

論 文 要 旨

Thesis Abstract

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主論文題名 (Title)			
REDUCING QOE LOSS AND DATA WASTAGE OF MOBILE SHORT-FORM VIDEO STREAMING WITH HTTP/3 PRIORITIZATION			
内容の要旨 (Abstract)			
<p>Nowadays, mobile short-form video streaming platforms, such as TikTok or Youtube Shorts are the key entertainment applications on mobile devices. Unlike traditional video streaming services, the short-form video application serves the user with endless short videos selected based on his/her preferences, subscriptions, or based on current trends. However, it is highly possible that a selected video is not in the user's interest. In this case, the user can conveniently scroll the screen to skip to the next video in the playlist. Although such a scrolling feature helps the user easily search for interesting videos, it leads to an emerging problem.</p> <p>Mobile short-form video streaming adopts HTTP-based streaming, where the client's video player downloads the video content (i.e., buffers the video) as ordered video segments of fixed duration to its playback buffer and plays them chronologically. Usually, the video player would buffer as many video segments as possible prior to the current playback in order to prevent playback stalls (i.e., unintentionally pauses due to no available segments in the buffer), thus avoiding the loss of the user's quality of experience (QoE). Also, as the currently-viewing video can be skipped at any time, the pending videos in the playlist must be buffered in advance (i.e., prebuffer) to their own pending video prebuffers to prevent playback stalls at their viewing turns. Such a mechanism is beneficial for short-form video streaming services as they are mainly used over mobile networks, which are well-known for their instability characteristics.</p> <p>However, when a video is skipped by the user, the unplayed downloaded segments are completely discarded, meaning that the data traffic on the network for downloading those segments is wasted. Such a data wastage problem consumes the operational costs of the providers and drains out the available mobile network quotas of the users. In fact, data wastage can be reduced by simply limiting the number of buffered or prebuffered segments. Nevertheless, it would expose the video player to a higher risk of playback stalls and causes QoE loss.</p>			

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<p>Realizing the above shortcomings, this dissertation proposes a solution to optimizing the user's QoE while maintaining the least data wastage for short-form video streaming. Specifically, the proposed method buffers the viewing video and prebuffers the pending videos simultaneously with respect to an optimized threshold. Such a threshold is based on an optimization of minimizing the risk of QoE loss caused by playback stalls and the risk of data wastage caused by downloading never-watched content.</p> <p>Moreover, to prevent the prebuffering process from deteriorating the bandwidth of the buffering process and causing playback stalls, the novel HTTP/3 prioritization is applied. That is, the buffering and prebuffering process are conveniently assigned the highest and lowest priority, respectively. Based on these settings, the transport QUIC of HTTP/3 can allocate higher bandwidth for the buffering process to ensure uninterrupted playback.</p> <p>Through evaluation, the proposed method is proven to provide the least QoE loss, data wastage, and a very balanced trade-off between them. Moreover, the crucial role of HTTP/3 prioritization in preventing bandwidth drop and avoiding playback stalls is clearly demonstrated.</p>			