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# YouTube QoE Monitoring with YoMoApp: A Web-based Data Interface for Researchers

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**Abstract**—In recent years, Quality of Experience (QoE) measurements have become an important means of determining customer satisfaction for a service on the Internet. With the tool YoMoApp exists an application that can determine the QoE for the most important video portal, namely YouTube. In this paper, we demonstrate and introduce the *YoMoApp Dashboard*, a web-based data interface for researchers. The dashboard allows the user to view and download his data as well as to display simple statistics. Researchers can independently conduct reliable QoE measurements and use and interpret the results in their own way.

## I. INTRODUCTION

Quality of Experience (QoE) measurements are important as they help to gain insight into customer satisfaction for a service on the Internet. Network operators use them to get information about the applications running on their network, mobile app developers get insight with QoE measurements, which feature is valued by the user and where there are any potential problems in the application. However, besides the benefits, it turns out that QoE measurements are challenging: the type of measurement is not easy to pin down, measurements need to be very well defined and set, and lastly, programming must be considered so that the measurement application does not affect the collection of measurement metrics [2].

YoMoApp is an established app publically available on the Google Play Store and first published in [2]. More than 3000 YouTube video sessions were measured worldwide with the app with over 70 different mobile service providers [3]. YoMoApp can measure QoE and QoE-related performance indicators (KPIs) on different layers by monitoring the YouTube session in the YoMoApp app. It also collects data about the device and the user context. All in all, YoMoApp makes it possible to measure performance indicators that are highly correlated to actual user QoE.

In this paper, we demonstrate the *YoMoApp Dashboard*, a web-based data interface for researchers. The dashboard allows the user to view and download their data and view simple statistics. Researchers can independently perform QoE measurements with the tested and mature YoMoApp, using and interpreting the results in their own way.

The remainder of this paper is structured as follows. First, we briefly introduce the YoMoApp in the Section II. After-

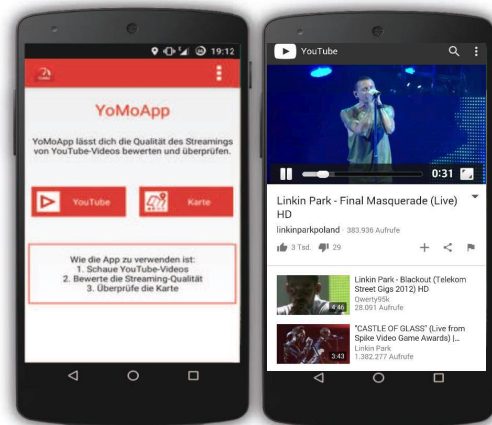


Fig. 1. Screenshot of the YoMoApp.

wards, we describe the *YoMoApp - Dashboard*. We conclude the paper in Section IV.

## II. THE YOMOAPP TOOL

The goal of YoMoApp is to provide a methodology to monitor application layer KPIs of YouTube that have a high correlation with the actual QoE of mobile app users. According to [1], the main influence parameters of the YouTube QoE are *stallings* and *video quality*. To obtain these parameters, we monitor the buffer and the resolution of the YouTube videos.

YoMoApp (YouTube Performance Monitoring Application) [2] fully replicates the original YouTube app in functionality and design. An Android WebView browser element is embedded to display the YouTube mobile web site on which HTML5 video playback, including adaptive streaming, is possible. Additional functions are added, which ultimately perform the monitoring of the application parameters in the newly created app. The monitoring is done at runtime via JavaScript, which queries the HTML5 *<video>* object.

An exemplary run for a YouTube measurement in their processed form can be found at [2]. After removing unusable runs and the recovery of missing events (e.g., stalling events can be estimated from buffer filling level), YoMoApp proved

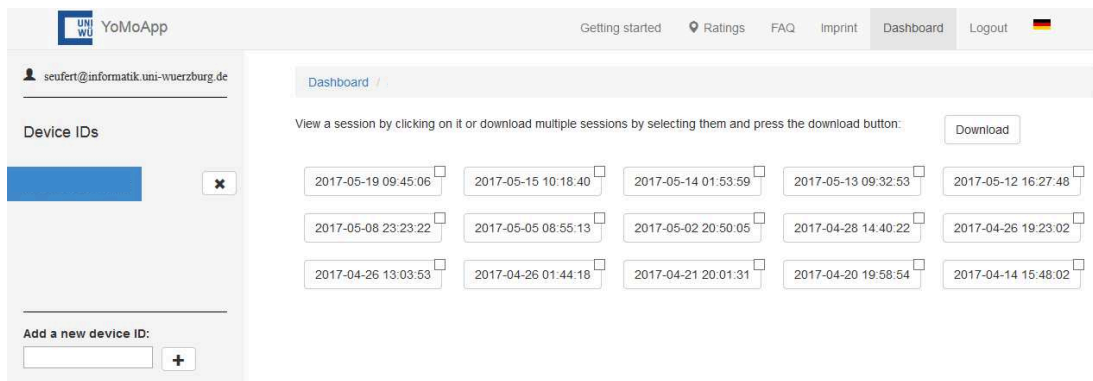


Fig. 2. YoMoApp Dashboard: <http://yomoapp.de/dashboard> [4]

to perform accurate measurements on a sufficiently small time scale ( $\sim 1$  s).

### III. YOMOAPP DASHBOARD: A WEB-BASED DATA INTERFACE FOR RESEARCHERS

In order to make the data of the app also available to the users, a web-based portal was created: <http://yomoapp.de/dashboard> [4]. It summarizes the measurement results and presents them in an overview. Fig. 2 shows the main page of the portal. The individual measurement parameters are grouped in separate logs and can be downloaded as simple structured text files. A user sees only his data, which he has measured with his smartphone. Using the Dashboard works in four steps:

Using the Dashboard works in four steps:

**Step #1:** Sign in with Google Account

**Step #2:** Add device ID (can be obtained in YoMoApp statistics view). Multiple devices can be added for one account.

**Step #3:** Select device and browse statistics of all YoMoApp sessions for this device.

**Step #4:** Download log files of single/multiple sessions.

In Table I, the available parameters are listed. Note that the obtained parameters can be displayed in YoMoApp for validation (see Table I). The parameters include above others: playout information (playtime, buffered playtime), event log information (device information, network information), statistics (streaming overview, user rating).

### IV. CONCLUSION

With the YoMoApp, there is a way to do QoE measurements for YouTube in a reliable way. In this demonstration, we show the YoMoApp dashboard for users and researchers, which aggregates the YoMoApp data and makes them available for download. Downloadable data include device characteristics,

streaming data, network statistics, and subjective feedback, which is measured through the Android app (screen size, volume, location, cell id, RAT, throughput.). In the demonstration, we show the YoMoApp and dashboard on the fly and show how to use both tools in a joint way.

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- [4] [Online]. Available: YoMoAppDashboard:<http://yomoapp.de/dashboard>

TABLE I  
SELECTED PARAMETERS FROM THE YOMOAPP AND THE DEVICE, WHICH CAN BE DOWNLOADED VIA THE PORTAL.

Name	Description
<i>operator</i>	Mobile operator and country
<i>network switches</i>	Number of network changes
<i>screen</i>	Screen size and density
<i>buffered</i>	Average buffer level and maximum buffer level
<i>height/width</i>	Height and width of the video's display area in CSS pixels
<i>played</i>	Number of pause events and play-time log
<i>currentTime</i>	Current video playtime
<i>youtubeId</i>	Object indicating YouTube identifier of the video content and title
<i>timestamp</i>	Timestamp of the data query
<i>name</i>	Pre-defined device name
<i>session timestamp</i>	Session timestamp to identify the YouTube session.
<i>engagement</i>	User engagement in %
<i>quality</i>	Number of quality switches
<i>stalling</i>	Number of stalling events and stalling duration
<i>rating</i>	Subjective rating results