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SERIES G: TRANSMISSION SYSTEMS AND MEDIA,  
DIGITAL SYSTEMS AND NETWORKS

Multimedia Quality of Service and performance – Generic  
and user-related aspects

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## Opinion model for video-telephony applications

Recommendation ITU-T G.1070



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# Recommendation ITU-T G.1070

## Opinion model for video-telephony applications

### Summary

Recommendation ITU-T G.1070 proposes an algorithm that estimates videophone quality for quality of experience (QoE)/quality of service (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. The model provides estimates of multimedia quality that take interactivity into account and it allows planners to avoid under-engineering.

The application of this Recommendation is limited to QoE/QoS planning. Other applications such as quality benchmarking and monitoring are outside the scope of this Recommendation.

### History

| Edition | Recommendation             | Approval   | Study Group | Unique ID*                                                                |
|---------|----------------------------|------------|-------------|---------------------------------------------------------------------------|
| 1.0     | ITU-T G.1070               | 2007-04-22 | 12          | <a href="http://handle.itu.int/11.1002/1000/9050">11.1002/1000/9050</a>   |
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### Keywords

MOS, multimedia, opinion model, QoE, QoS, quality planning, subjective quality, video telephony.

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\* 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>.

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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.

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As of the date of approval of this Recommendation, ITU had not 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 G.1070

## Opinion model for video-telephony applications

### 1 Scope

This Recommendation describes a computational model for point-to-point interactive videophone applications over IP networks that is useful as a quality of experience (QoE)/ quality of service (QoS) planning tool for assessing the combined effects of variations in several video and speech parameters that affect the QoE. This model can be used by QoE/QoS planners to help ensure that users will be satisfied with end-to-end service quality. Actually, they want to avoid under-engineering. Network, application and terminal quality parameters of high importance to QoE/QoS planners are incorporated into this model.

The model provided in this Recommendation needs to be a flexible tool capable of providing feedback on individual qualities as well as overall quality.

This Recommendation is very different from [ITU-T J.148] in terms of input parameters. In this Recommendation, multimedia quality is calculated by using network, application and terminal equipment parameters, whereas in [ITU-T J.148], the calculation is done by using speech and video signals.

This Recommendation assumes videophone applications using dedicated videophone terminals, desktop PCs, laptop PCs, personal digital assistants (PDAs) and mobile phones. The speech bandwidth is limited to the telephone band (300-3400 Hz).

The application of this Recommendation is limited to QoE/QoS planning. Other applications such as quality benchmarking and monitoring are outside the scope of this Recommendation.

### 2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- [ITU-T G.107] Recommendation ITU-T G.107 (2015), *The E-model: a computational model for use in transmission planning*.
- [ITU-T G.107.1] Recommendation ITU-T G.107.1 (2015), *Wideband E-model*.
- [ITU-T G.113] Recommendation ITU-T G.113 (2007), *Transmission impairments due to speech processing*.
- [ITU-T G.122] Recommendation ITU-T G.122 (1993), *Influence of national systems on stability and talker echo in international connections*.
- [ITU-T G.711] Recommendation ITU-T G.711 (1988), *Pulse code modulation (PCM) of voice frequencies*.
- [ITU-T J.144] Recommendation ITU-T J.144 (2004), *Objective perceptual video quality measurement techniques for digital cable television in the presence of a full reference*.

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- [ITU-T J.148] Recommendation ITU-T J.148 (2003), *Requirements for an objective perceptual multimedia quality model.*
- [ITU-T P.79] Recommendation ITU-T P.79 (2007), *Calculation of loudness ratings.*
- [ITU-T P.561] Recommendation ITU-T P.561 (2002), *In-service non-intrusive measurement device – Voice service measurements.*
- [ITU-T P.562] Recommendation ITU-T P.562 (2004), *Analysis and interpretation of INMD voice-service measurements.*
- [ITU-T P.563] Recommendation ITU-T P.563 (2004), *Single-ended method for objective speech quality assessment in narrow-band telephony applications.*
- [ITU-T P.564] Recommendation ITU-T P.564 (2007), *Conformance testing for voice over IP transmission quality assessment models.*
- [ITU-T P.800] Recommendation ITU-T P.800 (1996), *Methods for subjective determination of transmission quality.*
- [ITU-T P.833] Recommendation ITU-T P.833 (2001), *Methodology for derivation of equipment impairment factors from subjective listening-only tests.*
- [ITU-T P.834] Recommendation ITU-T P.834 (2002), *Methodology for the derivation of equipment impairment factors from instrumental models.*
- [ITU-T P.862] Recommendation ITU-T P.862 (2001), *Perceptual evaluation of speech quality (PESQ): An objective method for end-to-end speech quality assessment of narrow-band telephone networks and speech codecs.*
- [ITU-T P.862.1] Recommendation ITU-T P.862.1 (2003), *Mapping function for transforming P.862 raw result scores to MOS-LQO.*
- [ITU-T P.862.2] Recommendation ITU-T P.862.2 (2007), *Wideband extension to Recommendation P.862 for the assessment of wideband telephone networks and speech codecs.*
- [ITU-T P.910] Recommendation ITU-T P.910 (2008), *Subjective video quality assessment methods for multimedia applications.*
- [ITU-T P.911] Recommendation ITU-T P.911 (1998), *Subjective audiovisual quality assessment methods for multimedia applications.*
- [ITU-T P.920] Recommendation ITU-T P.920 (2000), *Interactive test methods for audiovisual communications.*
- [ITU-R BS.1387-1] Recommendation ITU-R BS.1387-1 (2001), *Method for objective measurements of perceived audio quality.*

### 3 Definitions

#### 3.1 Terms defined elsewhere

None.

#### 3.2 Terms defined in this Recommendation

This Recommendation defines the following terms shown in Table 1:

**Table 1 – List of definitions**

| Name           | Description                                                                                                                     | Unit   |
|----------------|---------------------------------------------------------------------------------------------------------------------------------|--------|
| $AD$           | Absolute audio-visual delay                                                                                                     | –      |
| $b_n$          | Video bit rate ( $n = 1, 2, \dots, N$ )                                                                                         | kbit/s |
| $Bpl_s$        | Speech packet-loss robustness                                                                                                   | –      |
| $Br_v$         | Video bit rate                                                                                                                  | kbit/s |
| $D_{bnfm}$     | Degree of video quality robustness against packet loss ( $n = 1, 2, \dots, N$ , $m = 1, 2, \dots, M$ )                          | –      |
| $D_{FrV}$      | Degree of video quality robustness due to frame rate reduction                                                                  | –      |
| $D_n$          | Degree of video quality robustness due to frame rate reduction ( $n = 1, 2, \dots, N$ )                                         | –      |
| $D_{PplV}$     | Degree of video quality robustness against packet loss                                                                          | –      |
| $f_m$          | Frame rate ( $m = 1, 2, \dots, M$ )                                                                                             | fps    |
| $Fr_v$         | Video frame rate                                                                                                                | fps    |
| $I_{coding}$   | Objective measurement of basic video quality accounting for coding distortion                                                   | –      |
| $I_{dd}$       | Degradation caused by pure delay in [ITU-T G.107]                                                                               | –      |
| $I_{dd,WB}$    | Degradation caused by pure delay in [ITU-T G.107.1]                                                                             | –      |
| $I_{dte}$      | Degradation caused by talker echo in a narrowband context                                                                       | –      |
| $I_{dte,WB}$   | Degradation caused by talker echo in a wideband context                                                                         | –      |
| $I_{e-eff}$    | Degradation caused by speech coding and packet loss in a narrowband context                                                     | –      |
| $I_{e-eff,WB}$ | Degradation caused by speech coding and packet loss in a wideband context                                                       | –      |
| $I_{es}$       | Speech coding distortion in a narrowband context                                                                                | –      |
| $I_{es,WB}$    | Speech coding distortion in a wideband context                                                                                  | –      |
| $I_n$          | Objective measurement of maximum video quality at each bit rate ( $n = 1, 2, \dots, N$ )                                        | –      |
| $I_{Ofr}$      | Objective measurement of maximum video quality at each bit rate                                                                 | –      |
| $MM_q$         | Objective measurement of multimedia quality accounting for the influence of speech and video quality and speech and video delay | –      |
| $MM_{SV}$      | Audio-visual quality                                                                                                            | –      |
| $MM_T$         | Audio-visual delay impairment factor                                                                                            | –      |
| $MS$           | Audio-visual media synchronization                                                                                              | –      |
| $Ofr$          | Optimal frame rate that maximizes video quality at each bit rate                                                                | –      |
| $O_n$          | Optimal frame rate ( $n = 1, 2, \dots, N$ )                                                                                     | –      |
| $Ppl_s$        | Speech packet-loss rate                                                                                                         | %      |
| $Ppl_v$        | Video packet-loss rate                                                                                                          | %      |
| $Q$            | Speech quality index                                                                                                            | –      |
| $R$            | Transmission rating factor                                                                                                      | –      |
| $S_q$          | Objective measurement of speech quality                                                                                         | –      |

**Table 1 – List of definitions**

| Name               | Description                                                                       | Unit |
|--------------------|-----------------------------------------------------------------------------------|------|
| $S_q(V_q)$         | Objective measurement of speech quality accounting for influence of video quality | –    |
| $TEL_R$            | Talker echo loudness rating in a narrowband context                               | dB   |
| $TEL_R, WB$        | Talker echo loudness rating in a wideband context                                 | dB   |
| $T_s$              | Speech delay                                                                      | ms   |
| $T_v$              | Video delay                                                                       | ms   |
| $V_q$              | Objective measurement of video quality                                            | –    |
| $V_q(S_q)$         | Objective measurement of video quality accounting for influence of speech quality | –    |
| $V_{qs}$           | Subjective video quality                                                          |      |
| $V_{qs}(b_n, f_m)$ | Subjective video quality under conditions of $b_n$ and $f_m$                      | –    |

#### 4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

|       |                                                 |
|-------|-------------------------------------------------|
| ACR   | Absolute Category Rating                        |
| AEC   | Acoustic Echo Canceller                         |
| BP    | Baseline Profile                                |
| CIF   | Common Intermediate Format (352 × 288 pixels)   |
| CT    | Codec Type                                      |
| ERL   | Echo Return Loss                                |
| HP    | High Profile                                    |
| KFI   | Key Frame Interval                              |
| LSA   | Least Square Approximation                      |
| MOS   | Mean Opinion Score                              |
| PDA   | Personal Digital Assistant                      |
| QCIF  | Quarter CIF (176 × 144 pixels)                  |
| QQVGA | Quarter Quarter VGA (160 × 120 pixels)          |
| QVGA  | Quarter Video Graphics Array (320 × 240 pixels) |
| RLR   | Receiving Loudness Rating                       |
| SLR   | Sending Loudness Rating                         |
| VDS   | Video Display Size                              |
| VF    | Video Format                                    |
| VGA   | Video Graphics Array (640 × 480 pixels)         |