

TECHNICAL REPORT



User's quality of experience on multimedia conferencing services – Part 1: General

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TECHNICAL REPORT



User's quality of experience on multimedia conferencing services – Part 1: General

INTERNATIONAL
ELECTROTECHNICAL
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CONFERENCING SERVICES –****Part 1: General****FOREWORD**

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Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Technical Report is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

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INTRODUCTION

With the global COVID-19 pandemic, business and education meetings have shifted from offline to online environments. Consequently, a range of multimedia conferencing services has been developed, enabling users to choose and enjoy conferencing services based on personal preferences. To ensure optimal user experience, it is essential to measure the quality of experience (QoE) for multimedia conferencing services. However, there is currently a lack of standardized methods for measuring a user's QoE in this context. Thus, there is a pressing need to provide guidelines for measuring and evaluating a user's QoE for multimedia conferencing services.

Traditionally, quality of service (QoS) has been measured for network data communication, represented by objective index values like delay, throughput, and jitter. In contrast, QoE represents a user's level of satisfaction with a specific service and reflects human emotional quality. As such, QoE is subject to overall service performance from the user's perspective. In the case of multimedia conferencing services, measuring QoE is challenging due to varying user preferences/requirements and service/application characteristics. Therefore, a unified framework is necessary to measure and evaluate a user's QoE for multimedia conferencing services.

This document aims to provide guidelines for enhancing a user's QoE for multimedia conferencing services. The series specifies general considerations and requirements to enhance a user's QoE and measurement methods for associated QoE parameters.

The IEC 63478 series consists of the following parts:

- Part 1: General;
- Part 2: Requirements; and
- Part 3: Measurement methods.

Part 1 of IEC TR 63478-1 (Technical Report) describes general considerations to measure user's QoE.

Part 2 of IEC 63478-2 (International Standard) describes the requirements to be considered to measure user's QoE.

Part 3 of IEC 63478-3 (International Standard) describes the measurement methods for QoE parameters.

USER'S QUALITY OF EXPERIENCE ON MULTIMEDIA CONFERENCING SERVICES –

Part 1: General

1 Scope

This part of IEC 63478 describes general considerations to be taken for measurement of a user's quality of experience (QoE) on multimedia conferencing services.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at <https://www.electropedia.org/>
- ISO Online browsing platform: available at <https://www.iso.org/obp>

3.1 Definitions

3.1.1

QoE

measure of delight or annoyance of a user's experiences for a multimedia service from the viewpoint of the entire service experience

3.2 Abbreviated terms

MCC	multimedia conferencing client
MCS	multimedia conferencing server
QMA	QoE measurement agent
QMM	QoE measurement manager
QoE	quality of experience
UI/UX	user interface/experience

4 Consideration on QoE

4.1 QoE characteristics

QoE refers to the quality that a user has experienced and perceived during a multimedia service. It can be represented by the subjective indicators of service users.

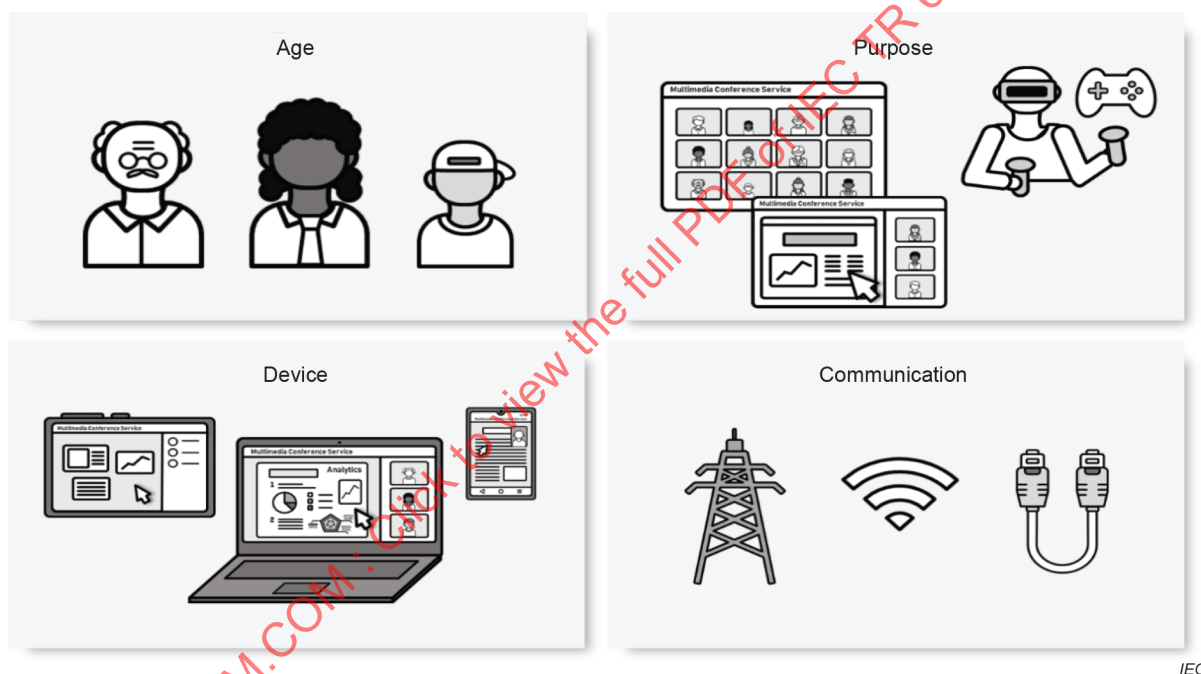
In general, QoE involves the subjective experience of users, and it might be possible to judge the QoE for a small number of people. However, it might be more accurate if the relevant data are collected from many people, if possible. A set of QoE parameters can be considered to measure a user's QoE. Such QoE parameters are associated with the functions that are

provided by the multimedia conferencing service and also the subjective quality experienced by the user. In addition, the emotions felt by each user can be considered to measure the user's QoE in a variety of ways. For example, QoE can be expressed as a simple expression of user satisfaction, such as a five-point satisfaction survey. Annex B provides various standards for measuring a user's QoE.

The QoE measurement is purposed to evaluate the user's satisfaction for a service and to help the user in choosing a specific service, as per their preference. This QoE measurement can also be used by service/application developers to provide much more enhanced services to users.

4.2 QoE requirements

The multimedia conferencing service refers to a service that allows users to participate in an online conference by using video and audio. It is noted that there can be many different requirements or preferences for a user's QoE on multimedia conferencing service, according to the age of user, the purpose of the service, the device used for the service, and the communication environment, as shown in Figure 1.



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Figure 1 – Various QoE requirements for multimedia conferencing services

- **Age**

The QoE requirements may depend on the age of the user. If the user is old age, a user might want large text rather than small text on the UI screen, and the user might focus on the volume and clarity of the audio, rather than the quality of the video. On the other hand, if the user is young, the user might focus on a high-quality image or video, rather than a high-quality voice.

- **Purpose**

The QoE requirements might also vary according to the purpose of the multimedia conferencing service. If it is used for group calls, the users want to focus on audio. On the other hand, the service for purpose of presentation will require an advanced functionality or UI to share documents, such as screen sharing. In addition, latency is important for a discussion, less so when giving a presentation.

- Device

The QoE requirements of users might also be different, depending on the type of device used in the multimedia conferencing service, such as a smartphone, a tablet, a laptop computer, and a smart TV.

- Communication

The QoE requirements might also be affected by the communication network environment in which the user is located, such as Wi-Fi, Ethernet, and cellular networks.

4.3 QoE parameters

The QoE parameters are used to evaluate the satisfaction level experienced by a user in a multimedia conferencing service. These QoE parameters include the specific functions of multimedia conferencing service and the user's opinion to represent its satisfaction level.

Table 1 shows some examples of QoE parameters that can be used for QoE measurement.

Table 1 – QoE parameters

QoE parameter	Description
Video quality	Indicates the satisfaction with the quality of the screen that the user has experienced during the multimedia conferencing services.
Audio quality	Indicates the satisfaction with the audio quality experienced by the user during the multimedia conferencing services.
Synchronization	Refers to the synchronization for video and audio playback and indicates the satisfaction with synchronization that the user has experience during the multimedia conferencing services.
Accessibility	Indicates how much the multimedia conferencing service can be easily accessed.
Inter-connectivity	Indicates how much the service can be easily linked with the other multimedia services, such as file sharing, screen sharing and whiteboard.
Openness	Indicates how much the service supports the compatibility with other applications during the multimedia conferencing services.
Participation	Represents how much the participant can actively participate in the meeting. For example, it represents functions such as raising hands during a meeting, chatting to answer questions and expressing emotions.
UI/UX	Indicates the quality of UI and UX experienced by users. For example, in the UX-Honeycomb model, the satisfaction level can be expressed by a total of seven scales.

5 QoE measurement framework

5.1 Functional entities

For QoE measurement, the following four functional entities are considered.

- Multimedia conferencing server (MCS)

An MCS is a server to provide a multimedia conferencing service. An MCS performs multimedia communication with an MCC during a multimedia conferencing service.

- Multimedia conferencing client (MCC)

An MCC is a client for a multimedia conferencing service, and it is implemented by a client program on the user's device. An MCC performs multimedia communications with an MCS.

- QoE measurement agent (QMA)

A QMA is used to measure the QoE parameter values by interaction with the MCS and the MCC. For QoE measurement, the QMA must be informed on QoE parameters to be measured from QMM before the QoE measurement operations begin. Based on this information, a QMA requests that the MCS and the MCC measure QoE parameters. In response to the QoE measurement request, the MCS and the MCC will send the measured QoE parameter values to the QMA, and the QMA will report the aggregated QoE parameter values to QMM.

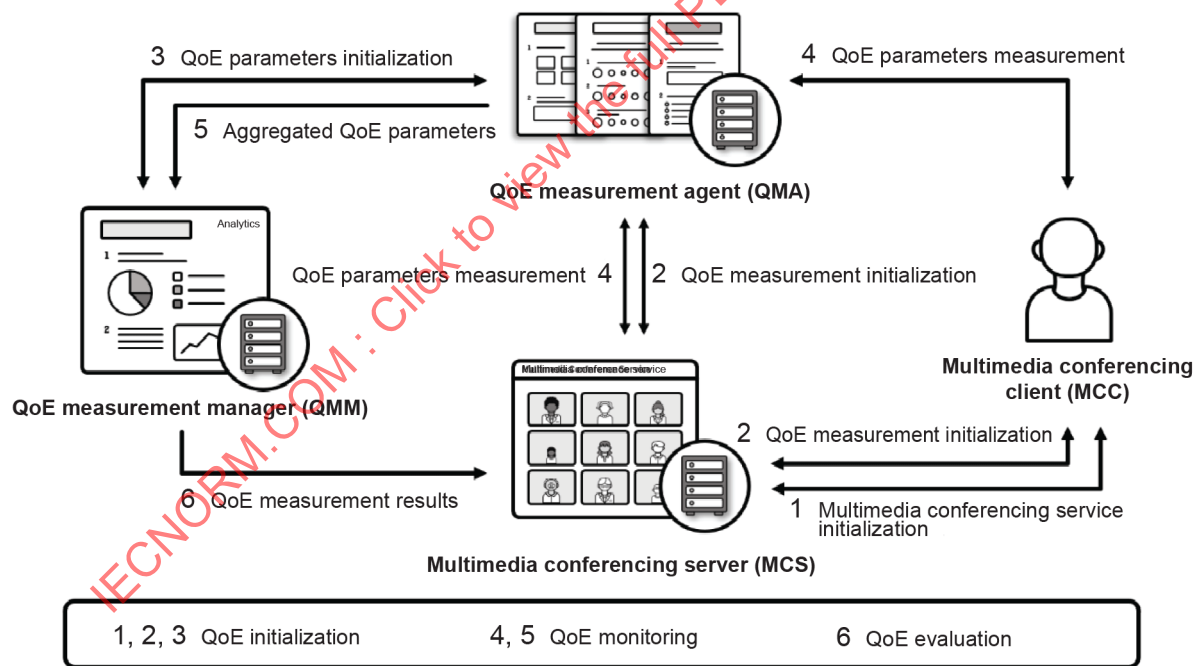
- QoE measurement manager (QMM)

A QMM is used to analyse the QoE parameter values that are reported from QMA to measure a user's QoE for the multimedia conferencing service. For this purpose, a QMM can request that the MCS measure the QoE parameters. The QoE measurement results can be used by the MCS to enhance the associated service or by the user of the multimedia conferencing service to choose an appropriate service as per their preference.

The QMA and the QMM are logically separated from the MCS. However, these entities may be implemented physically together with the MCS. The QMM and the QMA may be implemented in a single device. However, for scalability enhancement, the QMM and the QMA can be separately implemented, in which case one QMM can support many QMAs for many different multimedia conferencing services.

5.2 QoE measurement operations between functional entities

Figure 2 shows the QoE measurement operations between functional entities.



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Figure 2 – QoE measurement operations between functional entities

The QoE measurement operations can be divided into the QoE initialization, the QoE monitoring and the QoE evaluation operations. The QoE monitoring and QoE evaluation operations can be repeated, when it is necessary.

When a multimedia conferencing service begins between the MCS and the MCC (step 1 of Figure 2), the QoE initialization operations for QoE measurement will be conducted between the MCS and the QMA (step 2), and between the QMA and the QMM (step 3). In this step, the MCS will request the QoE measurement from the QMA and further from the QMM. In response to this initialization request, the QMM sends the list of QoE parameters to be measured to the

QMA, and this information is delivered to the MCS. These three steps are the QoE initiation operations.

During the multimedia conferencing service, the QoE monitoring operations perform as follows: the QMA performs the QoE monitoring operation for measurement of the associated QoE parameters with the MCS and the MCC (step 4). In this step, QoE parameters are measured by the MCS and the MCC, and the measured QoE parameter values are reported to the QMA. These measurement and aggregation operations between the QMA and the MCS/MCC can be repeated during the service. For the QoE measurement, the QMA sends the aggregated QoE parameter values to the QMM (step 5).

Finally, the QoE evaluation operations, in which the QMM will analyse these QoE parameter values to assess overall user's QoE and satisfaction level. Such QoE measurement results will be reported to the MCS (step 6). This information can be used for an MCS to enhance the multimedia conferencing service, and for users to choose a suitable service in the future.

6 QoE measurement models

6.1 General

A variety of QoE measurement models can be considered for QoE measurement. In this document, the following three models are used: common survey model, timeline rating model, and Honeycomb model. These QoE measurement models can be considered together for QoE measurement in a multimedia conferencing service, and they can be visualized as in Annex A.

6.2 Common survey model

A common survey model is a model that aggregates the measured QoE parameters from users in a multimedia conferencing service. Each QoE parameter value can be aggregated from many different sources. For example, some QoE parameters (e.g. network status) can be aggregated from the system, and other QoE parameters (e.g. video and audio quality) can be aggregated from users. Figure 3 shows the common survey model for QoE measurement.

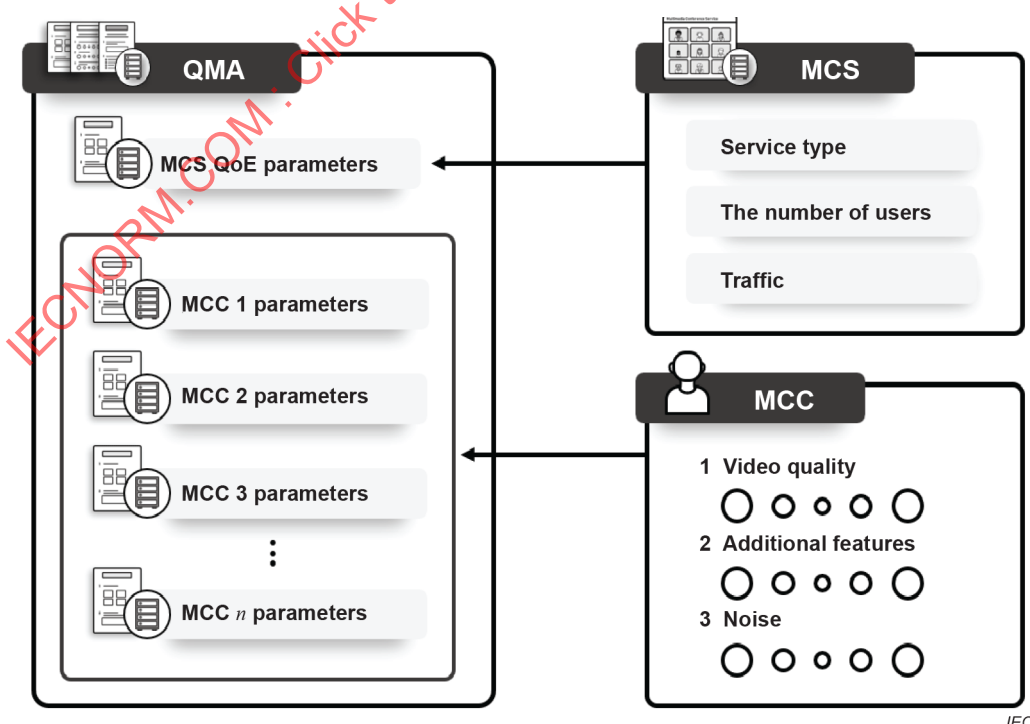


Figure 3 – Common survey model

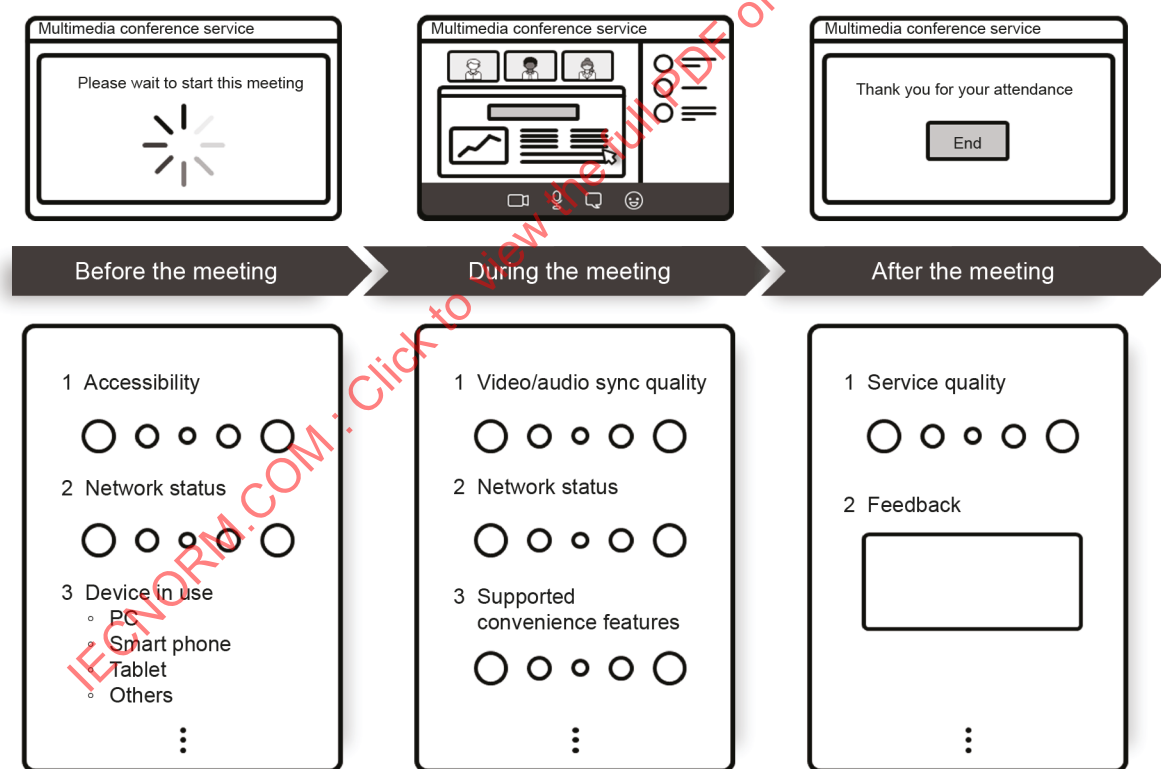
In the common survey model, depending on the type of QoE parameter, the QoE parameter values can be measured or recorded in a numerical form or in a narrative form. For example, the audio quality can be measured by using a number (or score) ranging from 1 to 10. In the meantime, the QoE parameter, which is ambiguous to express as a score, may be expressed in a narrative (descriptive) form.

6.3 Timeline rating model

In the timeline rating model, the QoE parameter values can be measured by a different timing of the multimedia conferencing service: before/during/and after the conferencing. Some QoE parameters must be measured before the multimedia conferencing service, whereas the other QoE parameters will be measured during the multimedia conferencing service. It is important to properly place the questioning timing for each QoE parameter.

User's age, type of device, purpose of the service use and communication environment will be important information that should be considered for QoE measurement before multimedia conferencing service. This is measured before the start of the QoE parameter aggregation service and the user's full-fledged service use. Video quality, audio quality and network status can be measured during the multimedia conferencing service. In the meantime, the user's overall satisfaction level or opinion can be measured after the service has been finished.

Figure 4 shows an overview of the timeline rating model for multimedia conferencing service.

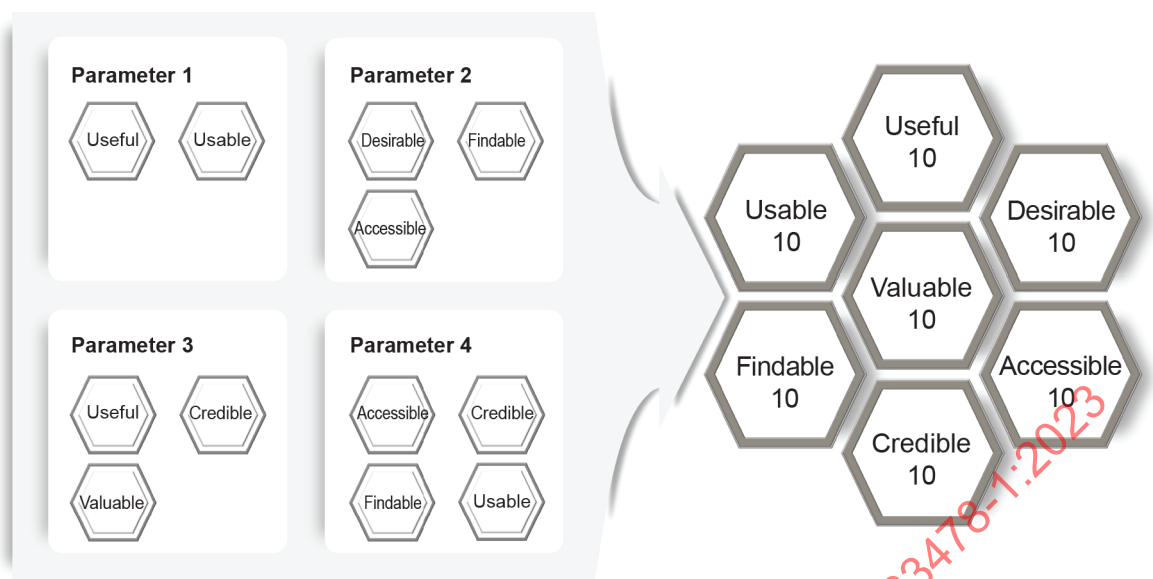


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Figure 4 – Timeline rating model

6.4 Honeycomb model

Since the QoE can be measured in various ways according to service users, it is difficult to obtain an objective indicator simply by using the common survey model. Therefore, the Honeycomb model can also be used together to measure QoE parameters. In the honeycomb model, the seven criteria are used to evaluate the overall QoE for the multimedia conferencing service. For each of the seven criteria, the user can give a score of 0 to 10, based on the users' experience for the service.



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Figure 5 – Honeycomb model for UI/UX measurement

Figure 5 shows the seven criteria used in the Honeycomb model. Each criterion has the following meanings:

- **Useful**
This indicates how much the service can give satisfaction in the viewpoint of the service purposes (e.g. meeting, lecture)
- **Usable**
This indicates how much the service can be usable. For example, the service needs to provide a user with the functions which the user wants to use, at the time that the user wants to use it.
- **Findable**
This indicates how easily users can find the information they want in the service duration. For example, if a user wants to easily find the information, such as screen size adjustment, microphone sound adjustment, and muting, etc.
- **Credible**
This indicates how much the multimedia service can be trusted as a stable service. For example, when a user participates in frequently repeated multimedia conferencing services, the user wants to receive the same high-quality services sustainably. If the quality varies each time, the user will give a low score. If a stable service is provided, the score will be increased.
- **Desirable**
This indicates how much the service is desirable for users. For example, the UI of the multimedia conferencing service can impact the user's satisfaction level. Although each user has a different flavour on the UI design, the score values collected from many users can represent how desirable the service is on average.
- **Accessibility**
This refers to how easily users can access the service. For example, the service needs to be accessible for disabled persons.
- **Valuable**
This indicates how much the service is valuable for users. The service needs to provide valuable services for the users, as per the user's purpose.

Annex A (informative)

Visualization of QoE measurement

A.1 QoE measurement timeline

The measurement of QoE parameters could be summarized and represented as a timeline. Figure A.1 shows a diagram of the QoE measurement timeline for an online meeting, as an example: before, during, and after the meeting.

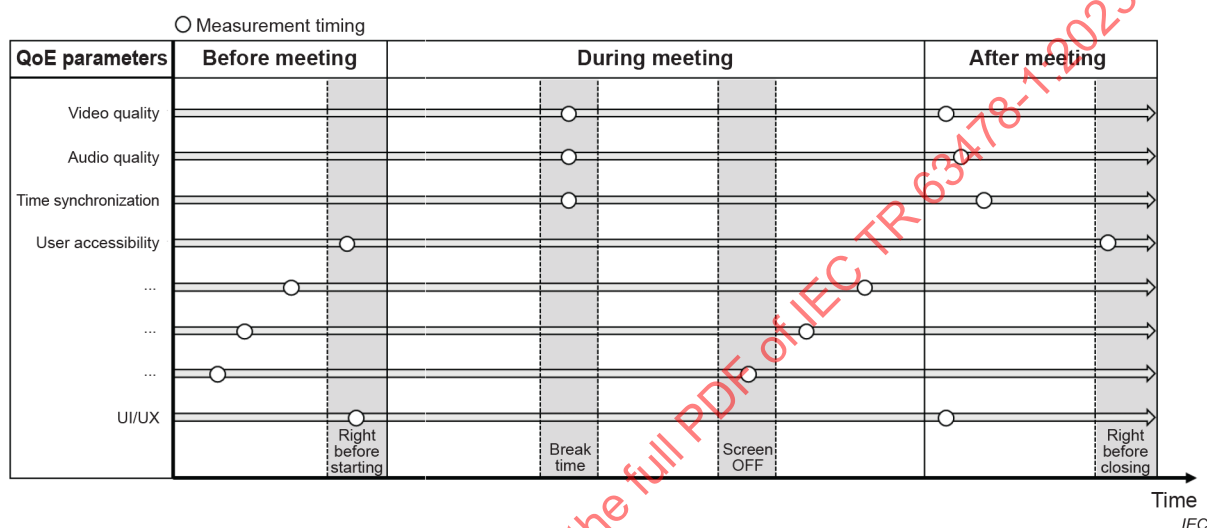


Figure A.1 – QoE measurement timeline

A.2 QoE grading

The measured QoE parameter values can be visualized, as shown in Figure A.2. The score is expressed as an average value ranging from 0 to 10 points, and it can be classified into the five stages: excellent, good, fair, poor, and bad.

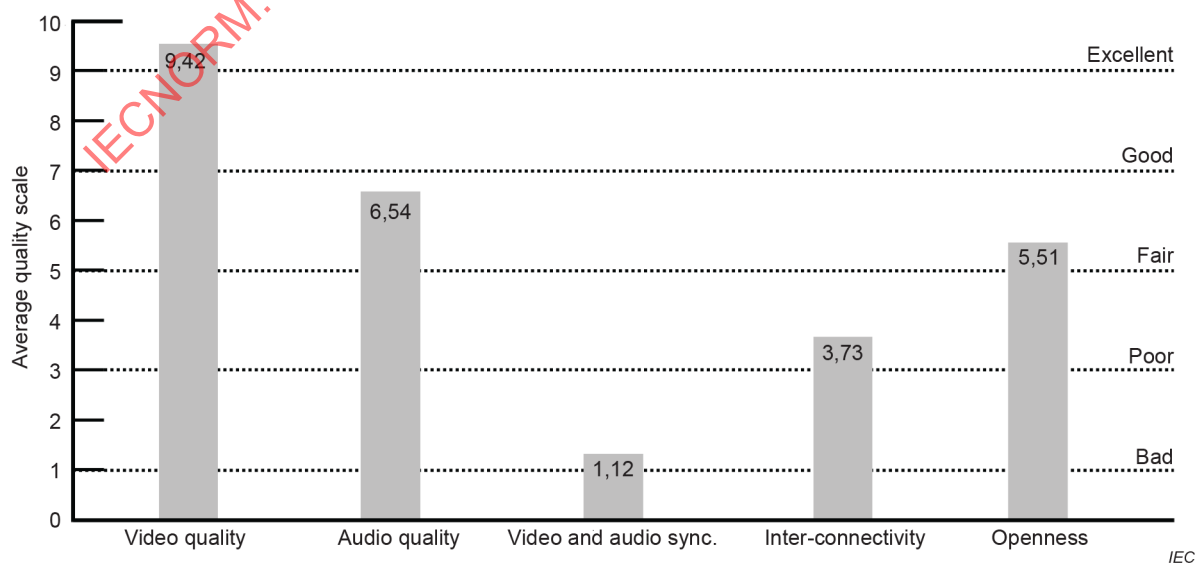


Figure A.2 – Grading of absolute category rating

In the case of UI/UX parameters, according to the Honeycomb model, the scores can be expressed by values ranging between 0 and 10 points, as shown in Figure A.3.

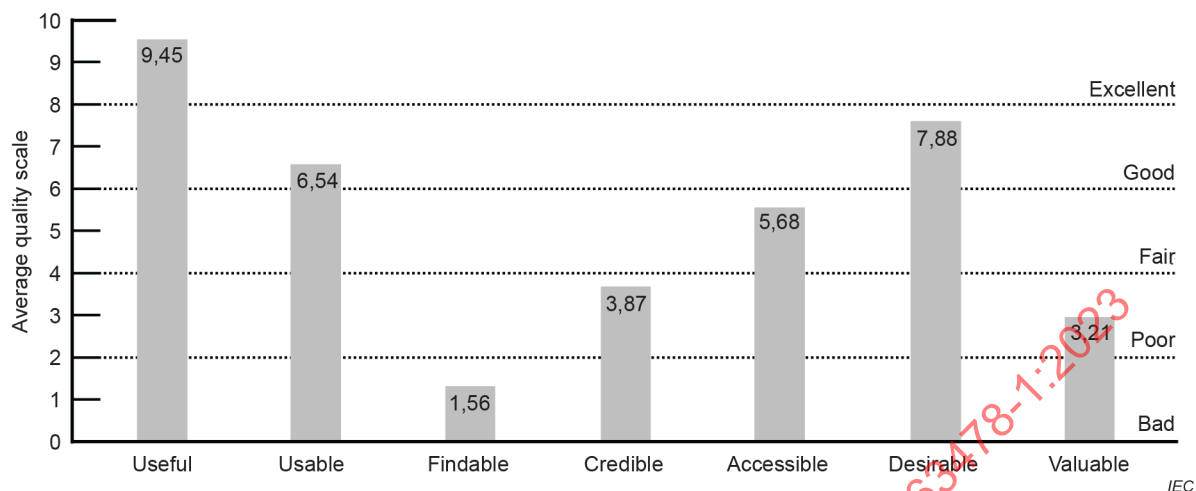


Figure A.3 – Grading of Honeycomb rating

A.3 QoE measurement table

Figure A.4 shows an example of a QoE measurement table that summarizes the QoE parameter values of various multimedia service applications for each device. In the table, the grade is determined based on the average scores that are collected from many users for the multimedia conferencing service.

QoE measurement table		Device type												Parameters	
		Desktop					Mobile phone				Tablet PC				
Apps	App1	① Excellent	② Good	③ Excellent	④ Not bad	⑤ Bad								① Video quality	
		⑥ Normal	⑦ Good	⑧ Good	⑨ Bad	⑩ Normal								② Audio quality	
	App2													③ Inter-connection	
															④ Time sync
	App3													⑤ User's accessibility	
															⑥ Audio video syncs
	App4													⑦ Openness	
															⑧ ...
	App5													⑨ ...	
															⑩ ...
	App6														

Figure A.4 – QoE measurement table

Annex B (informative)

Gap analysis with the existing relevant standards

This annex describes the gap analysis between the existing relevant standards and this document. Figure B.1 gives an overview of the existing relevant standards on QoE, which are classified into model and measurement (MM), multimedia service and application (SA), network performance (NP), and user experience (UX). As shown in the figure, there is not enough work related to this document on UX and SA.

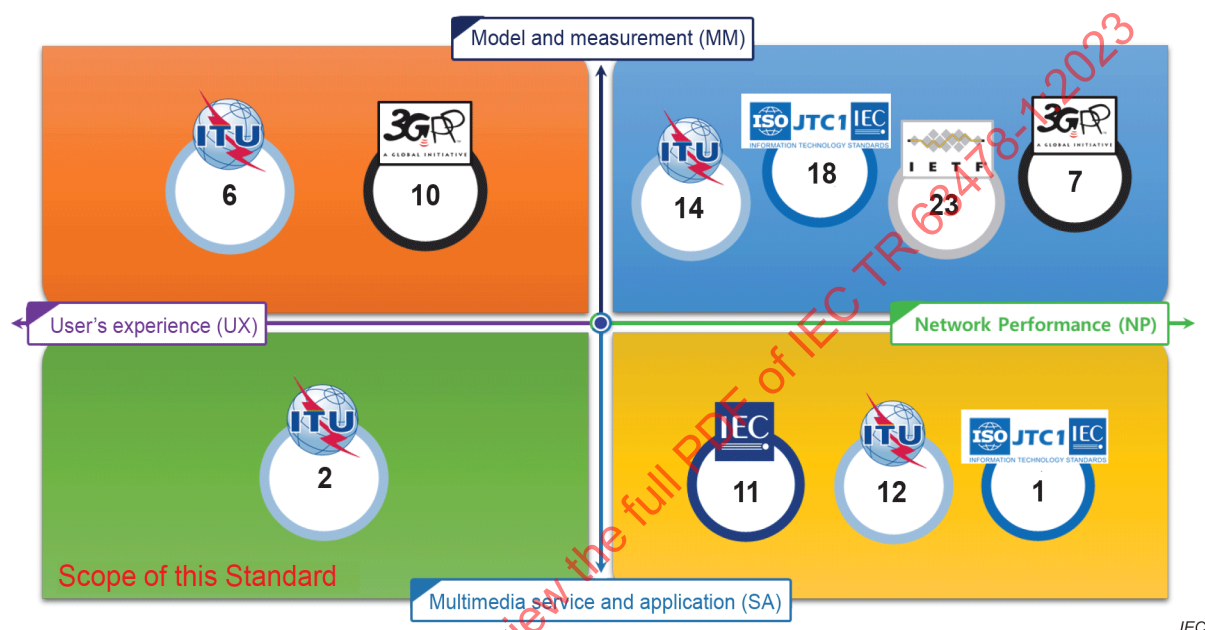


Figure B.1 – Overview of relevant standards

Table B.1 shows a list of standards on UX and MM.

Table B.1 – List of standards on UX and MM

SDO	WG	Standard	Title
ITU-T	SG 12	G.1034	Quality of experience metrics for mobile telephony communication during rail travel
ITU-T	SG 12	G.1035	Influencing factors on quality of experience for virtual reality services
ITU-T	SG 12	G.1011	Reference guide to quality of experience assessment methodologies
ITU-T	SG 12	G.1091	Quality of Experience requirements for telepresence services
ITU-T	SG 12	Under Study	Triangle QoE proposal
ITU-T	SG 12	Under Study	Contribution to ITU-T Rec G.1035: Contribution for Human Influencing Factors – Static and Dynamic Human Factors
3GPP	RAN 3	TR 38.890	Study on NR QoE (Quality of Experience) management and optimizations for diverse services
3GPP	SA 4	TR 26.909	Study on improved streaming Quality of Experience (QoE) reporting in 3GPP services and networks
3GPP	SA 4	TR 26.929	QoE parameters and metrics relevant to the Virtual Reality (VR) user experience

SDO	WG	Standard	Title
3GPP	SA 5	TS 28.307	Telecommunication management; Quality of Experience (QoE) measurement collection Integration Reference Point (IRP); Requirements
3GPP	SA 5	TS 28.308	Telecommunication management; Quality of Experience (QoE) measurement collection Integration Reference Point (IRP); Information Service (IS)
3GPP	SA 5	TS 28.309	Management of Quality of Experience (QoE) measurement collection Integration Reference Point (IRP); Solution Set (SS) definitions
3GPP	SA 5	TS 28.404	Telecommunication management; Quality of Experience (QoE) measurement collection; Concepts, use cases and requirements
3GPP	SA 5	TS 28.405	Quality of Experience (QoE) measurement collection; Control and configuration
3GPP	SA 5	TS 28.406	Quality of Experience (QoE) measurement collection; Information definition and transport
3GPP	SA 5	-	Enhancement of QoE Measurement Collection

Table B.2 shows a list of standards on NP and MM.

Table B.2 – List of standards on NP and MM

SDO	WG	Standard	Title
JTC1	JTC1	ISO/IEC 29341-10-1	Information technology – UPnP Device Architecture – Part 10-1: Quality of Service Device Control Protocol – Quality of Service Architecture
JTC1	JTC1	ISO/IEC 29341-10-10	Information technology – UPnP Device Architecture – Part 10-10: Quality of Service Device Control Protocol – Quality of Service Device Service
JTC1	JTC1	ISO/IEC 29341-10-11	Information technology – UPnP Device Architecture – Part 10-11: Quality of Service Device Control Protocol – Quality of Service Manager Service
JTC1	JTC1	ISO/IEC 29341-10-12	Information technology – UPnP Device Architecture – Part 10-12: Quality of Service Device Control Protocol – Quality of Service Policy Holder Service
JTC1	JTC1	ISO/IEC 29341-11-1	Information technology – UPnP Device Architecture – Part 11-1: Quality of Service Device Control Protocol – Level 2 – Quality of Service Architecture
JTC1	JTC1	ISO/IEC 29341-11-10	Information technology – UPnP Device Architecture – Part 11-10: Quality of Service Device Control Protocol – Level 2 – Quality of Service Device Service
JTC1	JTC1	ISO/IEC 29341-11-11	Information technology – UPnP Device Architecture – Part 11-11: Quality of Service Device Control Protocol – Level 2 – Quality of Service Manager Service
JTC1	JTC1	ISO/IEC 29341-11-12	Information technology – UPnP Device Architecture – Part 11-12: Quality of Service Device Control Protocol – Level 2 – Quality of Service Policy Holder Service
JTC1	JTC1	ISO/IEC 29341-11-2	Information technology – UPnP Device Architecture – Part 11-2: Quality of Service Device Control Protocol – Level 2 – Quality of Service Schemas
JTC1	SC 6	ISO/IEC 13236	Information technology – Quality of service: Framework
JTC1	SC 6	ISO/IEC 14476-1	Information technology – Enhanced communications transport protocol: Specification of simplex multicast transport
JTC1	SC 6	ISO/IEC 14476-2	Information technology – Enhanced communications transport protocol: Specification of QoS management for simplex multicast transport
JTC1	SC 6	ISO/IEC 14476-4	Information technology – Enhanced communications transport protocol: Specification of QoS management for duplex multicast transport
JTC1	SC 6	ISO/IEC 14476-6	Information technology – Enhanced communications transport protocol: Specification of QoS management for n-plex multicast transport
JTC1	SC 6	ISO/IEC 24771	Information technology – Telecommunications and information exchange between systems – MAC/PHY standard for ad hoc wireless network to support QoS in an industrial work environment

SDO	WG	Standard	Title
JTC1	SC 6	ISO/IEC 24792	Information technology – Telecommunications and information exchange between systems – Multicast Session Management Protocol (MSMP)
JTC1	SC 6	ISO/IEC 29181-8	Information technology – Future Network – Problem statement and requirements – Part 8: Quality of Service
JTC1	SC 6	ISO/IEC 13236	Information technology – Quality of service: Framework
ITU-T	SG 12	E.800	Definitions of terms related to quality of service
ITU-T	SG 12	E.803	Quality of service parameters for supporting service aspects
ITU-T	SG 12	E.804.1	Application guide for Recommendation ITU-T E.804 on quality of service aspects for popular services in mobile networks
ITU-T	SG 12	E.806	Measurement campaigns, monitoring systems and sampling methodologies to monitor the quality of service in mobile networks
ITU-T	SG 12	E-800 Sup.10	QoS/QoE framework for the transition from network oriented to service oriented operations
ITU-T	SG 12	E-800 Sup.8	Guidelines for inter-provider quality of service
ITU-T	SG 12	E-800 Sup.9	Guidelines on regulatory aspects of QoS
ITU-T	SG 12	G.1000	Communications Quality of Service A framework and definitions
ITU-T	SG 12	G.1010	End-user multimedia QoS categories
ITU-T	SG 12	GSTP-IPTV-QoS	Performance metrics for end-to-end IPTV video quality
ITU-T	SG 12	P.10/G.100 Amd. 1	Vocabulary for performance, quality of service and quality of experience
ITU-T	SG 12	Y.1541 Amd. 1	Network performance objectives for IP-based services
ITU-T	SG 12	Y.1545.1 Amd.1	Framework for monitoring the quality of service of IP network services
ITU-T	SG 12	Y.2617	Quality of service guaranteed mechanisms and performance model for public packet telecommunication data networks
3GPP	SA 2	TR 23.802	Architectural enhancements for end-to-end Quality of Service (QoS)
3GPP	SA 2	TS 23.107	Quality of Service (QoS) concept and architecture
3GPP	CT 3	TS 29.208	End-to-end Quality of Service (QoS) signalling flows
3GPP	CT 3	TS 29.213	Policy and charging control signalling flows and Quality of Service (QoS) parameter mapping
3GPP	CT 3	TS 29.513	5G System; Policy and Charging Control signalling flows and QoS parameter mapping; Stage 3
3GPP	SA 2	TS 23.207	End-to-end Quality of Service (QoS) concept and architecture
3GPP	SA 4	TR 26.924	Multimedia telephony over IP Multimedia Subsystem (IMS); Study on improved end-to-end Quality of Service (QoS) handling for Multimedia Telephony Service for IMS (MTSI)
IETF	dime WG	RFC 5624	Quality of Service Parameters for Usage with Diameter
IETF	dime WG	RFC 5777y	Traffic Classification and Quality of Service (QoS) Attributes for Diameter
IETF	dime WG	RFC 5866	Diameter Quality-of-Service Application
IETF	gen	RFC 5160	Considerations of Provider-to-Provider Agreements for Internet-Scale Quality of Service (QoS)
IETF	iab	RFC 2990	Next Steps for the IP QoS Architecture
IETF	icnrg RG	RFC 9064	Considerations in the Development of a QoS Architecture for CCNx-Like Information-Centric Networking Protocols
IETF	ipcdn WG	RFC 4323	Data Over Cable System Interface Specification Quality of Service Management Information Base (DOCSIS-QoS MIB)