FRAMEWORK FOR THE ASSESSMENT OF SERVICE QUALITY OF TELECOMMUNICATION SYSTEMS AND SERVICES

2017

Table of Contents

1 Background

The authority has finalized the development of a new QOS Assessment framework. The new framework takes effect on 1ˢᵗ of July albeit partially in view of the components involved.

The premise of this framework is based on the fact that, the continuing emergence, adoption and reliance of new ICT services by the public has brought about the need for a review of the regulatory approach particularly in respect of quality of service so that the services that are increasingly assuming greater importance and reliance by the public are covered within the context of consumer protection principles.

The contents of the new framework are as detailed below.

2 Technical Context of Quality of Service (QoS) /Quality of Experience (QoE) and Customer Satisfaction

2.1 Introduction

There are three main components that constitute the quality of the ICT service as illustrated in figure 1 and described thereafter below:

- Overall Network Performance (NP) - quality of the network infrastructure.

- End-to-End (QoS) - QoS for network infrastructure working with the end user devices. Recommendation ITU-T E.800 defines QoS as; "*Totality of characteristics of a telecommunications service that bear on its ability to satisfy stated and implied needs of the user of the service*"

- Quality of Experience (QoE) – quality of service of networks & devices plus Customer Perception. QoE is defined under ITU-T P.10 as "*the overall acceptability of an application or service, as perceived subjectively by the end user*"

Figure 1 below illustrates the three (3) QoS components and is basis for all definitions
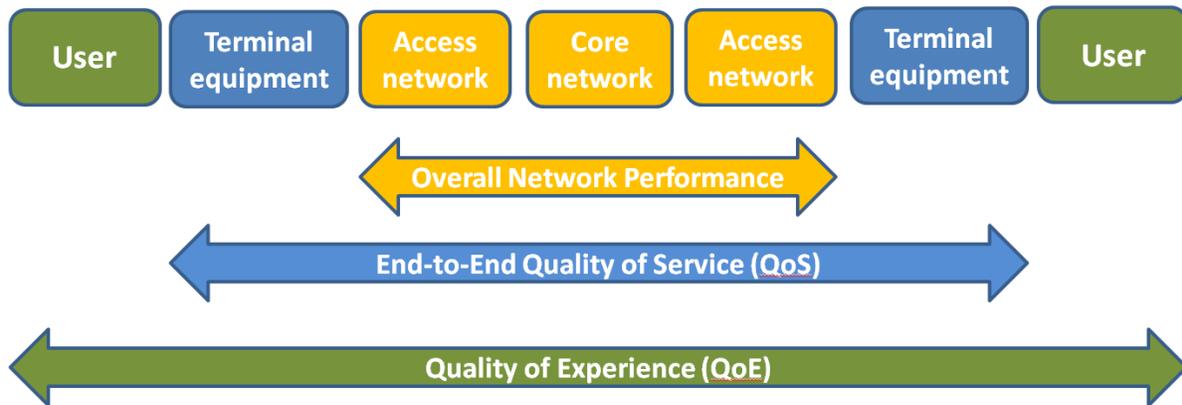

Figure 1 –Illustration of QoS Functional Components

2.2 Overall Network Performance:

Overall network Performance is determined by undertaking an overall performance assessment of a network between two network interfaces. It does not take into account the influence of the end-user devices. It is also referred to as network counters obtained directly from the core network.

2.3 End-to-end quality of service (QoS):

End-to-end quality of services is determined by undertaking assessment of the overall transmission chain within a network from a user's perspective. This takes into account the complete transmission chain including the end-user devices from a user's perspective while excluding the users' subjective elements such as personal experience and expectations.

In undertaking this QoS assessment, a standardized approach is used so as to have an objective determination and comparison between several networks. The standardization includes using same terminal devices, carrying out assessment at the same time and same environmental and geographic conditions.

Both the Overall Network Performance and End-to-end QoS assessment are based on key QoS elements namely; accessibility, integrity, and retainability.
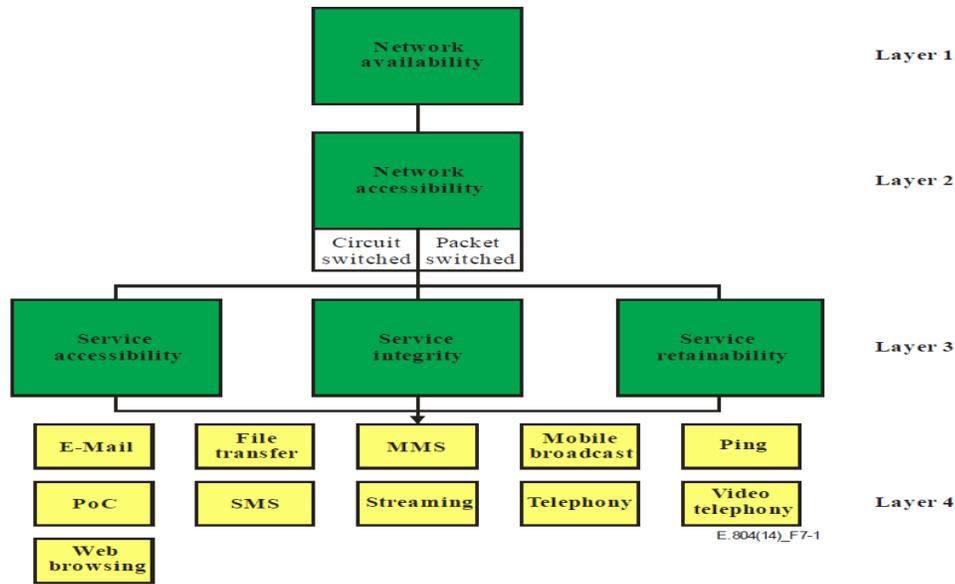
Figure 2 –Illustration of QoS Technical Components

Figure 2 (sourced from ITU-T Rec. E804) illustrates these elements in the context of the network-layered model.

The technical elaboration is given below.

Network Availability (Layer 1):
This is the degree to which a network is functional and not in a state of failure or outage.
- This indicator also carries with it the element of network coverage often expressed in the received signal level. Network availability however goes beyond coverage in view of the requirement of a network to be reliable and capable of guaranteeing continuity of a service.
- The QoS parameters in respect of these are aimed at reflecting the user's experience of the performance of the services provided by the service provider within the coverage area.
- Network coverage information captured and presented in terms of signal strength will also be reflected separately under this KPI category.

Network Accessibility (Layer 2):

This is the degree to which a user can perform a successful registration on the network, which delivers the service. Please note that the network can only be accessed if it is available to the user.

Service Accessibility (Layer 3):
This is the degree to which a user can access the service he wants to use. A given Network Accessibility is a precondition for this phase

Service Integrity (Layer 3):
This describes the QoS during service use and contains elements such as the quality of the transmitted content, speech quality, video quality or number of bit errors in a transmitted file. The Service Integrity can only be determined if the service has been accessed successfully

Service Retain-ability (Layer 3):
This describes the degree to which a service is retained or terminated while in use. Examples for QoS parameters under this KPI are cut-off parameters, e.g. the call drop rate, or the data link drop ratio. A previously performed successful service access is a precondition for this phase.

2.4 Quality of experience (QoE):

Quality of Experience relates to the overall quality of service that include the network, devices as well as the users' experiences and expectations of a particular service. QoE therefore is more about **subjective** considerations that vary from person to person. **QoE is however determined using objective measurements statistical analysis through** *Customer Satisfaction Surveys.*

Figure 3 & 4 below illustrates some of the factors that influence QoE and the relationship with customer satisfaction.
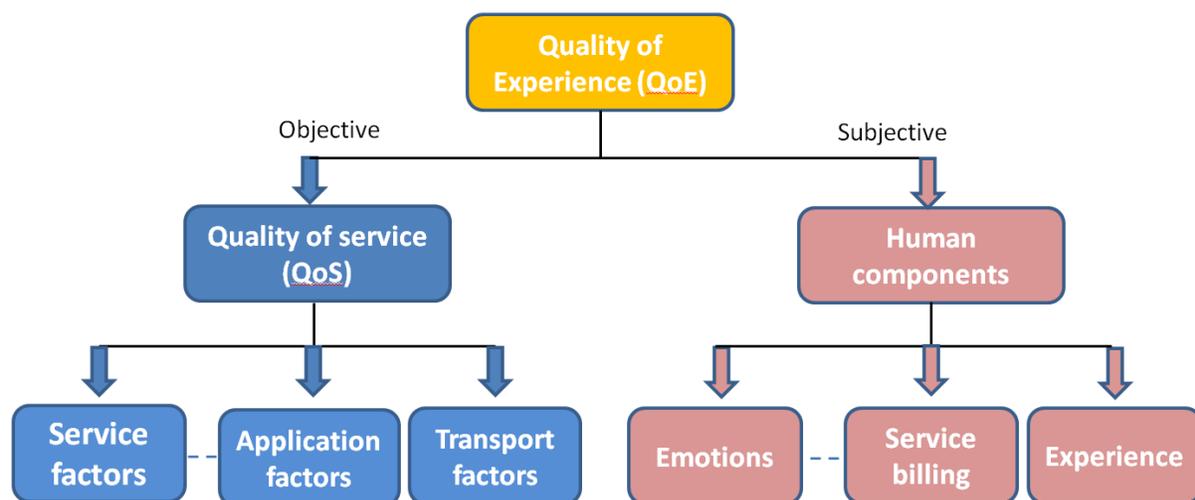
Figure 3 –Illustration of QoE Ecosystem

Figure 4 –Illustration of factors influencing QoE

3 Assessment Framework

The overall QoS framework is summarized and presented in **Annex 1** attached. The end-to-end QoS assessment parameters are detailed in **Annex 2** attached. The key highlights of the overall framework are as follows:

3.1 Scope of Services to be covered

The QoS assessment framework contains the following services:

- ✓ Mobile Voice
- ✓ SMS
- ✓ Data/Internet

3.2 Assessment Structure

I. Overall Aggregation of QoS Components

In view of convergence of technologies that increasingly results in a single network platform delivering a multiplicity of services, it is considered appropriate to structure the quality of service assessment framework in line with the concept of convergence while delineating the three (3) quality of service components explained earlier in the manner indicated in Table 1 below.

Table 1: QoS Assessment Structure

Nature of QoS Assessment	Areas of Assessment	Source of Assessment Data	Contribution to the overall Assessment (Year 1) *
Network Performance	The Quality of the Network Infrastructure without terminal Devices	Operator's Network Management Systems	0%
End-to-End (QoS) Performance	The Overall Quality of the Network including Standardized Devices	Contracted entities / CA using innovative data capture/analysis	100%
Quality of Experience (QoE)	Overall Consumer Experience. *(To commence after 2 years)*	Customer Surveys	0%

Note: CA or its appointed agent will do the aggregation.
* - As amended by the transitional arrangements detailed in section 7.

II. Data Capture & Sourcing Approach

The data capture and analysis strategy shall be structured based on the 3 QoS components namely: Network Performance, end-to-end QoS Performance and Customer satisfaction assessments as expounded below.

a. Overall Network Performance

Respective network operators and services providers will provide the network coverage and the overall network performance data and analysis on monthly basis to the Authority based on data out of their network operations & maintenance facilities. The tools they will need may differ from one network/service operator/provider to the other. They include the network Operations & Maintenance Centre (OMC) resources, Protocol Analyzers, Automatic Applications Testers among other tools.

Raw data shall be transmitted automatically by the operators' systems to a CA's server on an hourly basis. At the same time the Licensees will analyse the same data and send the subsequent reports in an agreed format to CA, specifying the manner in which the sampling has been done with sufficient detail to enable the Authority to verify the accuracy of the any given report. CA on the other hand will randomly sample raw data of particular months, analyse and compare with the relevant reports provided by the Licensees. This will enable CA to

independently verify the reports submitted by the Licensees. Recommendation ITU-T E.804 will be the general guiding document in this respect.

It is noted that there exist solutions that can take in near real-time data and perform data analysis on the data dumb from operators' OMC systems to determine QoS performance KPIs, which systems will be procured by the Authority for this purpose. A test phase will be provided for by the Authority prior to utilization.

b. End-to-end quality of service (QoS):

End-to-end QoS assessment is normally based on simulation of end user experience. Several methodologies exist in the determination of this QoS assessment. They include the following:

i. Conducting service usage tests through drive/walk test as presently undertaken by CA;

Based on benchmarks conducted by CA, there are other solutions in place, which employ the use of:

ii. Specialized stationary or mobile units installed on vehicles.
iii. Subscriber handsets installed with appropriate software and programmed to transmit raw data to a central server, which carries out post processing to determine the levels of the KPIs.

This approach offers a big advantage both from a cost perspective as well as the fact that it makes it possible to carry out assessments inside buildings, which is the predominant environment where ordinary subscribers go about their day-to-day activities. This methodology is therefore highly preferred and shall be exploited by CA for possible implementation.

Given the expanded scope of services to be put under QoS regulatory oversight, the Authority will develop internal capacity but may also outsource to third parties the collection of end-to-end QoS assessment data with segregation based on type of service and/or nature of parameters to be measured. The tools necessary for receiving and analysing the said data will be procured and deployed by the Authority.

In order to manage the cost of doing this, the sample size will be restricted to the minimal level that is scientifically sufficient to provide an accurate reflection of the end-to-end QoS status of a particular network and service across the coverage area. The weighting will be on population sampling levels

only; Recommendation ITU-T E.804 will be the general guiding document in this respect.

c. Quality of Experience (QoE)

QoE will be determined based an annual Customer Satisfaction Surveys undertaken with a view to eliciting customers' views relating to Network Availability, Service Quality, Service Tariffs, and Customer Care aspects among others.

III. Sourcing of Equipment & Tools

Given the growing interest and demand worldwide for the need to undertake QoS/QoE assessment both from operational as well as regulatory perspectives, in the recent past there has been a dramatic increase in the number of suppliers of appropriate tools in this regard. The emergence of competition in this area has witnessed a dramatic reduction in the cost of these products. In view of these developments it is believed that the overall equipment and service costs will be reasonable.

Table 2 below illustrates the roles and responsibilities vs equipment and service procurement.

Table 2: QoS Assessment Roles and Responsibilities.

Service Type	Type of QoS Assessment	Tools Required	Platforms/ Tools Sourcing	Comments
1.Mobile Voice	Network Performance	OMC & Analytics	MNOs/NFPs	It is presumed that all operators already have these equipment
	Drive/Walk Tests	Voice Drive/Walk Test & Analytics	CA alone Contractors and CA in partnership.	✓ Miniature test & analytic tools to be procured. ✓ CA may engage contractors in order to ease management of the work volumes.
	Customer Satisfaction Survey	Survey Analytic Tool	CA Contractors	CA shall undertake annual customer satisfaction surveys, which would need to be modified to bring out relevant QoS KPIs.
2.SMS	Network Performance	OMC & Analytics	MNOs	It is presumed that all operators already have these equipment
	Drive/Walk	Voice	CA	✓ Miniature test & analytic tools to be

Service Type	Type of QoS Assessment	Tools Required	Platforms/ Tools Sourcing	Comments
	Tests	Drive/Walk Test & Analytics	Contractors	procured ✓ CA may engage contractors in order to ease management of the work volumes
	Customer Satisfaction Survey	Survey Analytic Tool	CA Contractors	CA shall undertake annual customer satisfaction surveys, which would need to be modified to bring out relevant QoS KPIs.
3.Data/ Internet	Network Performance	OMC & Analytics	ASPs	It is presumed that all operators already have these equipment
	Field Tests	Application Tester Protocol Analyzer	CA Contractors	✓ Miniature test & analytic tools to be procured ✓ CA may engage contractors in order to ease management of the work volumes.
	Customer Satisfaction Survey	Survey Analytic Tool	CA Contractors	CA shall undertake annual customer satisfaction surveys, which would need to be modified to bring out relevant QoS KPIs.

IV. Data Sampling/Processing Guidelines

The data sampling in general shall be guided by international best practices and the guidelines contained herein. It is to be noted that the said QoS regulatory framework was developed with due regard to international standards, most of which are from ITU-T and ETSI.

Measurements shall be made, where relevant, under similar conditions such as tests carried out in an automatic way in order to eliminate the possible subjectivity inherent in human intervention situations.

Time factors with regard to distribution of the tests shall be such that it reflects traffic variations over the period of day and days of the week, type of calls for example originating vs. terminating, etc. Measurements to be performed wherever there is network availability.

The number of observations (sample size) shall aim at obtaining a minimum absolute statistical accuracy of less or equal to 2 % with a confidence level of 95%. Coverage assessment statistical accuracy shall be, as a minimum, less or

equal to 0.5%.

There shall be a pilot period whose results shall form the basis for making any necessary adjustments to the framework. Where contracted entities are using different test platforms/tools, at the beginning of the Pilot Phase, the said platforms/tools shall be appropriately configured, calibration undertaken and confirmed and necessary adjustments undertaken in order to avoid significant variance of the results.

The test platforms/tools shall be periodically verified by the Authority during field-tests as appropriate. Contracted firms shall use qualified and experienced personnel. Where exceptional conditions arise that may distort assessment measurements, CA may exclude the results of such measurements and may order a retake of the measurements. The QoS Regulatory Framework shall be reviewed and updated periodically.

4   Compliance Declaration & Application of Penalties

A licensee will be deemed compliant if they attain an aggregate of 80% or above. In the event of failure by a Licensee, penalties and/or other sanctions will be applied on an annual basis, or as may be varied from time to time under the Act.

5   Publication of QOS Reports

The network coverage/points of presence and the results of the overall QoS assessments as well as the various components assessed shall be published on CA's website and/or in local dailies.

6   Launch of the Framework and Methodology

This framework has been developed by CA with the input from earlier work done for the Authority by a consultant and was subsequently subjected to a Stakeholders consultation. The comments and suggestions received from respondents have been considered and incorporated to the best extent possible, taking due regard to the rights of every stakeholder. It is scheduled to take effect immediately (2017/18) and to replace the framework and methodology that has been in force since the year 2009.

7 Transition from Current Framework to New Framework

This framework has been developed by CA with input from earlier work done for the Authority by a consultant and was subsequently subjected to a Stakeholders' consultation. The comments and suggestions received from respondents have been duly considered and incorporated to the extent possible, taking due regard to the rights of every stakeholder. It is scheduled to take effect immediately (2017/18) and to replace the framework and methodology that has been in force since the year 2009.

During the public consultation process, certain stakeholders expressed their desire that a phased approach be taken with regard to the introduction of the Quality of Experience and the Network Performance components of the new framework. Consequent to this, and recognizing that the Authority is at various stages in the acquisition of various tools that will be required to implement the different components of the new framework, the phasing detailed in this notice will be used to implement the new framework.

7.1 Weighting of Framework Components

The weights provided in the table below will apply with effect from the first year, upon launch of this framework.

Weighting and Phasing Matrix

Phasing	Component Weighting in Assessment		
Year	NP	End-to-End QoS	QoE
1st	0%	100%	0%
2nd	30%	70%	0%
3rd	25%	60%	15%
4th	25%	60%	15%
5th	25%	60%	15%
6th and beyond	25%	60%	15%

7.2 Framework Component Piloting

The Authority will commence the implementation of the framework by implementing the End-to-End QoS and the Network Performance components starting with a six-month pilot phase for these two components, while the QoE component will be carried out on a pilot basis for the first two years following the launch of the framework.

The pilot phases will enable the Authority, together with the MNOs, to fine-tune the processes and the tools to be used for the determination of the QoE. After

the respective pilot phases have ended, the various QoE components will be included in the assessment.

It should be noted that where any component of the new framework is not operational on account of piloting or other factors, the percentage to be contributed by each component not affected by those factors shall be determined by the Authority and communicated to the Licensees and such weighting shall continue to be applicable until such a time as the relevant component(s) will have come into full operation. In this regard, the weighting that will be adopted will be based on a proportionate redistribution of the percentage contributed by the component of the framework that cannot be implemented because of the challenge faced. The appropriate weighting set out in the table above will be reinstated thereafter.