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Foreword

This ETSI Guide (EG) has been produced by ETSI User Group (USER).

The present document is part 1 of a multi-part deliverable covering the quality of telecom services, as identified below:

Part 1: "Methodology for identification of indicators relevant to the Users";

Part 2: "User related indicators on a service specific basis";

Part 3: "Template for Service Level Agreements (SLA)".

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**may not**", "**need**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

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Introduction

Quality in the service area can be evaluated from different perspectives and therefore using different measurement methods:

a) the first is related to the reliability of the equipment and can be measured accurately via technical means, although these measurements might be expensive because of both the dispersion of the test results and the size of the sample to be tested;

b) the second is related to the service provision and is closely linked to the kind of use of the service. Therefore appropriate indicators have to be defined according to use;

c) the last is intended to measure the subjective satisfaction of the customer and there is often no other means than a survey to get it.

In the two first categories, technical means can be used to perform the measurements and in such cases, standards are often useful to achieve a common approach; such standards are given as references where appropriate. They include a precise definition of what is meant as a failure: total failure, poor performance, backup situation, etc.

Assessing these different aspects is of paramount importance to the provider who endeavours to improve the offered QoS. From a user viewpoint, the end-to-end QoS is the most relevant. Hence objective and subjective measurements may be usefully combined for a better assessment of the QoS.

Measurements of every potentially interesting indicator all the time might be very expensive and could even jeopardize service performances. It is often cheaper to get them via a poll. In addition, it may be convenient to rely on a third party and also audit to carry out these measurements in order to avoid any criticism from one of the involved parties.

The present document is dedicated to the methodology to analyse the user's needs which is the first step in a Total Quality Management (TQM) process.

1 Scope

In the current competitive world, Quality of Service (QoS) is becoming, jointly with cost, a key indicator in selling and buying telecommunications services. At the same time, technology and liberalization trends are raising new types of concerns unknown with the Plain Old Telephony Services (POTS) using switched connections provided by a single monopoly supplier.

Nowadays, there are several standards describing QoS measurements but the questions of which indicators are to be monitored and which values they should meet are still open. The present document proposes a methodology for the identification of indicators relevant to the users that can be used either to monitor the QoS of Telecom services used by the private customers or for a Service Level Agreement (SLA) between a business customer and a supplier of Telecommunications services such as that proposed in ETSI EG 202 009-3 [i.22]. This part 3 gives guidelines on how to express explicit user's QoS requirements, prioritize the indicators, establish a preferred value for each of these indicators, while ETSI EG 202 009-2 [i.21] proposes QoS indicators for each service and each step of the Customer Relationship Course.

The present document was written to make available to the providers and users of any kind of telecom services (legacy network based or IP network based services) a common basis for mutual understanding about quality of service. It aims to assist users in identifying rationally their QoS requirements in terms of Service Level Objectives (SLO), helping the providers to better meet them for their mutual benefit.

2 References

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

NOTE: While any hyperlinks included in this clause were valid at the time of publication ETSI cannot guarantee their long term validity.

2.1 Normative references

The following referenced documents are necessary for the application of the present document.

Not applicable.

2.2 Informative references

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] Recommendation ITU-T E.721: "Network grade of service parameters and target values for circuit-switched services in the evolving ISDN".

[i.2] Recommendation ITU-T E.800: "Telephone network and ISDN quality of service, network management and traffic engineering: Terms and definitions related to quality of service and network performance including dependability".

[i.3] Recommendation ITU-T G.107: "The E-Model, a computational model for use in transmission planning".

[i.4] Recommendation ITU-T G.109: "Definition of categories of speech transmission quality".

[i.5] Recommendation ITU-T G.111: "Loudness ratings (LRs) in an international connection".

[i.6] Recommendation ITU-T G.1000: "Communications Quality of Service: A framework and definitions".

[i.7] Recommendation ITU-T I.112-417: "Vocabulary of terms for ISDNs".

[i.8] Recommendation ITU-T I.113: "Vocabulary of terms for broadband aspects of ISDN".

[i.9] Recommendation ITU-T I.350: "General aspects of quality of service and network performance in digital networks, including ISDNs".

[i.10] Recommendation ITU-T I.430: "Basic user-network interface - Layer 1 specification".

[i.11] Recommendation ITU-T I.431: "Primary rate user-network interface - Layer 1 specification".

[i.12] Recommendation ITU-T M 60: "Maintenance terminology and definitions".

[i.13] Recommendation ITU-T O.172: "Jitter and wander measuring equipment for digital systems which are based on the synchronous digital hierarchy (SDH)".

[i.14] Recommendation ITU-T P.10/G.100: "Vocabulary for performance and quality of service".

[i.15] Recommendation ITU-T P.800.1: "Mean Opinion Score (MOS) terminology".

[i.16] ETSI ETR 003: "Network Aspects (NA); General aspects of Quality of Service (QoS) and Network Performance (NP)".

[i.17] ETSI ETR 138: "Network Aspects (NA);Quality of service indicators for Open Network Provision (ONP) of voice telephony and Integrated Services Digital Network (ISDN)".

[i.18] ETSI EG 201 013: "Human Factors (HF); Definitions, abbreviations and symbols".

[i.19] ETSI EG 201 219: "User requirements; Guidelines on the consideration of user requirements when managing the standardization process".

[i.20] ETSI EG 201 940: "Human Factors (HF); User identification solutions in converging networks".

[i.21] ETSI EG 202 009-2: "User Group; Quality of telecom services; Part 2: User related parameters on a service specific basis".

[i.22] ETSI EG 202 009-3: "User Group; Quality of telecom services; Part 3: Template for Service Level Agreements (SLA)".

[i.23] ETSI EG 202 843: "User Group; Quality of ICT services; Definitions and methods for assessing the QoS parameters of the customer relationship stages other than utilization".

[i.24] ETSI ES 202 057-1: "Speech Processing, Transmission and Quality Aspects (STQ); User related QoS parameter definitions and measurements; Part 1: General".

[i.25] ETSI GS ISI 003: "Information Security Indicators (ISI); Key Performance Security Indicators (KPSI) to evaluate the maturity of security event detection".

[i.26] ETSI TR 101 287: "Services and Protocols for Advanced Networks (SPAN); Terms and definitions".

[i.27] ETSI TR 101 329-1: "Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON) Release 3; End-to-end Quality of Service in TIPHON systems; Part 1: General aspects of Quality of Service (QoS)".

[i.28] ETSI TR 101 830-1: "Transmission and Multiplexing (TM); Access networks; Spectral management on metallic access networks; Part 1: Definitions and signal library".

[i.29] ETSI TR 102 008: "Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON) Release 3; Terms and Definitions".

[i.30] ETSI TR 102 276: "User Group; Users' Quality of Service Criteria for Internet Access in Europe".

[i.31] ETSI TR 121 905: "Digital cellular telecommunications system (Phase 2+); Universal Mobile Telecommunications System (UMTS); LTE; Vocabulary for 3GPP Specifications".

[i.32] ETSI TS 101 329-5: "Telecommunications and Internet Protocol Harmonization Over Networks (TIPHON) Release 3; End-to-end Quality of Service in TIPHON systems; Part 5: Quality of Service (QoS) measurement methodologies".

[i.33] ETSI TS 102 728: "Digital Video Broadcasting (DVB); Globally Executable MHP (GEM) Specification 1.3 (including OTT and hybrid broadcast/broadband)".

[i.34] ETSI TS 102 844: "User Group; Quality of Telecom Services; Conformity assessment; Requirements for bodies providing QoS assessments and surveys".

[i.35] ETSI TS 102 845: "User Group; Quality of ICT Services; Requirements for Check-up on Metering and Billing Processes".

[i.36] ETSI TS 102 846: "User Group; Quality of ICT Services; Requirements for Bodies Providing Conformity Assessment of Checking-up on Metering and Billing Processes".

[i.37] ETSI TS 102 852: "User Group; Quality of ICT Services; Assessment process of the QoS parameters of the customer relationship stages".

[i.38] ETSI EN 300 462-1-1: "Transmission and Multiplexing (TM); Generic requirements for synchronization networks; Part 1-1: Definitions and terminology for synchronization networks".

[i.39] ISO/IEC 7498-2:"Information processing systems -- Open Systems Interconnection -- Basic Reference Model -- Part 2: Security Architecture".

[i.40] ISO/IEC 9797-1: "Information technology -- Security techniques -- Message Authentication Codes (MACs) -- Part 1: Mechanisms using a block cipher".

[i.41] ISO/IEC 11770-3: 1999: "Information technology -- Security techniques -- Key management -- Part 3: Mechanisms using asymmetric techniques".

[i.42] ISO/IEC 13888-1: "Information technology -- Security techniques -- Non-repudiation -- Part 1: General".

[i.43] ISO/IEC 15408: "Information technology - Security techniques - Evaluation criteria for IT security".

[i.44] ISO/IEC 15945: "Information technology -- Security techniques -- Specification of TTP services to support the application of digital signatures".

[i.45] ISO/IEC 17021: "Conformity assessment - Requirements for bodies providing audit and certification of management systems".

[i.46] ISO/IEC 18028-4:2005: "Information technology -- Security techniques -- IT network security -- Part 4: Securing remote access".

[i.47] ISO/IEC 20000: "Information technology -- Service management -- Part 2: Guidance on the application of service management systems".

3 Definitions and abbreviations

3.1 Definitions

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

(service) accessibility: ability of a component or service to perform its required function at a stated instant or over a stated period of time, within specified tolerances and other given conditions, when requested by the user

NOTE: For readability accessibility is used alone in the current document but stands for "**service accessibility**" and not "**accessibility for all**".

assurance (in the supplier-customer interface): knowledge and courtesy of employees and their ability to convey trust and confidence

audit: control carried out by a third party on the compliance of a provider organization to a code of practice or a regulation

authentication: provision of assurance of the claimed identity of an entity

NOTE: See ISO/IEC 18028-4 [i.46].

authorization: granting of permission based on authenticated identification (see ISO/IEC 7498-2 [i.39])

availability: likelihood with which the relevant components of the service function can be accessed, at the instant of request, as required by the specified conditions, in particular those related to open hours, geographic coverage and resource size aspects if any

NOTE: See ETSI ETR 003 [i.16] modified.

call: any connection (fixed or temporary) capable of transferring information between two or more users of a telecommunications system. In this context a user may be a person or a machine

call set-up time: period starting when the address information required for setting up a call is received by the network (e.g. recognized on the calling user's access line) and finishing when the called party busy tone or ringing tone or answer signal is received by the calling party (e.g. recognized on the calling user's access line)

NOTE 1: See ETSI ETR 138 [i.17].

NOTE 2: In some standards, Post Dialling Delay (PDD) is used instead of call set-up time. (See the definition below (ETSI TS 101 329-5 [i.32])).

capacity: ability of an item to meet a demand of a given size under given internal conditions

NOTE: In the present set of documents, the reader should have in mind that, if SLO are expected with regard to this criterion, these SLO are the expression of a trade off between a user and the provider i.e. a contractual commitment. If a measurement is done in this domain, it is not a QoS assessment per se but rather a check up of the conformance to the SLO of both the use by the customer(s) and the means made available by the provider.

certificate: certificate issued by a certification body in accordance with the conditions of its accreditation and bearing an accreditation symbol or statement

cessation: all activities associated with the cessation of a telecommunication service from the time it was requested by a customer, to the time it was completed to the satisfaction of the customer

charging/billing: all relevant activities associated with the charging and billing for a telecommunication service to a customer

Charging Data Record (CDR): formatted collection of information about a chargeable event (e.g. time of call set-up, duration of the call, amount of data transferred, etc.) for use in billing and accounting

NOTE: For each party to be charged for parts of or all charges of a chargeable event a separate CDR should be generated, i.e. more than one CDR may be generated for a single chargeable event, e.g. because of its long duration, or because more than one charged party is to be charged (see ETSI TR 121 905 [i.31]).

Circuit Loudness Rating (CLR): loudness loss between two electrical interfaces in a connection or circuit, each interface terminated by its nominal impedance which may be complex

NOTE: See ETSI TR 102 008 [i.29].

connection: connection provides for transfer of information between endpoints

NOTE: See Recommendation ITU-T I.113-504 modified [i.8].

connection set up time: time between end of dialling and start of display of the first screen of a web page

defect: limited interruption of the ability of an item to perform a required function

NOTE 1: It may or may not lead to maintenance actions depending on the results of additional analysis.

NOTE 2: See Recommendation ITU-T I.113- 601 [i.8].

dependability (in the supplier-customer interface): the ability to provide what was promised, dependably and accurately

digital signature: data appended to, or a cryptographic transformation of, a data unit that allows a recipient of the data unit to prove the origin and integrity of the data unit and protect the sender and the recipient of the data unit against forgery by third parties and sender against forgery by the recipient

NOTE: See ISO/IEC 11770-3 [i.41].

directory enquiry service: operator or machine based service intended to provide information on phone number, addresses or e-mail addresses of people or organizations on user request

empathy (in the supplier-customer interface): degree of caring and individual attention provided to customers

encryption: (reversible) transformation of data by a cryptographic algorithm to produce ciphertext, i.e. to hide the information content of the data

NOTE: See ISO/IEC 9797-1 [i.40].

fault: inability of an item to perform a required function, excluding that inability due to preventive maintenance, lack of external resources, or planned actions

NOTE: See Recommendation ITU-T I.113-603 [i.8].

flexibility: ability of a service to be customized with elasticity and scalability features

NOTE: Flexibility embraces:

- Customization: options required by the customer and offered by the provider in order to accommodate special requirements, i.e. the ability for the customer to adjust some specific features of the subscribed service, e.g. additional features or some configuration parameters.
- Elasticity: variable resource allocation.
- Scalability: ability to size the system configuration.

function: process which conveys or transforms data in a predictable way, it may be affected by hardware, software or a combination of the two

NOTE: See ETSI TS 102 728 [i.33].

identification: process of establishing the identity of an object or person

NOTE: See ETSI EG 201 940 [i.20].

indicator: when a metric is defined with boundaries and scope unambiguously and clearly stated this then becomes an indicator

integrity: property of a system such that information offered at an input is delivered unchanged at an output

NOTE: See ETSI TR 101 287 [i.26].

jitter: functional description for measuring output jitter at a digital interface can be found in Recommendation ITU-T O.172 [i.13]

KPI: metric capturing some aspects of the performance of one or more resources (including supplier resources or services) which is measured either directly, or could be defined in hierarchies

NOTE 1: A KPI is meaningful to the SP, but not necessarily to the Customer.

NOTE 2: See TMF SLA Management Handbook.

KQI: metric capturing some aspects of the performance of a Service or a Product, meaningful to the Customer

NOTE 1: A KQI is typically expressed as a percentage of customers, resources or telecom entities (like a call or a session) meeting a certain level of quality.

NOTE 2: A KQI possibly aggregates a mix of KPIs, intermediate computed components (usually from KPIs), other KQIs (from one or even several SPs) and direct measurements, using appropriate mathematical formulas (which are the KQI Estimators).

NOTE 3: See TMF SLA Management Handbook.

Loudness Rating (LR): objective measure of the loudness loss, i.e. a weighted, electro-acoustic loss between certain interfaces in the telephone network

NOTE 1: If the circuit between the interfaces is subdivided into sections, the sum of the individual section LRs is equal to the total LR. In loudness rating contexts, the subscribers are represented from a measuring point of view by an artificial mouth and an artificial ear respectively, both being accurately specified (Recommendation ITU-T G.111 [i.5], ETSI TR 101 329-1 [i.27]).

NOTE 2: As used in the G-Series Recommendations for planning.

Mean Opinion Score (MOS): mean of opinion scores, i.e. of the values on a predefined scale that subjects assign to their opinion of the performance of the telephone transmission system used either for conversation or for listening to spoken material (according to Recommendations ITU-T. P.10/G.100 [i.14] and P.800.1 [i.15])

NOTE 1: Apart from subjective opinion, the abbreviation MOS is also used for scores that originate from objective models or network planning models. The following identifiers are recommended to be used together with the abbreviation MOS in order to distinguish the area of application, where N refers to narrow-band, W refers to wideband, LQ refers to Listening Quality, CQ refers to Conversational Quality, S refers to Subjective, O refers to Objective, and E refers to Estimated.

	Listening-only	**Conversational**	**Talking**
Subjective	MOS-LQSy	MOS-CQSy	MOS-TQSy
Objective	MOS-LQOy	MOS-CQOy	MOS-TQOy
Estimated	MOS-LQEy	MOS-CQEy	MOS-TQEy

NOTE 2: The letter "y" at the end of above acronyms is a placeholder for the descriptor of the respective audio bandwidth, see the following provisional instructions:

- N for MOS scores obtained for narrow-band (300-3 400 Hz) speech relative to a narrow-band high quality reference. This is applicable for instance to narrow-band only subjective tests or to P.862.1 scores.
- W for MOS scores obtained for wideband (50-7 000 Hz) speech relative to a wideband high quality reference. This is applicable for instance to wideband only subjective tests or to P.862.2 scores.
- M for MOS scores obtained for narrow-band or wideband speech relative to a wideband high quality reference in a mixed bandwidths context. This is applicable for instance to mixed bandwidths subjective tests.

  The effects of audio bandwidth on MOS scores are currently under investigation in ITU-T Study Group 12. In cases where the bandwidth denominators N, W or M do not properly reflect the actual situation, it is suggested that provisionally the placeholder "y" be replaced by a proper notation.

NOTE 3: The MOS ranges from 1 (lowest quality) to 5 (highest quality).

metric: QoS measurement related to a particular QoS criterion

NOTE 1: Several metrics may be needed for an extensive assessment of the quality of a service with respect to a single criterion.

NOTE 2: Several indicators may be needed to assess a single metric.