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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

Framework and methodologies for the determination and application of QoS parameters

ITU-T Recommendation E.802

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ITU-T Recommendation E.802

Framework and methodologies for the determination and application of QoS parameters

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Summary

ITU-T Recommendation E.802 provides a framework and methodologies for the identification of QoS criteria relevant to users and guidelines for conversion of these criteria into QoS parameters that can be used to evaluate the QoS of telecommunication services.

Guidelines are also given to obtain user's QoS requirements and to prioritize the criteria or parameters. All these may be applied to services supported by the terrestrial and wireless legacy networks as well as services supported by the emerging IP network.

Source

ITU-T Recommendation E.802 was approved on 8 February 2007 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. 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.

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ITU-T Recommendation E.802

Framework and methodologies for the determination and application of QoS parameters

1 Scope

This Recommendation provides a framework and methodologies for the identification of QoS criteria relevant to users and guidelines for conversion of these criteria into QoS parameters that can be used to evaluate the QoS of telecommunication services.

Guidelines are also given to obtain user's QoS requirements and to prioritize the criteria or parameters. All these may be applied to services supported by the terrestrial and wireless legacy networks as well as services supported by the emerging IP network.

These QoS criteria are primarily of interest to users and service providers. Those criteria which are of primary concern to the service/network providers (e.g., network performance parameters that contribute to QoS and other performance criteria) to ensure the delivery of the required level of QoS to the user are not covered in this Recommendation.

NOTE – For information on performance measures from the service/network provider's perspective, refer to [ITU-T E.419] on key performance indicators (KPI).

The QoS criteria are based on the 'QoS Requirements of the User', one of the four viewpoints mentioned in Figure 1 of [ITU-T G.1000]. These criteria, with slight modifications, may be used for expressing the offered QoS, the delivered QoS and the perceived QoS as described in [ITU-T G.1000]. The particular use/application of each of these four QoS viewpoints is given in clause 6.1.1.

This Recommendation introduces three models for the identification of QoS criteria of any telecommunication service. All models or a combination of these models may be used for a particular service to enable most, if not all, QoS criteria to be identified. For a particular purpose, a selection of QoS criteria may be chosen from the list of criteria identified. Guidelines are given on how to convert the identified criteria into measurable QoS parameters and on the adoption and measurement of the parameters.

The QoS parameters may be used for various purposes including:

- Specifying the level of quality of service in customer telecommunication service contracts or in the description of terms and conditions of the service.
- Comparing the level of quality and quality commitments of services of different service providers.
- Preparing long-term studies on the level of quality attributes of a specific service.
- Preparing statistics, reports and publications of the quality of a service.
- Regulatory purposes including specification of the minimum level of quality (e.g., for universal service, interconnection regulations) and monitoring of services by, for example, reports on a regular basis and statistics for specific situations.

Appendix I provides references for the development of QoS metrics and examples of QoS parameters.

Appendix II gives quality objectives that are currently available in standardization.

Appendix III gives examples for the use of the three models for the identification of QoS criteria.

2 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.419] ITU-T Recommendation E.419 (2006), *Business oriented key performance indicators for management of networks and services*.
- [ITU-T E.470] ITU-T Recommendation E.470 (2005), *Operational considerations for QoS of voice over IP-based networks with PSTN-IP-PSTN architecture*.
- [ITU-T E.800] ITU-T Recommendation E.800 (1994), *Terms and definitions related to quality of service and network performance including dependability*.
- [ITU-T G.1000] ITU-T Recommendation G.1000 (2001), *Communications quality of service: A framework and definitions*.
- [ITU-T G.1010] ITU-T Recommendation G.1010 (2001), *End-user multimedia QoS categories*.
- [ITU-T G.1020] ITU-T Recommendation G.1020 (2006), *Performance parameter definitions for quality of speech and other voiceband applications utilizing IP networks*.
- [ITU-T G.1030] ITU-T Recommendation G.1030 (2005), *Estimating end-to-end performance in IP networks for data applications*.
- [ITU-T G.1040] ITU-T Recommendation G.1040 (2006), *Network contribution to transaction time*.
- [ITU-T G.1050] ITU-T Recommendation G.1050 (2005), *Network model for evaluating multimedia transmission performance over Internet Protocol*.
- [ITU-T I.350] ITU-T Recommendation I.350 (1993), *General aspects of quality of service and network performance in digital networks, including ISDNs*.
- [ITU-T O.211] ITU-T Recommendation O.211 (2006), *Test and measurement equipment to perform tests at the IP layer*.
- [ITU-T Y.1540] ITU-T Recommendation Y.1540 (2002), *Internet protocol data communication service – IP packet transfer and availability performance parameters*.
- [ITU-T Y.1541] ITU-T Recommendation Y.1541 (2006), *Network performance objectives for IP-based services*.
- [ITU-T Hdbk QoS] ITU-T Handbook (2004), *Quality of Service and Network Performance*.
- [ISO 9000] ISO 9000:2005, *Quality management systems – Fundamentals and vocabulary*.
- [ISO/IEC Guide 62] ISO/IEC Guide 62:1996, *General requirements for bodies operating assessment and certification/registration of quality systems*.
- [ISO/IEC Guide 65] ISO/IEC Guide 65:1996, *General requirements for bodies operating product certification systems*.
- [ETSI ETR 003] ETSI ETR 003 ed.2 (1994), *Network Aspects (NA); General aspects of Quality of Service (QoS) and Network Performance (NP)*.

- [ETSI EG 202 057-1] ETSI EG 202 057-1 V1.2.1 (2005), *Speech Processing, Transmission and Quality Aspects (STQ); User-related QoS parameter definitions and measurements; Part 1: General*.
- [ETSI EG 202 057-2] ETSI EG 202 057-2 V1.2.1 (2005), *Speech Processing, Transmission and Quality Aspects (STQ); User-related QoS parameter definitions and measurements; Part 2: Voice telephony, Group 3 fax, modem data services and SMS*.
- [ETSI EG 202 057-3] ETSI EG 202 057-3 V1.1.1 (2005), *Speech Processing, Transmission and Quality Aspects (STQ); User-related QoS parameter definitions and measurements; Part 3: QoS parameters specific to Public Land Mobile Networks (PLMN)*.
- [ETSI EG 202 057-4] ETSI EG 202 057-4 V1.1.1 (2005), *Speech Processing, Transmission and Quality Aspects (STQ); User-related QoS parameter definitions and measurements; Part 4: Internet access*.

3 Definitions

This Recommendation defines the following terms:

NOTE – Several terms and definitions used in this Recommendation are defined in [ITU-T E.800] and [ITU-T G.1000].

3.1 accuracy: A performance criterion that describes the degree of correctness with which a function is performed. (The function may or may not be performed with the desired speed.)

3.2 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.

3.3 criterion: A single characteristic of a product or a service that is observable and/or measurable.

3.4 customer: The party that uses a telecommunication service(s) under a contractual agreement.

3.5 flexibility: The degree of variations in the function within the boundaries of technical and operational characteristics of the service.

3.6 measure: A unit by which a parameter may be expressed.

3.7 network operator: An organization that provides and operates a telecommunication network for the purpose of transporting bearers of telecommunication services.

NOTE – If the same organization also offers services, it also becomes a service provider.

3.8 quality: The totality of characteristics of an entity that bear on its ability to satisfy stated and implied needs, where the characteristics should be observable or measurable. When the characteristics are defined, they become parameters and parameters are expressed by measures.

3.9 quality of service:

- 1) Totality of characteristics of a telecommunication service that bear on its ability to satisfy stated and implied needs of the user of the service.
- 2) The collective effect of service performances, which determine the degree of satisfaction of a user of the service.

NOTE – These definitions may be seen to be considered complementary, and either or both definitions may be used.

3.10 four viewpoints of QoS: Concept for clarifying the management of QoS by sub-classifying QoS into four viewpoints:

3.10.1 QoS requirements of user/customer: A statement of the level of quality required by the applications of customers/users of a service, which may or may not be expressed non-technically.

3.10.2 QoS offered by the service provider: A statement of the level of quality expected to be offered to the customer by the service provider.

3.10.3 QoS delivered/achieved by the service provider: A statement of the level of the actual quality achieved and delivered to the customer.

3.10.4 QoS perceived by user/customer: A statement expressing the level of quality that customers believe they have experienced.

3.11 QoS parameter: A definition of the scope of a QoS criterion with clear boundaries and explicit measurement method to enable a quantifiable or qualifiable value to be assigned.

3.11.1 objective (quantitative) parameters: Parameters that may be measured with instruments and the performance value assigned may be classified as objective parameters.

3.11.2 subjective (qualitative) parameters: Parameters that can be expressed using human judgement and understanding may be classified as subjective or qualitative parameters. Qualitative parameters are expressed by opinion ratings.

3.12 reliability:

- 1) Probability that a product or system will perform as required for a specified period of time.
- 2) The ability of an item to perform a required function under given conditions for a given time period.

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.

3.13 security:

- 1) 'Security' is the protection of information availability, integrity and confidentiality.
- 2) 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. A threat is a potential violation of security.
- 3) The ability to prevent fraud as well as the protection of information availability, integrity and confidentiality.

3.14 service provider: An organization that offers a telecommunication service to the customer and/or users.

3.15 simplicity: Ease and lack of complexity in the benefit to the user of a function of the service.

3.16 speed: A performance criterion that describes the time interval required to perform a function or the rate at which the function is performed. (The function may or may not be performed with the desired accuracy.)

3.17 telecommunications: The technical process of sending, transmitting and receiving any kind of message in the form of signs, voice, images or sounds by means of telecommunications systems.

3.18 telecommunication service: The provision of telecommunications and the provision of other additional services that are closely related to the provision of telecommunications, e.g., billing, directory services.

3.19 telecommunications systems: The technical equipment or systems capable of sending, transmitting, switching, receiving, steering or controlling as messages identifiable electromagnetic signals.

3.20 user: An individual or organization using or requesting publicly available telecommunications services.

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

CDR	Call Detail Record
INMD	In-service Non-intrusive Measurement Device
IP	Internet Protocol
KPI	Key Performance Indicator
KQI	Key Quality Indicator
NI	Network Interface
NP	Network Performance
POTS	Plain Old Telephone Service
QoS	Quality of Service
SLA	Service Level Agreement

5 Conventions

None.

6 Methodology for identification of QoS criteria and parameters

6.1 General considerations

6.1.1 Viewpoints of QoS criteria

Management of QoS may be clarified by sub-classifying this into four viewpoints. These viewpoints cover all aspects of QoS, both from the service provider's and user's (and customer's) viewpoints.

NOTE – The concept of the four viewpoints of QoS is copied from and explained in detail in [ITU-T G.1000]. An overview on this concept is given here for convenience.

These four viewpoints are:

- customer's QoS requirements;
- service provider's offerings of QoS (or planned/targeted QoS);
- QoS achieved or delivered;
- customer perception (survey ratings of QoS).

The four viewpoints are to be applied as follows:

Customer's QoS requirements This is an expression of the level of QoS required by the customer. The criteria and parameters identified to express these reflect the requirements.

<i>Service provider's offerings of QoS</i>	The QoS criteria or parameters offered by the service provider are formal terms specified unambiguously and may be used for the following: • As the basis for SLA between the service provider and clients on a bilateral basis of agreement. • Public declaration by the service provider about the level of quality that can be expected by the users at large. • As the basis for planning and maintaining the service at the level of performance being offered. • As the basis for users to choose a level of quality to meet their particular requirements among the service provider's offerings.
<i>QoS achieved or delivered</i>	The QoS delivered is the actual level of quality achieved or delivered by the service provider and may be used for the following: • As the basis to compare the delivered with the offerings by the users, regulators and as a check in the SLAs. • As the basis for any corrective action by the service providers.
<i>Customer/User perception</i>	The QoS perceived by the user may be expressed by ratings based on customer surveys and is an indicator of what the user thinks the level of quality received or experienced. This data may be used for: • Comparison with delivered quality and identifying causes of any ambiguities. • Planning any corrective actions.

When identifying the quality criteria of a telecommunication service, these different viewpoints need to be taken into account. The pertinent QoS criteria or parameters should be used for a given application or context. This consideration is necessary for sharply focused interpretation of the meaning of the values represented by the QoS criterion or parameter. Based on this approach, the QoS parameters that are relevant to the users can be defined and measurement methods as well as quality assessment methodologies can be elaborated.

6.1.2 General aspects of quality of service criteria and parameters

The following basic aspects of QoS criteria and parameters have to be considered when identifying the criteria and determining the scope and measurement methods of parameters:

NOTE – Detailed information on these aspects is given in the following clauses.

- QoS criteria and parameters are to be considered on a service-by-service basis.
- QoS criteria are to be specified on an end-to-end basis, the end-to-end being the points at which the user's terminals are connected.
- QoS criteria and parameters are to be specified in terms understandable to the customers. In addition, where necessary, these criteria and parameters may also be specified in more technical terms for use within the industry. (Both customer terms and industry terms may use ITU-T recommended definitions to eliminate ambiguity and to provide the most efficacious understanding.)