

## Human Factors (HF); Quality of Experience (QoE) requirements for real-time communication services

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**ETSI**

650 Route des Lucioles  
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C  
Association à but non lucratif enregistrée à la  
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# Contents

Intellectual Property Rights .....	4
Foreword.....	4
1 Scope .....	5
2 References .....	5
2.1 Normative references .....	5
2.2 Informative references.....	5
3 Definitions and abbreviations.....	8
3.1 Definitions.....	8
3.2 Abbreviations .....	12
4 What is Quality of Experience (QoE)?.....	12
4.1 A definition of QoE for the current document.....	13
4.2 QoE and QoS.....	13
4.3 Usability and user experience.....	14
4.3.1 Technology-centred approach: Quality of Service (QoS).....	15
4.3.2 User-centred approaches: QoE and User-perceived QoS .....	15
4.3.2.1 Quality of Perception (QoP).....	15
4.3.2.2 Quality of Experience (QoE).....	16
4.3.3 The co-existence of QoS and QoE.....	17
4.4 The QoE context of the present document .....	17
4.4.1 The Choosing situation .....	18
4.4.2 The Usage situation .....	19
5 For whom are QoE data important? .....	20
6 How can QoE data help? .....	20
6.1 To prevent churn .....	20
6.2 To prevent product or service rejections .....	21
6.3 To optimise a product or service .....	21
6.4 By expressing QoE expressed in terms of QoS.....	21
7 Providing QoE data for real-time communication services.....	21
7.1 Real-time communication services.....	21
7.2 Guidelines development and dissemination .....	27
7.2.1 Guideline development .....	27
7.2.2 Guideline dissemination .....	29
8 Web-Based Guideline and Tutorial System for improved dissemination and application of QoE data .....	29
8.1 The main facilities of the web-based system.....	29
8.1.1 Navigation facility .....	30
8.1.2 Education facility .....	31
8.1.3 Dissemination facility .....	32
8.2 Types of Guidelines.....	32
8.3 Maturity and restrictions of the guidelines .....	34
8.4 Maintenance of the Web-based system .....	34
9 Towards generic QoE guidelines by including non real-time services .....	35
10 Conclusions .....	35
11 Recommendations for further work .....	35
11.1 Extend towards generic QoE guidelines.....	35
11.2 Document the user test framework and guideline derivation methodology in a separate ETSI document .....	36
11.3 Update the Web-Based Guideline and Tutorial System .....	36
History .....	37

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## Foreword

This Technical Report (TR) has been produced by ETSI Technical Committee Human Factors (HF).

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# 1 Scope

The present document is based on Guidelines produced in Specialist ETSI Task Force 354 and a Web-Based Guideline access and Tutorial System (WBGTS) ([http://portal.etsi.org/stfs/STF\\_HomePages/STF354/STF354.asp](http://portal.etsi.org/stfs/STF_HomePages/STF354/STF354.asp)). The main content of the WBGTS are Quality of Experience (QoE) guidelines for real-time communication services expressed in Quality of Service (QoS) terms.

The Guidelines and the present document are primarily intended for professionals in network operator, equipment manufacturer and service provider organisations who are concerned with the user experience of communication services. Over the last 10 years that include pre-cursor projects to STF 354 about 2000 intended guideline users have been involved in the development work of the WBGTS. The present document describes an assessment of the current guidelines and the tutorial system and identifies needs for future work.

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# 2 References

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## 2.1 Normative references

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## 2.2 Informative references

The following referenced documents are not essential to the use of the present document but they assist the user with regard to a particular subject area. For non-specific references, the latest version of the referenced document (including any amendments) applies.

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## 3 Definitions and abbreviations

### 3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

**asynchrony:** when audio and video information that leaves one communicating party at the same time is received by the other communicating party at different times

NOTE 1: E.g. typically the audio information arrives before the video information in an asynchronous situation.

NOTE 2: It is calculated as audio delay subtracted from video delay (e.g. if audio delay is 50 ms and video delay is 200 ms, then asynchrony is 150 ms; if audio delay is 100 ms and video delay is 50 ms, then asynchrony is -50 ms).

**audio communication:** use of a service that transmits voice in real-time over a telecommunication network, such as ordinary telephony with a handset and loud-speaking audio conferencing

**audio conferencing:** telephone service that does not rely on amplification of the voice signal in very close proximity to the recipient's ear

EXAMPLE: Loud-speaking audio communication.

**audio delay:** time required for an audio signal generated at the talker's mouth to reach the listener's ear

**audio protocol:** set of rules defining the way audio information is represented in a network

**audio telephony:** "ordinary" telephone service using a handset as distinct from loud-speaking audio conferencing

**avatar telephony:** service for transmitting voice signals in real-time over a telecommunication network in combination with a graphical (human) representation of the speaker

**bandwidth:** range of frequencies which can safely be conveyed in a communication channel

**burst packet loss:** loss of two or more packets in sequence

**communication media:** types of information with which humans communicate

NOTE: Examples are text, audio and moving image (graphics and video). This is consistent with the "Nature of information" component of the ETSI definition of a *representation medium*, which has various possible coded forms (ETR 160 [i.16]).

**communication service:** service that is provided via a telecommunication network

NOTE: Examples are audio-telephony, email, videoconferencing, avatar-telephony, audio conferencing.

**communication situation:** combination of task, motive, content and user (group) characteristics

**communication task:** what the end-users (want to) do with a communication service

NOTE: E.g. social chatting, buying or selling shares, conducting a job interview, etc.

**communicative behaviour:** end-user behaviour while using a communication service, including turn taking, interruptions, verbal and non-verbal back-channels and gaze



**conversational text:** See real-time text.

**data communication:** use of a service that transmits personal computer-based information (e.g. presentation slides)

**data conferencing:** See data communication.

**duration:** length of time of the communication task

**dyadic communication:** (distance) communication between two people

**effectiveness:** accuracy and completeness with which specified users can achieve specified goals in particular environments

NOTE: See ISO 9241 [i.27] definition.

**efficiency:** resources expended in relation to the accuracy and completeness of goals achieved

NOTE: See ISO 9241 [i.27] definition.

**end-users:** people who use a communication service

**fitness-for-purpose:** correct balance between technological performance and human performance, such that the interaction is both sufficient and beneficial for communication and consistent with human expectations

**frame-rate:** frequency by which a full video frame is updated, sometimes called video temporal resolution or image frequency

**group:** (distance) communication between three or more people

NOTE: Either in a point-to-point or a multi-point configuration.

**interpersonal perception:** extent to which the perception of the other person's attributes (how likeable, intelligent, friendly, etc.) is positive or negative

**media effects:** effect a particular communication medium has on an end-users task outcome, communicative behaviour, attitudes and beliefs

**media/medium:** See Communication Media/Medium.

**monitor size:** number in inches of the diagonal of the image screen on a screen

**multimedia communication:** use of a service that transmits voice, video and data signals in real-time over a telecommunication network

**multimedia conferencing:** service for transmitting voice, video and data signals over a telecommunication network

**multi-point:** distance communication between three or more locations

**network quality of service:** degree of conformance of the service delivered to a user by a provider with an agreement between them

NOTE: From ITU-T Recommendation E.860 [i.32].

**packet loss:** loss of one packet that can be described using a certain statistical model

**packet size:** magnitude of a data being transmitted over a packet switching network in number of Bytes

**personal involvement:** extent to which the communication parties are committed to the outcome of the task or perform the task more on behalf of another party than themselves

**point-to-point:** communication between two locations

**quality of experience (1):** measure of user performance based on both objective and subjective psychological measures of using an ICT service or product

NOTE 1: It takes into account technical parameters (e.g. QoS) and usage context variables (e.g. communication task) and measures both the process and outcomes of communication (e.g. user effectiveness, efficiency, satisfaction and enjoyment).

NOTE 2: The appropriate psychological measures will be dependent on the communication context. Objective psychological measures do not rely on the opinion of the user (e.g. task completion time measured in seconds, task accuracy measured in number of errors). Subjective psychological measures are based on the opinion of the user (e.g. perceived quality of medium, satisfaction with a service).

EXAMPLE: A service provider may conclude that a service with a certain level of QoS used for a particular communication situation offers users excellent QoE, whilst with a different level of QoS provides poor QoE.

**quality of experience (QoE) (2):** overall acceptability of an application or service, as perceived subjectively by the end-user

NOTE 1: Quality of experience includes the complete end-to-end system effects (client, terminal, network, services infrastructure, etc.).

NOTE 2: Overall acceptability may be influenced by user expectations and context.

NOTE 3: ITU-T Recommendation P.10 [i.37]/G.100 Amendment 2 definition.

**quality of service:** totality of characteristics of a telecommunications service that bear on its ability to satisfy stated and implied needs of the user of the service

NOTE: ITU-T Recommendation E.800 [i.31] definition.

**Quality of service delivered/achieved by service provider (QoSD):** statement of the level of QoS achieved or delivered to the customer

NOTE 1: Achieved or delivered QoS is expressed by metrics for the pertinent parameters for a service.

NOTE 2: ITU-T Recommendation E.800 [i.31] definition.

**Quality of service experienced/perceived by customer/user (QoSE):** statement expressing the level of quality that customers/users believe they have experienced

NOTE 1: The level of QoS experienced and/or perceived by the customer/user may be expressed by an opinion rating.

NOTE 2: QoSE has two main components: quantitative and qualitative. The quantitative component can be influenced by the complete end-to-end system effects (network infrastructure).

NOTE 3: The qualitative component can be influenced by user expectations, ambient conditions, psychological factors, application context, etc.

NOTE 4: QoSE may also be considered as QoS delivered/achieved by service provider) received and interpreted by a user with the pertinent qualitative factors influencing his/her perception of the service.

NOTE 5: ITU-T Recommendation E.800 [i.31] definition.

**Real-time (1):** describes information and communication technologies that are able to generate and deliver information in a time-frame similar to the real-life process that it is assisting

EXAMPLE 1: Real-time charging and billing information is to be generated, processed, and transported to a desired conclusion in less than 1 second

EXAMPLE 2: Refers to the generation of network management information in a time frame comparative to the real life process that it is controlling or monitoring

**real time (2):** Occurring immediately. The term is used to describe a number of different [computer](#) features. For example, real-time [operating systems](#) are [systems](#) that respond to [input](#) immediately. They are used for such tasks as navigation, in which the computer reacts to a steady flow of new information without interruption. Most general-purpose operating systems are not real-time because they can take a few seconds, or even minutes, to react. Real time can also refer to events simulated by a computer at the same speed that they would occur in real life. In [graphics animation](#), for example, a real-time [program](#) would display [objects](#) moving across the [screen](#) at the same speed that they would actually move.

NOTE: Wikipedia definition.

**real-time communication service:** service with which users expect to share information instantly and continuously with one or more other user

NOTE 1: A real-time communication service generates and delivers either text, audio, graphics, video and data or some combination of these communication media.

NOTE 2: The information sharing process occurs either by: (1) a person interacting via technology directly to another person (person-to-person) or; (2) a person interacting with a machine (person-to-machine).

EXAMPLE: An example real-time person-to-person communication service is videoconferencing and an example real-time person-to-machine communication service is Live TV.

**real-time computing:** study of [hardware](#) and [software](#) systems that are subject to a "real-time constraint", i.e. operational deadlines from event to system response

NOTE 1: By contrast, a non-real-time system is one for which there is no deadline, even if fast response or high performance is desired or preferred. The needs of real-time software are often addressed in the context of [real-time operating systems](#), and [synchronous programming languages](#), which provide frameworks on which to build real-time application software.

NOTE 2: Wikipedia definition.

**real-time text:** service for transmitting alpha-numeric characters in real-time over a telecommunication network

**Real-time Transport Protocol:** standardized packet format for delivering audio and video over the [Internet](#)

NOTE 1: RTP is frequently used in [streaming media](#) systems (together with the [RTSP](#)) as well as in [videoconferencing](#) and [push to talk](#) systems. For these it carries media streams controlled by [H.323](#) or [Session Initiation Protocol](#) (SIP) signalling protocols, making it the technical foundation of the [Voice over IP](#) industry.

NOTE 2: RTP is usually used in conjunction with the [Real-time Transport Control Protocol](#) (RTCP). While RTP carries the media streams (e.g. audio and video) or out-of-band signalling (DTMF), RTCP is used to monitor transmission statistics and quality of service [QoS](#) information. When used in conjunction, RTP is usually originated and received on even [port numbers](#), whereas RTCP uses the next higher odd port number.

NOTE 3: Wikipedia definition [i.44].

**remote inspection:** videoconferencing with video as data (e.g. for a remote person to see an object or environment rather than the person(s) with whom they are talking) (sometimes also called Tele-inspection and Tele-data)

**resolution:** term denoting the degree of detail which can be created by a particular visual display system expressed in pixels in x- and y-directions

**satisfaction:** comfort and acceptability of the work system to its users and other people affected by its use

NOTE: ISO 9241 [i.27] definition.

**situation formality:** relative amount of ceremonious or conventional communication versus casual or unconstrained communication

**task outcome:** extent to which task performance dependent on the medium

**task:** what users of *communicative technology* actually do in order to accomplish some *task goal*

NOTE: In experiments tasks may be described to the participants or they are embedded in scenarios as a part of a *situation*.

**telephony:** service for transmitting voice signals in real-time over a telecommunication network

**text communication:** use of a service that transmits alpha-numeric characters in real-time over a telecommunication network

NOTE: Also known as real-time text and conversational text.