

International Telecommunication Union

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

E.800

(09/2008)

**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

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

INTERNATIONAL OPERATION	
Definitions	E.100–E.103
General provisions concerning Administrations	E.104–E.119
General provisions concerning users	E.120–E.139
Operation of international telephone services	E.140–E.159
Numbering plan of the international telephone service	E.160–E.169
International routing plan	E.170–E.179
Tones in national signalling systems	E.180–E.189
Numbering plan of the international telephone service	E.190–E.199
Maritime mobile service and public land mobile service	E.200–E.229
OPERATIONAL PROVISIONS RELATING TO CHARGING AND ACCOUNTING IN THE INTERNATIONAL TELEPHONE SERVICE	
Charging in the international telephone service	E.230–E.249
Measuring and recording call durations for accounting purposes	E.260–E.269
UTILIZATION OF THE INTERNATIONAL TELEPHONE NETWORK FOR NON-TELEPHONY APPLICATIONS	
General	E.300–E.319
Phototelegraphy	E.320–E.329
ISDN PROVISIONS CONCERNING USERS	E.330–E.349
INTERNATIONAL ROUTING PLAN	E.350–E.399
NETWORK MANAGEMENT	
International service statistics	E.400–E.404
International network management	E.405–E.419
Checking the quality of the international telephone service	E.420–E.489
TRAFFIC ENGINEERING	
Measurement and recording of traffic	E.490–E.505
Forecasting of traffic	E.506–E.509
Determination of the number of circuits in manual operation	E.510–E.519
Determination of the number of circuits in automatic and semi-automatic operation	E.520–E.539
Grade of service	E.540–E.599
Definitions	E.600–E.649
Traffic engineering for IP-networks	E.650–E.699
ISDN traffic engineering	E.700–E.749
Mobile network traffic engineering	E.750–E.799
QUALITY OF TELECOMMUNICATION SERVICES: CONCEPTS, MODELS, OBJECTIVES AND DEPENDABILITY PLANNING	
Terms and definitions related to the quality of telecommunication services	E.800–E.809
Models for telecommunication services	E.810–E.844
Objectives for quality of service and related concepts of telecommunication services	E.845–E.859
Use of quality of service objectives for planning of telecommunication networks	E.860–E.879
Field data collection and evaluation on the performance of equipment, networks and services	E.880–E.899
OTHER	E.900–E.999

For further details, please refer to the list of ITU-T Recommendations.

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

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications, information and communication technologies (ICTs). The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

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.

NOTE

In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

Compliance with this Recommendation is voluntary. However, the Recommendation may contain certain mandatory provisions (to ensure e.g., interoperability or applicability) and compliance with the Recommendation is achieved when all of these mandatory provisions are met. The words "shall" or some other obligatory language such as "must" and the negative equivalents are used to express requirements. The use of such words does not suggest that compliance with the Recommendation is required of any party.

INTELLECTUAL PROPERTY RIGHTS

ITU draws attention to the possibility that the practice or implementation of this Recommendation may involve the use of a claimed Intellectual Property Right. ITU takes no position concerning the evidence, validity or applicability of claimed Intellectual Property Rights, whether asserted by ITU members or others outside of the Recommendation development process.

As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementers are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database at <http://www.itu.int/ITU-T/ipr/>.

© ITU 2009

All rights reserved. No part of this publication may be reproduced, by any means whatsoever, without the prior written permission of ITU.

CONTENTS

	Page
1 Introduction	1
1.1 Overview	1
1.2 General guide to concepts	1
2 General terms.....	2
3 Quality-of service terms	5
3.1 Service related terms	5
3.2 Network-related terms	12
3.3 Management-related terms	14
Annex A – Related QoS/NP Handbooks and E-Series Recommendations	17
Annex B – List of recommended abbreviations.....	20
Index – Alphabetical list of definitions contained in this Recommendation	21

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.

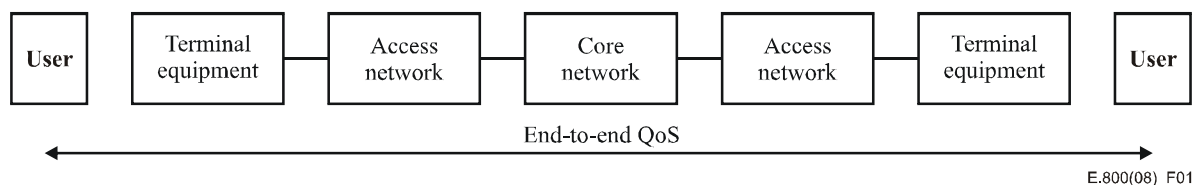


Figure 1 – Schematic contributions to end-to-end QoS

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.

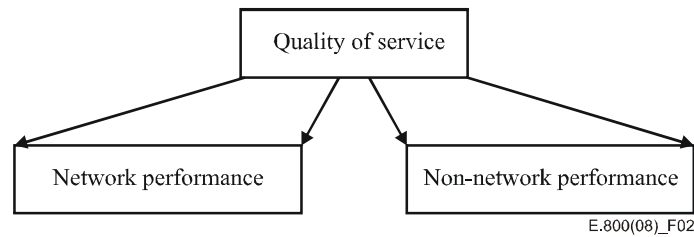


Figure 2 – Quality of service comprises network and non-network criteria

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.

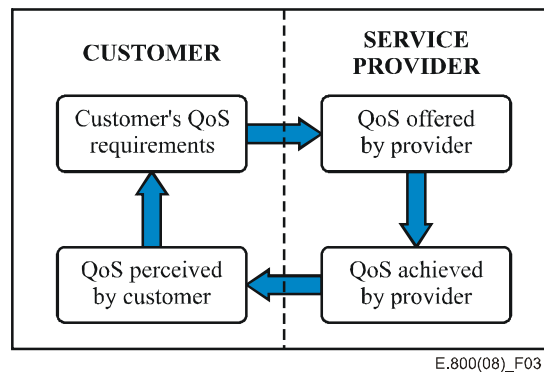


Figure 3 – Four viewpoints of quality of service

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_R)

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_O)

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_D)

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_E)

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_E 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_E may also be *considered* as QoS_D 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 QoSO.

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.

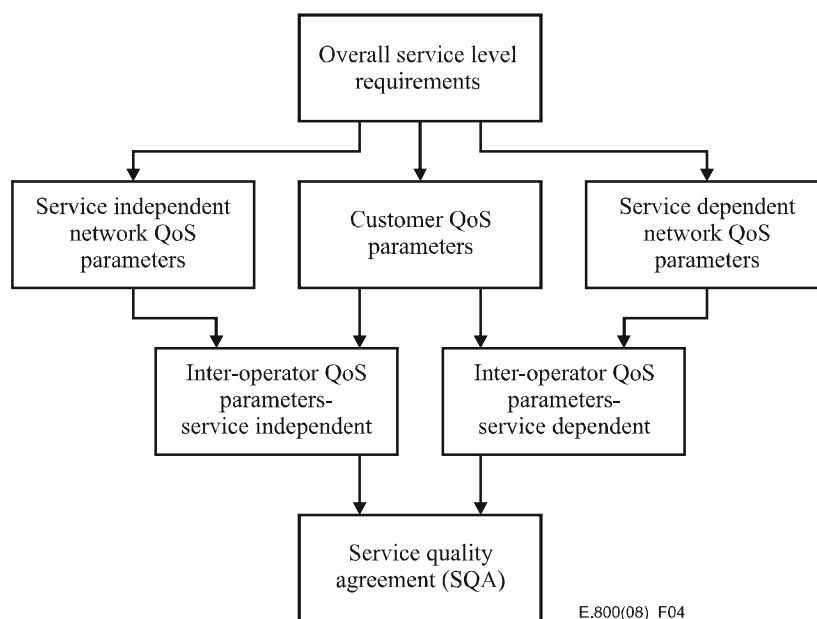


Figure 4 – Service quality agreement

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.*
- [ITU-T E.417] Recommendation ITU-T E.417 (2005), *Framework for the network management of IP-based networks.*
- [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.*
- [ITU-T G.109] Recommendation ITU-T G.109 (1999), *Definition of categories of speech transmission quality.*
- [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.*
- [ITU-T Q.1741.2] Recommendation ITU-T Q.1741.2 (2002), *IMT-2000 references to release 4 of GSM evolved UMTS core network with UTRAN access network.*
- [ITU-T Q.1741.3] Recommendation ITU-T Q.1741.3 (2003), *IMT-2000 references to release 5 of GSM evolved UMTS core network.*
- [ITU-T X.500] Recommendation ITU-T X.500 (2001) | ISO/IEC 9594-1:2001, *Information technology – Open Systems Interconnection – The Directory: Overview of concepts, models and services.*
- [ITU-T X.509] Recommendation ITU-T X.509 (2005) | ISO/IEC 9594-8:2005, *Information technology – Open Systems Interconnection – The Directory: Public-key and attribute certificate frameworks.*
- [ITU-T X.800] Recommendation ITU-T X.800 (1991), *Security architecture for Open Systems Interconnection for CCITT applications.*
- [ITU-T X.843] Recommendation ITU-T X.843 (2000) | ISO/IEC 15945:2002, *Information technology – Security techniques – Specification of TTP services to support the application of digital signatures.*
- [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*.
- [ITU-T Y.1561] Recommendation ITU-T Y.1561 (2004), *Performance and availability parameters for MPLS networks*.
- [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

Index

Alphabetical list of definitions contained in this Recommendation

A

Accuracy
Availability

B

Benchmark
Billing
Billing error probability
Billing integrity (probability)
Bit error ratio (BER)
Bit transparency
Break of service
Business continuity

C

Call abandonment probability
Call set-up time
Cessation
Characteristic
Charging
Class of service
Compensation schemes
Complaint
Computer virus
Confidence coefficient
Confidence interval
Confidence level
Confidentiality
Connection
Connection accessibility
Connection clearing failure probability
Connection establishment error probability
Connection establishment failure probability
Connection establishment success ratio (CESR)
Conversational quality
Conversational speech quality
Corrective maintenance
Cryptography
Criterion
Customer
Customer premises equipment
Customer relationship management (CRM)
Cybersecurity

D

Data confidentiality
Data integrity
Data security
Denial of service
Dependability
Dialling mistake probability
Directory services
Disaster recovery
Download

E

Encryption
End-to-end IP network
End-to-end IP network performance
End-to-end quality
Error free seconds ratio (EFSR)

F

Failure rate acceleration factor
Fault
Fault coverage
Forgery
Fraud

H

Hacking

I

Incorrect charging
Information security
Integrity
Interconnection
Interruption
Interruption duration
Item

L

Loss ratio

M

Malware
Mean opinion score (MOS)
Mean service access delay
Mean service provisioning time
Mean time between failures (MTBF)

Mean time between interruptions (MTBI)
Mean time to failure (MTTF)
Mean time to first failure (MTTFF)
Mean time to restoration (MTTR)
Measure
Metric
Misrouting probability
Multimedia
Multimedia service

N

Network accessibility
Network/user interface
Network performance
Network provider
No tone probability

O

Objective parameters
One-way voice transmission quality
Opinion score (in telephony)
Overcharging probability

Q

QoS achieved by service provider
QoS delivered by service provider
QoS experienced by customer
QoS experienced by user
QoS offered by service provider
QoS perceived by customer
QoS perceived by user
QoS planned by service provider
QoS requirements of customer
QoS requirements of user
QoS resource management
QoS variable
Quality
Quality of service
Qualitative parameters
Quantitative parameters

P

Parameter
Password
Percent IP service availability (PIA)
Phishing
Privacy

Probability
Propagation performance
Provision

R

Relative QoS
Release failure probability
Reliability
Reliability performance
Repair
Repair coverage

S

Security
Service
Service accessibility performance
Service integrity performance
Service level agreement (SLA)
Service Provider
Service quality agreement (SQA)
Service user mistake probability
Service restoration
Spam
Spamming
Speech quality
Speech transmission quality
Speed
Streaming
Subjective parameters
Simplicity

T

Time between interruptions
Trafficability performance
Transmission performance
Trojan horse

U

Unacceptable transmission probability
Undercharging probability
User

V

Virus

W

Worms

SERIES OF ITU-T RECOMMENDATIONS

Series A	Organization of the work of ITU-T
Series D	General tariff principles
Series E	Overall network operation, telephone service, service operation and human factors
Series F	Non-telephone telecommunication services
Series G	Transmission systems and media, digital systems and networks
Series H	Audiovisual and multimedia systems
Series I	Integrated services digital network
Series J	Cable networks and transmission of television, sound programme and other multimedia signals
Series K	Protection against interference
Series L	Construction, installation and protection of cables and other elements of outside plant
Series M	Telecommunication management, including TMN and network maintenance
Series N	Maintenance: international sound programme and television transmission circuits
Series O	Specifications of measuring equipment
Series P	Telephone transmission quality, telephone installations, local line networks
Series Q	Switching and signalling
Series R	Telegraph transmission
Series S	Telegraph services terminal equipment
Series T	Terminals for telematic services
Series U	Telegraph switching
Series V	Data communication over the telephone network
Series X	Data networks, open system communications and security
Series Y	Global information infrastructure, Internet protocol aspects and next-generation networks
Series Z	Languages and general software aspects for telecommunication systems