Information & Communication Technologies Authority

Consultation Ref.: ICTA/01/2023

CONSULTATION PAPER ON IMPLEMENTATION OF CROWDSOURCING–BASED PLATFORM FOR ASSESSMENT OF QUALITY OF SERVICE (QOS) OF BROADBAND INTERNET SERVICES

31 January 2023

EXPLANATORY MEMORUNDUM

Considering that:

1) The ICT Authority (ICTA) has as function under section 18 (1) (b) of the ICT Act 2001 (as amended), "*to provide economic and technical monitoring of the information and communication industry in accordance with recognized international standard practices, protocols and having regard to the convergence of technology*";

2) The ICT Authority has as function under section 18 (1) (h) of the ICT Act 2001 (as amended) "*to report, in such manner as may be required, to the Minister or to any other person on any matter that lies within its purview, such as the performance of public operators, the quality of consumer service and consumer satisfaction, measured against the best available international standards of practice*";

3) The ICT Authority has as function under section 18 (1) (n) of the ICT Act 2001 (as amended) "*to ensure the safety and quality of every information and communication services including telecommunication service and, for that purpose, determine technical standards for telecommunication network, the connection of customer equipment to telecommunication networks*";

4) The ICT Authority has as power under section 17 (1) of the ICT Act 2001 (as amended) to *"commission expert evaluations, conduct studies, collect data related to the information and communication industry"* and to *"authorise any person to conduct such technical tests or evaluations relating to information and communication services including telecommunication as it thinks fit"*;

5) The Information and Communication Technologies (Quality of Service) Regulations 2014 were made and published in the Government gazette on 26 April 2014, to establish the regulatory framework for Quality of Service of information and communication services;

6) Recent works carried out by standards bodies and regulators worldwide underpin the need to implement appropriate Quality of Service regulatory frameworks for Broadband services;

The ICT Authority resolves to:

1. make available for public consultation this Consultation Document Ref (01/2023);
2. invite views, contributions and comments on the Consultation document.

GUIDELINES ON RESPONDING TO THIS CONSULTATION

1. All comments that you may have to improve this document are welcome. Your input is specially required on Section 3. It would make the task of analyzing responses easier if comments were referenced to the relevant question numbers as listed at ANNEX.

2. You are invited to send your written views and comments on the issues raised in this document by email to icta@intnet.mu at latest by **16h00** on **28 February 2023**.

3. Should you be including confidential information as part of your responses, you are requested to clearly identify the said confidential materials and to place same in a separate annex to your response.

1. INTRODUCTION

Quality of Service (QoS) regulation received much attention globally in the mid-2000s, with many ICT regulators setting out to establish comprehensive QoS regulatory frameworks for information and communication services. By 2017, Quality of Service was being monitored in at least 158 countries across the world[1].

The International Telecommunication Union (ITU) notes that the information asymmetry between operators and consumers regarding service quality conditions, especially in the retail market, is a significant issue and a cause of market failure[2]. It thus recommends regulators "*to set frameworks targeting the quality offered in the retail market by undertaking measures to guarantee transparency to coverage figures and overall quality results, the compliance with the capacity or quality advertised, comparing the service quality effectively delivered by the main competitors, in order to help consumers make informed choice*"[3].

It is increasingly recognised that the need to guarantee transparency, to ensure compliance with the quality advertised and to empower consumers in making informed choices are important objectives of quality of service regulation, especially for broadband services where there is often disparity between the quality advertised and that experienced by consumers. In Mauritius, Broadband Internet services have experienced a significant and continuous uptake over the past years, with population penetration rate of the services growing from about 46% in 2014 to about 142% as at end of 2022. Having regard to above regulatory objectives, the Authority considers that QoS regulation of Broadband Internet services in Mauritius is necessary for the benefit of consumers and the industry as a whole.

In line with international best practices on QoS regulation, the ICT Authority proposes to make available to end-users of Broadband Internet services in Mauritius, a QoS measurement platform based on a crowdsourcing approach that will allow end-users to assess the QoS (including Quality of Experience (QoE)) of the Broadband Internet services to which they are subscribed. The QoS measurement platform would also allow the ICT Authority to make comparative publications on the performance of different Broadband Internet service providers.

[1]ITU Quality of Service Regulation Manual (2017) : https://www.itu.int/dms_pub/itu-d/opb/pref/D-PREF-BB.QOS_REG01-2017-PDF-E.pdf

[2] ITU-T Recommendation E.805 (12/2019)

[3] ITU-T Recommendation E.805 (12/2019)

Through this consulation exercise, the ICT Authority intends to adopt a concerted approach involving all relevant stakeholders, including the public, in view of defining the technical specifications of the proposed QoS measurement platform for implementation purpose.

2. TRENDS IN QoS REGULATION

2.1 Over time, regulators have reviewed their QoS regulatory frameworks to keep pace with the evolution in technologies, services and applications. ITU notes that while QoS requirements have historically been applied to voice services, regulators have few years ago been incorporating minimum QoS requirements for data services[4].

2.2 Some pertinent recommendations and guidelines have recently been issued by ITU with a view to providing guidance to regulators on establishing QoS regulatory frameworks and measuring mobile/ broadband QoS, namely:

- ITU Quality of Service Manual 2017;
- ITU-T Recommendation Y.1545.1 *"Framework for monitoring the quality of service of IP network services"* issued in March 2017;
- ITU-T Recommendation E.806 "*Measurement campaigns, monitoring systems and sampling methodologies to monitor the quality of service in mobile networks*" issued in June 2019;
- ITU-T Recommendation E. 805 *"Strategies to establish quality regulatory frameworks"* issued in December 2019;
- ITU-T Recommendation E.812 "*Crowdsourcing approach for the assessment of end-to-end quality of service in fixed and mobile broadband networks*" issued in May 2020.

2.3 While traditional 'command and control' approach to QoS regulation based on enforcement and sanctions are still most common, many regulators are also adopting 'consumer-focused' approaches based on transparency and user empowerment[5]. The latter approach mostly entails the regulator providing consumers with tools that empower them to choose service providers that meet their expected quality of service level. The tools may allow consumers *"to compare offers and services from service providers, such as speed testing tools, coverage maps, and apps to measure various services, as well as channels to provide feedback and complain about poor services*".

2.4 A recent research from GSMA shows a growing trend towards more modern methodologies and tools, which underpin the co-regulatory and consumer-focused

[4] ITU Quality of Service Regulation Manual (2017):
https://www.itu.int/dms_pub/itu-d/opb/pref/D-PREF-BB.QOS_REG01-2017-PDF-E.pdf

[5] ITU Workshop on Telecommunication Service Quality Regulatory Frameworks and Experience-Driven Networking - 26 November 2018, Geneva, Switzerland

approaches[6]. GSMA further notes that "*modern QoS regulations that are developed in collaboration with operators and through consumer lens are a step in the right direction"*.

2.5 The European Electronic Communication Code (EECC) established in 2018 as a reform to the EU's regulatory framework, is considered to have modernised and broadened the EU's QoS policy, strengthening transparency and consumer empowerment and reinforcing the regulator's objective of QoS monitoring and publication of information on quality offered by providers. The EECC provides inter-alia that *"end users must have the right to have access, free of charge, to at least one independent comparison tool which includes the possibility to compare the quality of service performance between available offers"* and that *"regulators should be able to collect comparable information on QoS offered by providers of publicly available internet access services and interpersonal communications services"*[7].

2.6 A survey carried out by ITU in 2018 shows that, while drive tests and operators' reports are still the most widely used strategies to measure QoS of mobile voice and broadband services, newer measurement approaches, like the use of probes and crowdsourcing are also well adopted, mainly for mobile broadband measurement[8].

2.7 ITU mentions that "*increasingly, players such as regulators and service providers have started to assess end-to-end quality of service (QoS) through a crowdsourcing approach"*. Crowdsourcing allows for monitoring and assessing QoS in broadband networks by collecting data from a large base of end-users, directly from end-user's equipment (e.g. mobile devices and customer premise equipment (CPEs)). Crowdsourcing has been made possible with the evolution of end-user's equipment and its software which have become faster, more powerful and able to perform data collection.[9]

[6] GSMA report- Modernising Quality of Service Regulations in Sub Saharan Africa (Sep 2020): https://www.gsma.com/subsaharanafrica/wp-content/uploads/2020/10/Modernising-QoS-Regulations-in-Sub-Sahran-Africa.pdf

[7] Official Journal of the European Union: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018L1972

[8] ITU-Report of the questionnaire on the status of national quality regulatory frameworks (27Nov-6Dec 2018)

[9] ITU-T Recommendation E.812 (05/2020)

2.8 The crowdsourcing approach may be deployed in multiple ways, each providing different views of QoS. For instance, measurements can be made using either active or passive methods. In active measurements, artificial traffic or test payload is created in order to assess end-to-end QoS parameters, while in passive measurements observation of QoS parameters is made on the actual traffic, without injecting artificial traffic in the network. Moreover, for each measurement method, the data collection may be user-initiated or automated (Ref: ITU-T Recommendation E.812).

2.9 The table below provides examples of some countries where crowdsourcing approach has been adopted for measuring broadband QoS.

Country	**Implementation**
United States	"The Measuring Broadband America (MBA)" is an ongoing nationwide program by the regulator FCC to improve the availability of information to consumers in US about their broadband service. For fixed broadband, volunteer participants are sent "whiteboxes" that run pre-installed software on off-the-shelf routers that perform automated tests to measure 13 QoS parameters including download speed, upload speed, and latency. The test results are then collected and analyzed to produce the annual Measuring Fixed Broadband report. Utilizing this data, the MBA program is able to measure actual performance speeds against what the ISPs advertise to the customer. For mobile broadband, the 'FCC speed test' is available as an App. for Android and iOS phones. The App. performs automated tests to actively measure 5 QoS parameters: *upload and download speed, latency, packet loss* and *jitter*. Information about the model of handsets and versions of operating systems tested are also collected. By default the Application is configured to use no more than 100 megabytes (MB) of data each month for automated testing. To better analyze wireless broadband performance, several other passive metrics are recorded, such as signal strength of the connection, and device manufacturer and model[10].

[10] FCC- Measuring Broadband America: https://www.fcc.gov/general/measuring-broadband-america

Singapore	As a complement to other QoS measurement tools, the regulator IMDA has been providing mobile users with the 'IMconnected' software application, which is based on voluntary crowdsourcing. 'IMconnected' gathers usage experience from users' mobile phones, such as broadband *speed*, *latency and coverage* on mobile cellular networks including 3G and 4G, as well as on Wi-Fi networks. This has allowed IMDA to have a better understanding of mobile broadband performance and to take measures to improve consumers' usage experience. The App was launched as a pilot in October 2014 which was successfully concluded in June 2015 and then adopted. IMDA has been publishing the 'IMconnected' results twice a year[11].
Bahrain	In Bahrain, crowdsourcing complements other QoS measurement solutions e.g. drive tests and dedicated hardware probes. The regulator App which is provided by "Speedchecker" allows data to be collected from mobile users' devices. The data is complemented with the Speedchecker's own App data to ensure that there are enough samples for analysis. Both active and passive measurements are available. The App may run in the background and collect data periodically but users can also initiate tests. The users may report about any QoS issues using a User Interface on the App. This information is analysed by the regulator and it may be forwarded to the respective operator. Each MNO in Bahrain has setup a dedicated measurement server with sufficient capacity to handle the testing traffic for this project[12].
Burkina Faso	The regulator uses a customised application called "5Gmark" which provides manual initiation of tests and active collection of QoS data. It also collects simple information about phone calls, by asking users to state whether calls succeed and to judge the voice quality, so it provides subjective information as well as objective information[13].

[11] IMDA Singapore-IMConnected: https://www.imda.gov.sg/imconnected

[12] https://speedtest.tra.org.bh/app/

[13] ITU/World Bank-Digital Regulation Platform : https://digitalregulation.org/crowdsourcing-techniques-in-quality-of-service-assessment/

3. PROPOSAL

3.1 The ICT Authority proposes to make available to end-users, a QoS measurement platform based on a crowdsourcing approach that will allow end-users to assess the Quality of Service (QoS)/ Quality of experience (QoE) of their Broadband Internet services by making QoS measurements directly from their devices (e.g. mobile phones, laptops, etc.).

3.2 In proposing the crowdsourcing-based solution, the ICT Authority seeks to adopt a consumer-centric approach whereby end-users become an integral part of the QoS regulation process, while achieving the objectives of transparency, consumer empowerment, and QoS monitoring.

3.3 The following is a typical scenario of how the proposed crowdsourcing platform would allow end-users to make QoS measurements and view their measurement results:

- End-users will be invited to participate in the QoS measurement exercise on a voluntary basis;
- End-users may either download and install the QoS measurement software application on their respective devices or may run QoS measurements on a software application that will be made available on the ICTA's website;
- The software application will enable end-users to set automated QoS tests (i.e. QoS tests will be automatically initiated in the background and QoS data sent to the crowdsourcing platform);
- End-users may further manually select, at any time, any individual QoS test or full QoS tests;
- The application shall allow as a minimum the following QoS measurements, excluding any personal data:
    - Download speed test
    - Upload Speed test
    - Latency test
    - Web Browsing performance test
    - Video Streaming performance test

- End-users will be able to view the QoS test results on real-time basis;
- End-users may further compare their results with those of other Broadband Internet service providers.
- The following picture is an example of the type of display that would be seen by a user on his/her device after selecting, for instance, a "download speed test".

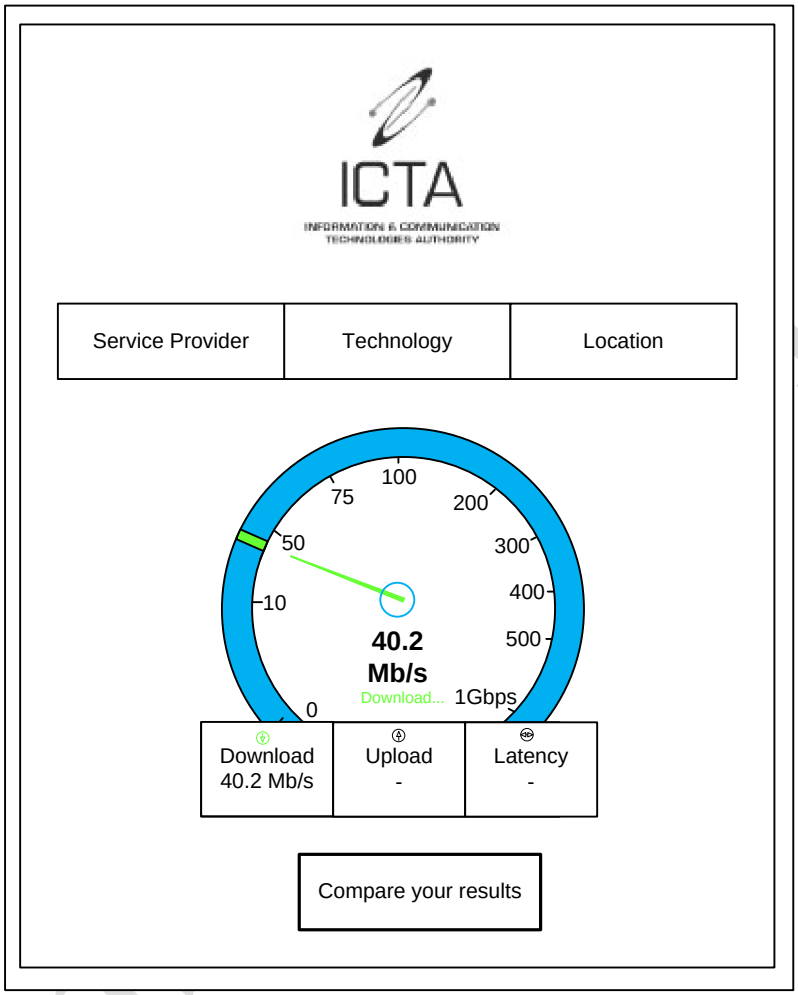

Fig 1: Illustrated picture of QoS test result displayed on an end-user's device

3.4 The ICT Authority intends to seek the services of a qualified, experienced and independent service provider for the implementation of the QoS measurement platform. For that purpose, the ICT Authority will work towards a Request for Proposal (RFP) in order to initiate the process of recruiting the said service provider. The main purpose of the current Consultation Paper it thus to invite views and comments on the technical requirements of the proposed QoS measurement platform.

3.5 The ICT Authority proposes that the following main technical requirements, as summarised below, be considered for the QoS measurement platform:

i) The service provider will be required to design, build and operate the QoS measurement platform;

ii) The QoS measurement platform is to use 'crowdsourcing' as its main measurement method;

iii) The platform should allow QoS measurement of broadband Internet services by fixed (including wireless) and mobile Internet users;
iv) A customised application software is to be made available to users, which may be downloaded and installed on their respective devices (e.g. mobile phones, tablets, etc.);
v) A customised application software should further be made available on the website of the ICT Authority where users can also run QoS tests.
vi) The platform should allow for active QoS measurements, which may be complemented with passive measurements;
vii) The platform should allow a combination of both user-initiated and automated QoS tests.
viii) Data consumption for the QoS tests should be minimal. The software application should allow users to set a threshold for monthly data usage and should provide for a notification when this threshold is reached;
ix) The platform should allow measurements of QoS parameters such as download speed, upload speed and latency;
x) The platform should allow measurements of QoE parameters pertaining to services commonly used by users such as Web-Browsing and Videostreaming;
xi) The service provider should propose appropriate QoS and QoE parameters that are based on the most popular forms of use by end-users;
xii) In case of insufficient QoS measurement data for analysis, the service provider may complement the user QoS measurement data with QoS measurement data obtained from its own App.;
xiii) The platform should allow appropriate filtering of results to eliminate possible abusive or fraudulent QoS tests.
xiv) The software application should provide easy User Interface to enable users to run QoS tests and access test results displayed in a meaningful and easy format and allow users to compare performance of different service providers;
xv) The platform should allow the ICT Authority to generate, with minimal manual intervention, comparative performance reports on a periodic basis. Such reports should be in a format which may be readily published by the ICT Authority and should further be meaningful and easily understood by the general user;
xvi) The User Interface on the software application should allow a user to report a QoS issue to his Broadband Internet service provider;
xvii) The QoS measurement platform is to be operational on a one-year pilot basis, and thereafter be adopted, as appropriate, on a three-year contract basis.

3.6 Following the Consultation exercise , the following Way Forward is proposed:

- ICTA to finalise the technical specifications of the QoS measurement platform;
- ICTA to draft a Request for Proposal so as to initiate the process of recruiting the independent service provider for implementation of the QoS measurement platform;
- Consultation with relevant operators and any other relevant stakeholder, if necessary, in view of finalising the RFP.
- Selection of service provider by ICT Authority;
- Joint preliminary meeting between ICTA, relevant operators and selected service provider to agree on work plan. Other meetings may be held as and when required to address technical issues;
- Issue of Directives/Guidelines (as appropriate) by the ICT Authority;
- Service provider to deploy and validate the QoS measurement platform. For validation purpose, ICTA may involve relevant operators at different stages of testing;
- Communication Campaign to educate and motivate users to participate in the QoS measurement exercise;
- Start of Pilot-Phase of the project.

ANNEX

CONSULTATION QUESTION LIST

1. ***What are your views on using 'crowdsourcing' as the main measurement method of the QoS/QoE measurement platform?***

2. ***Should a data collection device that is separate from the terminal ("white-box") be used rather than a software application in the case of fixed networks?***

3. ***Is there any category of Broadband Internet service that you think should be excluded from the proposed QoS measurements and if so, why?***

4. ***Should tests be automated (run in background) or be user-initiated (manual) or both? Why?***

5. ***What according to you should be the limit on data consumed by the QoS tests?***

6. ***Which main QoS/QoE parameters should be measured by the platform?***

7. ***What other useful QoS-related information should be made available to end-users by the QoS measurement platform?***

8. ***Do you have any suggestion regarding possible location of test servers to be used by the service provider?***

9. ***Do you think the service provider should not complement user data with measurement data obtained from its own App in case of insufficient data? Why?***

10. ***Which factors should be considered by the ICT Authority in proposing the format of the comparative performance reports?***

11. ***Do you agree that the QoS measurement platform should allow end-users to report QoS issues to the service provider? If so, what kind of QoS issues should be reported, how should the complaints be channelled?***

12. ***Please suggest how consumers may be motivated to participate in the measurements.***

13. ***Do you agree that the QoS measurement platform should initially be operated on a pilot-basis? If so, do you agree with the proposed duration of one year as pilot phase?***

14. ***Please provide any other general comments or suggestions.***