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| **Keywords:** | QoS; QoE; driver distraction; car communications; video quality; SG12; |
| **Abstract:** | In line with WTSA-16 Resolution 1, this report provides updates about the SG12 lead study group activities. |

## Lead study group on quality of service and quality of experience

In the reporting period, SG12 held one study group meeting; one meeting of its Working Party 3 on Multimedia QoS and QoE; one meeting of its Regional Group on QoS for the Africa Region (SG12RG-AFR); one meeting of the Quality of Service Development Group (QSDG); and organized two workshops.

Since the last meeting of TSAG, new organizations have enrolled in ITU-T SG12 as new Associates, a positive trend that can be attributed to proactive outreach, technically sound outputs, and constructive and cordial working environment.

The executive summary of the May 2019 meeting can be found at <https://www.itu.int/en/ITU-T/studygroups/2017-2020/12/Pages/1905-summary.aspx>. A webinar ([announcement](https://news.itu.int/webinar-itu-standards-measure-ip-performance-4g-voice-quality/) | [recording](https://itu.int/en/ITU-T/studygroups/2017-2020/12/Documents/2019-05-16-webinar.mp4) | [slides](https://www.itu.int/md/T17-SG12-190507-TD-GEN-0924/en)) was held on 16 May 2019​ following the closing plenary, summarizing key meeting results.​

Among other achievements in the reporting period, the membership approved new and revised Recommendations developed by SG12, including Recommendations ITU-T

– E.806: Measurement campaigns, monitoring systems and sampling methodologies to monitor the QoS in mobile networks;

– G.107.1: Wideband E-model;

– G.107.2: Fullband E-model;

– G.1028: End-to-end quality of service for voice over 4G mobile networks;

– G.1028.2: Assessment of the LTE circuit switched fall back - impact on voice QoS;

– P.64: Determination of sensitivity/frequency characteristics of local telephone systems;

– P.700: Calculation of loudness for speech communication; and

– P.863.1: Application guide for Recommendation ITU-T P.863.

Recommendation ITU-T E.806 and draft new Recommendation ITU-T E.805 on strategies to establish quality regulatory frameworks (currently in TAP consultation), in particular, are addressing WTSA Resolution 95, ITU Telecommunication Standardization Sector initiatives to raise awareness on best practices and policies related to service quality. Several other related work items are nearing completion.

Following over 20 years as an in-force Recommendation, the 2019 Edition of Recommendation ITU-T Y.1540 Internet protocol data communication service – IP packet transfer and availability performance parameters, currently undergoing Additional Review, recognizes many changes in the design of IP services and in the protocols employed by end-users.

It introduces the new Annex A that defines IP-layer Capacity parameters in ways that cater toward assessment, and provides requirements for methods of measurement of IP-layer Capacity.

This new Annex is the result of years of study, and application of ITU-T Study Group 12 principles of accurately evaluating performance parameters and methods of measurement against a “ground truth” reference in laboratory and field measurements.

Flow-related Throughput Parameters and Methods of Measurement (Reliable delivery transport), remain for further study, and the text makes a clear distinction between this IP-layer Capacity parameters. In the same way, parameters describing performance of a specific reliable transport layer protocol (TCP) remain for further study, and recognize that reliable transport protocols for the Internet are constantly changing and the subject of on-going research.

SG12 completed the work at a time in which TCP transport is rapidly being replaced by UDP transport, payloads with open and encrypted portions, and application-layer retransmission and congestion-control.

The use of Google QUIC and impending approval of IETF QUIC will rapidly change the transport landscape of the Internet, and consumers using popular browsers are/will be among the earliest adopters, a trend acknowledged by the recent CTO Meeting and Study Group Leadership Assembly.

The updated text is coordinated and aligned with related relevant work in ETSI, BBF, IETF, among others. The work was discussed in depth in the workshops on performance, QoS and QoE convened in the reporting timeframe in Kigali and Singapore. The events convened leading vendors and service providers measuring internet performance and network diagnostics.

The updated Recommendation is also anticipated by the regulatory community as a means to accurately evaluating performance parameters and measuring IP-layer capacity, as opposed to relying on methods prone to significant measurement errors discussed elsewhere.

Achievements related to video communications and applications will be discussed below.

## Lead study group on driver distraction and voice aspects of car communications

Q4/12 on objective methods for speech and audio evaluation in vehicles held one rapporteur group meeting in the reporting period. The current focus of the work is on transmission characteristics for in car communication (P.ICC).

While completion is targeted for 2019, the work continues to witness great interest from the automotive industry.

SG12 is liaising with the newly established Focus Group on Vehicular Multimedia.

## Lead study group on quality assessment of video communications and applications

A table covering important elements of the work on this topic is made available in Annex.

**Annex: Recommendations and Work Items quality assessment of video communications and applications**

|  | **Recommendation** | **Title** | **Summary** |
| --- | --- | --- | --- |
| Factors or measurement parameters | G.1010 | End-user multimedia QoS categories | This Recommendation defines a model for multimedia QoS categories from an  end-user viewpoint. By considering user expectations for a range of multimedia applications, eight  distinct categories are identified, based on tolerance to information loss and delay. |
| G.1028.1 | End-to-end QoS for video telephony over 4G mobile networks |  |
| G.1032 | Influence factors on gaming QoE | This Recommendation describes the QoE factors of video gaming. |
| G.1080 | QoE requirements for IPTV services | This Recommendation defines user requirements for QoE for IPTV services. |
| G.QoE-VR  (ongoing) | Influencing factors on QoE for virtual reality (VR) services |  |
| G.QoE-AR  (ongoing) | QoE factors of augmented reality (AR) |  |
| G.MDKT  (ongoing) | Methodology for determining QoE-relevant KPI thresholds | This Recommendation will provide a methodology for selecting QoE-relevant KPIs (e.g., throughput) as independent variables and the per-session MOS predicted with a QoE model as a dependent variable |
| Planning models | G.1071 | Opinion model for network planning of video and audio streaming applications | This Recommendation provides algorithmic models for network planning of video and audio quality of IP-based video services. |
| G.1070 | Opinion model for video-telephony applications | This Recommendation defines an algorithm that estimates videophone quality for QoE/QoS planners. This model can be used by QoE/QoS planners to help ensure that users will be satisfied with end-to-end service quality. |
| G.OMG  (ongoing) | Opinion model for gaming applications |  |
| G.QUIT  (ongoing) | Objective model for assessing impact of initial loading delay on user experience |  |
| Monitoring models | P.1201 (PNAMS) | Parametric non-intrusive assessment of audiovisual media streaming quality | This Recommendation provides an algorithmic model for non-intrusive monitoring of the audio, video and audiovisual quality of IP-based video services based on packet-header information. Video resolution should be HD or below. |
| P.1203 (PNATS) | Parametric bitstream-based quality assessment of progressive download and adaptive audiovisual streaming services over reliable transport | This Recommendation provides model algorithms for monitoring the integral media session quality for TCP-type video streaming. Supported video resolution should be HD or below. |
| P.NATS-PH2  (ongoing in Q14, Recommendation planned end of 2019) | Parametric bitstream-based and pixel based quality assessment of progressive download and adaptive audiovisual streaming services over reliable transport for HEVC and UHD | This work extends P.1203 to UHD, and also includes pixel-based and hybrid model types. |
| P.NAMS-PH2  (ongoing in Q14) | Parametric Non-intrusive Bitstream Assessment for High Efficiency Video Coding (HEVC) and 4K Media Streaming Quality over UDP | This work extends P.1201 to UHD. |

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