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

Influence Factors on Gaming Quality of Experience

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New Recommendation ITU-T G.1032 (ex G.QoE-gaming)

Influence Factors on Gaming Quality of Experience

Summary

This document presents a list of factors which may influence the Quality of Experience (QoE) of cloud gaming and online gaming. The factors are grouped into user, system, and context factors. They should be taken into account when planning and implementing online gaming services, and when evaluating their Quality of Experience with subjective methods or instrumental quality prediction models.

Keywords

QoE; game; influence factor

Introduction

In addition to voice, video and web browsing, increasingly popular services running on top of IP-based networks are online computer games. However, in comparison to the aforementioned services, less information exist on factors (and their interactions) influencing the Quality of Experience (QoE) experienced by the user (player) of such online computer games. Knowledge of such influence factors is important to apply subjective methods for assessing gaming QoE, or for building instrumental quality prediction models. This document is the basis of the related ITU Recommendations describing subjective evaluation methods for gaming quality, as well as describing prediction models for gaming quality.

1 Scope

This Recommendation is intended to present a list potential influencing factors for gaming Quality of Experience (QoE) assessment. The presented list of influencing factors can be considered for several purposes including, but not limited to, interactive and passive gaming QoE assessment, steps during the game development circle, and network service providers for (cloud) online gaming.

2 Definitions

2.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

2.1.1 Frame Rate The rate at which frames are output from the decoding process. ITU-T H.262 (02/2012).

2.2 Terms defined in this Recommendation

This Recommendation defines the following terms:

2.2.1 Cloud Gaming: Cloud gaming is characterized by game content delivered from a server to a client as a video stream with game controls sent from the client to the server. The execution of the game logic, rendering of the virtual scene, and video encoding are performed at the server, while the client is responsible for video decoding and capturing of client input.

2.2.2 Critical Flicker Fusion threshold: A threshold that is referring to the frequency at which an intermittent light stimulus appears to be completely steady to the average human observer.

2.2.3 eSport: A form of sports where the primary aspects of the sport are facilitated by electronic systems; the input of players and teams as well as the output of the eSports system are mediated by human-computer interfaces.

2.2.4 Game bricks: Game bricks are a rule-based game classification splitting the games into several fundamental elements such as moving and shooting. In total, ten “gameplay bricks” in two categories are proposed by [1], rules stating goals, including avoid, match, and destroy, and rules defining the means and constraints to reach the goals consisting of create, manage, move, random, select, shoot, and write.

2.2.5 Genre: Genre is referring to a classification of games which games with similar gameplay characteristics group into a specific genre.

2.2.6 Online gaming: A service that enables a video game to be either partially or primarily played over a broadband network. The service renders the game at the client device while the updated states of game are transferred over a broadband network.

2.2.7 Refresh Rate: The rate at which frames can be displayed on monitor.

3 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

CBR	Constant Bit Rate
CQP	Constant Quantization Parameter
CRF	Constant Rate Factor
FPS	First Person Shooter
GoP	Group of Pictures
HD	High-Definition video
LED	Light-Emitting Diode
LCD	Liquid-Crystal Display
MMORPGs	Massively-Multiplayer Online Role-Playing Games
QoE	Quality of Experience
QP	Quantization Parameter

4 Conventions

In this document, we refer to online gaming as a service that renders the game at the client device while the updated states of game are transferred over a broadband network. In contrast, in cloud gaming there is no processing (execution of the game logic, rendering of the virtual scene) on the client. Within the scope of this Recommendation we refer to the person interacting with a game as player, whereas we consider the software, which is used in cloud gaming setups to display a remotely rendered game video stream, as a client.

5 Categorization of Influence factors

The COST Action Qualinet has defined a QoE influence factor as follows [2]:

“Any characteristic of a user, system, service, application, or context whose actual state or setting may have influence on the Quality of Experience for the user.”

In this Recommendation, the factor groups proposed in the Qualinet White Paper is followed. These are Human influence factors (Section 6), System influence factors (Section 7), and Context influence factors (Section 8).

QoE of an online gaming service can be measured through subjective tests as a passive viewing-and-listening (watching videos of recorded game play) or interactive scenario (participants are playing the game). In addition, an experiment could aim to investigate either cloud gaming or online gaming services. Based on the design and aim of the experiment, some of the factors may have a significant impact on the QoE. For example, video-encoding factors are not relevant for an experiment that aims at online gaming. The list of relevant influence factors for each test paradigm is shown in Table 1. Detailed information on each factor is presented in the latter sections.

Table 1: List of relevant influencing factors based on test paradigm.

Factors	Test paradigm		
	Passive viewing-and-listening	Interactive online gaming	Interactive cloud gaming
User influencing factors			
Experience	X	X	X
Intrinsic and extrinsic motivation	X	X	X
Static and dynamic human factors	X	X	X
Human vision	X	X	X
System influencing factors (Game)			
Game Genre	X	X	X
Game mechanics and rules		X	X
Temporal and spatial accuracy		X	X
Temporal and spatial video complexity	X		X
Pace		X	X
Visual perspective of the player		X	X
Aesthetics and design characteristics	X	X	X
Learning difficulty		X	X
System influencing factors (Playing Device)			
Device Portability	X	X	X