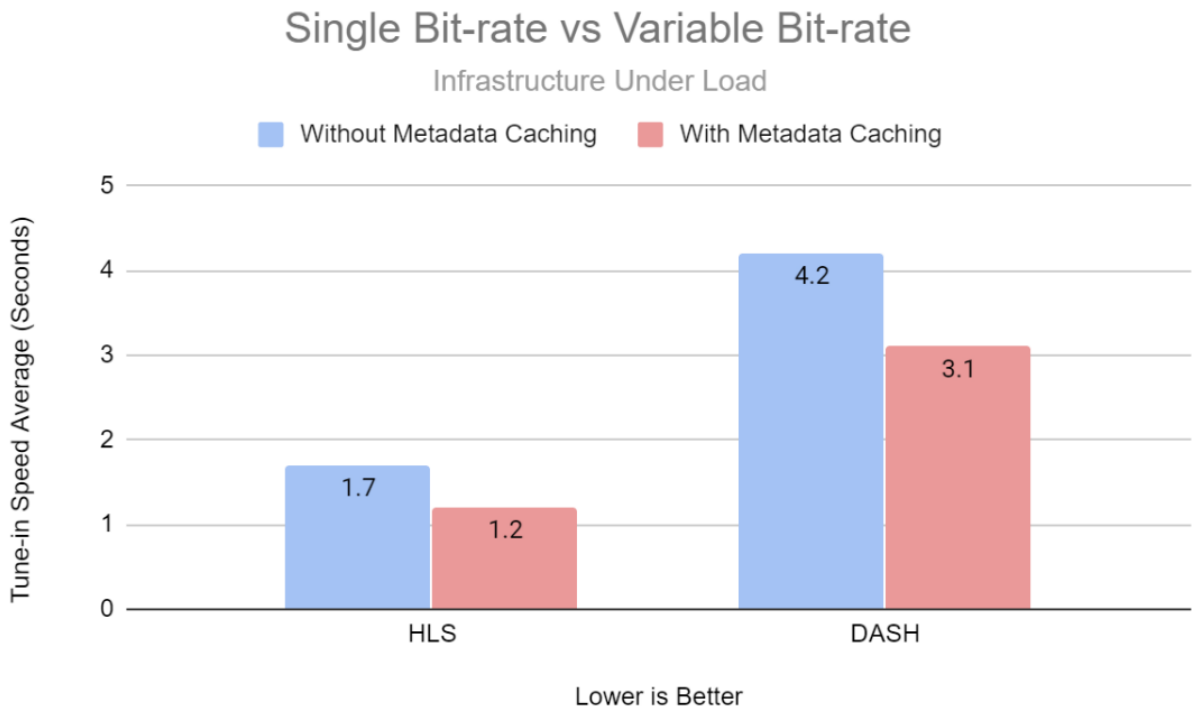
presents the basic idea of HTTP Adaptive Streaming (HAS), specifically providing some of the issues involved in this technology. Specifically, it introduces quality issues of HTTP live streaming bitrate adaptation methods.

In chapter 2, the researcher conducted a review of literature on similar studies previously completed on the quality of HTTP live streaming bitrate adaptation methods. It reviewed past studies on cache replacement modules, using multi-tier fog architecture, and the application of three-tier fragmentation systems. Common issues observed during HTTP adaptive streaming, bit-rate adaptation, cache partitioning, the results in bit-rate adaptation, replacing cache based on distance, and use of HTTP adaptive streaming were also reviewed. The review of a study by Fisher (2015) revealed that broadcast television is becoming obsolete for online media services because of the advancement of streaming solutions which leverage the robust internet networks. Further, the review established that content distribution networks (C.D.N) which entail performance, as well as video cache optimization, is crucial to the evaluation process (Fisher, 2015).

The review of work completed by Osuga, Asakura, and Taniguchi (2013, p. 1151) acknowledge that live streaming has gained popularity in recent times. The review identified a research gap that would need to be addressed, that is, the issue of commonplace evidenced in high-traffic usage. It emphasized the effective address for high-performance cache servers since ejection content appears to exhibit a higher probability of working status, especially in high traffic events.

In chapter 3, the researcher covered the methodology used to analyse the quality of HTTP Live Streaming bitrate adaptation methods with multi-tier caching servers. The chapter outlined the implementation method of various subsidiaries, including HLS & DASH video packaging and delivery, centralized storage with HDD and RAM-Disk infrastructure, and variable bitrate configuration for adaptive bitrate response. It also covered the subsidiaries of non-variable bitrate configuration, separate HLS and DASH video re-packaging using cache modules, and IP based load

balancing implementation. The chapter also presented the adopted testing methods and the study research limitation. The adopted testing methods for this study comprised the comparison of HLS and DASH performance, HDD based storage compared with Cache based storage, adaptive bitrate versus single bitrate comparison, single node versus dispersed caching nodes, and load-balanced set-up versus point to point.



In Chapter 4, the study presents the results of the analysis obtained from the quantitative data collected through a multitude of performance as well as qualitative tests conducted on the Video-On-Demand platform utilizing JMeter for reliable as well as accurate results. The findings obtained were contrasted with the previous studies reviewed in the second chapter of this study. The comparison was done to ascertain areas of similarities or differing opinions. On the observation of the quality of the live stream, the findings established that a non-adaptive stream quality is achieved from the stream's capability of not dropping the frames because both streams are HTTP-based, have similar technologies, and possess similar quality. Nonetheless, the study observed an 8 percent increment in HLS dropped frames. The study recommended the

development of adaptive bit-rate streams to improve the viewer experience and minimize the chance of drooped frames and buffering.

On tests done on adaptive bit-rate versus single bit-rate comparison, the findings of the study proved that both DASH and HLS are similar. However, both exhibited more critical performance results in different instances. The study established that the DASH variable bit-rate potentially swap between various bit-rate more coherently and tune-in faster as well as consistently compared with HLS. On HDD based storage versus cache based storage, the study found that despite RAM-based disks being faster compared to traditional drives when simultaneously accessing small volume of content, that is, 2 second video segments, the RAM storage suffer the limitation of the process to obtain the location of the video data as well as metadata.

The findings obtained from the comparison of single node versus dispersed caching modules, the test results showed a substantial decrease of dropped frames as well as buffering time. The outcome of this observation demonstrates the fact that 100 clients differed between four dissimilar cache servers, as well as the additional transmission between the cache server and VOD server, has substantially decreased.

References

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