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

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Contents

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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.

monitoring: use of any available technical tool to assess permanently or for a given period of time a particular QoS indicator, e.g. a server load or the response time for a directory enquiry service

network/service management by the user/customer: all activities associated with the customer's control of predefined changes to telecommunication services or network configurations

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

non-repudiation: ability to prove an action or event has taken place, so that this event or action cannot be repudiated later

NOTE: See ISO/IEC 13888-1 [i.42] and ISO/IEC 7498-2 [i.39].

offer: all the service components needed for the relationship between the customer and the provider along the whole customer relationship course

Opinion Rating (OR): quantitative value (a number) assigned to a qualitative performance criterion on a predefined rating scale to reflect the merit of that criterion to a user/customer

NOTE: More details are available in clause 4.1 of ETSI EG 202 843 [i.23].

overall transmission quality rating (R): full acoustic-to-acoustic (mouth to ear) quality, experienced by an average user, for a typical situation using a "standard" telephony handset

NOTE 1: The overall transmission quality rating is calculated using the E-Model (see Recommendation ITU-T G.107 [i.3]). The relation between overall transmission quality rating (R) and user perception of quality is defined in Recommendation ITU-T G.109 [i.4].

NOTE 2: See ETSI TR 102 276 [i.30].

performance: measure of how well a transmission system fulfils defined criteria under specified conditions

NOTE: Adapted from ETSI TR 101 830-1 [i.28].

poll: panel of a sufficient number of users or observers are asked to assess a particular QoS parameter, e.g. "Delay to provide a draft contract"

Post Dialling Delay (PDD): time in milliseconds between dialling the last digit and an audible tone being heard at the originating end

NOTE 1: The audible tone is typically ring-back or the engaged tone (Recommendation ITU-T E.721 [i.1], ETSI TS 101 329-5 [i.32]).

NOTE 2: Some systems have shown to present the user with a ring-back tone before a connection has been established, this gives the impression that the PDD is low. If the connection fails this is later switched to an engaged tone. This is an unacceptable operation and should be tested.

provision: all activities associated with the provision of a telecommunication service, from the time of effective contract to the time the customer is able to use the service

QoS criterion: element of a set of characteristics of a service needed for an extensive assessment of the quality of this service

Quality of Service (QoS): collective effect of service performance which determines the degree of satisfaction of a user of the service

NOTE 1: The quality of service is characterized by the combined aspects of service support performance, service operability performance, serve ability performance, service security performance and other factors specific to each service.

NOTE 2: The term "quality of service" is not used to express a degree of excellence in a comparative sense nor is it used in a quantitative sense for technical evaluations. In these cases a qualifying adjective (modifier) should be used.

NOTE 3: See Recommendations ITU-T E.800 [i.2] and G.1000 [i.6].

NOTE 4: Complementary definition on QoS requirements of the user/customer, QoS offered by service provider, QoS achieved by service provider, QoS perceived by the user/customer are given in ETSI ETR 003 [i.16].

Quality of Service Assessment Party (QoSAP): SP internal department or an independent third party expected to manage the QoS assessment process, to analyse the data stored by the SP, to convene an expert panel, to launch a customer survey and to gather the results

NOTE: A QoSAP can usefully be certified by a recognized certification body.

QoS achieved by service provider: statement of the level of quality achieved by the service provider

NOTE 1: See ETSI ETR 003 [i.16] and Recommendation ITU-T G.1000 [i.6] modified.

NOTE 2: This is expressed by values assigned to indicators, which are, as far as possible, same as those for the QoS offered. These performance figures are summarized for specified periods of time, e.g. for the previous 3 months.

EXAMPLE: The service provider may state that the achieved accessibility for a given duration (e.g. one year) was 99,95 % or unavailable for not more than 262,8 minutes over a 365 days year.

QoS offered by service provider: statement of the level of quality expected to be offered to the user/customer by the service provider

NOTE 1: See ETSI ETR 003 [i.16] and Recommendation ITU-T G.1000 [i.6] modified.

NOTE 2: The level of quality is expressed by values assigned to QoS indicators. These parameters are usually designed to be understandable to the user/customer. Each service would have its own set of QoS parameters (see ETSI ETR 003 [i.16]).

EXAMPLE: A service provider may state that the accessibility of basic telephony service is 99,9 % in a year with not more than a 15 minutes break on any one occasion.

QoS perceived by the user/customer: statement expressing the level of quality experienced by user/customers

NOTE 1: See ETSI ETR 003 [i.16] and Recommendation ITU-T G.1000 [i.6] modified.

NOTE 2: The QoS perceived is expressed, usually in terms of degrees of satisfaction and not in technical terms. Technical terms may be expressed where the user/customer is able to understand and use these. QoS perceived is assessed by customer surveys and from user's/customer's own comments on levels of service.

EXAMPLE: An user/customer may state that on unacceptable number of occasions there was difficulty in getting through the network to make a call; a satisfaction rating of 2 may be given on a 4 point scale.

QoS requirements of the user/customer: statement of the level of quality required by the applications of customers/users of a service, which may be expressed non-technically

NOTE 1: See Recommendation ITU-T G.1000 [i.6].

NOTE 2: These requirements may be gathered for representative groupings of users/customers. For their own use, the service provider may translate these into technical indicators easier to manage, if needed to better fulfil the requirements.

reliability: ability of an item to perform a required function under stated conditions for a given time period

NOTE 1: See Recommendations ITU-T E.800 [i.2] and M.60 [i.12].

NOTE 2: It is generally assumed that the item is in a state to perform this required function at the beginning of the time interval.

NOTE 3: In French, the term *fiabilité* is also used to denote the performance quantified by this *probability*.

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

repair: See trouble-shooting.

response time for directory enquiry services: duration from the instant 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) to the instant the human operator or an equivalent voice-activated response system answers the calling user to provide the number information requested

NOTE: See ETSI ES 202 057-1 [i.24].

response time for operator services: duration from the instant 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) to the instant the human operator answers the calling user to provide the service requested

NOTE 1: See ETSI ES 202 057-1 [i.24].

NOTE 2: Services provided wholly automatically, e.g. by voice response systems are excluded (ETSI ETR 138 [i.17]). The services covered are the services for operator controlled and assisted calls that are accessed with special access codes. Access to emergency services is excluded.

NOTE 3: The period in this definition includes waiting times because operators are busy, and times for going through voice response systems to reach the operator. However it excludes the handling of the call by the operator, e.g. conversation with the operator. The reasons are that the variety of calls to operators is too wide and that it is too difficult/costly in practice to measure the operator's performance precisely.

responsiveness (in the supplier-customer interface): willingness to help customers and provide prompt services

sales: all relevant activities from the time communications are established between the provider and the customer to the time the contract is signed for the provision of a service by the provider

security: ability of a service to ensure the confidentiality of the pieces of information worked out, exchanged or stored, the communication privacy, the authenticity and integrity of the information exchanged or stored as well as the protection of the user and his communication means against any type of threat (virus, spam, etc.)

NOTE: Traceability (ability to verify the history, location, or application of an item by means of documented recorded identification) is an additional important security element.

service: means of delivering value for the customer by facilitating results the customer wants to achieve

NOTE 1: Service is generally intangible.

NOTE 2: A service can also be delivered to the service provider by a supplier, an internal group or a customer acting as a supplier.

NOTE 3: See ISO/IEC 20000 [i.47].

service alteration: all activities associated with the alteration of a telecommunication service, from the time alteration to a service is requested by the customer to the time these alterations are carried to the satisfaction of the customer, ETSI ETR 003 [i.16]

Service Level Objective (SLO): specific user requirement expressed as an assessable characteristic of the Service Level (KQI)

NOTE: To fulfil a SLO, the provider may need to manage one or more QoS assessments (KPI) for each usage context.

Service Provider (SP): organization that provides electronic communications services to users and customers

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

service support: all activities associated with the support of a telecommunication service to enable the customer's use of the service

NOTE 1: This includes documentation, technical support, commercial support and customers' complaint management.

NOTE 2: See ETSI ETR 003 [i.16].

speed: performance criterion that describes the time interval required to perform a function or the rate at which the function is performed

NOTE 1: The function may or may not be performed with the desired accuracy.

NOTE 2: See Recommendation ITU-T I.350 [i.9].

survey: enquiry carried out to assess a particular QoS parameter, e.g. "Queue time at the information desk" or "percentage of cities of more than 5 000 inhabitants with an information desk"

technical upgrade: all activities associated with the technical evolution of any component of the service at the provider initiative

Terminal Equipment (TE): functional group on the user side of a user-network interface

NOTE 1: See Recommendation ITU-T I.112 [i.7].

NOTE 2: In Recommendations ITU-T I.430 [i.10] and I.431 [i.11], "TE" is used to indicate terminal terminating layer 1 aspects of TE1, TA and NT2 functional groups.

threshold: reference value to determine that a parameter is within the acceptable contractual fork

time: instant (time of the day) or measure of time interval.

NOTE 1: See ETSI EN 300 462-1-1 [i.38].

NOTE 2: In the present document "time" is used as the time interval for the service achievement.

time stamping service: service which attests the existence of electronic data at a precise instant of time

NOTE 1: Time stamping services are useful and probably indispensable to support long-term validation of signatures.

NOTE 2: See ISO/IEC 15945 [i.44].

time to connect: time between the end of dialling and ringing or lift up or busy tone

traceability: ability to verify the history, location, or application of an item by means of documented recorded identification

trafficability: ability of an item to meet a traffic demand with a given size and other characteristics, under given internal conditions

NOTE 1: See Recommendation ITU-T E.800 [i.2].

NOTE 2: Internal conditions refer for example to any combination of faulty and not faulty sub-items.

trouble-shooting: all activities associated with the restoration of a telecommunication service to the customer after a fault resulting in partial or complete loss of service or service features

usability: effectiveness, efficiency and satisfaction with which specified users can achieve specified goals (tasks) in a particular environment with respect to the user profile

NOTE 1: In telecommunications, usability should also include the concepts of learnability and flexibility; and reference to the interaction of more than one user (the A and B parties) with each other and with the terminals and the telecommunications system.

NOTE 2: See ETSI EG 201 013 [i.18].

NOTE 3: Similar to simplicity (see ETSI ETR 003 [i.16]) but includes conformance to design for all, accessibility and ergonomic aspects.

user: individuals, including consumers, or organizations using or requesting telecommunications services available on public or private networks

NOTE 1: The user may or may not be the person who has subscribed to the provision of the service. Without any specific addition this word is used to identify the telecommunication user community in general, e.g. end-users and IT&T managers who use products and services possibly conforming to standards.

NOTE 2: See ETSI EG 201 219 [i.19].

NOTE 3: Taking into account the current developing automation, a machine has to be considered as a disembodied "user".

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

ACD	Automatic Call Distribution
AoC	Advice of Charge
IP	Internet Protocol
KPI	Key Performance Indicator
KQI	Key Quality Indicator
MOS	Mean Opinion Score
POTS	Plain Old Telephony Service
QoS	Quality of Service
SLA	Service Level Agreement
SLO	Service Level Objective
SME	Small and Medium Enterprise
SOHO	Small Office - Home Office
SP	Service Provider
TQM	Total Quality Management

4 About telecommunication service QoS

Before discussing Quality of Service issues it is crucial to well understand how current services are designed.

4.1 About telecommunication services

A telecommunication service, per se, is designed to carry out one self-sufficient function or self-sufficient set of functions expressed in perceptible way to bring value to the customer and the supplier under preset conditions of use. Each function conveys or transforms data in a predictable way. The way it is done and the content and type of the data characterizes the function. Each function may be achieved with differing performances. Each service may be provided as a service element to enter in a wider service, i.e. in a service make up.

4.2 Services versus offers

A service as described in the previous clause is expected to be sold by a Service Provider (SP) in an offer with a precise description, including the detailed contractual characteristics with specified performances defining a particular behaviour.

Two services with the same characteristics but having differing contractual performances values are sold as two different offers. For instance, a low cost mobile communication offer may differ from a "classic" offer from the same provider only by the fact that the human helpdesk is replaced by some kind of customer self-help group.

Commercial offers are packages of service elements that are expected to match the Service level requirements of a particular user category with appropriate means to make them more or less flexible, secure and user-friendly. An offer may contain a fixed or variable composition of service elements. Some of these service elements may be included to face specific circumstances with a fee adjusted according to preset conditions.

Hence, thanks to all these details, the customer should be able to check among the various offers which ones best match his own requirements.

In an offer, the word "service" is used in its broader sense, i.e. a service element or a composition of services.

NOTE: An offer includes all the service components needed for the relationship between the customer and the provider, along the whole customer relationship course, that are crucial to the overall quality of its service. These tasks are discussed in the present document as customer relationship steps and are detailed in clauses 5 and 6.

4.3 About Quality of Services

First of all, it is essential to bear in mind the difference between performance and quality of service.

It is always possible to define a set of metrics related to the various aspects of a service and to check what are the values obtained for the corresponding set of indicators during a given period. This allows to assess the technical performances regarding the defined criteria but not to assess the service behaviour.

It should be kept in mind that a key aspect of the Telecommunication services is that two ends are needed to provide the service. Therefore both ends may influence the QoS, including the terminal used, and these have to be taken into account to assess the QoS.

In addition, since Telecommunication services belong to the High Tech area and are mainly seen by the users from an end-to-end viewpoint, the psychological aspects are crucial in the QoS assessment. Hence, the user satisfaction is the outcome of the Perceived QoS, resulting from the comparison between the QoS he expected (contractualized) and the achieved QoS.

As different telecommunication technologies are used to provide the various services, appropriate tools have to be selected for each of these technologies. The purpose of the present document is to provide guidance on how to identify the metrics and indicators (KQI) actually relevant to the Users as SLO. To ensure the SLO are met, providers have to use KPI management and all the appropriate means. The present document deals with the measurement results and not the tools used to make these measurements.

The assessment of the Quality of a specific offer is another issue aiming at assessing its behaviour. Dealing with QoS of telecommunication services, assumes that, first of all, the characteristics (performances) of the service functions are defined and expressed in Service Level Objectives (SLO), i.e. their contractual service level range that can differ with regard to the usage conditions (e.g. fixed, nomadic or full mobile use).

4.4 SLO (Service Level Objective)

SLOs should generally be specified in terms of an achievement value or service level, a target measurement, a measurement period, and where and how measured. As an example, "90 % of calls to the helpdesk should be answered in less than 20 seconds measured over a one month period as reported by the ACD system". Results should be reported by the percent of time that the target answer time was achieved compared to the desired service level (90 %). The agreement between the customer and the provider on the SLO values is formalized in a SLA. The SLO should be:

- Reachable with regard to the objectives
- Repeatable
- Assessable
- Understandable
- Meaningful
- Controllable with regard to the contract
- Affordable
- Mutually acceptable

Then indicators related to the SLO should be measured and monitored to check whether the contractual service level range is achieved.

When a service element is part of the Universal Service, it is the regulator responsibility to ensure that it is compliant to the corresponding legal obligations. When a service element is part of a SLA between the customer and the provider, SLO are crucial to the SLA management and the SLO target values should be specified in the contract between the provider and the customer. In both cases, to avoid any misunderstanding, the method of measurement and monitoring should also be defined and available to all the stakeholders.

Nevertheless, for some particular aspects, it is not always possible to define and monitor indicators in real time. Therefore other means to define SLO and monitor the achievements have to be implemented. This issue is tackled in clause 6 of the present document and in clause 7 of ETSI EG 202 009-2 [i.21].

5 Scope of telecommunications offers

Telecommunications offers include several provision of the service and its management:

a) The delivery of the service itself:

- All the service elements included in the contract and their functional and non-functional aspects.

NOTE: Functional aspects include all the subscribed functionalities contained in the offer. Non-functional aspects include QoS (Behaviour).

- An access to the telecommunication network (the access can be supplied by a provider differing from the service provider).

b) Several additional provisions needed for the management of the service:

- Information on the service.
- Implementation and setting up.
- Possible hardware and software up-dates.
- Documentation.
- Helpdesk to take the users' problems into account and report on the progress of restoring.
- Processing of service failures (repair and setting back to working order).
- Statistics on operation and traffic.
- Billing and accounting.
- Etc.

In short, this means that SLO should be defined for all the aspects of the customer relationship course from the preliminary information to cessation. On the service utilization aspect, services are differing considerably from each other and therefore, SLO indicators have to be carefully defined and monitored on a service-by-service basis. To avoid any misunderstanding, the service functions and specifications have to be detailed in the contract between the provider and the customer, as well as the provider commitments throughout the customer relationship course. In addition, it should be reminded that the human interface to the customer is a key aspect of the perceived QoS, in particular reliability, empathy and responsiveness.

Table 1 details the steps along the customer relationship course with respect to the scope proposed by the provider including the service provision and its management.

Table 1: Steps along the customer relationship course

Provider responsibilities		Customer view
Sales		Preliminary information, advertisement
		Terms and conditions of contract
Service management	Service provisioning	Installation
		Activation and acceptance
	Service alteration / Technical upgrade	Customer initiative
		Provider initiative
	Service support	Documentation for service activation and set-up Documentation for service use
		Technical support
		Commercial support
		Complaint management
	Repair/Troubleshooting	Human intervention
	Charging/Billing	Paying
	User account withdrawal	Cessation
Use of Service	Network/service management by the customer	
	Service utilization	Access
		Bearer service
		Service usage
		Presentation and user interface
NOTE: A description of the various aspects of the customer relationship course and service elements is given in clause 6.1.		

6 Methodology to identify the customer's QoS requirements

Different users may expect different levels of performance. This is why defining the user requirements is crucial to ensure the service fulfils the user needs and provides an optimal quality/cost ratio in order to gain a maximum user satisfaction.

ETSI ETR 003 [i.16] and Recommendation ITU-T G.1000 [i.6] provide a useful methodology to capture the users'/customers' quality requirements. Nevertheless, since these documents were delivered, there have been a lot of improvements in the QoS assessment methodology. For example, ETSI ETR 003 [i.16] and Recommendation ITU-T G.1000 [i.6] use a set of 7 criteria: **Speed, Accuracy, Availability, Reliability, Security, Simplicity, Flexibility**. Keeping in mind that in the present document the intention is to identify the SLO, it is critical to define all that can have an impact on the QoS. As such, the volume of information to handle being a key parameter for the QoS, in order to allow for a better understanding between the users and the providers, it is useful to add **capacity** as a new criterion. As an example in the professional context, it is crucial to the provider to know the maximum information data rate to carry. Although speed is often given as KQI in SLO, **time** seems more appropriate than speed that stands for the distance/time ratio, to describe response time and all issues related to time. Also using the word **integrity** instead of **accuracy** seems more suitable in users' mind to express that there is no change in the information content and that such criterion apply at any step of the customer relationship course as well and not only to communication functions. Finally, **usability** is more explanatory than **simplicity,** has a broader meaning and can more easily include "design for all" aspects.

In conclusion, the definitions for the criteria taken in this set of documents to assess the QoS are the following:

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

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

NOTE 1: 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 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.

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

time: instant (time of the day) or measure of time interval

reliability: ability of an item to perform a required function under stated conditions for a given time period

NOTE 2: **Reliability** is a composed criterion bringing an additional notion of compliance of the previous criteria to the specified ratings for a given period of time.

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

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.

usability: effectiveness, efficiency and satisfaction with which specified users can achieve specified goals (tasks) in a particular environment with respect to the user profile

NOTE 3: In telecommunications, usability should also include the concepts of learnability and flexibility; and reference to the interaction of more than one user (the A and B parties) with each other and with the terminals and the telecommunications system.

security: ability of a service to ensure the confidentiality of the pieces of information worked out, exchanged or stored, the communication privacy, the authenticity and integrity of the information exchanged or stored as well as the protection of the user and his communication means against any type of threat (virus, spam, etc.)

IT security embraces:

- confidentiality - the property that information is not made available or disclosed to unauthorized individuals, entities, or processes (ISO/IEC 7498-2 [i.39]);
- integrity - property of a system such that information offered at an input is delivered unchanged at an output;
- availability - likelihood with which the relevant components of the service function can be accessed as required by the contractual conditions (temporal and spatial);
- traceability - ability to verify the history, location, or application of an item by means of documented recorded identification.

In this area, KQI are practically impossible to monitor in real time. Therefore, the compliance of the management system to a good practice code seems more appropriate than a KQI monitoring. Such a conformance should be recognized by a trusted body complying with available relevant standards like ISO/IEC 15408 [i.43] and ISO/IEC 17021 [i.45]. Although the present document is not intended to define in depth IT security functional and assurance requirements, for this criterion instead of defining KQI, some of the sensitive aspects of the service with regard to the security are given in the tables of the following clauses, for an audit to focus on the particular security features:

- mechanism efficiency: ability to ensure and take part in the security in predefined conditions;
- mechanism resistance: ability to counter or block an action or a force;
- robustness: force intrinsic to resist, resistance.

Therefore, the implementation of the security criterion to each step of the customer relationship course will endeavour, in a certification perspective, to identify, according to these principles, which type of threats are particularly undermining to this service.

Among the major changes in the current QoS approach, services are nowadays considered as a composition of service elements.

In this aspect, **Security** can be considered as an optional service component if a specific option has been taken for enhanced performances at this regard.

Similarly, a specific option may be subscribed for an enhanced **Flexibility** if the customer wishes to have the service features matching in real time the requirements of particular types of use of the service.

It is not the purpose of the present set of documents to assess the effectiveness of such service elements regarding the function they are supposed to achieve but only to assess their influence on the main service QoS with respect to the above criteria. Therefore, specific service elements like security or flexibility are tackled in clause 7 of ETSI EG 202 009-2 [i.21] regarding their impact on the main service QoS.

As, it might often be difficult to define and monitor indicators on specific aspects like flexibility, usability, security or charging/billing integrity from the user side, it could be better instead to rely on a provider certification on the relevant aspects or to ask for an appraisal by an expert or user panel. In the particular case of security, ETSI GS ISI 003 [i.25] can help to assess the maturity of security event detection of providers' as well as users' organizations.

The purpose of the present set of documents is to propose a methodology to both identify the users' requirements (SLO in clause 6.1) and the indicators to monitoring the QoS actually achieved (tables in clauses 5 and 6 of ETSI EG 202 009-2 [i.21]). Regarding security, flexibility or usability, as the current offers are rarely specifying commitments from the SP, the service level cannot always be checked against the SP specifications but rather against the users' requirements if any or just assessed in the absolute.

For ease of understanding, differing colours are used in table 2 columns to show the different natures of security, flexibility and usability regarding the SLO definition and monitoring.

6.1 Matrix for the determination of communications QoS criteria

The matrix in the table 2 is an extrapolation of that of ETSI ETR 003 [i.16]. If explored cell by cell, it enables to consider and hence to capture a comprehensive range of QoS requirements (SLO) for a specific service or offer, the purpose being to choose for each of these cells metrics allowing for an overall QoS evaluation.

The usage conditions in a service contract should specify the precise conditions of use of services to ensure an effective QoS assessment enables comparisons of performance to be made when the usage conditions vary. In the definitions given above or hereafter for each cell, the words "specified conditions" refer to the contract between the customer and the provider (SLA) that can be based on any national or European regulations or a mutual agreement while "stated conditions" refer to sales conditions made publicly available by the provider. Obviously, as highlighted above, it is crucial that the contract details the QoS specifications.

Table 2: Matrix to facilitate the capture of customer's QoS requirements

Customer relationship steps		Detailed customer relationship steps		QoS criteria				Composite KQI	Specific service needs		
				Availability	Integrity	Time	Capacity	Reliability	Flexibility	Usability	Security
			Cell ref.	X1	X2	X3	X4	X5	X6	X7	X8
1-Sales		Preliminary information, advertisement	Y1.1								
		Establishment of the contract (Terms and conditions)	Y1.2								
Service management	2-Service provisioning	Installation, activation and acceptance	Y2								
	3-Service alteration / Technical upgrade	Change at the customer initiative	Y3-1								
		Change at the provider initiative	Y3-2								
	4-Service support	Documentation	Y4.1								
		Technical support	Y4.2								
		Commercial support	Y4.3								
		Complaint management	Y4.4								
	5-Repair/Trouble-shooting		Y5								
	6-Charging/Billing		Y6								
	7-Cessation		Y7								
Use of Service	8-Network/service management by the customer		Y8								
	9-Service utilization	Access	Y9.1								
		Bearer service	Y9.2								
		Service usage	Y9.3								
		Presentation and user interface	Y9.4								

Header of lines and columns of table 2 are derived from ETSI ETR 003 [i.16]. These headers are described hereafter.

The customer relationship steps: On Y axis, are a set of uniquely identifiable or definable elements, which, collectively cover, all tasks associated with or those forming part, of a telecommunications service. They are detailed in clauses 6.1.1 to 6.1.9.

The Service quality criteria: On X axis, which collectively cover all quality aspects of a telecommunication service are defined at the beginning of clause 6 (see also clause 3.1).

QoS criteria

In order to express the service user requirements (SLO): X1 Availability, X2 Integrity, X3 Time and X4 Capacity.

KQI composite

In order to express the behaviour in a given period: X5 Reliability.

Specific service needs

In order to express the customization of the composition of service: X6 Flexibility, X7 Usability and X8 Security.

The content of each cell is detailed hereafter.

6.1.1 Matrix line Y1 - Sales

Any requirement related to activities from the time communications are established between the provider and the customer to the time the contract is signed for the provision of a service by the provider. The term Telco is also intended to cover the service provider or a network provider.

Examples of relevant activities are:

- supply of information on the service;
- technical enquiries;
- feasibility; and
- study of options available.

6.1.1.1 Matrix line Y1.1 - Preliminary information/Advertisement

Any requirement related to information on the service provided on request of the prospect or in newspapers, magazines, booklets, Web, etc. to help him choosing the service and provider most appropriate to his needs.

Cell reference Y1.1-X1: Preliminary information - Availability

Description: Availability requirements regarding access to the appropriate information. This includes not only the public availability of such an information but also its legibility, size of the print font, ease of reading, use of words from the common language, etc.

SLO examples:

EXAMPLE 1: The preliminary information should be available to any user request in the wished format. For a panel of users an acceptable rate could be 90 %.

EXAMPLE 2: The preliminary information should include all the conditions for resiliation.

Cell reference Y1.1-X2: Preliminary information - Integrity

Description: Requirements regarding the correctness and completeness of all relevant information on the service, normally expected by the customer before effective contract, e.g. service features, performance, charges and service support. This includes any advertising material supplied to the customer.

SLO example:

EXAMPLE: The preliminary information provided should express clearly, concisely and unambiguously all the service features including the tariff conditions.

Cell reference Y1.1-X3: Preliminary information - Time

Description: Requirement regarding the time taken from the initial contact between the customer and the provider to the instant the pertinent information is supplied to the customer.

SLO example:

EXAMPLE: The time taken from the instant a request for PI was sent to the SP to the instant all requested information was delivered to the customer requesting the information should be appropriate to the request mode, e.g.:

- For a user panel, 95 % of email enquiries for preliminary information to the commercial desk should be answered within x hours.
- For a user panel, 80 % of call to the commercial desk for preliminary information should be answered within x minutes.

Cell reference Y1.1-X4: Preliminary information - Capacity

Description: Requirement about the number of customers expected to simultaneously accessing this service, density of sales offices, hours staff can be accessed, etc.

SLO examples:

EXAMPLE 1: The content of the preliminary information should embrace at least 95 % of the service features description for a user panel.

EXAMPLE 2: The content of the preliminary information should include at least 95 % of the service management process for a user panel.

Cell reference Y1.1-X5: Preliminary information - Reliability

Description: Reliability requirements regarding the provision of the preliminary information over a given time period.

SLO example:

EXAMPLE: During the launching period of a new service the previous SLO should be fulfilled.

Cell reference Y1.1-X6: Preliminary information - Flexibility

Description: Options required by the customers in the provision of the preliminary information.

SLO examples:

EXAMPLE 1: The preliminary information should be delivered via multiple modes.

EXAMPLE 2: Provision of sales information in person, by the telephone, advertising, electronic transfer.

Cell reference Y1.1-X7: Preliminary information - Usability

Description: Requirement regarding the ease to carry out all activities associated with the preliminary information provision.

SLO examples:

EXAMPLE 1: The point of contact for sales should be easily located.

EXAMPLE 2: The Internet user interface should be user-friendly.

EXAMPLE 3: The service desk operators should be user-friendly.

Cell reference Y1.1-X8: Preliminary information - Security

SLO example:

EXAMPLE: The information source should be clearly authenticated.

6.1.1.2 Matrix line Y1.2 - Establishment of the contract (Terms and conditions)

Any requirement related to activities from the customer decision to contract with the provider to the time of effective contract. Establishment of the contract is meant here for agreeing to the contractual conditions, conditions of use, customer and provider commitments whether or not there is a formal signature of the contract.

Cell reference Y1.2-X1: Establishment of the contract - Availability

Description: Requirement regarding availability of access to the appropriate sales facilities.

SLO example:

EXAMPLE: Availability includes also the legibility of the text of the contract, size of the print font, ease of reading, use of words from the common language, etc.

Cell reference Y1.2-X2: Establishment of the contract - Integrity

Description: Requirement regarding conformance of the information contained in the contract to the information provided to the customer at the preliminary information stage as well as the exhaustiveness and clarity of the description of the conditions of the service use.

SLO example:

EXAMPLE: The cancellation conditions should be consistent with the preliminary information and clearly stated.

Cell reference Y1.2-X3: Establishment of the contract - Time

Description: Requirement regarding the time taken from the initial contact between the customer and the provider to the instant the service contract is placed. This has to take into account the ease with which all activities associated with the establishment of the contract may be carried out with the provider.

SLO example:

EXAMPLE: The contract should be signed and made available to the customer as soon as the customer has sent his consent formally.

Cell reference Y1.2-X4: Establishment of the contract - Capacity

Description: Requirement regarding the number of customers expected to simultaneously accessing the sales facilities, density of sales offices, hours staff can be accessed.

NOTE: Capacity requirements are a provider and not a customer issue. Their impact is expected to be covered by the previous criteria.

Cell reference Y1.2-X5: Establishment of the contract - Reliability

Description: Requirement regarding the reliability of the establishment of the contract facilities.

SLO example:

EXAMPLE: The availability, time and integrity scores should be 100 % compliant to the offer.

Cell reference Y1.2-X6: Establishment of the contract - Flexibility

Description: Modes available for the establishment of the contract.

SLO examples:

EXAMPLE 1: Provision of sales information in person, by the telephone, advertising, electronic transfer.

EXAMPLE 2: Facility to place contract by the customer may be by fax, electronic mail, post or telephone.

Cell reference Y1.2-X7: Establishment of the contract - Usability

Description: Requirement regarding the ease with which all activities associated with the establishment of the contract should be carried out with the provider (ease with which information supplied is understandable, ease with which forms can be filled and ease with which orders can be placed).

SLO examples:

EXAMPLE 1: The contractual document describing the supply, maintenance and cessation for a telecommunication service by a SP should be clear, accurate, complete, understandable and unambiguous.

EXAMPLE 2: The language, phrasing and expressions chosen in the contract are aimed at maximum understanding for the target customer segment.

Cell reference Y1.2-X8: Establishment of the contract - Security

Description: Identification of the aspects of the establishment of the contract where the customer security, privacy or confidentiality requirements should be met by the provider.

SLO example:

EXAMPLE: The content of the contract should not be published except to the provider and the customer.

6.1.2 Matrix line Y2 - Service provisioning

Any requirement related to activities associated with the provision of a telecommunication service, from the time of effective contract to the time the customer is able to use the service.

Installation: All activities associated with the installation of the equipment and the related software needed to use a telecommunication service.

Activation and acceptance: All activities associated with the activation and acceptance of the provision, e.g. test, certificate, etc.

Cell reference Y2-X1: Service provisioning - Availability

Description: Requirement regarding the availability of resources for provision: installation and acceptance.

NOTE: Capacity requirements are a provider and not a customer issue. Their impact is expected to be covered by the time criteria.

Cell reference Y2-X2: Service provisioning - Integrity

Description: Requirement regarding the correctness and completeness of the provision, installation and acceptance facilities.

SLO example:

EXAMPLE: The equipment and service provided should be compliant to the contract.

Cell reference Y2-X3: Service provisioning - Time

SLO example:

EXAMPLE: The service should be provided within x days as stated in the contract

NOTE: From the SP point of view, the service provisioning time is often defined as the maximum time period for which the service is effectively provisioned. For the user this time may be found too long. The expected time from the user should be also noted in the contract.

Description: Requirement regarding the time taken from the effective contract to the instant the service is available for use. This time has to be defined for the main aspects of the provision: installation and acceptance.

Cell reference Y2-X4: Service provisioning - Capacity

Description: Requirement regarding the number of customers expected to require simultaneously the provision, installation and acceptance facilities.

NOTE: Capacity requirements are a provider and not a customer issue. Their impact is expected to be covered by the previous criteria.

Cell reference Y2-X5: Service provisioning - Reliability

Description: Requirement regarding the reliability of the provision: installation and acceptance facilities.

SLO example:

EXAMPLE: The availability, time and integrity scores should be 100 % compliant to the contract.

Cell reference Y2-X6: Service provisioning - Flexibility

Description: Options required by customer to accommodate special requirements on the provision, installation and acceptance facilities.

SLO examples:

EXAMPLE 1: Scheduling of the provision of the service should suit the customer wish within the offer perimeter.

EXAMPLE 2: Provision of terminal equipment to match customer preferences where possible.

Cell reference Y2-X7: Service provisioning - Usability

Description: Requirement regarding the ease and convenience with which a service should be.

SLO example:

EXAMPLE: The installation, softwares and equipments should match as far as possible the customer wishes.

Cell reference Y2-X8: Service provisioning - Security

Description: Identification of the aspects of the provision: installation and acceptance where the customer security, privacy or confidentiality requirements should be met by the provider.

SLO example:

EXAMPLE: The customer should be informed by the provider on all the current security threats.

6.1.3 Matrix line Y3 - Service alteration/Technical upgrade

This activity has been split into two lines one for modification to the service conditions at the customer initiative and the other one for technical upgrade of any service component at the provider initiative.

6.1.3.1 Matrix line Y-3.1 - Service alteration

Any requirement related to activities associated with the alteration of a telecommunication service, from the time alteration to a service is requested by the customer to the time this alteration is carried to the satisfaction of the customer.

Cell reference Y3.1-X1: Alteration (Change at customer initiative) - Availability

Description: Requirement regarding the availability of resources at the provider to carry out alteration to the service as requested by the customer.

SLO example:

EXAMPLE: 100 % of alteration requests compliant to the offer should be accepted by the SP.

Cell reference Y3.1-X2: Alteration (Change at customer initiative) - Integrity

Description: Requirement regarding the correctness and completeness with which requests for alteration to service should be carried out.

SLO example:

EXAMPLE: Any alteration should be carried out without error or mismatch.

Cell reference Y3.1-X3: Alteration (Change at customer initiative) - Time

Description: Requirement regarding the time taken from request to the provider for an alteration to a service to the instant the altered service is available for use.

SLO example:

EXAMPLE: The alteration time should be less than x week.

Cell reference Y3.1-X4: Alteration (Change at customer initiative) - Capacity

Description: Requirement regarding the number of alteration requests expected simultaneously.

SLO example:

EXAMPLE: The number of requests for update is expected to be around x a month.

NOTE: x may depend on the user' activities (work, leisure, etc.) and could be established in the expectations from the user, when contracting.

Cell reference Y3.1-X5: Alteration (Change at customer initiative) - Reliability

Description: Requirement regarding the reliability to carry out the alteration request.

SLO example:

EXAMPLE: The availability, time and integrity scores should be 100 % compliant to the contract.

Cell reference Y3.1-X6: Alteration (Change at customer initiative) - Flexibility

Description: Options required to accommodate special requirements relating to alteration of a service.

SLO examples:

EXAMPLE 1: The customer's request for reading meter at a requested time when moving to a new address should be met within the offer conditions.

EXAMPLE 2: The customer's request to carry his telephone number to a new address should be met within the offer conditions.

Cell reference Y3.1-X7: Alteration (Change at customer initiative) - Usability

Description: Requirement regarding the ease and convenience with which alteration to a service should be carried out for the customer by the provider.

SLO example:

EXAMPLE: The use of the updated service should not be less user-friendly than before the update.

Cell reference Y3.1-X8: Alteration (Change at customer initiative) - Security

Description: Identification of the aspects of service provisioning where the customer security, privacy or confidentiality requirements should be met by the provider.

SLO example:

EXAMPLE: The update should not create additional security threats.

6.1.3.2 Matrix line Y-3.2 - Technical upgrade

Any requirement related to activities associated with the technical evolution of any component of the service at the provider initiative.

Cell reference Y3.2-X1: Technical upgrade (Change at provider initiative) - Availability

Description: Requirement regarding the availability of the upgrade facility.

SLO example:

EXAMPLE: The upgrade should be accessible as soon as announced by the provider.

Cell reference Y3.2-X2: Technical upgrade (Change at provider initiative) - Integrity

Description: Requirement regarding the correctness and completeness with which the technical upgrade to service should be carried out.

SLO example:

EXAMPLE: Upgrades should not bring unexpected incompatibility.

Cell reference Y3.2-X3: Technical upgrade (Change at provider initiative) - Time

Description: Requirement regarding the time taken to perform all activities associated with the technical evolution of any component (hardware or software) of the service from the time the decision is taken to the time the upgrade is achieved.

SLO example:

EXAMPLE: The upgrades should not bring service interruption longer than x hours.

Cell reference Y3.2-X4: Technical upgrade (Change at provider initiative) - Capacity

Description: Requirement regarding the number of simultaneous technical upgrade to be carried out.

SLO example:

EXAMPLE: The customer expects not to have multiple upgrades simultaneously.

Cell reference Y3.2-X5: Technical upgrade (Change at provider initiative) - Reliability

Description: Requirement regarding any upgrade activity to be carried out without any performance lessening of the service.

SLO example:

EXAMPLE: The availability, time and integrity scores should be 100 % compliant to the contract.

Cell reference Y3.2-X6: Technical upgrade (Change at provider initiative) - Flexibility

Description: options required to accommodate special requirements relating to the technical upgrade of the service.

SLO example:

EXAMPLE: The customer should be able to negotiate the upgrade conditions.

Cell reference Y3.2-X7: Technical upgrade (Change at provider initiative) - Usability

Description: Requirement regarding the ease and convenience with which the technical upgrade to a service should be carried out.

SLO example:

EXAMPLE: The upgrade should not introduce new utilization complexities.

Cell reference Y3.2-X8: Technical upgrade (Change at provider initiative) - Security

Description: Identification of the aspects of service provisioning where the customer security, privacy or confidentiality requirements should be met by the provider.

SLO example:

EXAMPLE: Upgrades should not bring additional security vulnerabilities.

6.1.4 Matrix line Y4 - Service support

Any requirement related to activities associated with the support of a telecommunication service to enable the customer's use of the service. This includes, documentation, technical support, commercial support and customers' complaint management.

6.1.4.1 Matrix line Y4.1 - Documentation

Any requirement related to activities associated with provision of documentation to install, set-up and use the various features of the service as well as to identify and fix possible troubles.

Cell reference Y4.1-X1: Documentation - Availability

Description: Requirement regarding the availability of the documentation to install and use the various features of the service with respect to the level of user knowledge.

SLO example:

EXAMPLE: The documentation service should be accessible by different means x days a week and y hours a day.

Cell reference Y4.1-X2: Documentation - Integrity

Description: Requirement regarding the correctness and completeness in the provision of the documentation.

SLO example:

EXAMPLE: The information available from the documentation service should match x % of the requests.

Cell reference Y4.1-X3: Documentation - Time

Description: Requirement regarding the time within which the documentation should be supplied.

SLO example:

EXAMPLE: The documentation should be supplied within less than one day after the request.

Cell reference Y4.1-X4: Documentation - Capacity

Description: Requirement regarding the number of support requests expected simultaneously.

SLO example:

EXAMPLE: The possibility, for the user, to access the support service, at least once a day. If the support service is not available for each user at any time, a message should inform the user about the time period to reach it, or to provide a time slot for a further access.

NOTE: The number of simultaneous support requests is around x requests a day.

Cell reference Y4.1-X5: Documentation - Reliability

Description: Requirement regarding the reliability of the documentation provision.

SLO example:

EXAMPLE: The availability, time and integrity scores should be 100 % compliant to the offer.

Cell reference Y4.1-X6: Documentation - Flexibility

Description: Customer's requirements to get a documentation suited to the user knowledge and experience (in paper or electronic format) on specific issues with the appropriate detail level.

SLO example:

EXAMPLE: The documentation should be provided via various modes (paper, on-line, etc.).

Cell reference Y4.1-X7: Documentation - Usability

Description: Requirement regarding the ease to use the documentation provided.

SLO example:

EXAMPLE: Convenient search tools should be provided to found the required information.

Cell reference Y4.1-X8: Documentation - Security

Description: Identification of the aspects of service support where the customer security, privacy or confidentiality requirements should be met by the provider.

SLO example:

EXAMPLE: The documentation provision process should not harm the user privacy.

6.1.4.2 Matrix line Y4.2 and Y4.3 - Technical and commercial support

Any requirement related to activities associated with the technical and commercial support of a telecommunication service to help users experiencing problems in the use of the service.

Cell reference Y4.2/4.3-X1: Technical and commercial support - Availability

Description: Requirement regarding the availability of the technical and commercial support facilities, including the hours of access as well as methods of access.

SLO example:

EXAMPLE: The support service should be accessible by different means x days a week and y hours a day.

Cell reference Y4.2/4.3-X2: Technical and commercial support - Integrity

Description: Requirement regarding the correctness and completeness in the provision of the technical and commercial support.

SLO example:

EXAMPLE: The instructions of the support service should solve x % of the requests.

Cell reference Y4.2/4.3-X3: Technical and commercial support - Time

Description: Requirement regarding the time taken from a request made to the provider for service support to the instant this has been provided to the satisfaction of the customer.

SLO example:

EXAMPLE: The time taken from a support request to the provider to the instant an efficient solution is made available to the user should be less than y hours.

Cell reference Y4.2/4.3-X4: Technical and commercial support - Capacity

Description: Requirement regarding the number of simultaneous support requests expected simultaneously.

SLO example:

EXAMPLE: The number of simultaneous support requests is around x requests a day.

Cell reference Y4.2/4.3-X5: Technical and commercial support - Reliability

Description: Requirement regarding the reliability of the support.

SLO example:

EXAMPLE: The availability, time and integrity requirements should be 100 % compliant to the offer.

Cell reference Y4.2/4.3-X6: Technical and commercial support - Flexibility

Description: Options required by the customer to satisfy special requirements with regard to the support.

SLO example:

EXAMPLE: The support instructions should be user-friendly.

Cell reference Y4.2/4.3-X7: Technical and commercial support - Usability

Description: Requirement regarding the ease and convenience with which service support is requested and provided. For example, varying levels of service support may be required by different segments of the customer population.

SLO example:

EXAMPLE: The implementation of the technical support instructions should not require technical expertise from the user.

Cell reference Y4.2/4.3-X8: Technical and commercial support - Security

Description: Identification of the aspects of the support where the customer security, privacy or confidentiality requirements should be met by the provider.

SLO example:

EXAMPLE: The implementation of the support instructions should not create additional security threats or harm the user privacy.

6.1.4.3 Matrix line Y4.4 - Complaint management

Any requirement related to activities associated with the customer's complaints to the provider about the service provided.

Cell reference Y4.4-X1: Complaint management - Availability

Description: Requirement regarding the availability of the complaint facility.

SLO example:

EXAMPLE: The complaint management should be available x days a week y hours a day.

Cell reference Y4.4-X2: Complaint management - Integrity

Description: Requirement regarding the correctness and completeness the complaints are dealt with.

SLO example:

EXAMPLE: The complaint should be correctly understood and the answer provided should fully reply to the complaint.

Cell reference Y4.4-X3: Complaint management - Time

Description: Requirement regarding the time taken from a complaint made to the provider to the instant this complaint has been processed to the satisfaction of the customer.

SLO example:

EXAMPLE: The complaint should solved within x days.

Cell reference Y4.4-X4: Complaint management - Capacity

Description: Information regarding the number of customers expected to require simultaneously the complaint management facility.

SLO example:

EXAMPLE: The possibility, for the user, to access the complaint management, at least once a day. If it is not available for each user at any time, a message should inform the user about the time period to reach it, or to provide a time slot for a further access.

NOTE: From the SP point of view: The number of complaint is not expected to exceed x complaint a day.

Cell reference Y4.4-X5: Complaint management - Reliability

Description: Requirement regarding the reliability of the complaint facility.

SLO examples:

EXAMPLE 1: The availability, time and integrity requirements should be 100 % compliant to the offer.

EXAMPLE 2: When the complaints are addressed to different entities of the SP, a global answer, taking into account the individual complaints should be given to the user.

Cell reference Y4.4-X6: Complaint management - Flexibility

Description: Options required to satisfy special requirements with regard to complaint address.

SLO example:

EXAMPLE: Multiple modes should be available for sending complaint to the provider, but all should be equally treated.

Cell reference Y4.4-X7: Complaint management - Usability

Description: Requirement regarding the ease and convenience complaints may be addressed to the provider.

SLO example:

EXAMPLE: The means for sending complaints to the provider should be easily found.

Cell reference Y4.4-X8: Complaint management- Security

Description: Identification of the aspects of complaint management where the customer security, privacy or confidentiality requirements should be met by the provider.

SLO example:

EXAMPLE: The complaint management should not harm the customer privacy.

6.1.5 Matrix line Y5 - Repair-Troubleshooting

Any requirement related to activities associated with the restoration of a telecommunication service to the customer after a fault resulting in partial or complete loss of service or service features.

Cell reference Y5-X1: Troubleshooting - Availability

Description: Requirement regarding the availability of the troubleshooting facilities by the user, including hours of access as well as methods of access.

SLO example:

EXAMPLE: The repair service should be accessible by different means x days a week and y hours a day.

Cell reference Y5-X2: Troubleshooting - Integrity

Description: Requirement regarding the correctness and completeness of the troubleshooting facilities.

SLO example:

EXAMPLE: The service after repair should be 100 % compliant with the contractual specifications.

Cell reference Y5-X3: Troubleshooting - Time

Description: The customer's requirement for the time taken from the report of fault to the provider to the time this fault is fixed.

SLO example:

EXAMPLE: The time taken from a repair request to the provider to the instant the service is again fully available to the user should be less than one week.

Cell reference Y5-X4: Troubleshooting - Capacity

Description: Requirement, if any, regarding the number of simultaneous requests to the troubleshooting facilities, for example in emergency situation.

SLO example:

EXAMPLE: The troubleshooting facilities capacity should be appropriate to face foreseeable service failures.

Cell reference Y5-X5: Troubleshooting - Reliability

Description: Requirement regarding the reliability of the troubleshooting facility.

SLO example:

EXAMPLE: The availability, time and integrity requirements should be 100 % compliant to the offer.

Cell reference Y5-X6: Troubleshooting - Flexibility

Description: Options available in carrying out repairs.

SLO example:

EXAMPLE: Repairs may be carried out, where possible, in the first instance, without access to customer premises. Repairs may also be carried out at customer's convenience should entry to premises be required. Alternative service may be requested if service is unusable.

Cell reference Y5-X7: Troubleshooting - Usability

Description: Requirement regarding the ease and convenience with which a fault can be reported to the provider and repair carried out.

SLO example:

EXAMPLE: The troubleshooting process should not require technical expertise from the user.

Cell reference Y5-X8: Troubleshooting - Security

Description: Identification of the aspects of troubleshooting where the customer security, privacy or confidentiality requirements should be met by the provider.

SLO example:

EXAMPLE: The troubleshooting operation should not bring additional security threats.

6.1.6 Matrix line Y6 - Metering/Charging/Billing

Any requirement related to activities associated with the metering, charging and billing of a telecommunication service to a customer.

This could be for one call, for a specified period or for a given billing amount, depending whether it is about a bill or any other type of expense information, e.g. electronic bill, expense signal, real time expense information on the provider website, AoC-S supplementary service, etc.

There are multiple causes that can lead to billing errors with respect to the actual use of the service but such errors can hardly be monitored in real time. Therefore, a conformity assessment of checking-up of the metering and billing system seems more appropriate than a real time KQI monitoring. Such checking-up should focus on several aspects:

- Ensure that there is no systematic error in the metering system.
- Ensure that there is no discrepancy between the metering and the billing.
- Ensure that any change in the metering and billing system does not lead to a new error cause.

A specific standard, ETSI TS 102 845 [i.35], has been developed for checking Metering and Billing systems and another one, ETSI TS 102 846 [i.36], for Bodies Providing Conformity Assessment of Checking-up on Metering and Billing Processes. The two previous standards define the conditions for a party to be chosen for the checking-up and conformity assessment. This conformity assessment has to be monitored and reviewed regularly in conformance with the available standards in the management area, e.g. ISO/IEC 17021 [i.45].

Cell reference Y6-X1: Charging/Billing - Availability

Description: Requirement regarding the availability of any type of expense information at the customer request.

SLO example:

EXAMPLE: The expense information should be accessible by different means x days a week and y hours a day.

Cell reference Y6-X2: Charging/Billing - Integrity

Description: Requirement regarding the completeness and the accuracy of any type of expense information in reflecting actual use of the service according to the conditions of the contract in particular every tariff parameter including day time and day of the week.

SLO example:

EXAMPLE: The expense information available should match 100 % of the expenses.

Cell reference Y6-X3: Charging/Billing - Time

Description: Requirement regarding the time taken from the end of a communication to the time the expense information is provided to the customer.

SLO example:

EXAMPLE: The expense information should be supplied within less than one day after the actual expense.

Cell reference Y6-X4: Charging/Billing - Capacity

Description: Requirement regarding the number of customers expected to require simultaneously access to the various types of expense information.

SLO example:

EXAMPLE: The charging/billing service capacity should process all the user expenses in due time.

Cell reference Y6-X5: Charging/Billing - Reliability

Description: Requirement regarding the reliability of any type of expense information. This particular aspect is expected to be better assessed by a commitment of the provider to conform to a code of best practices or still better by the certification of the provider charging/billing process on this particular aspect.

SLO example:

EXAMPLE: The availability, time and integrity scores should be 100 % compliant to the offer.

Cell reference Y6-X6: Charging/Billing - Flexibility

Description: Options required for:

a) the format of the billing information made available;

b) the time when billing information may be available;

c) any other type of expense information.

SLO example:

EXAMPLE: The expense information should be provided via various modes (paper, on-line, etc.).

Cell reference Y6-X7: Charging/Billing- Usability

Description: Requirement regarding the ease and convenience with which the various types of expense information are provided.

SLO example:

EXAMPLE: Convenient search tools should be provided to found the required information (type of expense, amount, period of time, etc.).

Cell reference Y6-X8: Charging/Billing - Security

Description: Identification of the aspects of any type of expense information where the customer security, privacy or confidentiality requirements should be met by the provider.

SLO example:

EXAMPLE: The expense information provision process should not harm the user privacy.

6.1.7 Matrix line Y7 - Cessation

Any requirement related to activities associated with the cessation of a telecommunication service from the time it is requested by a customer, to the time it is completed to the satisfaction of the customer.

Cell reference Y7-X1: Cessation - Availability

Description: Requirement regarding the availability of the facilities offered to the customers for cessation of service.

SLO example:

EXAMPLE: The cessation process should be available to any user request according to the contract conditions.

Cell reference Y7-X2: Cessation - Integrity

Description: Requirement regarding the correctness and completeness in carrying out the cessation of a service and the associated activities irrespective of whether the cessation was initiated by the customer or the provider.

Comments: Cessation of a service may include the removal of associated equipment from customer premises; cessation of a service may include closing of all records and associated transactions between the customer and the provider.

SLO example:

EXAMPLE: The cessation should include all the service elements of the offer.

Cell reference Y7-X3: Cessation - Time

Description: Customer's requirements for the time taken from the request for cessation of service to the instant cessation is carried out by the provider.

SLO example:

EXAMPLE: The cessation should be effective in a time period compliant to the contract.

Cell reference Y7-X4: Cessation - Capacity

Description: Requirement regarding the means allocated to perform the cessation process.

NOTE: Capacity requirements are a provider and not a customer issue. Their impact is expected to be covered by the previous criteria.

Cell reference Y7-X5: Cessation - Reliability

Description: Requirement regarding the reliability of the facility for the cessation of a service and the associated activities.

SLO example:

EXAMPLE: The availability, time and integrity scores should be 100 % compliant to the offer.

Cell reference Y7-X6: Cessation - Flexibility

Description: Requirement related to minimizing inconvenience during the process of cessation of a service.

SLO example:

EXAMPLE: Cessation process should be available in person, by the telephone, email or on-line.

Cell reference Y7-X7: Cessation - Usability

Description: Requirement regarding the ease and convenience of activities connected with cessation of a service subscription.

SLO example:

EXAMPLE: The language, phrasing and expressions chosen in the cessation process are aimed at maximum understanding for the target customer segment.

Cell reference Y7-X8: Cessation - Security

Description: Identification of the aspects of the cessation process where the customer security, privacy or confidentiality requirements should be met by the provider.

SLO example:

EXAMPLE: After cessation, all the customer information should be destroyed.

6.1.8 Matrix line Y8 - Network/service management by the customer

Any requirement related to activities associated with the customer's control of predefined changes to telecommunication services or network configurations.

Cell reference Y8-X1: Network/service management by customer - Availability

Description: Requirement regarding the availability of the networks/service management facilities.

SLO example:

EXAMPLE: 100 % of network/service management requests compliant to the offer should be activated by the user.

Cell reference Y8-X2: Network/service management by customer - Integrity

Description: Requirement regarding the correctness and completeness of the network or service management facilities.

SLO example:

EXAMPLE: Any network/service management should be carried out without error or mismatch.

Cell reference Y8-X3: Network/service management by customer - Time

Description: Customers requirement for the time taken for access and responses to a request to the network/service management facilities.

SLO example:

EXAMPLE: The time taken from the request for a network/service management action to the instant this action is effective should be less than x hours/minutes.

Cell reference Y8-X4: Network/service management by customer - Capacity

Description: Requirement regarding the means allocated to perform the network/service management.

SLO example:

EXAMPLE: The network/service management means should be appropriate to face the agreed number of foreseeable customer management requests.

Cell reference Y8-X5: Network/service management by customer - Reliability

Description: Requirement regarding the reliability of the network/service management facilities.

SLO example:

EXAMPLE: The availability, time and integrity requirements should be 100 % compliant to the offer.

Cell reference Y8-X6: Network/service management by customer - Flexibility

Description: Options required for customizations in the network/s service management facilities.

SLO example:

EXAMPLE: The network/service management facilities should be available in customizable modes, according to the offer conditions.

Cell reference Y8-X7: Network/service management by customer - Usability

Description: Requirement regarding the ease and convenience to access the network/service management facilities.

SLO example:

EXAMPLE: The use of the network/service management facilities should not require technical expertise from the user.

Cell reference Y8-X8: Network/service management by customer - Security

Description: Identification of the aspects of network/service management process where the customer security, privacy or confidentiality requirements should be met by the provider.

SLO example:

EXAMPLE: The usage of the network/service management facilities should not create additional security threats or harm the user privacy.

6.1.9 Matrix line Y9 - Service utilization

Any requirement related to the use of a telecommunication service, i.e. assessment of the service technical quality. The use of the service includes all the aspects of the technical quality at the transport level as well as at the service level, taking into account whether the access to the service is switched or not. All these aspects of the technical quality are detailed for each service in ETSI EG 202 009-2 [i.21].

NOTE 1: The information given in the following cells should be tailored to the features of each service and of its specific functions. This has to take into account whether the access to the service uses a switched or an always on connection. Details can be found in ETSI EG 202 009-2 [i.21]. Therefore, if the identification of the users' QoS requirements has to take into account various services with multiple functions, this set of cells has to be fulfilled for each of these services and functions.

NOTE 2: For the particular case of service utilization, accessibility seems preferable to availability as the server may be available with no network to gain access to it.

Y9.1 Access: The various aspects of the technical quality at the access level.

Cell reference Y9.1-X1: Access - Accessibility

Description: Accessibility requirement including temporal and spatial conditions for the access function.

SLO example:

EXAMPLE: The percentage of unsuccessful log-ins with respect to the total number of attempts should not be exceeding 1 %.

Cell reference Y9.1-X2: Access - Integrity

Description: Reference levels required for the faithfulness and completeness in carrying out the access function.

SLO example:

EXAMPLE: The number of unsuccessful transmissions of a test file due to data alteration with respect to the total number of transmission attempts should not be exceeding 1 %.

Cell reference Y9.1-X3: Access - Time

Description: Required time conditions for the access function.

SLO example:

EXAMPLE: The end to end measurement of service availability in term of capacity for an Internet customer to access to the Internet should not exceed 2 s.

Cell reference Y9.1-X4: Access - Capacity

Description: Capacity conditions required for the components of the access function if any.

SLO example:

EXAMPLE: 95 % of the data transmission rate achieved in kbit/s should not be lower than x MBit/s.

Cell reference Y9.1-X5: Access - Reliability

Description: Requirements regarding the reliability of the access function over a given time period.

SLO example:

EXAMPLE: The availability, integrity, time and capacity scores should be 100 % compliant to the contract.

Cell reference Y9.1-X6: Access - Flexibility

Description: Options required in using the access function.

SLO examples:

EXAMPLE 1: The assessment of the change ease by a representative user panel (OR value) should not be lower than x over a 7 step scale (from 0 to 6).

EXAMPLE 2: The Time to change one contractual specification should not exceed one day.

Cell reference Y9.1-X7: Access - Usability

Description: Requirement for the ease in the application of the access function.

SLO examples:

EXAMPLE 1: The assessment of the user friendliness by a representative user panel (OR value) should not be lower than x over a 7 step scale (from 0 to 6).

EXAMPLE 2: The assessment of the user friendliness by a representative user panel of people with disabilities (OR value) should not be lower than x over a 7 step scale (from 0 to 6).

Cell reference Y9.1-X8: Access - Security

Description: Identification of the aspects of the transport function where the customer security, privacy or confidentiality requirements should be met by the provider.

SLO example:

EXAMPLE: The efficiency and robustness of the authentication should be certified by an entitled body.

Y9.2 Bearer service: The various aspects of the technical quality at the transport level.

Cell reference Y9.2-X1: Bearer service - Availability

Description: Availability requirement including temporal and spatial conditions for the transport function.

SLO example:

EXAMPLE: The probability that Internet is attainable from the user access should not be lower than 95 %.

Cell reference Y9.2-X2: Bearer service - Integrity

Description: Reference levels required for the faithfulness and completeness in carrying out the transport function.

SLO example:

EXAMPLE: The error rate of the bearer service should not exceed x %.

Cell reference Y9.2-X3: Bearer service - Time

Description: Required time conditions for the transport function.

SLO example:

EXAMPLE: 95 % of the ping request should not exceed x ms.

Cell reference Y9.2-X4: Bearer service - Capacity

Description: The bandwidth required for the components of the transport function.

SLO example:

EXAMPLE: The bit rate between a defined Web site and the user's computer should not be less than x Mbit/s.

Cell reference Y9.2-X5: Bearer service - Reliability

Description: Requirements regarding the reliability of the transport function over a given time period.

SLO example:

EXAMPLE: The availability, integrity, time and capacity scores should be 100 % compliant to the contract.

Cell reference Y9.2-X6: Bearer service - Flexibility

Description: Options required in using the transport function.

SLO example:

EXAMPLE: Different bandwidths should be provided according to an agreed schedule.

Cell reference Y9.2-X7: Bearer service - Usability

Description: Requirement for the ease in the use of the transport function.

SLO example:

EXAMPLE: The selection of the bearer service should be user-friendly.

Cell reference Y9.2-X8: Bearer service - Security

Description: Requirement regarding the security of the bearer service.

SLO example:

EXAMPLE: The link between the server A and the terminal B should be secured.

Y9.3 Service usage: The requirements related to the core service functions.

Cell reference Y9.3-X1: Service usage - Availability

Description: Accessibility requirement including temporal and spatial conditions for the core service function.

SLO example:

EXAMPLE: The service should be attainable in more than x % of attempts.

Cell reference Y9.3-X2: Service usage - Integrity

Description: Requirements for the faithfulness and completeness in carrying out the core service function.

SLO example:

EXAMPLE: The number of requests loss should be less than x %.

Cell reference Y9.3-X3: Service usage - Time

Description: Required time conditions for the core service function.

SLO example:

EXAMPLE: x % of the transactions should be achieved in less than y s.

Cell reference Y9.3-X4: Service usage - Capacity

Description: Request number processed by the service component per time unit.

SLO example:

EXAMPLE: X transactions should be processed per second.

Cell reference Y9.3-X5: Service usage - Reliability

Description: Requirements regarding the reliability of the service function over a given time period.

SLO example:

EXAMPLE: The availability, integrity, time and capacity scores should be 100 % compliant to the contract.

Cell reference Y9.3-X6: Service usage - Flexibility

Description: Requirements for the elasticity for the resources needed by the service.

SLO example:

EXAMPLE: x % additional resources are needed the last week of the month.

Cell reference Y9.3-X7: Service usage - Usability

Description: Requirements for the ease in the usage of the core service function.

SLO example:

EXAMPLE: An help menu in the man machine interface should be included in the service usage.

Cell reference Y9.3-X8: Service usage - Security

Description: Requirement regarding the security of the core service function.

SLO example:

EXAMPLE: An unique authentication is required for all the service components.

Y9.4 Presentation and user interface: The various aspects of the quality of the facilities provided to make the service usage user friendly, particularly in having similar services converging in a single interface. This includes the presentation quality of the possible various built-in functions of the service.

Cell reference Y9.4-X1: Presentation and user interface - Availability

Description: Requirement for the presentation of the service to the user and the user interface.

SLO example:

EXAMPLE: The presentation and user interface should fit a set of selected terminals.

Cell reference Y9.4-X2: Presentation and user interface - Integrity

Description: Requirements for the faithfulness and completeness in carrying out the presentation of the service to the user and the user interface.

SLO example:

EXAMPLE: The number of exchange loss should be less than x %.

Cell reference Y9.4-X3: Presentation and user interface - Time

Description: Required time conditions for the presentation of the service to the user and the user interface.

SLO example:

EXAMPLE: x % of exchanges should be achieved in less than y seconds.

Cell reference Y9.4-X4: Presentation and user interface - Capacity

Description: Exchange number processed by the service component per time unit.

SLO example:

EXAMPLE: The number of exchange per second should not be less than y.

Cell reference Y9.4-X5: Presentation and user interface - Reliability

Description: Requirements regarding the reliability of the presentation of the service to the user and the user interface over a given time period.

SLO example:

EXAMPLE: The availability, integrity, time and capacity scores should be 100 % compliant to the contract.

Cell reference Y9.4-X6: Presentation and user interface - Flexibility

Description: Requirements for the customization for the presentation of the service to the user and the user interface.

SLO example:

EXAMPLE: The presentation and user interface service should fit the maturity of the user knowledge.

Cell reference Y9.4-X7: Presentation and user interface quality - Usability

Description: Requirement for the ease in using the presentation of the service to the user and the user interface.

SLO example:

EXAMPLE: The presentation and user interface should be user-friendly (no specific knowledge required).

Cell reference Y9.4-X8: Presentation and user interface - Security

Description: Requirement regarding the security of the presentation.

SLO example:

EXAMPLE: The data exchanges should be secured with security level x.

6.2 Recommendations to fulfil the table cells

6.2.1 Service specific assessable metrics

The next step is to define parameters/indicators that can be used to measure quantitatively the QoS of each aspect of the telecommunications services.

Some aspects of the service throughout its life cycle are more or less generic and should fit almost all services:

Availability:

a) Availability of documentation within specified period of time.

b) Unsuccessful call ratio.

c) Number of successful service alteration within specified period.

d) Dropped call ratio.

Capacity:

a) Ratio of the data bit-rate provided compared to the contractual commitment.

b) Number of pages by time unit.

c) The mean value and standard deviation of the data transmission rate in kbit/s.

Integrity:

a) Listening speech quality **MOS.**

b) Listening speech quality stability **MOS.**

Time:

a) Time for provisioning.

b) Login time.

c) Response time of the technical support.

d) Call set up time.

e) Etc.

6.2.2 Prioritization

In principle all the criteria on the X axis of the matrix given in table 1 are needed for a comprehensive assessment of the QoS. Nevertheless, taking into account that too many parameters would bring a useless management cost and that, depending on the type of service, some criteria are usually more difficult to keep at a high level, it can be sufficient to monitor only the most sensitive ones. Hence, it will be easier to come to a reasonable number of parameters to achieve the best possible compromise between the number of parameters and the accuracy of the QoS evaluation, taking care that a too few may lead to overlook some key aspects. Going through each cell of the table 1 matrix should help to study with the relevant parties involved what is the relative priority of each parameters. Such prioritization should be revised regularly according to the user experience.

Again depending on the application considered, different parameters may be chosen as the most important ones for different uses of the same service.

6.2.3 Selection of the user sample

When QoS parameters are defined or measured, it has to be done according to the target study area. Therefore, it is of paramount importance that the user sample used to carry out the user requirement analysis is chosen carefully in accordance with the aim of the study and usage of the service. In addition, the results should be weighted according to the type of user.

Alternatively enough information should be collected on the users' features to enable the breakdown of the results with respect to these features, or else it would be difficult to use them effectively. This is in principle the case for a survey among the general public.

6.2.4 Practical means to define the SLO

At this stage of the methodologic process, the purpose is to identify for each cell the user requirements, their relative priority with respect to the requirements in the other cells and measurable values for SLO. It should be kept in mind that users do not have the same knowledge of the technology as the providers and therefore appropriate language should be used. This is still more difficult when the issue is about a new technology not implemented yet. In such case, analogy with existing services has to be found in order to refer to current usage. In any case, users are expecting their QoS requirements be seen in an end-to-end perspective not from a narrow technical viewpoint.

While roaming from one cell to another cell, the answers may be provided by various means like questionnaire, face-to-face interviews, telephone interviews, analysis of complaints or case studies.

Questionnaires are most suited for public enquiries as well as telephone interviews. Face-to-face interviews are more appropriate for surveys in business areas or to get confirmation on some specific issues.

Depending on the SLO, appropriate samples have to be defined since different categories of users have often differing requirements even for the same service. The composition and the size of the sample should fit the area covered whether it is the private customer at large, a corporation, a SME or SOHO.

Finally, it is important to remember that not every indicator will be relevant to every user.

6.3 QoS requirements review

It is not always easy to define a value as the acceptable QoS level. Different situations may arise:

1) The user (in most cases the general public) wants to compare the QoS assessment of service offers from different providers, for example before contracting. In such case, the user wants to check the balance between the prices and the QoS actually achieved for these offers in order to identify which ones best match his needs. Then, in an ideal world, the user will have to find the best compromise between prices and contractual performances. In the current world, the situation is more complex as the SP has not always clear QoS commitments. Therefore, the user has to take into account the available QoS statistics.

2) The answer may be in the parameters itself: e.g. the mean opinion score for voice telephony is found "excellent". More often the QoS will be evaluated "good" depending on a statistical treatment of the results, e.g. > 80 % of answers states "high" or higher or alternately < 5 % states poor or less.

3) In other cases, the parameters, e.g. call set-up time, is checked against a reference value; the issue is then to define this reference value. ETSI EG 202 009-2 [i.21] proposes some indicative values but these values have often to be adapted to take into account specific needs. Therefore, if no well recognized values are available, it can be useful to refer to data provided from a panel of users having the same kind of requirements, e.g. same activity sector, same size, etc. These data may be available either from an adequate public repository or from a private contract with a consulting company specialized in such benchmarking surveys. The issue is then again to find a panel of users in the appropriate area of activity, size, etc. The reference value can be taken with respect to the results of such survey (mean value, best of breed, best practice, best in class, etc.) depending of the specific requirements.

Since the technology is evolving very fast, users' QoS requirements and the parameters should be reviewed periodically to take into account new services and user expectations for improvement.

An annual cycle is a mean value for such review depending of course of particular cases.

7 Measurements

The assessment of the QoS may be evaluated against reference values. As seen above these parameters are measured either objectively via technical means or subjectively (perceived QoS) via surveys amongst the users. A mix of objective and subjective measurements is the best means to get the whole QoS picture. As stated above, both ends of the communication may influence the QoS and have to be taken into account for the measurements. In particular, the telecommunication network architecture is more and more often designed to include access networks and transport networks, the influence of which on QoS has to be taken into account in a QoS measurement policy as well as the terminals and any piece of equipment included in the communication path. Therefore, particular terminal types might be specified in order to enable comparisons between different provisions.

7.1 Objective measurements

Parameters like call set up time, call failures, interruptions can quite easily be measured with adequate probes in appropriate locations. Measurements can be made either on real traffic or on artificially generated traffic. This can be done either on public traffic or private networks. As QoS may be different with respect to the location, the geography of the network should be taken into account for the measurements, particularly if the choice is made not to monitor all the parts of the network. A compromise should be set between the wish to monitor everything all the time and the costs and the possible oversizing of the network to ensure the management traffic. Optimization of the measurements may need to focus on some key point of the network or to perform the measurements at busiest hours of the day or week.

7.1.1 Intrusive measurements

This type of measurements is performed on artificially generated traffic and can provide more information since the traffic can be tailored to check almost everything. The drawback of intrusive measurements is to add traffic to the actual one and therefore to lead to additional costs and some possible disturbance.

7.1.2 Non-intrusive measurements

This type of measurements is performed on real traffic conditions and therefore is expected to give a more realistic vision of the QoS but its drawback is that some deficiencies might be missed since not all the communication paths and types are checked.

7.2 Subjective measurements

Subjective measurements are also needed to check the customer perception of a parameter that is monitored objectively. Such measurements may be carried out once a year or if a complaint is raised.

7.3 Measurement by a third party

For some particular aspects of the service, KQI can hardly be monitored and need specific assessments. This is particularly the case for some aspects of charging and billing integrity checking or for security matters for which the assessment is easier to carry out via a survey by a third party independent of the service provision.

The most appropriate procedure is to resort to a Quality of Service Assessment Party (QoSAP) that can be an SP internal department or an independent third party. The QoSAP is expected to manage the QoS assessment process, to analyze the data stored by the SP, to convene an expert panel, to launch a customer survey and to gather the results.

7.4 Who should perform the measurements

There are various ways to perform the measurements. Big corporations may have their own organization to deal with this issue or, alternatively, the task may be given to a third party. Another possibility is to entrust the provider himself to supply also the QoS information. It is expected in such case that a process is set to ensure the confidence in the information provided.

Taking into account that the private users (general public) have requirements and resources differing from Business users, it is expected that a public authority asks a third party to perform the measurements related to their requirements and then makes the results publicly available.

There are now publicly available tools allowing a user for measuring, from his own terminal, some QoS information namely, latency, download and upload bit rates (KPI) and possibly some Web pages download time. This allows the user to get KPI on his own service in his own context. Nevertheless, as there is no direct link between KQI and KPI, this is just an indication and not an accurate measure of the QoS.

A current trend for collecting information on the service performance is to make use of crowd sourcing, i.e. measures made by the consumers with the tools mentioned in the previous clause. This methodology may bring rapidly a lot of interesting data in the actual end-to-end context. Nevertheless, drawing overall conclusions from such measurements needs specific information on the context of the measure (e.g. not only the provider but the type of contract, terminal, location, etc.) and a very careful statistical process taking into account the various possible bias and a thorough segmentation of the measures.

Additional information on the way to perform QoS assessment can be found in ETSI EG 202 843 [i.23] and ETSI TS 102 852 [i.37]. ETSI TS 102 844 [i.34] provides information on how to ensure that the assessment process is performed according to the best practices.

7.5 Result presentation

The result presentation is crucial for the understanding by the users. Taking into account that many measurements result in widely scattered data, it is of upmost importance to provide these results with all the information needed on their spreading, i.e. with histograms, charts or similar information. Detailed information on this can be found in ETSI EG 202 843 [i.23]. This is why it is often preferable to chose parameters like "the times by which the fastest 50 %, 95 % and 99 % of orders are completed" rather than "the mean time to complete the orders" or "the percentage of enquiries answered within the delay taken as a commitment by the provider" rather than "the mean time to answer the enquiries".

8 Conclusion

The present document provides useful guidance on how to structure, define and get the users expectations on QoS to the standard makers, regulators and providers. It is expected also that the users themselves can find here some help, e.g. general public when choosing a provider or user organizations when formulating recommendations or business users when establishing a SLA with their preferred provider. ETSI EG 202 009-2 [i.21] when assessing the quality of services and ETSI EG 202 009-3 [i.22] in establishing a SLA are intended to provide additional support.

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History

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