



ETSI
TECHNICAL
REPORT

ETR 003

October 1994

Second Edition

Source: ETSI TC-NA

Reference: RTR/NA-042102

ICS: 33.080

Key words: Quality of service, network performance

**Network Aspects (NA);
General aspects of Quality of Service (QoS)
and Network Performance (NP)**

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Foreword

This second edition ETSI Technical Report (ETR) was produced by the Network Aspects (NA) Technical Committee of the European Telecommunications Standards Institute (ETSI). This ETR replaces ETR 003 (1990) (Edition 1): "General aspects of quality of service and network performance in digital networks, including ISDN", which shall be withdrawn by ETSI.

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Introduction

The Quality of Service (QoS) is defined in a generic sense and definitions of four viewpoints are added. These viewpoints are the customer's (or user's) QoS requirements, QoS offered by the service or Network Provider (NP), QoS achieved by the service or NP and QoS perceived by the user or customer. Addition of these four viewpoints helps to deal with the QoS in a clearer manner.

The relationships between the four viewpoints are shown. A methodology shows how the associated activities of the four viewpoints fit together. The progression of activities associated with the four QoS viewpoints (starting with the users/customer's QoS) is termed the QoS cycle.

Capture of user's/customer's QoS requirements is the starting point. An example framework to facilitate this capture is described in the annex. This framework may be used to ascertain the user's/customer's QoS requirements for any telecommunications service. This exercise is to allow service providers to plan future service offerings more in accordance with user's/customer's requirements.

A brief description is given on the handling of the principal activities associated with the QoS cycle.

The ultimate aim is to facilitate the provision of a level of service as agreed between the user/customer and the service provider.

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1 Scope

This second edition ETSI Technical Report (ETR):

- a) states the general aspects pertinent to Quality of Service (QoS) and Network Performance (NP);
- b) states the relationship between the QoS and NP; and
- c) identifies the salient aspects of the principal stages in the management of QoS related to NP.

The content of this ETR reflects the need to provide a level of quality to be agreed by the user/customer and the service provider.

2 References

This ETR incorporates by dated and undated reference, provisions from other publications. These references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this ETR only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies.

- [1] CCITT Recommendation E.800 (1988): "Quality of service and dependability vocabulary".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of this ETR, the following definitions apply:

customer: The party that pays for the telecommunication services provided.

network provider: An organisation that provides a network for the provision of telecommunications service. If the same organisation offer services it also becomes the service provider.

service provider: An organisation that offers a telecommunications service to the customers and/or users. A service provider need not be a network provider.

user: The party that make use of the telecommunication services provided.

3.2 Abbreviations

For the purposes of this ETR, the following abbreviations apply:

CPE	Customer Premises Equipment
NP	Network Performance
QoS	Quality of Service
Telco	Telecommunications company

4 Quality of Service (QoS)

4.1 Generic definition of QoS

QoS defined in CCITT Recommendation E.800 [1] may be considered as the generic definition. It is reproduced below:

"The collective effect of service performance which determine the degree of satisfaction of a user of the service".

4.2 Particular definitions of QoS

In addition to the generic definition it is useful to define the various viewpoints of QoS. The purpose of recommendations relating to QoS and NP can then be more easily be focused if the different QoS viewpoints are defined.

4.2.1 QoS requirements of the user/customer

QoS requirements by the user/customer is the statement of the level of quality of a particular service required or preferred by the user/customer. The level of quality may be expressed by the user/customer in technical or non-technical language.

A typical user/customer is not concerned with how a particular service is provided, or with any of the aspects of the network's internal design, but only with the resulting end-to-end service quality. From the user's/customer's point of view, QoS is expressed by parameters that:

- focus on user/customer-perceivable effects, rather than their causes within the network;
- do not depend in their definition on assumptions about the internal design of the network;
- take into account all aspects of the service from the user's/customer's point of view;
- may be assured to a user/customer by the service provider(s);
- are described in network independent terms and create a common language understandable by both the user/customer and the service provider.

EXAMPLE: A user may state that the acceptable number of occasions when moderate difficulty in call clarity could be tolerated is once in one hundred calls. The service provider translates this requirement into NP parameters and assign target values in the performance of the network elements to achieve the target of not more than 1 call in 100 experiencing moderate difficulty.

4.2.2 QoS offered by service provider

QoS offered by the service provider is a statement of the level of quality expected to be offered to the user/customer by the service provider. The level of quality is expressed by values assigned to QoS parameters. These parameters are usually designed to be understandable to the user/customer. Each service would have its own set of QoS parameters.

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

4.2.3 QoS achieved by service provider

QoS achieved by the service provider is a statement of the level of quality achieved by the service provider. This is expressed by values assigned to parameters, which are, as far as possible, same as those for the QoS offered. These performance figures are summarised for specified periods of time, e.g. for the previous 3 months.

EXAMPLE: The service provider may state that the achieved availability for a given duration (e.g. one year) was 99,95 % or unavailable for 262,8 minutes over a 365 day year.

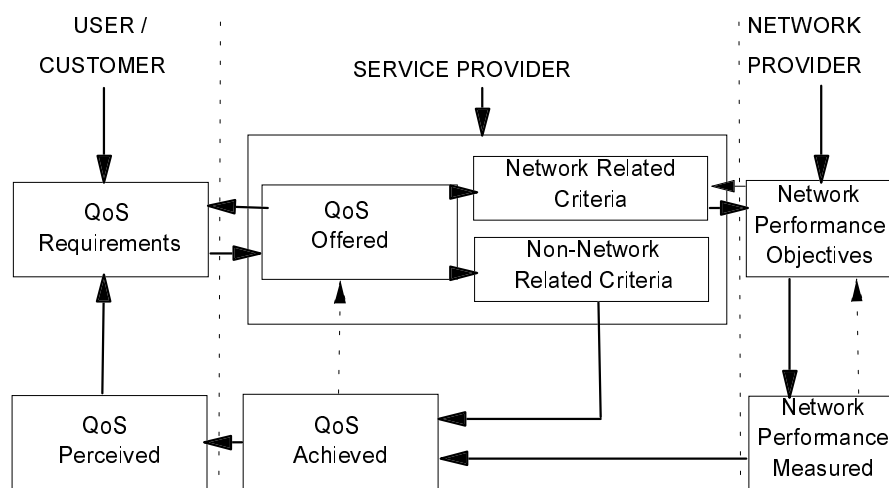
4.2.4 QoS perceived by the user/customer

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

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

4.3 General comments

Figure 1 shows how the various QoS viewpoints inter-relate with each other.



Legend

- - - - -> Shows feedback
- > Shows activity & flow

Figure 1: Inter-relationships between various viewpoints of QoS

The QoS is of concern to the user/customer and the service provider. Where the service provider is also the NP the latter usually takes responsibility for the QoS. For clarity the service provider and the NP are separated for ease of illustrating the relationships.

5 Network Performance (NP)

A general definition of NP is given in CCITT Recommendation E.800 [1] and is reproduced below:

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

Network performance is a statement of the performance of connection element or concatenation of connection elements employed to provide a service. It is defined and measured in terms of parameters which are meaningful to the network and service provider and are used for the purposes of system design, configuration, operation and maintenance. NP is defined independently of terminal performance and user/customer actions. It is also service independent in that it must be able to support all the services the particular network level is required to transport.

The performance of the network is generally aimed to provide the QoS offered to the user/customer.

6 Service performance

Service performance is a statement of performance of a telecommunications service expressed in parameters, applicable to that service, together with values for those parameters. These parameters will apply to QoS, technical and non-technical features of the service.

Each service would have its own set of performance parameters and values to constitute the service performance.

Service performance is expressed in a more formal language, yet understandable and meaningful to the user/customer. The QoS parameters included in the service performance is the QoS offered. It is up to the service provider to state if any guarantee of the QoS is implied over a period of time.

It is often convenient to translate the user's/customer's QoS requirements into service performance before these are translated into network performance parameters.

Examples of service performance parameters are:

- a) the loss of service may be repaired within "x" hours in 90 % of the cases;
- b) the incidence of intelligible crosstalk from another conversation will be less than 1 in 1 000 conversations;
- c) the service is available in "n" countries from UK.

7 Relationship between QoS and NP

The relationship between QoS and NP is illustrated in figure 2.

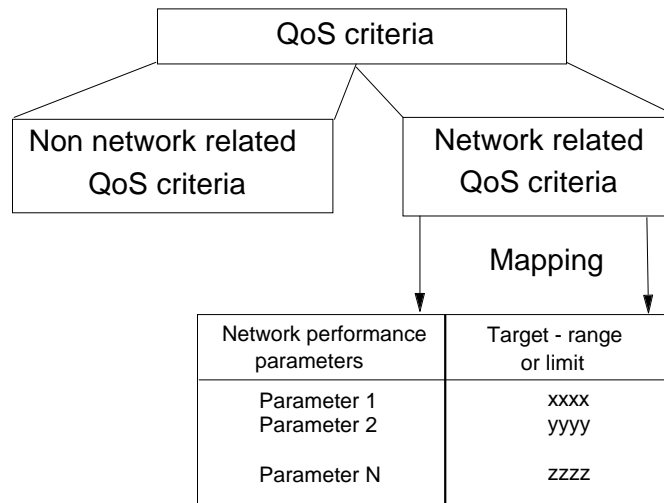


Figure 2: Relationship between QoS and NP

In figure 2, QoS is the starting point for the development of NP parameters and targets. NP parameters specified are chosen for the most effective operation of the network.

An example of mapping of QoS into NP is shown below:

- QoS requirement for telephony: not more than x % of connections made to experience difficulty on the clarity of conversation;
- the NP requirements upon mapping may be stated as; parameters identified as contributing to call clarity: transmission loss, noise (impulsive and non impulsive), echo, delay, crosstalk, voice clipping, (and possibly others);
- end-to-end target values for each parameter may be specified. The sum effect should result in not more than x % of calls experiencing difficulty in call clarity.

Empirical relationships between values for the above parameters and the percentage of users/customers experiencing call clarity difficulty should be made available. From these relationships meaningful allocation of target values for individual parameters can be made so that not more than a specified percentage of users/customers are likely to experience difficulty for call clarity. The parameter target values are then broken down to element performance.

8 Methodology for handling aspects of NP related to QoS

8.1 The basics of the methodology

A methodology illustrated in figure 3 shows the key elements in the derivation of network performance parameters from the QoS requirements of the user/customer and the subsequent management of NP. The principal activities on the part of the user/customer, service provider and the NP are separated by a dotted line.

The user's QoS requirements is the starting point. This is mapped to QoS offered parameters by the service provider. These are mapped to network and non-network related performance parameters. The network related parameters are mapped into NP parameters and target values are assigned. Planning documentation are derived from these. A set of monitoring systems keeps track of the desired performance. The achieved end-to-end QoS performance is derived from the measurements and combined with the non network related QoS. This is compared with the users/customer's QoS perceived obtained, usually customer surveys. Corrective action is taken where necessary.

The following subclauses deal with the principal stages of the methodology in more detail.

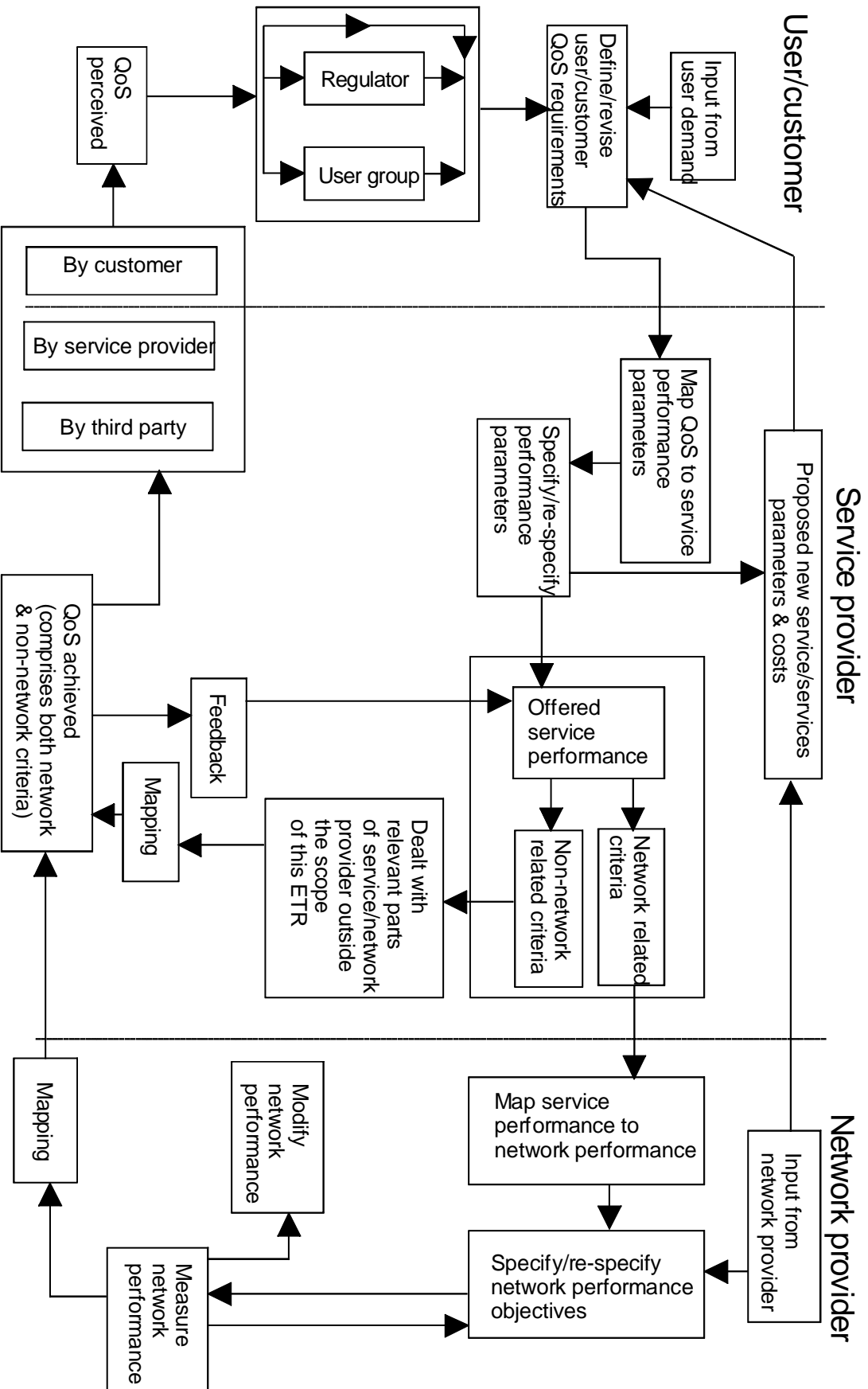


Figure 3: Methodology for the management of NP related to QoS

8.2 Capture and defining of user's/customer's QoS requirements

The method for capturing user's/customer's QoS requirements for any telecommunications service involves two steps. An example of a generic method is shown in annex A. In the first step a service-specific framework is derived by identifying the service specific criteria for the particular service under consideration.

In the second step the QoS requirements of the users/customers are ascertained. This is done by administering the service specific framework by an agency familiar with obtaining such information from the user/customer. The service specific framework is used as a template for the capture of the QoS requirements of the user/customer.

It is important that the derivation of the service specific framework and the questionnaire is not too narrowly defined restricting user's/customer's expression of their concerns.

There are three other sources which may influence or generate the QoS requirements.

The first is the user/customer. They may state new service requirements with performance requirements. They may also generate new performance requirements for existing services.

The second is the service provider. The service provider may wish to amend the performance in consultation with the user or customer and will create a new set of performance requirements.

The third source is the regulator or the user groups. Their influence may be based on performance achieved by the service provider and the resulting amendments in the quality that are needed.

Once the QoS requirements of the user are agreed the next step is to translate these into service performance.

8.3 Arriving at QoS offered

The service provider studies the implications of the level of quality required and may wish to review the cost, strategic and other relevant implications before deciding the level of performance to be offered. This level of performance becomes the QoS offered.

The QoS offered is expressed, where possible, in user/customer understandable terms. The service provider decides on the number of parameters with which to specify the QoS offered. The service provider may also reserve the right to specify within their own organisation other QoS parameters and values to be assigned. These need not be expected to be made available to the user/customer. The principal purpose is to assist the management of services within the service provider's organisation.

8.4 Mapping and specifying NP objectives

The parameters of QoS offered are separated into non-network and network related. The network related QoS criteria are mapped (or translated) into network performance parameters.

The following are the salient factors in the process of specifying the NP objectives:

- 1) the network related QoS criteria are mapped to the contributing network performance parameters. Target values are then assigned to these parameters for the end-to-end performance;
- 2) it may be more convenient, and in many cases necessary, to break down the end-to-end network performance into elemental performance. In these cases it is essential that the effect of the additive performance of the elements can be estimated.

The relationship between end-to-end performance and the sum of network elements is sometimes based on empirical information.

Division into elemental performance is preferably not broken down further than is necessary to enable the network provider to study the performance of the individual elements for their own monitoring purposes;

- 3) the network performance is more conveniently specified for one service at a time. The network usually supports more than one service and a decision to pitch the level/s of service to be offered by the network has to be made;
- 4) the network performance targets, once arrived at, are aimed to become planning documents.

8.5 Measurement of NP (including feedback)

In a carefully designed network monitoring system maximum benefit will accrue from the minimum set of measurements.

The following guidelines may be helpful in establishing a set of monitors:

- 1) wherever possible the measurement systems should reflect directly the network performance parameters specified in subclause 8.4;
- 2) where it is necessary to break down the network performance to elemental performance the end-to-end performance should be estimated. A minimum set of element performance should be aimed for;
- 3) measurements are recommended only for those parameters which will be of concern to the user/customer, the regulator, the service provider or the NP. The mix of measurements is for the service provider or the NP to decide;
- 4) measurements may be taken on a sample basis. The sampling details will be decided by the network provider based on the requirements of the user/customer, regulator and the needs of the service and NP.

8.6 Establishment of QoS achieved

The QoS achieved is obtained by combining results achieved from the non-network and network related monitoring systems.

When the network related QoS is estimated from the measurements the following considerations are to be given:

- 1) where the elemental performance is measured the resulting end-to-end performance is to be estimated;
- 2) the confidence limit of the resulting end-to-end performance is to be stated whenever these are computed from samples;
- 3) where possible mapping is to be carried out to express the QoS achieved with the same parameters as the QoS offered.

8.7 Assessment of QoS perceived and subsequent follow-up

The perceived QoS may be assessed by the service provider, user/customer or their representative or by another third party. This assessment is usually made by customer surveys. Customer surveys have to be designed by those knowledgeable and familiar with telecommunications and the culture of the local market.

Perceived QoS may or may not be technically specified depending upon the service and the type of customers. For a sophisticated organisation it is possible to carry out end-to-end measurements which are technically more meaningful than the service provider can measure. Where detailed technical measurements are not possible, e.g. in the assessment of residential customer's difficulty with the clarity of calls, the subjective opinion is to be quantified to indicate maximum accuracy.

The QoS perceived and the QoS achieved are compared for correlation. Due to the subjective element on the part of the user there is likelihood of variation in the correlation between QoS perceived and achieved.

The variation in correlation could be studied for accountable reasons. If no reasons are found this becomes a matter for further investigation.

The aim will be to reach a level of QoS achieved which correlates satisfactorily with the QoS perceived.

Annex A: An example of generic framework for capture of user's/customer's QoS requirements

A.1 Introduction

The framework comprises of cells arising from the creation of a matrix comprising of service functions on one axis and quality criteria on the other axis. The choice of service functions and the quality criteria is intended to cover most, if not all possible QoS criteria which are likely to be of concern to the customer.

The matrix is shown in figure A.1.

Individual cells are described from the customer's perspective. The cell descriptions are generic and are to be used as a guide for the capture of QoS features of any service. To capture the customer's QoS requirements a service specific matrix (for the service under consideration) is derived and used to facilitate the capture. These cell descriptions are given after the glossary of terms used in the matrix.

Definitions of terms and cell descriptions used in this annex may not necessarily coincide with same or similar ones defined in other documents published in the international fora. These terms and cell descriptions have specific meaning in the context of the capture of user's/customers QoS requirements. Caution should therefore be exercised in their application.

A.2 Glossary of terms

The matrix is formed by "Service functions" on the Y axis and "Service quality criteria" on the X axis (refer to figure A.1).

Figure A.1: Matrix to facilitate capture of customer's QoS requirements

Service Quality Criteria		Speed	Accuracy	Availability	Reliability	Security	Simplicity	Flexibility
		1	2	3	4	5	6	7
Sales	1							
Service management	provision	2						
	alteration	3						
	service support	4						
	repair	5						
	cessation	6						
Call technical quality	connection establishment	7						
	information transfer	8						
	connection release	9						
Billing	10							
Network/service management by customer	11							

Service functions are a set of uniquely identifiable or definable elements, which, collectively cover, all functions associated with or those forming part, of a telecommunications service. These are defined below:

Y-1 Sales: all relevant activities from the time communications are established between the Telecommunications company (Telco) and the customer to the time the contract is signed for the provision of a service by the Telco. The term Telco is also intended to cover the service provider or a network provider.

Examples of relevant activities are:

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

Y-2 Provision: all activities associated with the provision of a telecommunication service, from the time of effective contract to the time the customer is able to use the service.

Y-3 Alteration: all activities associated with the alteration of a telecommunication service, from the time alteration to a service is requested by the customer to the time these alterations are carried to the satisfaction of the customer.

Y-4 Service support: all activities associated with the support of a telecommunication service to enable the customer's use of the service.

EXAMPLE: Enquiries on the use of services.

Y-5 Repair: all activities associated with the restoration of a telecommunication service to the customer after a fault resulting in partial or complete loss of service or service features.

Y-6 Cessation: all activities associated with the cessation of a telecommunication service from the time it was requested by a customer, to the time it was completed to the satisfaction of the customer.

Y-7 Connection establishment: all activities associated with the establishment of a telecommunication service, from the time the customer requests service (e.g. lifting of the handset of telephone) to the time any of the following indications are received:

- ring tone or equivalent;
- destination engaged tone;
- call answered indication;
- any other signal indicating the status of the called party or the network.

Y-8 Information transfer: all activities from the time connection is answered to the time either party indicates the connection is to be released.

Y-9 Connection release: all activities associated with a request for release of an established connection to the time the network components are restored for further use.

Y-10 Charging/Billing: all relevant activities associated with the charging and billing for a telecommunication service to a customer.

Y-11 Network/service management by the user/customer: all activities associated with the customer's control of predefined changes to telecommunication services or network configurations.

Service quality criteria comprises of quality elements, e.g. speed, accuracy, etc. which collectively cover all quality aspects of a telecommunication service.

The service quality criteria are:

X-1 Speed: the speed with which a service function is to be carried out e.g. the speed with which the provision of a telecommunication service is carried out for the customer.

- X-2 Accuracy:** the faithfulness and completeness in carrying out the communication function with respect to a reference level. The reference level may be specified or may be an independent function or a function of an input.
- X-3 Availability:** the likelihood with which the relevant components of the service function can be accessed for the benefit of the user/customer at the instant of request.
- X-4 Reliability:** reliability is the probability that the service function will perform within the specified limits for speed, accuracy or availability for a period of one year.
- X-5 Security:** the confidentiality with which the service function is carried out by the Telco for the customer, e.g. in the case of service support function the information on the customer should not be divulged to a third party without the permission of the customer.
- X-6 Simplicity:** the ease in the application of the service function.
- X-7 Flexibility:** the options required by the customer and offered by the Telco in order to accommodate special requirements.

A.3 Description of cells in the generic QoS matrix

In all cell references the first digit is from the Y axis and the second digit from the X axis.

A.3.1 Cell reference 1

Cell reference 1.1: Sales - Speed

Description: the time taken from the initial contact between the customer and the Telco to the instant the effective contract is placed for a service.

NOTE 1: This includes the time taken for the decision making and placing contract by the customer.

NOTE 2: Not all contacts will result in sales. In these cases the speed of sales will be the time taken from initial contact to the instant offer is made by the Telco after all the pertinent information has been supplied to the customer.

Cell reference 1.2: Sales - Accuracy

Description: the correctness and completeness of all relevant service information, normally expected by the customer before effective contract, e.g. service features, performance, charges and service support.

Measure: quantification of the accuracy of sales is not envisaged; however the number of complaints and/or repeat questions from customers may be taken as an indication on the accuracy of sales information given by the Telco.

Cell reference 1.3: Sales - Availability

Description: access to the appropriate sales functions.

NOTE 3: Density of sales offices, hours staff can be accessed will contribute to the availability of sales function to the customer.

Cell reference 1.4: Sales - Reliability

Description: the probability of sales speed, sales accuracy and sales availability (cell references 1.1, 1.2 and 1.3) being within specified limits over a period of one year.

Cell reference 1.5: Sales - Security

Description: confidentiality requirements of customers from the Telco on all activities related to sales.

Cell reference 1.6: Sales - Simplicity

Description: the ease with which all activities associated with sales (and purchase) may be carried out with the Telco.

EXAMPLE 1: Ease of identification of the point of contact for sales.

EXAMPLE 2: Ease with which information supplied is understandable.

EXAMPLE 3: The ease with which forms can be filled and ease with which orders can be placed.

Cell reference 1.7: Sales - Flexibility

Description: options available to the customers in the provision of the sales function.

EXAMPLE 4: Provision of sales information in person, by the telephone, advertising, electronic transfer.

EXAMPLE 5: Facility to place contract by the customer may be by fax, electronic mail, post or telephone.

A.3.2 Cell reference 2

Cell reference 2.1: Provision - Speed

Description: the time taken from the effective contract to the instant the service is available for use.

Cell reference 2.2: Provision - Accuracy

Description: the correctness and completeness in the provision of any service specified or implied in the contract.

Cell reference 2.3: Provision - Availability

Description: the access to resources to meet provision of service or product agreed with the customer in the contract.

Cell reference 2.4: Provision - Reliability

Description: the probability of the performance of 2.1, 2.2 and 2.3 being within the specified limits over a period of one year.

Cell reference 2.5: Provision - Security

Description: confidentiality aspects with the Telco on all aspects of provision.

EXAMPLE 1: Telco is expected to meet customer's confidentiality requirements on service details from third party on matters such as customer's ex-directory requirements, complying to the Data protection Act or equivalent and privacy in the storage of customer's service records.

Cell reference 2.6: Provision - Simplicity

Description: the ease and convenience with which a service will be provided after effective contract.

Cell reference 2.7: Provision - Flexibility

Description: the options required by customer to accommodate special requirements on the provision of the service without departing from the terms of the contract.

EXAMPLE 2: Timing of the provision of the service to suit the customer.

EXAMPLE 3: Provision of terminal equipment to match customer preferences where possible.

A.3.3 Cell reference 3

Cell reference 3.1: Alteration - Speed

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

Cell reference 3.2: Alteration - Accuracy

Description: the correctness and completeness with which requests for alteration to service is carried out as specified or implied in the contract.

Cell reference 3.3: Alteration - Availability

Description: access to resources at the Telco to carry out alteration to the service as requested by the customer to meet contractual dates.

Cell reference 3.4: Alteration - Reliability

Description: the probability of the performance of 3.1, 3.2 and 3.3 being within the specified limits over a period of one year.

Cell reference 3.5: Alteration - Security

Description: customer's confidentiality requirements from the Telco with regard to all aspect of alterations carried out on a service.

Cell reference 3.6: Alteration - Simplicity

Description: the ease and convenience with which alteration to a service is carried out for the customer by the Telco.

Cell reference 3.7: Alteration - Flexibility

Description: customer requirements on the options to accommodate special requirements relating to alteration of a service.

EXAMPLE 1: Accommodating the customer's request for reading meter at a requested time when moving to a new address.

EXAMPLE 2: Capability to accommodate a customer's request to carry his telephone number to a new address.

A.3.4 Cell reference 4

Cell reference 4.1: Service support - Speed

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

EXAMPLE: A customer may have difficulties with transmission of facsimile. The speed with which the difficulties are isolated and dealt with will determine the speed of service support.

Cell reference 4.2: Service support - Accuracy

Description: the correctness and completeness in the provision of service support as specified or implied in the contract.

Cell reference 4.3: Service support - Availability

Description: customers' access facilities for making service support. The facilities will include the hours of access as well as methods of access.

Cell reference 4.4: Service support - Reliability

Description: the probability of the performance of 4.1, 4.2 and 4.3 being within the specified limits over a period of one year.

Cell reference 4.5: Service support - Security

Description: customer's confidentiality requirements from the Telco on all matters relating to requests for service support and the receipt of such support.

Cell reference 4.6: Service support - Simplicity

Description: customer's requirements on the ease and convenience with which service support may be requested and provided. For example, varying levels of service support may be required by different segments of the customer population.

Cell reference 4.7: Service support - Flexibility

Description: customer requirements on the options available to satisfy special requirements with regard to service support.

A.3.5 Cell reference 5

Cell reference 5.1: Repair - Speed

Description: the customer's requirement for the time taken from the report of fault to the Telco to the time this fault has been rectified.

Cell reference 5.2: Repair - Accuracy

Description: the correctness and completeness of the repair carried out as agreed or implied in the contract.

Cell reference 5.3: Repair - Availability

Description: the facilities for making requests for repair to a service. These facilities would include hours of access as well as methods of access.

Cell reference 5.4: Repair - Reliability

Description: the probability of performance of 5.1, 5.2 and 5.3 being within the specified limits over a period of one year.

Cell reference 5.5: Repair - Security

Description: customer's requirements from the Telco on confidentiality in matters relating to repair service. Typically this would include sending of approved staff for defence establishments and respecting customer's installation information not being divulged to third party.

Cell reference 5.6: Repair - Simplicity

Description: the ease and convenience with which a fault is reported and repair carried out. The procedure for reporting fault and carrying out a fault repair may be simplified.

Cell reference 5.7: Repair - Flexibility

Description: customer's requirements on the options available in carrying out repairs.

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

A.3.6 Cell reference 6

Cell reference 6.1: Cessation - Speed

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

Cell reference 6.2: Cessation - Accuracy

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

Comments:

- cessation of a service may include the removal of associated equipment from customer premises;
- cessation of a service may include closing of all records and associated transactions between the customer and Telco.

Cell reference 6.3: Cessation - Availability

Description: facilities offered to customers for making requests for cessation of service.

Cell reference 6.4: Cessation - Reliability

Description: the probability of the performance of 6.1, 6.2 and 6.3 being within the specified limits over a period of one year.

Cell reference 6.5: Cessation - Security

Description: customer's confidentiality requirements from Telco with regard to all activities relating to the cessation of service to the customer.

Cell reference 6.6: Cessation - Simplicity

Description: customer's requirements on the ease and convenience with which activities connected with cessation of a service are carried out.

EXAMPLE 1: Customer may wish to close an account with the Telco in one transaction.

Cell reference 6.7: Cessation - Flexibility

Description: customer's requirements in minimising inconvenience during the process of cessation of a service.

EXAMPLE 2: Considerations of possibility of errors before the cessation due to non-payment is carried out.

EXAMPLE 3: Cessations to be carried out at the time prescribed by the customer. This may include reading the meter at the time of cessation.

A.3.7 Cell reference 7

Cell reference 7.1: Connection establishment - Speed

Description: customer's requirement for the time taken from the input of the last address digit to the instant the signal is received from the network to indicate the status of the called party.

NOTE: This would include the speed with which the access to network is available (e.g. time for receipt of dial tone) and the post dialling delay.

Cell reference 7.2: Connection establishment - Accuracy

Description: customer's requirement on:

- a) the correct and complete indication of the status of the called party when it has been reached by the address digits;
- b) reaching the called party identified by the address digits.

Cell reference 7.3: Connection establishment - Availability

Description: the probability of a customer being able to establish a connection when requested.

Cell reference 7.4: Connection establishment - Reliability

Description: the probability of the performance of 7.1, 7.2 and 7.3 being within the specified limits over a period of one year.

Cell reference 7.5: Connection establishment - Security

Description: customer's confidentiality requirements on connection attempts.

EXAMPLE 1: Display of calling line identify to the called party against the wishes of the customer.

EXAMPLE 2: Routing a wrong number which would indicate to the called party the identification of the caller.

Cell reference 7.6: Connection establishment - Simplicity

Description: customer's requirements on the ease and convenience with which connections may be established.

EXAMPLE 3: Personalised numbering schemes.

EXAMPLE 4: Short dialling codes.

EXAMPLE 5: Easily identifiable blocks of numbers for different types of numbers.

EXAMPLE 6: Providing easy to understand network reactions resulting in tones and announcements.

Cell reference 7.7: Connection establishment - Flexibility

Description: customer's requirements in the options available in the process of setting up connections.

EXAMPLE 7: Call forwarding facility offered to customers whereby the called party can transfer call to another attended number in the event of the main number being unattended.

EXAMPLE 8: Ring back when free and/or call waiting indication options/s when the called party is engaged.

A.3.8 Cell reference 8

Cell reference 8.1: Information transfer - Speed

Description: customer's requirements for the rate at which information needs to be transferred from calling to called end where speed of transfer is relevant.

Cell reference 8.2: Information transfer - Accuracy

Description: customer's requirements on the degree of faithfulness of the received information to the information sent on a connection.

NOTE: In the case of telephony this is expressed by "call quality".

In the case of data communications a range of parameters define acceptable connection performance.

Cell reference 8.3: Information transfer - Availability

Description: the probability that an established connection will be sustained for its full intended duration.

Cell reference 8.4: Information transfer - Reliability

Description: the probability of the performance of 8.1, 8.2 and 8.3 being within the specified limits over a period of one year.

Cell reference 8.5: Information transfer - Security

Description: customer's confidentiality requirements during information transfer phase.

EXAMPLE 1: Information exchanged with the called party may not be available to another party e.g. in the form of intelligible crosstalk.

Another requirement may be encryption at the Customer Premises Equipment (CPE) or dedicated circuits.

Cell reference 8.6: Information transfer - Simplicity

Description: customer's requirements on the ease and the convenience with which interactions with the networks may be undertaken.

EXAMPLE 2: Ease with which additional codes may be inserted by the customer during the information transfer for optional services and facilities.

EXAMPLE 3: Over riding of announcements by input digits for the benefit of customers who are familiar with the use of service.

EXAMPLE 4: User instructions may be made simple where interactive services are offered.

Cell reference 8.7: Information transfer - Flexibility

Description: customer's requirements on the options available for the use of the service.

EXAMPLE 5: Call waiting indication could offer visual, audible or both indications to the user.

EXAMPLE 6: Options available on the customer-network interactions.

A.3.9 Cell reference 9

A.2.2 Cell reference 9.1: Connection release - Speed

Description: customer's requirements for the time taken for the release of the connection to enable the next call to be made.

A.2.2 Cell reference 9.2: Connection release - Accuracy

Description: customer's requirements on accuracy of network release times of a connection.

A.2.2 Cell reference 9.3: Connection release - Availability

Description: the availability of resources for the connection to be released when either party requests release of connection.

A.2.9 Cell reference 9.4: Connection release - Reliability

Description: the probability of the performance of 9.1, 9.2 and 9.3 being within the specified limits over a period of one year.

Cell reference 9.5: Connection release - Security

Description: customer's confidentiality requirements on the information of the call or clearing or the call being not available to a third party during clearing procedure.

Cell reference 9.6: Connection release - Simplicity

Description: understandable and easy procedures for the release of an established connection.

Comments: where many services are provided rationalisation of release procedures may be encouraged.

Cell reference 9.7: Connection release - Flexibility

Description: capability of the Telco to offer options on the connection release times.

A.3.10 Cell reference 10

Cell reference 10.1: Billing - Speed

Description: customer's requirement for the time taken from end of call to the time the billing information is provided to the customer.

This could be for one call, for a specified period or for a given billing amount.

Cell reference 10.2: Billing - Accuracy

Description: customer's requirements on the completeness and the accuracy of the billing information in reflecting actual use of the service.

Cell reference 10.3: Billing - Availability

Description: the probability of the billing information being accessible to the customer at request.

Cell reference 10.4: Billing - Reliability

Description: the probability of the performance of 10.1, 10.2 and 10.3 being within the specified limits over a period of one year.

Cell reference 10.5: Billing - Security

Description: confidentiality between customers and the Telco with regard to all billing transactions.

Security of the network against fraud of any sort.

An example of fraud is the ability to make unpaid calls on pay phones.

The customer would wish to ensure that no other customer can incur charges against his or a specified account number.

Cell reference 10.6: Billing - Simplicity

Description: customer's requirements on the ease and convenience of billing presentation.

Cell reference 10.7: Billing - Flexibility

Description: customer's requirements for options available on:

- a) the format of the billing information made available;
- b) the time when billing information may be available.

A.3.11 Cell reference 11

Cell reference 11.1: Network/service management by customer - Speed

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

Cell reference 11.2: Network/service management by customer - Accuracy

Description: customer's requirements on the correctness and completeness of execution of a network or service management request, as specified or implied in the contract.

Cell reference 11.3: Network/service management by customer - Availability

Description: the probability of access to the user of the networks/service management functions when required.

Cell reference 11.4: Network/service management by customer - Reliability

Description: the probability of the performance of 11.1, 11.2 and 11.3 being within the specified limits over a period of one year.

Cell reference 11.5: Network/service management by customer - Security

Description: customer's confidentiality requirements on the correct management of network service management facilities and functions (e.g. use only by authorised users/customers).

Cell reference 11.6: Network/service management by customer - Simplicity

Description: customer requirements on the user friendliness of the network or service management facilities offered to the customers. This could adhere to the ISO seven - layer model (top layer) or something simpler.

Cell reference 11.7: Network/service management by customer - Flexibility

Description: customer's requirements in the options for customisations in the network/s service management facilities.

History

Document history	
August 1990	First Edition
October 1994	Second Edition
March 1996	Converted into Adobe Acrobat Portable Document Format (PDF)