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**SERIES E: OVERALL NETWORK OPERATION,  
TELEPHONE SERVICE, SERVICE OPERATION AND  
HUMAN FACTORS**

Quality of telecommunication services: concepts, models,  
objectives and dependability planning – Terms and  
definitions related to the quality of telecommunication  
services

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**Definitions of terms related to quality of service**

Recommendation ITU-T E.800



ITU-T E-SERIES RECOMMENDATIONS  
**OVERALL NETWORK OPERATION, TELEPHONE SERVICE, SERVICE OPERATION AND HUMAN FACTORS**

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## **Recommendation ITU-T E.800**

### **Definitions of terms related to quality of service**

#### **Summary**

Recommendation ITU-T E.800 provides a set of commonly used terms in the study and management of quality of service (QoS). The technical and non-technical terms related to the QoS listed in this Recommendation are intended to represent the interests of all parties of telecommunications service market, i.e., user, service provider, manufacturer and regulator.

The definition of terms is in the context of QoS. Some terms may be defined differently in other documents in another context. Therefore, care should be taken in the use of such terms in their appropriate context. For a comprehensive set of QoS terms, one is referred to Recommendations related to specific services or performance characteristics.

#### **Source**

Recommendation ITU-T E.800 was approved on 23 September 2008 by ITU-T Study Group 2 (2005-2008) under the WTSA Resolution 1 procedure.

## FOREWORD

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The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

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# Recommendation ITU-T E.800

## Definitions of terms related to quality of service

### 1 Introduction

#### 1.1 Overview

Terminology standardization is necessary for two main reasons:

- to avoid confusion to standards users by introducing conflicting terms and definitions;
- to assist alignment between the various groups involved in telecommunication standards development.

A consistent set of terms and definitions is required, therefore, to develop the important areas of quality of service (QoS) and network performance (NP). The technical and non-technical terms related to the QoS listed in this Recommendation are intended to represent the interests of all parties of telecommunications service market, i.e., user, service provider, manufacturer and regulator.

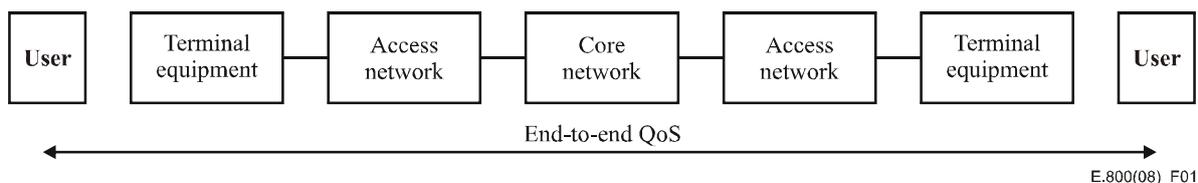
The definition of terms is in the context of QoS. Some terms may be defined differently in other documents in another context. Therefore, care should be taken in the use of such terms in their appropriate context.

The intention of this Recommendation is to set out a comprehensive set of terms and definitions relating to these concepts. These collective terms and definitions can be universally applied to all telecommunication services and the network arrangements used to provide these.

This Recommendation is intended to cover the commonly used terms in the study and management of QoS. For a comprehensive set of QoS terms, one is referred to Recommendation(s) related to specific services or performance characteristics.

#### 1.2 General guide to concepts

The end-to-end QoS depends on the contributions made by the components as illustrated in Figure 1.



**Figure 1 – Schematic contributions to end-to-end QoS**

NOTE 1 – The configuration illustrated above is for the conventional service with users at each end of a connection. However, the principle of this configuration may be applied to services offered by a service provider at one end and user/s at the other end.

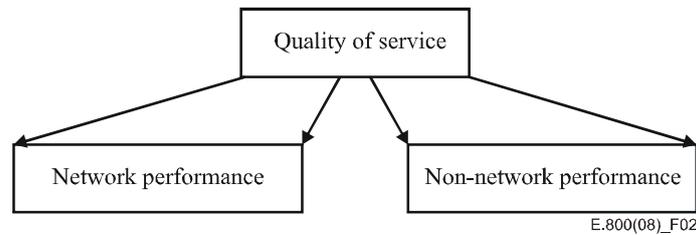
NOTE 2 – Terminal equipment: Contribution to the end-to-end QoS could depend on the variability of the performance of the terminal equipment.

NOTE 3 – Access network: The contributions of access network to the end-to-end QoS depend on the combination of access medium and technology used for a particular service (e.g., wireless, cable, ADSL etc.).

NOTE 4 – Core network: The core network may be a single provider or a concatenation of different provider's networks. QoS contribution to end-to-end performance from core network will be governed by the contributions from individual network components (whether single provider or multi providers); technology used (digital multiplexing, IP, etc.) transmission media (air, cable optical or metal) and other factors.

To specify the end-to-end QoS, it is necessary to state the specified operating conditions in which a service is supported over a connection (connectionless or connection oriented) that takes place. The QoS could also be altered for a given set of specified operating conditions by environmental conditions, such as traffic and routing.

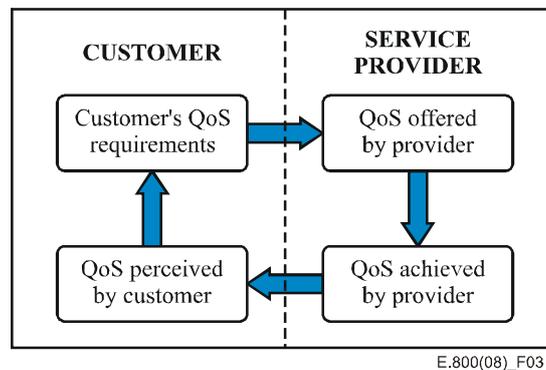
Figure 2 illustrates the relationship between QoS and network performance (NP). QoS comprises both network performance and non-network related performance. Examples of NP are bit error rate, latency, etc., and for non-network performance provision time, repair time, range of tariffs and complaints resolution time, etc. The list of QoS criteria for a particular service would be dependent upon the service and their relevance could vary among the segments of the customer population.



**Figure 2 – Quality of service comprises network and non-network criteria**

At a more detailed level, QoS can be divided into four viewpoints as illustrated in Figure 3. This concept is described further in [ITU-T G.1000].

A generic definition of QoS is derived from a definition of quality and is given in clause 2. Of particular interest is QoS experienced by the user (expressed by QoSE or QoSP – QoS perceived). QoSE is influenced by the delivered QoS and the psychological factors influencing the perception of the user. Understanding of the QoSE is of primary importance to help optimize revenue and resources of the service provider.



**Figure 3 – Four viewpoints of quality of service**

Various issues related to QoS are brought together in [ITU-T E.802]. It also shows the inter-relationship between various QoS aspects.

## 2 General terms

### 2.1 Quality

The totality of characteristics of an entity that bear on its ability to satisfy stated and implied needs.

NOTE – The *characteristics* should be observable and/or measurable. When the characteristics are defined, they become parameters and are expressed by metrics (see clauses 2.7 to 2.13).

## **2.2 Quality of service (QoS)**

Totality of characteristics of a telecommunications service that bear on its ability to satisfy stated and implied needs of the user of the service.

## **2.3 QoS requirements of user/customer (QoS<sub>R</sub>)**

A statement of QoS requirements by a customer/user or segment/s of customer/user population with unique performance requirements or needs.

NOTE – The customer/user needs may be expressed in descriptive terms (criteria) listed in the order of priority, with preferred performance value for each criterion. The service provider then translates these into parameters and metrics pertinent to the service (see [ITU-T E.802]).

## **2.4 QoS offered/planned by service provider (QoS<sub>O</sub>)**

A statement of the level of quality planned and therefore offered to the customer by the service provider.

NOTE – Level of QoS the service provider plans to achieve (and therefore offers) to the customer/user is expressed by target values (or range) for measures of parameters pertinent to a specified service.

## **2.5 QoS delivered/achieved by service provider (QoS<sub>D</sub>)**

A statement of the level of QoS achieved or delivered to the customer.

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

## **2.6 QoS experienced/perceived by customer/user (QoS<sub>E</sub>)**

A statement expressing the level of quality that customers/users believe they have experienced.

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

NOTE 2 – QoS<sub>E</sub> has two main components: quantitative and qualitative. The quantitative component can be influenced by the complete end-to-end system effects (network infrastructure).

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

NOTE 4 – QoS<sub>E</sub> may also be *considered* as QoS<sub>D</sub> received and interpreted by a user with the pertinent qualitative factors influencing his/her perception of the service.

## **2.7 Characteristic**

A property which helps to differentiate between the individuals of a given population.

NOTE – The differentiation may be either quantitative (by variables) or qualitative (by attributes).

## **2.8 Criterion**

Collections of characteristics or a single characteristic, as appropriate, to describe benefit to user of a product or a service.

## **2.9 Parameter**

A quantifiable characteristic of a service with specified scope and boundaries.

Example: The parameter for estimating the 'misdialling probability' would be expressed as: 'The number of misdialled calls per 100 call attempts'.

NOTE – Parameters may be objective or subjective.

## **2.10 Objective (Quantitative) parameters**

Parameters that are measurable (with instruments or observations) and a performance value assigned quantitatively may be classified as objective parameters.

NOTE – Examples: error rate of a channel, repair time.

## **2.11 Subjective (Qualitative) parameters**

Parameters that can be expressed using human judgment and understanding may be classified as subjective or qualitative parameters.

NOTE 1 – Qualitative parameters are expressed by opinion ratings.

NOTE 2 – Example: The ergonomic quality of a mobile handset ('feel good' factor) may be expressed by ratings on a given scale.

## **2.12 Measure**

A unit by which a parameter may be expressed.

Example: Waiting time for provision of a service may be expressed as *calendar or working days*.

## **2.13 Metric (also called 'Indicator')**

Value calculated from observed attribute/s of a measure.

NOTE 1 – When the temperature is expressed, as 38 degrees Centigrade, 38 is the metric and Centigrade is the measure.

NOTE 2 – Availability of a connection link expressed as 99.99% (metric) may be *calculated* by the summation of the individual availabilities (*observed attributes*) of the router, transmission link of access and the core network.

## **2.14 Service**

A set of functions offered to a user by an organization constitutes a service.

## **2.15 Connection**

Connection is used in the context of establishing communication between two points in a network. Connection is "bearer path, label switched path, virtual circuit, and/or virtual path established by call routing and connection routing". ([ITU-T E.360.1] and [ITU-T E.361])

## **2.16 Item**

Any part, device, subsystem, functional unit, equipment or system that can be individually considered.

NOTE – An item may consist of hardware, software or both, and may also include people, e.g., operators in a telephone operator system.

## **2.17 User**

User is an entity that makes use of CE (e.g., initiates or answers a call ([ITU-T Q.1300]).

or

A person or entity external to the network, which utilizes connections through the network for communication.

NOTE – Connection is used in the context of establishing communication between two points in a network. Connection is "bearer path, label switched path, virtual circuit, and/or virtual path established by call routing and connection routing". ([ITU-T E.360.1] and [ITU-T E.361])

## **2.18 Customer**

A user who is responsible for payment for the services.

## **2.19 Network performance**

The ability of a network or network portion to provide the functions related to communications between users.

NOTE 1 – Network performance applies to the network provider's planning, development, operations and maintenance and is the detailed technical part of QoS.

NOTE 2 – Network performance parameters are meaningful to network providers and are quantifiable at the part of the network which they apply.

## **2.20 Network provider**

An organization that owns a telecommunications network for the purpose of transporting bearers of telecommunication services.

## **2.21 Service provider**

An organization that provides services to users and customers.

## **3 Quality of service terms**

Quality of service terms have been classified into three broad areas; *service, network and management*.

### **3.1 Service-related terms**

#### **3.1.1 General**

##### **3.1.1.1 Service provision**

###### **3.1.1.1.1 Provision**

All activities associated with the provision of a service by the service provider from the instant an order for a service is contracted to the instant the service is available for use by the customer/user.

or

All activities undertaken by the service provider from the instant an order for a service is contracted to the instant the service is available for use by the customer/user.

###### **3.1.1.1.2 Cessation**

All activities associated with the cessation of a service by a service provider from the instant a contractual agreement is in force between the customer and the service provider to the instant all hardware and software associated with the service is made inoperative and/or removed from the customer's premises.

or

All activities associated with suspension of a service by a service provider from the instant a contractual agreement is in force between the customer and the service provider to the instant all hardware and software associated with the service is made inoperative and/or removed from the customer's premises.

##### **3.1.1.2 Call set-up**

###### **3.1.1.2.1 Call set-up time**

The period starting when the address information required for setting up a call is received by the network (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 (i.e., recognized on the calling user's access line). Local, national and service calls should be included, but calls to Other Licensed Operators should not, as a given operator cannot control the QoS delivered by another network.

###### **3.1.1.2.2 Service accessibility performance**

The ability of a service to be obtained, within specified tolerances and other given conditions, when requested by the user.

### **3.1.1.2.3 Mean service access delay**

The expectation of the time duration between an initial bid by the user for the use of a service and the instant the user has access to the service, the service being obtained within specified tolerances and other given operating conditions.

### **3.1.1.2.4 Service user mistake probability**

Probability of a mistake made by a user in his attempt to utilize a service.

### **3.1.1.2.5 Dialling mistake probability**

The probability that the user of a telecommunication network makes dialling mistakes during his call attempts.

### **3.1.1.2.6 Call abandonment probability**

The probability that a user abandons the call attempt through a telecommunication network.

NOTE – Abandonment may be caused by excessive *user* mistake rates, by excessive service access delays, etc.

## **3.1.1.3 Call progress**

### **3.1.1.3.1 Interruption; break (of service)**

Temporary inability of a service persisting for more than a given time duration, characterized by a change beyond given limits in at least one parameter essential for the service.

NOTE 1 – An interruption of a service is generally an interruption of the transmission, which may be characterized by an abnormal value of power level, noise level, signal distortion, error rate, etc.

NOTE 2 – An interruption of a service may also be caused by disabled states of the items used for the service or by external reasons such as high service demand.

### **3.1.1.3.2 QoS variable**

Any performance variable (such as congestion, delay, etc.), which is perceivable by a user. ([ITU-T E.360.1])

### **3.1.1.3.3 Relative QoS**

Traffic delivery where bounds on QoS parameters such as delay, etc., are not expressed in absolute terms. It describes the circumstances where certain classes of traffic are handled differently from other classes of traffic, and the classes achieve different levels of QoS. ([ITU-T Y.2111])

## **3.1.1.4 Service restoration/repair**

### **3.1.1.4.1 Service restoration**

A set of automated or manual methods, invoked after service failure, to enable successful communications to be restored. The activities associated may involve network and/or non-network related issues.

Examples: Service failure may involve failure of network elements, failure of functionalities and/or human errors causing disconnections to service.

### **3.1.1.4.2 Repair (corrective maintenance)**

The maintenance carried out after fault recognition and intended to restore an item to a state in which it can perform a required function.

### **3.1.1.5 Service quality characteristics**

#### **3.1.1.5.1 Speed**

Performance criterion that describes the time interval that is used to perform the function or the rate at which the function is performed. (The function may or may not be performed with the desired accuracy.) ([ITU-T I.350])

#### **3.1.1.5.2 Accuracy**

Performance criterion that describes the degree of correctness with which the function is performed. (The function may or may not be performed with the desired speed.) ([ITU-T I.350])

#### **3.1.1.5.3 Dependability**

Performance criterion that describes the degree of certainty (or surety) with which the function is performed regardless of speed or accuracy, but within a given observation interval. ([ITU-T I.350])

#### **3.1.1.5.4 Availability**

Availability of an item to be in a state to perform a required function at a given instant of time or at any instant of time within a given time interval, assuming that the external resources, if required, are provided. ([ITU-T E.802])

#### **3.1.1.5.5 Reliability**

The probability that an item can perform a required function under stated conditions for a given time interval.

#### **3.1.1.5.6 Simplicity**

Ease and lack of complexity in the benefit to the user of a function of the service. ([ITU-T E.802])

### **3.1.1.6 Charging and billing**

#### **3.1.1.6.1 Charging**

The set of functions needed to determine the price assigned to the service utilization. ([ITU-T Q.825])

#### **3.1.1.6.2 Incorrect charging or accounting probability**

The probability of a call attempt receiving incorrect charging or accounting treatment.

#### **3.1.1.6.3 Undercharging probability**

The probability that a call attempt will be undercharged for any reason.

#### **3.1.1.6.4 Overcharging probability**

The probability that a call attempt will be overcharged for any reason.

#### **3.1.1.6.5 Billing**

Administrative function to prepare bills to service customers, to prompt payments, to obtain revenues and to take care of customer reclaims. ([ITU-T Q.825], [ITU-T Q.1703], [ITU-T Q.1741.2], [ITU-T Q.1741.3])

#### **3.1.1.6.6 Billing error probability**

The probability of an error when billing a user of a service.

#### **3.1.1.6.7 Billing integrity**

The probability that the billing information presented to a user correctly reflects the type, destination and duration of the call attempt.

### **3.1.1.7 Common**

#### **3.1.1.7.1 End-to-end quality**

Quality related to the performance of a communication system, including all terminal equipment.

NOTE – For voice services, it is equivalent to mouth-to-ear quality ([ITU-T P.10]).

#### **3.1.1.7.2 Confidence interval**

The random interval limited by two statistics or by a single statistic, such that the probability that a parameter to be estimated is covered by this interval is equal to a given value.

#### **3.1.1.7.3 Confidence coefficient; confidence level**

The value of the probability associated with a confidence interval or a statistical tolerance interval.

#### **3.1.1.7.4 Probability**

For practical reasons, it may be considered that, whenever the conditions of a test can be reproduced, the probability  $Pr(E)$  of an event  $E$  occurring is the value around which the occurrence frequency of the latter oscillates and towards which it tends when the number of tests are indefinitely increased.

NOTE – The concept of *probability* may be introduced in either of two forms, depending on whether it is intended to designate a degree of belief or whether it is considered as the limit value of a frequency. In both cases, its introduction requires that some precautions be taken which cannot be developed within the context of an International Standard and for which users should refer to specialized literature.

### **3.1.2 Service-specific terms**

#### **3.1.2.1 Mean service provisioning time**

The expectation of the duration between the instant of time a potential user requests that an organization provides the necessary means for a service, and the instant of time when these means are furnished, expressed as the arithmetic mean of a representative number of samples.

#### **3.1.2.2 Service integrity performance**

The degree to which a service is provided without excessive impairments, once obtained.

NOTE – An acceptable level of impairments has to be specified.

#### **3.1.2.3 Speech quality**

Quality of spoken language as perceived when acoustically displayed. Result of a perception and assessment process, in which the assessing subject establishes a relationship between the perceived characteristics, i.e., the auditory event, and the desired or expected characteristics ([ITU-T P.10]).

#### **3.1.2.4 Speech transmission quality**

Speech quality related to the performance of a communication system, in general terms. Categories of speech transmission quality are defined in [ITU-T G.109], based on the prediction of the E-model, i.e., in terms of ranges for the transmission rating factor  $R$  ([ITU-T P.10]).

#### **3.1.2.5 Conversational quality**

Quality with which a bi- or multidirectional conversation is perceived by a communication partner ([ITU-T P.10]).

#### **3.1.2.6 Conversational speech quality**

Speech quality as experienced in a bi- or multidirectional conversation ([ITU-T P.10]).

### **3.1.2.7 One-way voice transmission quality**

Speech quality related to voice signals transmitted over a communication system, experienced by a user of that system in a listening-only situation. Refers to the one-way transmission characteristics only ([ITU-T P.10]).

### **3.1.2.8 Opinion score (in telephony)**

The value on a predefined scale that a subject assigns to his or her opinion of the performance of the telephone transmission system used either for conversation or only for listening to spoken material ([ITU-T P.10]).

### **3.1.2.9 Mean opinion score (MOS)**

The 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. ([ITU-T P.800.1])

NOTE – There are some further different types of MOS. Their definitions are in [ITU-T P.800.1].

### **3.1.2.10 Multimedia**

The combination of multiple forms of media such as audio, video, text, graphics, fax, and telephony in the communication of information ([ITU-T J.148], [ITU-T Q.1702])

### **3.1.2.11 Multimedia services**

A telecommunications service that supports the simultaneous use of multiple media types (e.g., voice, data, video). ([ITU-T E.417])

### **3.1.2.12 Streaming (in multimedia services)**

Multimedia data (usually combinations of voice, text, video and audio) transferred in a stream of packets that are interpreted and rendered, by a software application as the packets arrive.

NOTE 1 – Streaming a technique for transferring multimedia data.

NOTE 2 – Streaming may or may not be in real time.

### **3.1.2.13 Download**

Transfer of data or programs from a server or host computer to one's own computer or device.

## **3.1.3 Security-specific terms**

### **3.1.3.1 Security**

The term 'security' is used in the sense of minimizing the vulnerabilities of assets and resources. An asset is anything of value. A vulnerability is any weakness that could be exploited to violate a system or the information it contains ([ITU-T X. 800]).

### **3.1.3.2 Information security**

Security preservation of confidentiality, integrity and availability of information ([ITU-T X.1051]).

### **3.1.3.3 Data security**

Security preservation of integrity and availability of data.

### **3.1.3.4 Privacy**

The right of individuals to control or influence what information related to them may be collected and stored and by whom and to whom that information may be disclosed.

NOTE – Because this term relates to the right of individuals, it cannot be very precise and its use should be avoided except as a motivation for requiring security ([ITU-T X.800]).

### **3.1.3.5 Password**

Confidential authentication information usually composed of a string of characters ([ITU-T X.800]).

### **3.1.3.6 Confidentiality**

The property that information is not made available or disclosed to unauthorized individuals, entities, or processes ([ITU-T X.800]).

### **3.1.3.7 Data confidentiality**

A service that can be used to provide for protection of data from unauthorized disclosure. The authentication framework supports the data confidentiality service. It can be used to protect against data interception ([ITU-T X.509]).

### **3.1.3.8 Integrity**

The property that data have not been altered in an unauthorized manner ([ITU-T H.235.0]).

### **3.1.3.9 Data integrity**

The property that data have not been altered or destroyed in an unauthorized manner ([ITU-T X.800]).

### **3.1.3.10 Malware**

A generic name for software which intentionally performs actions which can damage data or disrupt systems.

### **3.1.3.11 Hacking**

The term used to describe malicious acts of a wide ranging nature such as overcoming access controls, denial of service, theft of information or installation of malware.

### **3.1.3.12 Phishing**

Creating a replica of an existing web page to fool a user into submitting personal, financial, or password data.

or

The act of sending an e-mail to a user falsely claiming to be an established legitimate enterprise in an attempt to scam the user into surrendering private information that will be used for identity theft. The e-mail directs the users to visit a website where they are asked to update personal information, such as passwords and credit card, social security, and bank account numbers that the legitimate organization already has. The website, however, is bogus and set up only to steal the user's information.

### **3.1.3.13 Virus (Computer virus)**

A computer program that can copy itself and infect a computer without permission or knowledge of the user

or

A program or code that replicates, that infects another program, boot sector, partition sector or document that supports macros by inserting itself or attaching itself to that medium. Most viruses just replicate, a lot also do damage.

#### **3.1.3.14 Worms**

A self-replicating computer program. Unlike a virus, it does not need to attach itself to an existing program. Worms always harm the network (if only by consuming bandwidth), whereas viruses always infect or corrupt files on a targeted computer.

or

A program that makes copies of itself, for example from one disk drive to another, or by copying itself using e-mail or some other transport mechanisms. It may damage and compromise the security of a computer. It may arrive in the form of a JOKE program or software of some sort.

#### **3.1.3.15 Trojan horse**

A piece of software which appears benign or even useful. This conceals the real purpose of the software which is to disrupt the system or to steal information.

#### **3.1.3.16 Fraud**

Fraud in telecommunications is the obtaining or procurement of services without correct payment to the service provider.

or

The obtaining of an unjust advantage through false representations. Advantage gained by unfair means.

#### **3.1.3.17 Forgery**

An entity fabricates information and claims that such information was received from another entity or sent to another entity ([ITU-T M.3016.0]).

#### **3.1.3.18 Spam**

Spam is unwanted, unsolicited and usually invasive Internet advertising.

#### **3.1.3.19 Spamming**

Spamming is the practice of posting unwanted duplicate articles (spam) to large number of network users.

#### **3.1.3.20 Cryptography**

The discipline which embodies principles, means, and methods for the transformation of data in order to hide its information content, prevent its undetected modification and/or prevent its unauthorized use.

NOTE – Cryptography determines the methods used in encipherment and decipherment.

#### **3.1.3.21 Encryption**

A method used to translate information in plaintext into ciphertext ([ITU-T J.170])

or

The process of scrambling signals to avoid unauthorized access ([ITU-T J.93]).

#### **3.1.3.22 Denial of service**

The prevention of authorized access to resources or the delaying of time-critical operations. ([ITU-T X.800]).

#### **3.1.3.23 Cybersecurity**

The protection of data and systems in networks that are connected to the Internet.

## **3.2 Network-related terms**

Some of the more common network related terms – network performance (NP) terms – are listed in this clause. Service-specific NP terms are listed in other Recommendations. A *selection* of such Recommendations are: [ITU-T P.10], [ITU-T Y.1540], [ITU-T Y.1541], [ITU-T Y.1560], [ITU-T Y.1561].

### **3.2.1 Customer premises equipment**

Telecommunications equipment located at the customer installation on the customer side of the network interface. ([ITU-T G.998.1])

### **3.2.2 Network/user interface**

Network/user interface is the physical interface between the network of the service provider and the customer premises equipment of the user or customer.

NOTE – In some instances, the customer premises equipment may be provided by the service provider. The above definition still holds good for such cases.

### **3.2.3 Interconnection**

'Interconnection' shall mean the physical and logical linking of public communications networks used by the same or a different service provider in order to allow the users of one service provider to communicate with users of another service provider, or to access services provided by another service provider.

### **3.2.4 Network accessibility**

The probability that the user of a service after a request (to a network) receives the proceed-to-select signal within specified conditions.

NOTE – The proceed-to-select signal is that signal inviting the *user* to select the desired *destination*.

### **3.2.5 Connection accessibility**

The probability that a connection can be established within specified tolerances and other given conditions following receipt by the exchange of a valid code.

### **3.2.6 Connection establishment error probability**

Ratio of the number of connection establishment attempts that result in an error in connection establishment to the total number of connection establishment attempts in a measurement period. ([ITU-T Y.1560])

### **3.2.7 Connection establishment failure probability**

Ratio of the number of connection establishment attempts that fail to establish a connection to the total number of connection establishment attempts in a measurement period. ([ITU-T Y.1560])

### **3.2.8 Unacceptable transmission probability**

The probability of a connection being established with an unacceptable speech path transmission quality.

### **3.2.9 No tone probability**

The probability of a call attempt encountering no tone following receipt of a valid code by the exchange.

### **3.2.10 Misrouting probability**

The probability of a call attempt being misrouted following receipt by the exchange of a valid code.

### **3.2.11 Trafficability performance**

The ability of an item to meet a traffic demand of a given size and other characteristics, under given internal conditions.

NOTE – Given internal conditions refer, for example, to any combination of faulty and not faulty sub-items.

### **3.2.12 Transmission performance**

An indication of the performance of a communication signal at the egress of a network compared to its performance at the ingress to the network. The indication of performance is expressed by a choice of pertinent parameters for the application or service in question.

Example 1: For voice communication over analogue connections, the transmission performance would be expressed by loss, distortion (various types), noise (various types), etc.

Example 2: For voice over IP networks, the performance would be expressed by delay (latency), jitter and packet loss.

### **3.2.13 Bit transparency**

The ability of a telecommunication system to transport a signal offered to an ingress point and to reproduce it without any change at an egress point within a given period of time.

### **3.2.14 Bit error ratio (BER)**

The ratio of the number of bit errors to the total number of bits transmitted in a given time interval.

### **3.2.15 Error free seconds ratio**

The ratio of the number of one-second intervals during which no bits are received in error to the total number of one-second intervals in the time interval.

NOTE 1 – The length of the *time interval* needs to be specified.

NOTE 2 – This ratio is usually expressed as a percentage.

### **3.2.16 Propagation performance**

The ability of a propagation medium, in which a wave propagates without artificial guide, to transmit a signal within the given tolerances.

### **3.2.17 End-to-end IP network**

The set of EL (exchange link) and NS (network section) that provide the transport of IP packets transmitted from SRC to DST. The MP (measurement point)s that bind the end-to-end IP network are the MPs at the SRC (source host) and the DST (destination host). ([ITU-T Y.1540])

### **3.2.18 End-to-end IP network performance**

Measurable relative to any given unidirectional end-to-end IP service. ([ITU-T Y.1540])

### **3.2.19 Percent IP service availability (PIA)**

Percentage of total scheduled IP service time (the percentage of  $T_{av}$  intervals) that is (are) categorized as available using the IP service availability function. ([ITU-T Y.1540])

### **3.2.20 Release failure probability**

The probability that the required release of a connection will not take place.

### **3.2.21 Connection clearing failure probability**

Ratio of connection clearing failures to the total number of connection release attempts in a measurement period. ([ITU-T Y.1560])

### **3.2.22 Connection establishment success ratio (CESR)**

Number of successful connection establishments divided by the total number of trials. ([ITU-T Y.1562])

## **3.3 Management-related terms**

### **3.3.1 QoS resource management**

Network functions which include class-of-service identification, routing table, derivation, connection admission, bandwidth allocation, bandwidth protection, bandwidth reservation, priority routing, and priority queuing. ([ITU-T E.360.1])

or

In allocating resources, the resource management system has to consider not only resource availability and resource control policy, but also an application's QoS requirements, measured in terms of the QoS parameters.

### **3.3.2 Class of service**

A group of end-to-end quality performance values (or range) for a service is denoted 'class of service'. A service offering may have around three to five classes of services with specified performance limits for the various parameters. These classes of services are usually provided to accommodate different tariffs to the customer.

### **3.3.3 Customer relationship management (CRM)**

Identification and resolution of the issues in the contractual relationship between the service provider and the user in the provision and consumption of a service.

NOTE – Examples of issues are customization of bills, tariff options, variants of service, negotiated repair arrangements, etc.

### **3.3.4 Benchmark**

Evaluation of performance value/s of a parameter or set of parameters for the purpose of establishing value/s as the norm against which future performance achievements may be compared or assessed.

### **3.3.5 Compensation schemes**

A portfolio of payments by the service provider to the customer for shortcomings in the level of the quality delivered, e.g., delays in provision, repair or not achieving the promised level of quality of service, etc.

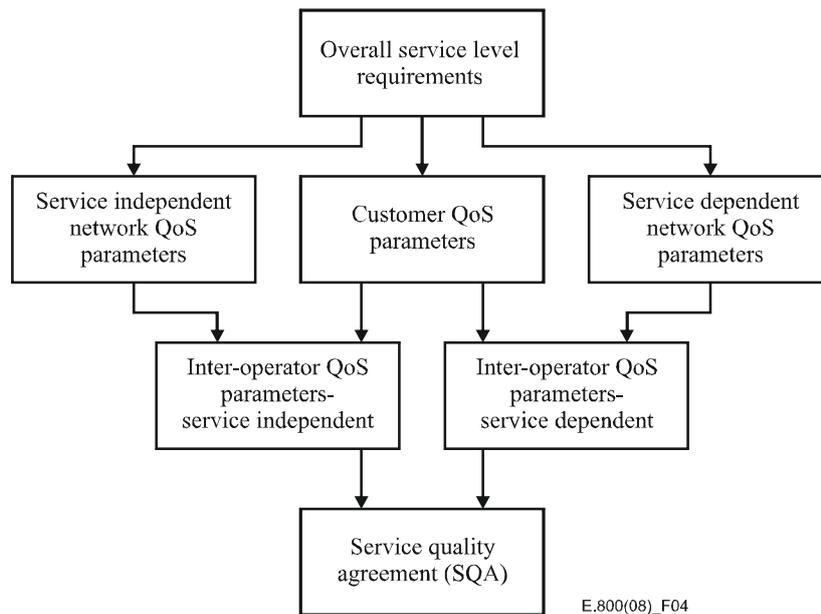
### **3.3.6 Service level agreement (SLA)**

A service level agreement is a formal document listing a set of performance characteristics and target values (or range) to be delivered for a service or portfolio of services by the service provider.

NOTE – A SLA may include statements about performance, tariffing and billing, service delivery compensations and escalation procedures in cases of disagreement.

### 3.3.7 Service quality agreement (SQA)

See Figure 4.



**Figure 4 – Service quality agreement**

### 3.3.8 Time between interruptions

The time duration between the end of one interruption and the beginning of the next.

### 3.3.9 Interruption duration

The time duration of an interruption.

### 3.3.10 Mean time between interruptions (MTBI)

The expectation of time between interruptions computed from a statistically significant number of samples usually expressed as the arithmetic mean.

### 3.3.11 Mean time to restoration (MTTR); Mean time to recovery; Mean time to repair

The expectation of repair time for a statistically significant number of repairs carried out from the instant a fault has been reported to the instant the service restored for use by the customer and usually expressed as the arithmetic mean.

### 3.3.12 Fault coverage

The proportion of faults of an item that can be recognized under given conditions.

### 3.3.13 Repair coverage

The ability of a maintenance organization, under given conditions, to provide upon demand the resources required to maintain an item, under a given maintenance policy.

NOTE – The given conditions are related to the *item* itself and to the conditions under which the *item* is used and maintained.

### 3.3.14 Fault

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

NOTE – A *fault* is often the result of a *failure* of the *item* itself, but may exist without prior *failure*.

### **3.3.15 Corrective maintenance; repair**

The maintenance carried out after fault recognition and intended to restore an item to a state in which it can perform a required function.

### **3.3.16 Reliability performance**

The ability of an item to perform a required function under given conditions for a given time interval.

NOTE 1 – It is generally assumed that the item is in a state to perform this required function at the beginning of the time interval.

NOTE 2 – The term reliability is used as a measure of reliability performance. For this performance concept, the measures in the following subclauses will be used.

#### **3.3.16.1 Mean time to first failure (MTTFF)**

The expectation of time to first failure computed from a statistically significant number of samples usually expressed as the arithmetic mean.

#### **3.3.16.2 Mean time to failure (MTTF)**

The expectation of time to failure computed from a statistically significant number of samples usually expressed as the arithmetic mean.

#### **3.3.16.3 Mean time between failures (MTBF)**

The expectation of the time between failures computed from a statistically significant number of samples usually expressed as the arithmetic mean.

### **3.3.17 Failure rate acceleration factor**

The ratio of the accelerated testing failure rate to the failure rate under stated reference test conditions.

NOTE – Both *failure rates* refer to the same time period in the life of the tested *items*.

### **3.3.18 Disaster recovery, Business continuity**

All activities associated with the restoration of a network provided service after disasters. Examples of such disasters are fire, earthquakes, vandalism, bombings, or software malfunctioning.

### **3.3.19 Complaint**

A statement by a user or customer expressing dissatisfaction due to a gap between the expected and the delivered benefits from the use of a service.

NOTE – A complaint may be made in various forms, writing, electronic means, or in person.

### **3.3.20 Directory services**

A service to search and retrieve information from a catalogue of well-defined objects, which may contain information about certificates, telephone numbers, access conditions, addresses, etc. An example is provided by a directory service conforming to [ITU-T X.500] ([ITU-T X.843]).

## Annex A

### Related QoS/NP Handbooks and E-series Recommendations

(This annex forms an integral part of this Recommendation)

#### References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- [ITU-T E.360.1] Recommendation ITU-T E.360.1 (2002), *Framework for QoS routing and related traffic engineering methods for IP-, ATM-, and TDM-based multiservice networks.*
- [ITU-T E.361] Recommendation ITU-T E.361 (2003), *QoS routing support for interworking of QoS services classes across routing technologies.*
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- [ITU-T E.470] Recommendation ITU-T E.470 (2005), *Operational considerations for QoS of voice over IP-based networks with PSTN-IP-PSTN architecture.*
- [ITU-T E.800] Recommendation ITU-T E.800 (1994), *Terms and definitions related to quality of service and network performance including dependability.*
- [ITU-T E.801] Recommendation ITU-T E.801 (1996) *Framework for service quality agreement.*
- [ITU-T E.802] Recommendation ITU-T E.802 (2007), *Framework and methodologies for the determination and application of QoS parameters.*
- [ITU-T E.860] Recommendation ITU-T E.860 (2002), *Framework of a service level agreement.*
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- [ITU-T G.998.1] Recommendation ITU-T G.998.1 (2005), *ATM-based multi-pair bonding.*
- [ITU-T G.998.2] Recommendation ITU-T G.998.2 (2005), *Ethernet-based multi-pair bonding.*
- [ITU-T G.998.3] Recommendation ITU-T G.998.3 (2005), *Multi-pair bonding using time division inverse multiplexing.*
- [ITU-T G.1000] Recommendation ITU-T G.1000 (2001), *Communications quality of service: A framework and definitions.*
- [ITU-T G.1010] Recommendation ITU-T G.1010 (2001), *End-user multimedia QoS categories.*
- [ITU-T G.1020] Recommendation ITU-T G.1020 (2006), *Performance parameter definitions for quality of speech and other voiceband applications utilizing IP networks.*

- [ITU-T G.1030] Recommendation ITU-T G.1030 (2005), *Estimating end-to-end performance in IP networks for data applications.*
- [ITU-T H.235.0] Recommendation ITU-T H.235.0 (2005), *H.323 security: Framework for security in H-series (H.323 and other H.245-based) multimedia systems.*
- [ITU-T I.350] Recommendation ITU-T I.350 (1993), *General aspects of quality of service and network performance in digital networks, including ISDNs.*
- [ITU-T J.93] Recommendation ITU-T J.93 (1998), *Requirements for conditional access in the secondary distribution of digital television on cable television systems.*
- [ITU-T J.148] Recommendation ITU-T J.148 (2003), *Requirements for an objective perceptual multimedia quality model.*
- [ITU-T J.170] Recommendation ITU-T J.170 (2005), *IPCablecom security specification.*
- [ITU-T M.3016.0] Recommendation ITU-T M.3016.0 (2005), *Security for the management plane: Overview.*
- [ITU-T P.10] Recommendation ITU-T P.10/G.100 (2006), *Vocabulary for performance and quality of service.*
- [ITU-T P.800.1] Recommendation ITU-T P.800.1 (2006), *Mean Opinion Score (MOS) terminology.*
- [ITU-T Q.825] Recommendation ITU-T Q.825 (1998), *Specification of TMN applications at the Q3 interface: Call detail recording.*
- [ITU-T Q.1300] Recommendation ITU-T Q.1300 (1995), *Telecommunication applications for switches and computers (TASC) – General overview.*
- [ITU-T Q.1702] Recommendation ITU-T Q.1702 (2002), *Long-term vision of network aspects for systems beyond IMT-2000.*
- [ITU-T Q.1703] Recommendation ITU-T Q.1703 (2004), *Service and network capabilities framework of network aspects for systems beyond IMT-2000.*
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- [ITU-T X.1051] Recommendation ITU-T X.1051 (2008) | ISO/IEC 27011:2008, *Information technology – Security techniques – Information security management guidelines for telecommunications organizations based on ISO/IEC 27002.*

- [ITU-T Y.1540] Recommendation ITU-T Y.1540 (2002), *Internet protocol data communication service – IP packet transfer and availability performance parameters*.
- [ITU-T Y.1541] Recommendation ITU-T Y.1541 (2006), *Network performance objectives for IP-based services*.
- [ITU-T Y.1560] Recommendation ITU-T Y.1560 (2003), *Parameters for TCP connection performance in the presence of middleboxes*.
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- [ITU-T Y.1562] Recommendation ITU-T Y.1562 (2007), *Framework for higher-layer protocol performance parameters and their measurement*.
- [ITU-T Y.2111] Recommendation ITU-T Y.2111 (2006), *Resource and admission control functions in Next Generation Networks*.
- [ITU-T Hdbk QoS] ITU-T Handbook (2004), *Quality of Service and Network Performance*.  
NOTE – In this Handbook Chapter 2 (with title "Roadmap to ITU-T Recommendations on QoS") offers two ways to access ITU-T Recommendations on QoS, the first through the concept (clause 2.1), and the second through the series organization with a short description of QoS-related content (clauses 2.2 to 2.9).
- [ETSI ETR 003] ETSI ETR 003 ed.2 (1994), *Network Aspects (NA); General aspects of Quality of Service (QoS) and Network Performance (NP)*.  
<<http://electronics.ihs.com/document/abstract/MOXICAAAAAAAAAAAA>>

## **Annex B**

### **List of recommended abbreviations**

(This annex forms an integral part of this Recommendation)

|       |  |
|-------|--|
| BER   | Bit Error Ratio                        |
| CESR  | Connection Establishment Success Ratio |
| COS   | Class of Service                       |
| CRM   | Customer Relationship Management       |
| IPER  | IP Packet Error Ratio                  |
| IPLR  | IP Packet Loss Ratio                   |
| MOS   | Mean Opinion Score                     |
| MTBF  | Mean Time Between Failures             |
| MTBI  | Mean Time Between Interruptions        |
| MTTF  | Mean Time to Failure                   |
| MTTFF | Mean Time to First Failure             |
| MTTR  | Mean Time to Restoration               |
| PIA   | Percent IP service availability        |
| PTD   | Packet Transfer delay                  |
| QoS   | Quality of Service                     |
| QoSD  | QoS Delivered                          |
| QoSE  | QoS Experienced                        |
| QoSO  | QoS Offered                            |
| QoSR  | QoS Requirements                       |
| SLA   | Service Level Agreement                |
| SQA   | Service Quality Agreement              |

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## SERIES OF ITU-T RECOMMENDATIONS

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