A Study on Adaptive Based HEVC 3D Multi-view Video Streaming over P2P Network

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Abstract. 3D multi-view video streaming has high data transmission as it must transmit multimedia more than several times of regular streaming. Besides, network throughput is unstable due to inherent limitations of network infrastructure, which degrades video quality streaming. Consequently, in this paper, we present a study on adaptive based High-Efficiency Video Coding with three dimension multi-view streaming over the peer-to-peer network. First, we encode video before transmitting over the peer-to-peer network. Then, we carry out the research of transmitting multi-view data over multi-path. Experiment result shows that transmitting high-volume data over multi-path network channel improves streaming quality significantly.

Keywords: HEVC, 3D Multi-view, Multi-path, Adaptive streaming, P2P, Video streaming.

1 Introduction

Since the emergence of the Internet, multimedia became an essential part of serving services. Nowadays, people interest in high-volume multimedia streaming such as ultra-high definition video streaming over the Internet, virtual reality, etc. This demand posed many challenges of network delivery. As addressed in [1], we first had the problem of variable bandwidth, packets loss, and delay since the best effort nature of the Internet. Besides, compression techniques are incredibly vulnerable to missing data at the client side. Finally, the heterogeneity of devices necessitates video streaming to adapt each device.

Recently, multi-view streaming is employed in many service providers due to its natural virtualization with different perspectives of view as shown in Fig. 1. In addition, the increasing popularity of smart portable devices, and their remarkable computing and networking capabilities open a range of exciting prospects for the

development of mobile 3D video applications. For instance, a spontaneous congregation of client devices can happen to independently record video content of a sporting event from different perspectives, at the same time. The clients may be interested in sharing their respective video feeds among themselves, for an enhanced visual experience of the event.

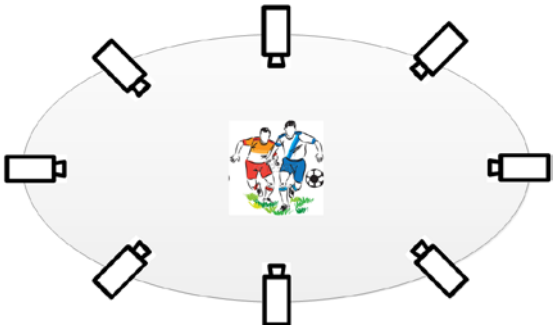

Fig. 1. Multi-view presented by multi-camera recording

Several approaches have been proposed to improve multi-view video streaming service, such as transmitting data in multi-path, using multi-view video coding, exploiting adaptive streaming to deal with network fluctuation, etc. However, these approaches still have some problems while delivering content over the Internet. Therefore, in this paper, we present a study on adaptive based High-Efficiency Video Coding (HEVC) [2] with three dimension multi-view streaming over the peer-to-peer network [3]. First, we encode video before transmitting over the peer-to-peer network (P2P). Then, we research transmitting multi-view data over multi-path.

The rest of paper is organized as follows. In section 2, we present related works which interest in multi-view video streaming. In Section 3, we introduce the multi-view streaming system with multi-path. In section 4, we describe our experiment and discuss the results achieved. Section 5 presents our findings with future research directions.

2 Related Works

Similar to our research, the authors [3] proposed a method which supported live streaming between different mechanisms over P2P. As a result, the technique could maintain a high performance at a low overhead in highly network fluctuating environments.

Our approach is based on an adaptive streaming 3D multi-view [4] with an extension to P2P network and multi-path streaming. In the found research, they showed that 3D video quality is significantly improved compared to traditional streaming approaches because they utilized the extra side information in view recovery of the media presentation description from dynamic adaptive streaming properties.

3 System Overview

In the system, we have four main components. First, multi-camera records scene from different views and depth. Secondly, the recorded data is transferred to encode and minimized storage space before storing in data servers. Thirdly, data servers represent as an agent to deliver streaming data to multi-user using the peer-to-peer network. Finally, a tracker tracks video streaming information of each participant in the P2P network. Fig. 2 shows the system with the mentioned components.

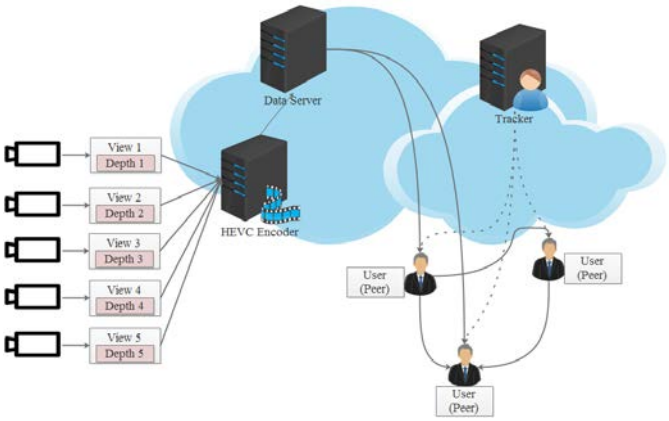

Fig. 2. HEVC based Multi-view P2P streaming overview

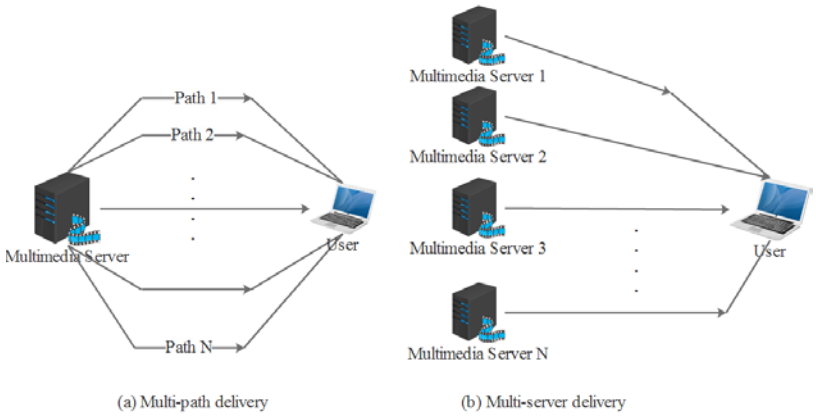

Fig. 3. Multi-path multimedia transmission

We deliver the recorded content by employing two methods as shown in Fig.3. First, using many data servers containing multi-part of content, each part is sent to a

user via multi-path. Secondly, a multimedia server can dispatch content in multi-path. These methods should ensure that more important data units must have a high priority to be sent in the high-quality path. By doing so, we can guarantee the streaming service is always available with the best quality.

4 Experiment and Discussion

We evaluate the performance system by implementing adaptive streaming servers, delivery servers and tracker servers for P2P network based on Node.js [5]. We set up a cloud using Docker [6] to virtualize network system and simulate delivery multi-path over the network. On the client side, we implement a web-based streaming application which is a hybrid content delivery network/P2P architecture for dynamic adaptive streaming over the hypertext transfer protocol.

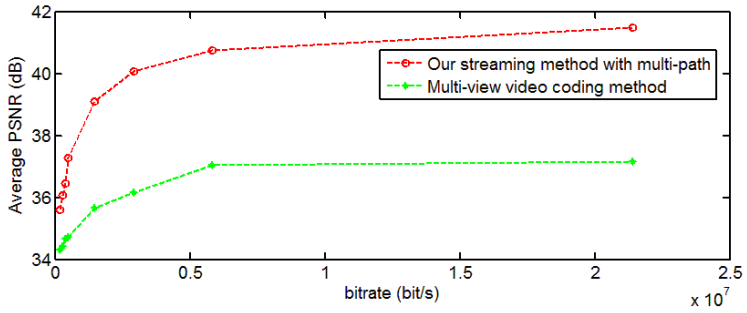

Fig. 4. Objective comparison of multi-view quality between our system streaming and multi-view video coding scheme

We experiment the system with a 3D video and compare the result with the streaming method in [4]. As shown in Fig.4, peak signal-to-noise ratio (PSNR) measurement in our method much higher than the based method in each adaptive streaming bitrate.

5 Conclusion

In this paper, we presented a study on adaptive based HEVC with 3D multi-view streaming over the peer-to-peer network. First, we encoded video before transmitting over the peer-to-peer network. Then, we carried out the research of transmitting multi-view data over multi-path. As a result, transmitting high-volume data over multi-path channel improves streaming quality significantly compared to traditional methods such as multi-view video encoding. In the future, we are intending to investigate transmission data over multi-path involving optimization path exploiting the Voronoi [8] region.

Acknowledgments

This work was supported by 'The Cross-Ministry Giga KOREA Project' grant from the Ministry of Science, ICT and Future Planning, Rep. of Korea (GK16P0100, Development of Tele Experience Service SW Platform based on Giga Media). Besides, this research was supported by Basic Science Research Program through the National Research Foundation of Korea (NRF) funded by the Ministry of Education, Science, and Technology (MEST) (Grant No. NRF-2017R1D1A1B03034429).

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