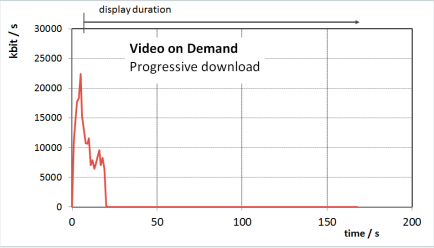
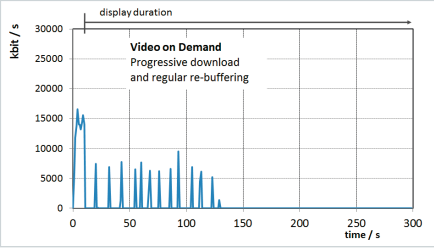
Video quality testing in mobile networks

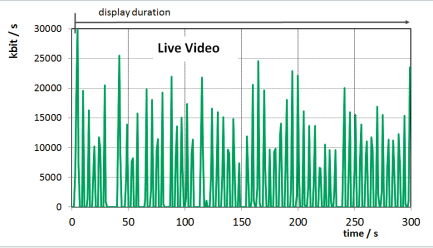
This application card highlights best practices for testing the quality of video services over a mobile network and discusses the different types of video services, including recent changes in video streaming applications.

Network resource usage varies depending on the video delivery methods that are applied. All video services have in common that the video client (on the smartphone) requests and starts to receive encoded video information from a content server, usually a third-party company and outside of the MNO's network. After buffering a certain amount of video, the video starts playing on the smartphone. There are different strategies for how the rest of the video file will be transmitted to the smartphone buffer (see figures below):

- Complete download
- Progressive download (red line)
- Chunk-wise transmission of video sections (blue line)
- Near realtime streaming (green line).







Your task

Video services by far demand the biggest chunk of data in today's mobile networks, and its share of data consumption will increase to 75% by 2020 according to the Cisco Visual Networking Index (VNI) 2016 forecast. There is also a general tendency towards higher resolutions in line with increasing transport capacities and high-resolution screens on smartphones and users' associated expectations. Thus, the performance of video services significantly impacts customer satisfaction. The decision to deliver higher or lower resolution and quality may have a considerable influence on a mobile network operator's (MNO) infrastructure due to the huge amount of data to be or not to be transmitted.

End user satisfaction is determined by waiting time (time to first picture), image quality and how fluently the video is played out (no freezing, sufficient frame rate). Video content providers are constantly adapting their compression, delivery and video buffering strategies to cope with imperfect networks, potential outages and bottlenecks and to find the best trade-off between these QoE factors.

Impact of network performance on video quality

Video transmission is almost never a continuous stream. Today it is much closer to a file download. If a part of the video has been stored in the buffer, there are always times where there is no transmission over the mobile network. This chunk-wise, file-like download covers many potential problems in the network, smooths over and bridges outages and declines in capacity. From a measurement point of view, the MNO would not get information in these times – problems remain invisible.

For file-like downloading and buffering, the client-to-server adaptation has some freedom to react to network issues. There are many fewer options for a realtime, live video. A more "live TV" streaming method requires a short delay to its origin and the video can hardly be buffered on the device. Therefore frequent and almost continuous data transmissions are required. This method relies more on the realtime capability of the mobile network. Because only small outages can be bridged by the buffer, there is a higher risk of video freezing. The network performance can be observed almost seamlessly because there is always activity on the network.

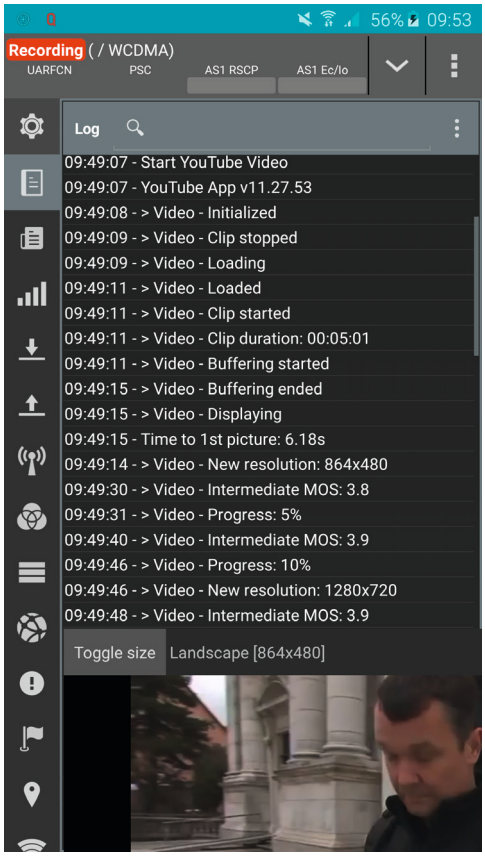
While video-on-demand is obligatory, live video is free-style. A network that is able to transmit a critical realtime live video in high quality will hardly have problems delivering video-on-demand.

T&M solution

It is valuable to measure technical key features such as resolution, frame rate, bit rate estimation and counting freezes, but ultimately all this just contributes to the quality perceived by the user. Video compression is highly scalable and based on the algorithm and its settings. For the same resolution and bit rate, the resulting image quality can be different. Therefore, an integrative, perception-based measure is the most reliable way to take into accounts all effects caused by compression and resolution degradation up to jerky video display and complete pausing of the video and combine them in a single score. These perceptual video quality measures are ideally based on direct image analysis, predicting a video MOS that relates to real user quality perception.

A widely accepted and standardized method for measuring perceived video quality is the prediction of mean opinion score (MOS). Recently, ITU-T approved ITU-T J.343.1 that was developed by SwissQual (an integral part of Rohde&Schwarz mobile network testing). This method analyzes the actually received video information and the displayed images to predict a visual quality as perceived by an average human viewer. Like a human viewer, the algorithm relies only on the received video. Because there is no need for a comparison to a reference source video, it is also applicable for live video. It can be applied to any of today's mobile video streaming services, even streaming encrypted content. This is also reflected in the recent ETSI TS 102 250-2 where J.343.1 is recommended as the visual quality measurement for all mobile video services.

This new video quality algorithm is made for use and execution on smartphones, is fully implemented under Android and is supported by all Rohde&Schwarz mobile network testing products – from the handheld QualiPoc Android up to a large-scale Benchmarker. The lean model can score arriving videos in realtime, even live video as the most critical test case for mobile networks. The evaluation of video quality is embedded in a fully automated test solution for video services, providing a comprehensive set of technical parameters and KPIs. Analyzing YouTube is the first realization in Rohde&Schwarz products and perfectly suited to cover the variable bit rates and resolutions that are currently used by YouTube.



Results and key benefits

With the Rohde&Schwarz video quality test solution, mobile network operators can verify whether the most popular video applications are running with good quality over their networks. Since the performance of video services has an essential impact on customer satisfaction, the ultimate benefits for mobile network operators are more satisfied subscribers, lower churn rate and being more attractive to competitors' users.

When the video quality of a video streaming service is measured, the performance of all parts of the transmission chain is analyzed, from the content server to the user device and the software client on the user device. The performance of the mobile network itself is only one of the performance drivers.

Additional information

For more information on the test and measurement solutions and products (such as QualiPoc Android and related products such as Freerider III and Benchmarker II) in this application card, please contact your Rohde&Schwarz sales representative or visit www.rohde-schwarz.com.

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