Seamless Video Streaming Algorithm Using Variable Media Chunk

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***Abstract*—This paper is about a seamless video streaming algorithm using variable media chunk in mobile devices and wireless networks. We propose a new video streaming algorithm using variable media chunk by changing the period of media chunk request time according to the wireless network signal strength and the network quality or status change such as bandwidth (bit rate) or handover between different networks. When we watch video contents using mobile devices, the proposed video streaming algorithm will be very effective for seamless video streaming service even in poor network quality or status situation.**

Keywords—Seamless video stream; Variable media chunk

I. INTRODUCTION

Lately, the number of mobile devices such as smartphone and tablet is increasing rapidly. Therefore the demand for video streaming services like mobile IPTV or YouTube is increasing also. Owing to the spread of high performance smartphones and 4G LTE services, mobile users can enjoy mobile multimedia services very easily and conveniently.

When we are watching a video using free Wi-Fi, 3G or LTE network at the public space or subway, sudden stopping or delaying of video streaming service is happening frequently. This happens when user is using call service or moving in the cell boundaries and network handover is not functioning well. And the Wi-Fi signal strength becomes weak when user is on moving. Then the video streaming service stops before the next media chunk is requested. If the weak Wi-Fi signal is not restored before the end of current media chunk reaches, the video streaming service stops. The conventional media chunk algorithm is not effective because the media service stops if network problem happens before the next media chunk is requested.

In this paper, we propose a seamless video streaming algorithm using variable media chunk. The proposed algorithm provides seamless video streaming service by controlling media chunk request time according to the wireless network signal strength and the network bandwidth change. Even though network quality problems such as network handover failure or bandwidth change happen, the algorithm can complete the requested media chunk download by varying media chunk size, media chunk compression ratio and media chunk request period from device to server.

II. VIDEO STREAMING ALGORITHM

A. HTTP progressive download

One of the mostly used mobile multimedia service applications, YouTube is using the algorithm shown in Figure 1 for requesting and transmitting video contents. HTTP progressive download shown in Fig. 1 downloads whole media file in one download request (HTTP GET). The "Gangnam Style" music video file of 88.8MB size, 4min. 12sec. length and 720p resolution can be downloaded within 40 seconds. If the user does not want to watch the video and stop playing at 40 seconds, then the unwanted video file of 3min. 32sec. length already downloaded to the user's device.

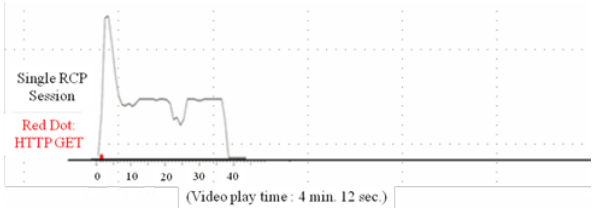

Fig. 1. HTTP progressive download

B. Media chunk download

In media chunk download, the video file in the server is divided into several media chunks before downloading, and each media chunk is downloaded from server to device upon request from the device as shown in Fig. 2. The "Gangnam Style" music video file is divided into 16 media chunks with each chunk size of 1.78MB. Chunks from 1 to 4 are downloaded first before playing the video in the device, and rest of chunks from 5 to 16 are downloaded continuously upon request during playing the video.

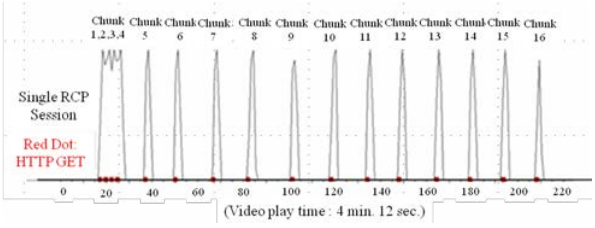

Fig. 2. Media chunk download

III. The Proposed Algorithm

The conventional video streaming algorithms using HTTP progressive download and media chunk download do not consider network quality or status change such as wireless signal strength, handover failure and bandwidth change etc. Therefore it has limitations to guarantee seamless video streaming services. The proposed video streaming algorithm uses the following procedure to ensure seamless video streaming service.

- Check wireless network signal strength and network quality change
- Varying media chunk request time, period, size and resolution upon network quality status
- Handover happens, device id. (call number, IP address, port number etc.) of the device is rechecked.

Fig. 3 is the procedure of media chunk request time change when Wi-Fi network failure and network handover happen.

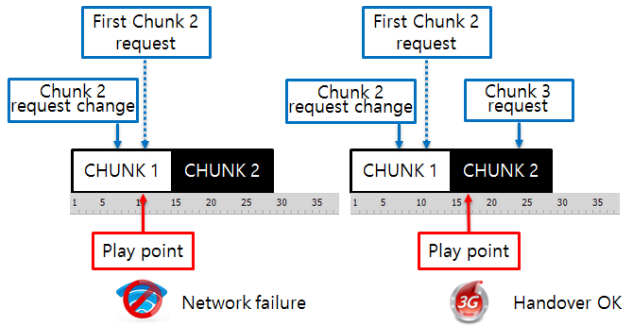

Fig. 3. Chunk request change upon Wi-Fi failure and 3G handover

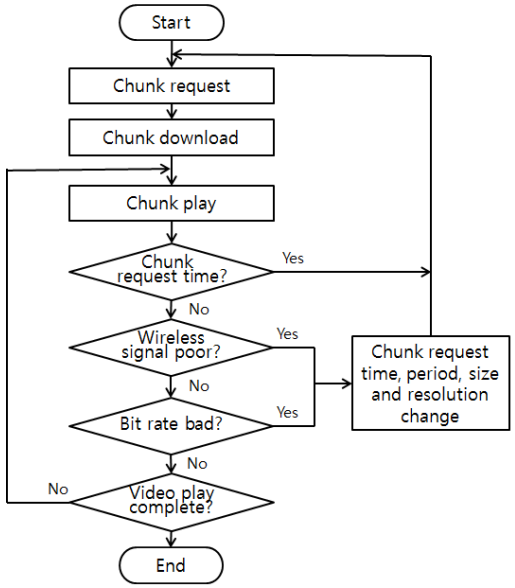

Fig. 4. Flowchart od the proposed video streaming algorithm

Fig. 4 shows the flowchart of the proposed video streaming algorithm using variable media chunk. The algorithm checks network quality or status change and changes media chunk request time, period, size and resolution repeatedly to complete the video playing seamlessly.

In order to determine the chunk request time and size, we measured wireless signal strength and data download speed using D-Link DIR-805L AP and LG Optimus G Pro as shown in Fig. 5. It shows download speed drops under 15Mbps below the signal strength of -50dBm.

From this results, we can determine the media chunk request time and bitrate. The chunk size of 1,000bitrate and 5sec. length is 1,000bitrate x 5sec. = 0.6MB. Because the 0.6MB chunk means 4.8Mbps, the chunk of 10sec. length needs 9.6Mbps speed for seamless transmission. The chunk request time can be determined by 3 times the network speed for seamless download. Then the bitrate of the chunk is network speed divided by time.

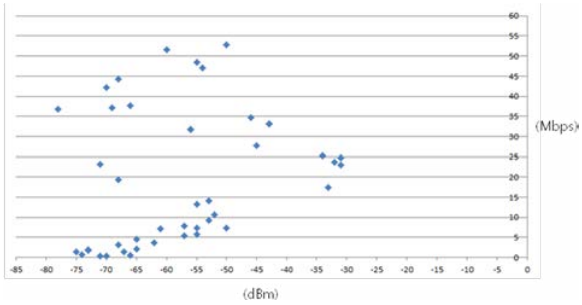

Fig. 5. Data download speed with Wi-Fi signal strength

IV. Conclusion

A new video streaming algorithm using variable media chunk has been proposed. The algorithm changes media chunk request time, period, size and resolution according to the network quality or status change. The effectiveness of the algorithm has been tested and compared with the conventional algorithms for seamless video streaming service.

Acknowledgment

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