IRate: Initial Video Bitrate Selection System for HTTP Streaming

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Motivation

HTTP streaming and DASH (Dynamic Adaptive Streaming over HTTP) tend to choose a low initial video bitrate to prevent clients from suffering a long buffering time. But delivering at a low bitrate may under-utilizes network resources and cannot provide the best QoE (Quality of Experience) to users [1]. Even though DASH ramps up the quality for fast clients during the streaming, frequent switching of bitrate can hurt the QoE. In this poster, we propose IRate which offers a light-weight, fast, and yet accurate decision-making for selecting the best initial video bitrate for given network condition.

System Overview

IRate measures the network path quality from the server side. It is easy to deploy, and offers light-weight network measurement which is supported by most platforms. Fig. 1 shows the overview of IRate which is an IP-less system installed in front of the web/video server. Hence, the modification required to the server and clients are kept to minimal. The server is only required to host a set of small-size probe kit scripts and slightly modify the web pages, whereas clients do not need to install any extra software.

IRate Probe Kit - It exploits the user think time to perform measurement. The probe script can be delivered and run together with the video site's front page. When users are choosing the video clips, the probe kit can measure the network at the background with TRIO [2]. The probe kit script is only responsible for establishing TCP connections to the IRate Probe Kit. In this demo, we show the Flash version of the IRate Probe Kit. The size of the compiled Flash object is only 24 KBytes.

IRate Quality Oracle - It determines the initial video bitrate according to the measurement results obatined by the IRate Probe Kit. The core of the oracle is a C4.5 decision tree as shown in Fig. 2. The decision tree used in this demo is trained with testbed results and can quickly determine the initial bitrate levels {240p, 360p, 480p, or 720p}. When users access the video loading page, the web server can read the decision and generate the respective URL of video object in the page. After that, the measurement flow stops and thus it will not compete network resource with the video flow.

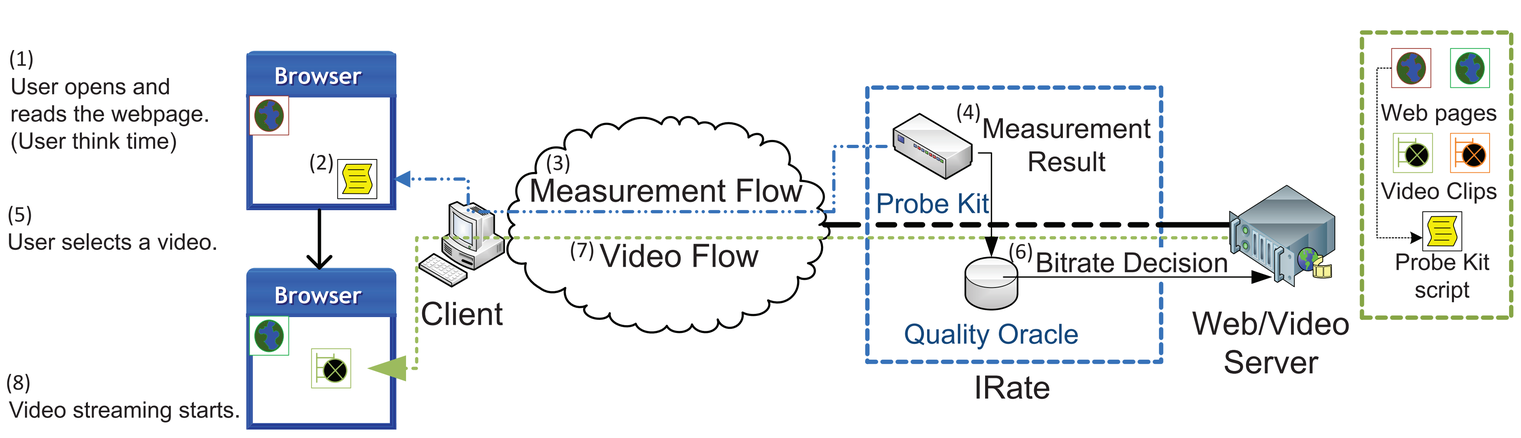

Fig. 1. An Overview of IRate.

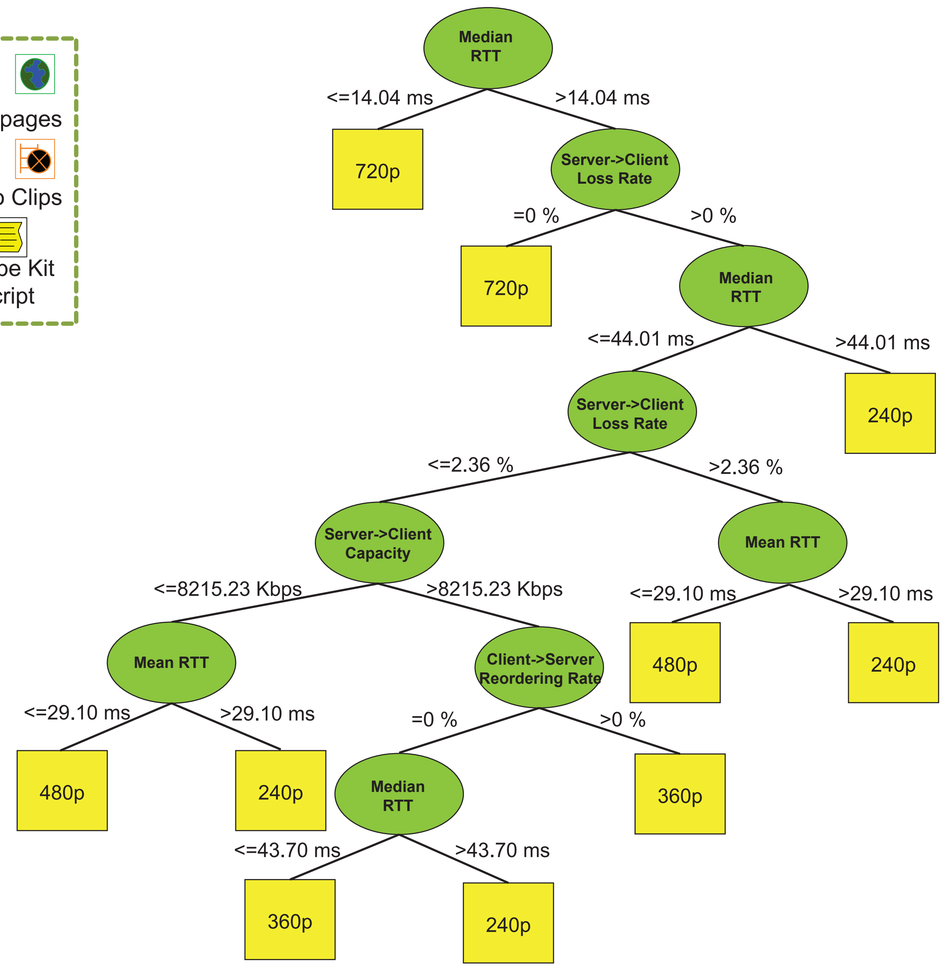

Fig. 2. The Decision Tree in the IRate Quality Oracle.

Results and Evaluations

We have performed testbed experiments under different path-quality conditions - Delay: {10, 40, 100} ms, Server->Client Loss Rate: {0, 2, 4} %, Client->Server Loss Rate: {0, 2, 4} %, Capacity: 10 Mbps. We measure the network path quality with the IRate Probe Kit for 120s, and then download a video clip.

Fig. 3 shows the accuracy of the IRate Quality Oracle against the duration of the probe kit measurement. We compare difference between the inital bitrate level chosen by the oracle and video downloading rate, e.g., 1 Level in Fig. 3 means the oracle under-estimated by one bitrate level. Our results show that the ratio of correct estimation (0 level in Fig. 3) increases from 73% to 85% as the measurement duration is increased from 5s to 15s. The result becomes stable after 15s. Only less than 10% of users used a one-level-higher initial bitrate (1 level in Fig. 3) than the TCP downloading rate.

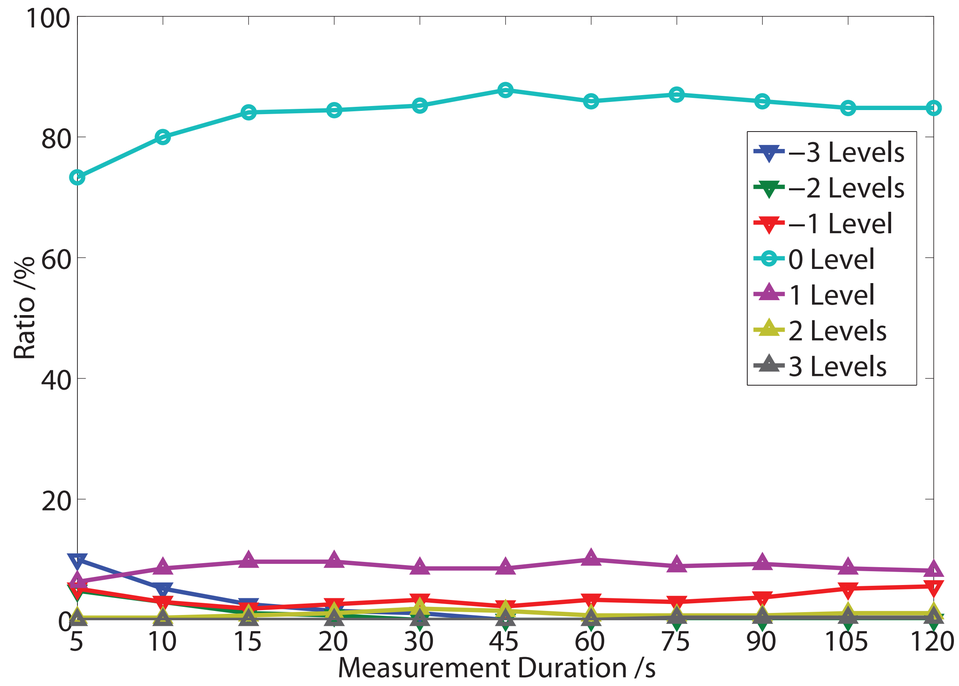

Fig. 3. Accuracy of IRate Quality Oracle.

References

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[2] E. Chan, A. Chen, X. Luo, R. Mok, W. Li, and R. Chang. TRIO: Measuring Asymmetric Capacity with Three Minimum Round Trip Times. In *Proc. ACM CoNEXT*, 2011.

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