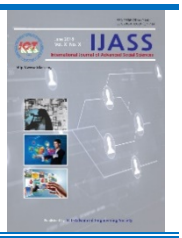
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Ensure DASH-based video quality in wireless environments

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Abstract

Dynamic adaptive streaming for HTTP (DASH) is an adaptive bitstream streaming technology that can adapt to network conditions using an HTTP web server. In a wireless environment, a typical DASH player does not guarantee the quality of experience because it does not take into account the radio channel conditions. To solve this problem, we evaluate the performance of the proposed DASH player based on the DASH reference player. In the wireless environment it is found that when the current radio signal strength indicator (RSSI) is worse than the existing one, the rate of downloading the media file is reduced by up to 3 times. In case of low rate of RSSI and the bandwidth as compared to wire, the rate of loss and instability of environment are taken into consideration Even if the response time for a segment or media file is fast.

Keywords*: mobile platform, streaming technology, DASH, contents.*

1. INTRODUCTION

Recently, with the development of wireless network technology and demand of streaming service have increased in various environments such as mobile platform, PC, and TV. Typically, video streaming sites such as 'You Tube' and 'Vimeo' are increasing. Users are required to provide high-quality services. However, high-quality images are often served in a wireless environment because of the lack of bandwidth compared to the video capacity. In the streaming site, dynamic adaptive streaming over HTTP (DASH) is applied, and the majority of images are applied in wireless environment as well.

As the smart technology environment spreads and the contents market based on this spreads, the mobile field is now becoming a big trend in the world. On the evolving network base, smartphones are evolving into mobile contents consumption channels, and mobile contents market is also growing rapidly. Content is becoming competitive in the mobile market. In addition, video shooting and real-time sharing services of individual users are becoming popular. Many TV programs are often viewed on the Internet or on smartphones. If you can not see a program that is broadcasting at a certain time, you can watch it through a mobile device at a desired time, place, etc. without restraint through the replay service.

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As the service to share personal images and videos with other people such as' You Tube ',' Instagram ',' Ustream 'etc. has increased rapidly, users' content sharing needs have also been greatly activated. Activation of social media such as 'Facebook', 'Twitter', and 'Pinterest' provided a window to share content in real time. The deployment of high-speed broadband and mobile Internet infrastructure accelerated the proliferation of video sharing services as the ability to transfer large volumes of video quickly.

In recent years, there is a tendency that a service uses a smart phone to shoot a scene in real time and immediately share a new one. As the number of mobile streaming users grows, bandwidth or traffic problems or overloads are causing video clutter. DASH is a technique in which a user requests an image to a server according to the bandwidth used by the user, and a server receiving the image changes the quality of the image by sending an image to the user. By changing the quality of video streaming, the video quality is deteriorated even if the video quality deteriorates, so that real-time streaming is possible, which enables adaptive communication to the network environment [1-2].

2. DASH (DYNAMIC ADAPTIVE STREAMING FOR HTTP)

2.1 DASH Reference Client Algorithm

DASH has been applied to 'Google' 'You Tube' algorithm for automatic quality control for users' convenience. Many users are using video streaming on a variety of platforms including mobile or PC. When used in mobile, the RSSI is low, so even in unstable situations, it simply sees the video segment response to the request and chooses a higher video quality so that the throughput will continue to drop when throughput is poor. In this paper, we propose Mobile Dynamic Adaptive Streaming over HTTP (M-DASH).

The DASH Reference Client provided by the DASH Industry Forum, the basic DASH player, determines the video quality based on the response speed. At this time, the necessary elements are defined in MPD (Media Presentation Description), and there exists Video Bandwidth which is an important element for values calculated for determining quality such as $R_{Download}$ and R_{Switch}. In addition, the address of the video segment and the factors such as the address, frame, and total video time of the first start video for each quality are shown in Figure 1.

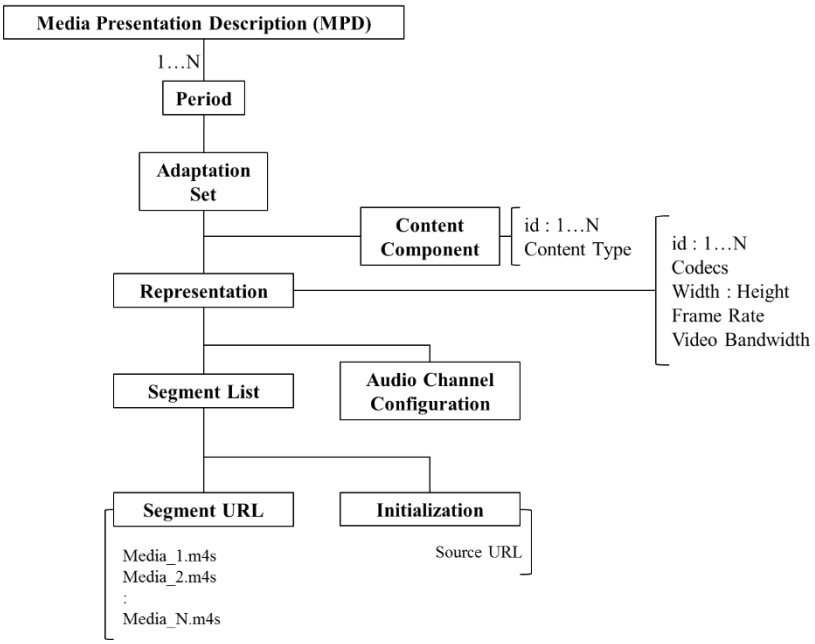


Figure 1. MPD structure

As shown in Figure 1, the client executes the algorithm using the values specified in the MPD file. The most important factor, Video Bandwidth, is different for each quality, and the higher the quality, the higher the value. When computing the algorithm using the values specified in the MPD file, the download time is first calculated as in equation (1).

$$T_{Download} = \text{Last Reques}_{Finish} - \text{Last Reques}_{Response} \quad (1)$$

At the time of receiving the last segment, the result of calculating the time when the last segment responded to the server and received by the client becomes Download Time or qq (Request Response Time), which is the time taken for downloading. This value is calculated as equation (2) using the Media Segment Duration (MSD) value specified in the Media Presentation Description (MPD) among the elements calculated in the request and response.

$$R_{Download} = \frac{MSD_{Last\ Request}}{T_{Download}} \times Download\ Ratio\ Safety\ Factor \quad (2)$$

The download rate or $R_{Download}$ is calculated by the MSD of the last requested segment. The minimum required bandwidth of the requested segment can be divided by the request response time and multiply by the Download Ratio Safety Factor to adjust the value of $R_{Download}$. The Download Ratio Safety Factor is defined as 0.75, not a fluctuating value. It exists as a protection aspect to drive the algorithm, and is omitted. $R_{Download}$ and a switch ratio or R_{Switch}, which is a value used as a comparison value to control the quality. Compared to $R_{Download}$, R_{Switch} is defined to increase quality if R_{Switch} is larger, and to $R_{Download}$ if quality is higher. The formula for R_{Switch} is (3).

$$Switch\ Ratio = \frac{Bandwidth_{OneUp}}{Bandwidth_{Current}} \quad (3)$$

R_{Switch} is the denominator of the video bandwidth required by the current quality level, and the video bandwidth above the current quality level is calculated as a numerator. With the calculated values, the client calculates the quality according to the network conditions and requests the corresponding segments soon. The server that receives the request exports the segments, and the client sees a higher quality image or a lower quality image.

Figure 2 shows the execution steps of the DASH Reference Client. The MPD file to the server is requested and downloaded and then the calculations of quality control can be prepared. When the first segment is requested, the initialized media image corresponding to the quality is downloaded from the server. The requested time and the downloaded time are calculated to determine the current network situation. After that, if the network situation does not change like the first situation, it requests the same quality segment again. In the second situation, the network is better and the download time is faster, so it is calculated whether the quality will be improved by one or more steps, and the server requests a higher quality video segment and initialization media image. The third situation is to request a higher quality video segment if it is determined that the response rate or the request speed is fast and the network situation can accommodate a higher quality video segment than the current video quality in the above manner. If the network situation is not good enough to accommodate the currently playing video segment in a situation where the network situation is worse than

the current one, the segment is requested by lowering the quality in one step or several steps [3-5].

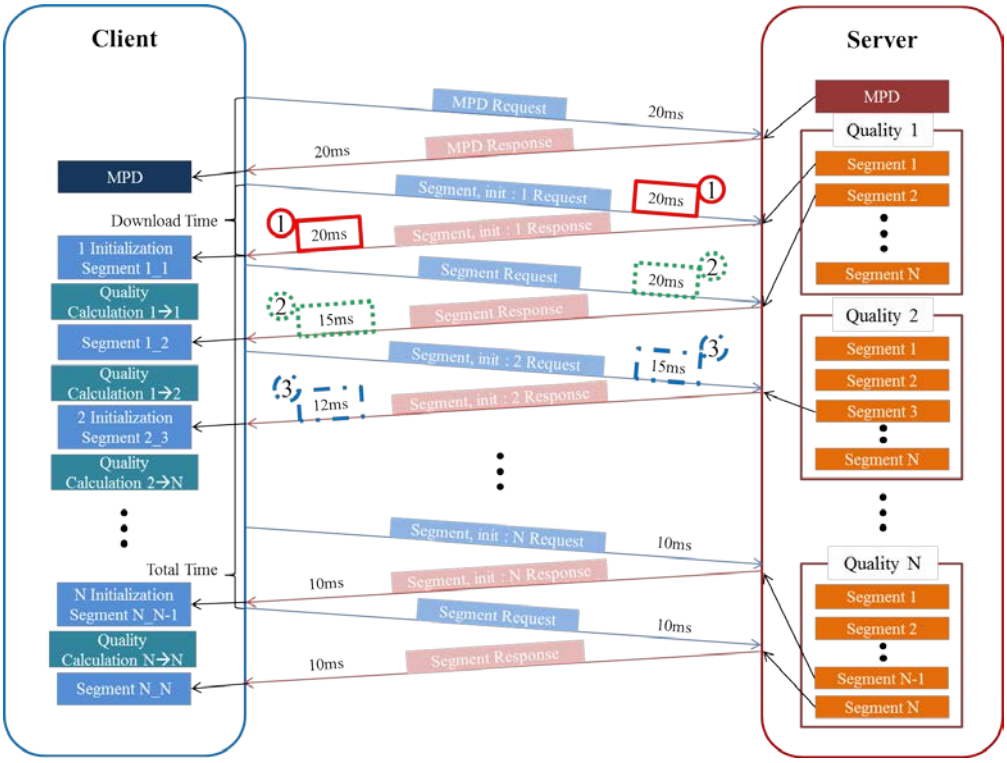


Figure 2. Server-Client communication flow

2. 2 M-DASH Algorithm

In this paper, we propose a modified DASH algorithm using RSSI. The rate of download referred to in Equation (2) is a very important factor in determining quality directly. By modifying the value with RSSI attached, it has a smaller value than the existing algorithm. In order for the receiving user to view the video without any interruption, it is necessary to consider that the characteristics of the wireless are the loss rate and instability, and the bandwidth is not higher than the cable. The RSSI is a unit of dBm and has a negative value. However, in order to apply the formula we calculate, we change it to a positive percentage because it is worthwhile to use it as a positive number. First, the RSSI value is defined as S_{i-1} and stored. The next RSSI value is S_i, which is calculated by comparing with S_{i-1}. Equation (4) shows the relationship between S_{i-1} andS_i, and 10000 of the denominator is determined based on the assumption that the signal strength is the best when the two signal values, S_{i-1} and S_i, are 100, which is the maximum signal strength [6-7].

$$RSSI\ Percentage = \frac{S_i \times S_{i-1}}{10000},\ (1 \le S_i, S_{i-1} \le 100) \tag{4}$$

Equation (5) represents the difference between the values of the two signals, S_{i-1} and S_i, as a ratio. The larger the difference, the sharper the signal, and the lower the value because it means that the signal received by the radio is unstable. The smaller the difference, the more stable the signal is received.

$$RSSI\ Subtraction\ Rate = 1 - \left|\frac{S_i - S_{i-1}}{S_i}\right|,\ (1 \le S_i, S_{i-1} \le 100) \tag{5}$$

The ratios of RSSI are determined by summarizing equation (4) and equation (5). equation (6) named RSSI Rate or S_{RSSI} is shown by multiplying RSSI Percentage and RSSI Subtraction Rate.

$$R_{RSSI} = \left(\frac{S_i \times S_{i-1}}{10000}\right) \times \left(1 - \left|\frac{S_i - S_{i-1}}{S_i}\right|\right), (-0.98 \leq R_{RSSI} \leq 1.00) \quad (6)$$

The calculated ratio has a range of $(-0.98 \leq R_{RSSI} \leq 1.00)$. In this case, the minimum value of -0.98 is the value when the current signal is 1 and the previous signal is 100, and the maximum value is 1.00 when the magnitudes of both signals are 100. When calculating the throughput, calculate the absolute value so that a positive value is obtained and a maximum value of 1 is added so that a positive value is obtained. Therefore, the equation applied to equation (2) can be expressed by equation (7).

$$R_{Download} = \frac{MSD_{Last\ Request}}{T_{Download}} \times \left(\frac{1}{|2.00 - R_{RSSI}|}\right) \quad (7)$$

After multiplying the omitted Download Ratio Safety Factor, the value of $R_{Download}$ will be much smaller than the existing one.

3. CONCLUSIONS

In the case of a mobile device that mainly uses the internet in a wireless environment, it uses a mobile communication network such as WiFi or 3G or 4G, and measures information (SSID) and signal strength (RSSI) of a connected device. 'You Tube' is already based on DASH, so it calculates the quality of bandwidth and sends out the best quality image to the user by calculating the quality. However, it is inconvenient to continue to say 'Please wait a moment'. In order to solve these problems, the proposed 'M-DASH' is meaningful to supplement user's network measurement. By measuring the RSSI received by the wireless device and applying it to the algorithm, it can be improved the disconnection but not its quality which is bettern than than using DASH in a wired environment.

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