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SERIES P: TELEPHONE TRANSMISSION QUALITY,
TELEPHONE INSTALLATIONS, LOCAL LINE
NETWORKS

Models and tools for quality assessment of streamed media

**Video quality assessment of streaming services
over reliable transport for resolutions up to 4K
with access to transport and received pixel
information**

Recommendation ITU-T P.1204.5

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TELEPHONE TRANSMISSION QUALITY, TELEPHONE INSTALLATIONS, LOCAL LINE NETWORKS

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Summary

Recommendation ITU-T P.1204.5 describes the hybrid no-reference video quality estimation model for monitoring the video quality for streaming using reliable transport (e.g., hypertext transfer protocol- (HTTP)-based adaptive streaming (HAS) over the transmission control protocol (TCP), quick user datagram protocol internet connections (QUIC)). The estimate is validated for videos encoded with H.264, H.265 or video payload type 9 (VP9) codecs at any resolution up to 4K/ultra-high definition-1 (UHD-1) resolution for personal computer (PC) monitors and television (TV) and up to $2\,560 \times 1\,440$ for mobile (MO) and tablet (TA) displays.

The ITU-T P.1204 series of Recommendations provide sequence-related (between 5 s and 10 s) and per-1-second video-quality estimation. In principle, the per-one-second outputs of these video-quality models can be used together with an audio model for integration into audiovisual quality and, together with information about initial loading delay and media playout stalling events, further into a final per-session model output, an estimate of integral per-session quality (see, for example, ITU-T P.1203, ITU-T P.1203.2, ITU-T P.1203.3).

Recommendation ITU-T P.1204.5 was developed in collaboration with the Video Quality Experts Group (VQEG).

The ITU-T P.1204-series of Recommendations addresses three application areas:

- large-screen presentation as with fixed-network video streaming;
- mobile streaming on handheld devices such as smartphones;
- presentation on tablet-type devices.

History

Edition	Recommendation	Approval	Study Group	Unique ID*
1.0	ITU-T P.1204.5	2020-01-13	12	11.1002/1000/14158

Keywords

Adaptive streaming, IPTV, mean opinion score, mobile video, mobile TV, monitoring, multimedia, MOS, OTT, progressive download, QoE, TV, video.

* To access the Recommendation, type the URL <http://handle.itu.int/> in the address field of your web browser, followed by the Recommendation's unique ID. For example, <http://handle.itu.int/11.1002/1000/11830-en>.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure, e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

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As of the date of approval of this Recommendation, ITU had received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at <http://www.itu.int/ITU-T/ipr/>.

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Recommendation ITU-T P.1204.5

Video quality assessment of streaming services over reliable transport for resolutions up to 4K with access to transport and received pixel information

1 Scope

This Recommendation describes the hybrid no-reference video quality assessment model that together with audio and integration modules can be used to form a complete model to predict the impact of audio and video media encodings and observed Internet protocol (IP) network impairments on quality experienced by the end-user in multimedia streaming applications. The streaming techniques addressed comprise progressive download and adaptive streaming, for both mobile and fixed network streaming applications. The video quality modules can also be used stand-alone as a video quality prediction model.

The model defined covers the use-case of monitoring video quality where the video payload is fully encrypted and the pixel information is available e.g., from the client side.

The model described here is applicable to progressive download and adaptive streaming or other streaming applications with reliable transport, where the quality experienced by the end user is affected by video degradations due to coding, spatial re-scaling or variations in video frame rates. Quality assessment of adaptive streaming includes aspects of media adaptation that may be handled in integration modules such as [ITU-T P.1203.3], and not in the video modules in this Recommendation. This Recommendation is able to handle various video codecs (i.e., H.264, H.265/high-efficiency video coding (HEVC), video payload type 9 (VP9), resolutions up to 4K/ultra-high definition-1 (UHD-1) and frame rates up to 60 frames/s. The video-quality module Pv of [b-ITU-T P.1203], i.e., [ITU-T P.1203.1], only addresses H.264 and full high definition (HD) with up to 30 frames/s.

The model predicts a mean opinion score (MOS) on a five-point absolute category rating (ACR) scale (see [ITU-T P.910]) as an overall video quality MOS (5 s to 10 s). In addition to the overall quality score, this video quality model produces a per-one-second quality score, suitable for diagnostics or integration into an integral quality score for longer sessions (see, for example, [ITU-T P.1203.3] for 1 min to 5 min duration sessions).

The model associated with this Recommendation cannot provide a comprehensive evaluation of the video quality as perceived by an *individual end-user* because the scores reflect the perceived impairments due to coded video media data being transmitted over an IP connection with certain performance and do not include specific terminal device or user-specific information. The scores predicted by such a general quality model necessarily reflect *average perceptual quality*.

Effects due to source generations, such as signal noise, video shake, certain colour properties (and other similar video factors), and other impairments related to the payload, are not reflected in the scores computed by this model.

As a consequence, this Recommendation can be used for applications such as:

- in-service quality monitoring for specific IP-based audiovisual services, as specified in more detail in clause 6.1;
- performance and quality assessment of live networks (including video encoding) considering the effect due to encoding bitrate, encoding resolution, and encoding frame rate;
- laboratory testing of video systems;
- benchmarking of different service implementations.

In particular, targeted applications are progressive download streaming and adaptive streaming (using reliable transport), which includes the following.