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GUIDELINES FOR BROADBAND INTERNET QUALITY OF SERVICE

September 2009

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I. INTRODUCTION

Rwanda Utilities Regulatory Agency was established, as per the law no 39/2001 of 13/09/2001, as an independent authority to administer the telecommunications sector, promote transparency, protect free competition and provide inclusive service, as well as protect user's rights.

In exercise of powers conferred upon the regulatory board under the chapter 2, article 3 section 9 of the presidential order no 04/01 of 15/03/2004 determining **specific duties of the regulatory board in telecommunications matters**, Rwanda Utilities Regulatory Agency (RURA) hereby makes the following Guidelines:

II. DEFINITION, SCOPE AND OBJECTIVES

2.1 Short title, extent and commencement

(1) These Guidelines shall be called as: ***'Broadband internet Quality of Service Guidelines 2009 (Sept. of 2009).***

(2) These Guidelines shall be applicable to all the Internet Service Providers, Telecom Operators and other entities related to the subject.

(3) These Guidelines shall come into force with effect from 04 September 2009.

2.2 Scope

These Guidelines identify minimum quality of service standards, and associated measurement, reporting and record keeping tasks.

2.3 Definitions

In these Guidelines, unless the context otherwise requires:

'Agency' means the Rwanda Utilities Regulatory Agency (RURA).

'Basic Service' means service derived from a Public Switched Telephone Network (PSTN) or a Public Land Mobile Network (PLMN) as specified in the license.

'Broadband' is defined as "An always-on data connection that is able to support interactive services including Internet access and has the capability of the minimum download speed of 256 kilobits per second (kbps) to an individual subscriber from the Internet node of the service provider intending to provide Broadband service where multiple such individual Broadband connections are

aggregated and the subscriber is able to access these interactive services including the Internet through this ISP node.

'CPE' means Customer Premises Equipment

'Customer' or 'Consumer' means a subscriber of Broadband service.

'DSLAM' means Digital Subscriber Line Access Multiplexer.

'DSL' means Digital Subscriber Line.

'Internet' is a global information system that is: logically linked together by a globally unique address, based on Internet Protocol (IP) or its subsequent enhancements/ up gradations; able to support communications using the Transmission Control Protocol / Internet Protocol (TCP/IP) suite or its subsequent enhancements/ up gradations, and all other IP compatible protocols.

'IGSP' means International Gateway Service Provider for Internet services.

'ISP' means Internet Service Provider licensed to provide access to Internet Service

'ISP Node' means a location where the ISP's Gateway Router is connected with upstream service provider

'LAN' means Local Area Network. It is a group of computers and associated devices that share a common communications line or wireless link.

'License' means a license granted by the Agency under which a service is provided by an operator, whereas a **'Licensee'** means an operator that is licensed to provide Internet Services

'OFC' means Optic Fiber Cable

'PC' means Personal Computer**.**

'POP' means Point Of Presence of the service provider intending to provide Broadband service where multiple such individual Broadband connections are aggregated and the subscriber is able to access interactive services including the Internet through this POP.

'Quality of Service': The term "Quality of Services" (QoS) is defined as "the collective effect of service performance which determines the degree of satisfaction of a user of the service indicating the performance of a broadband network and of the degree to which the network conforms to the stipulated norms".

'RINEX' or 'IX' means National Internet Exchange of Rwanda

'Service Provider' means a licensee of Internet Service, Basic Service Cellular Mobile Service, and Commercial VSAT Service who is licensed to provide Internet service.

'SLA' means Service Level Agreement

'Time Consistent Busy Hour (TCBH)': The one hour period starting at the same time each day for which the average traffic of the resource group concerned is greatest over the days under consideration. ITU recommends analysis of 90 days to establish TCBH.

'Telecom Law' means the Law No 44/2001 of 30/11/2001 organizing telecommunications

'VSAT' mean Very Small Aperture Terminal

2.4 Objectives

These Guidelines have the following objectives:

a) Create transparency and standards that can be monitored in services through Predetermined Quality of Service norms for Broadband which the service provider is required to provide and the user has a right to expect.

b) Measure the Quality of Service for Broadband provided by the Service Providers from time to time and to compare them with the norms so as to assess the level of performance.

c) Improve service quality, by identifying service deficiencies and by encouraging or requiring appropriate changes;

d) Protect the interests of consumers of Broadband service and thus enhance consumer satisfaction.

e) Make information available to help with informed Customer choice of Services and Licensees;

f) Assist the development of related telecommunications markets.

III. QUALITY OF SERVICES (QOS) PARAMETERS

3.1 Quality of Services Parameters

The service providers shall meet the Quality of Service parameters for Broadband as laid down below:

S/N	Parameters Name	Minimum QoS	Averaged over a period of
i	**Service Provisioning / Activation Time**	• >95% of work should be done within 5 working days, subject to technical feasibility • In case of NTF(Non Technical Feasibility), greater than 99% within should be done on the date specified and agreed with the customer • An SLA should always be signed between the ISP and the customer.	Quarterly
ii.	**Fault Repair / Restoration Time**	• >85% of all faults should be cleared within 24 Hrs • >99% of all faults should be cleared within a maximum of four(4) days unless in the case of Natural disasters/Acts of God may arise.	Quarterly
iii.	**Customer complaint resolution**	• Within 24hrs >95% complaints should be resolved (24/7) • Within 72hrs >99% complaints should be resolved (24/7)	Monthly
iv.	**Billing Performance** Billing complaints per 100 bills issued	<2% of bills issued during the billing period	Quarterly
v.	**Bandwidth Utilization/ Throughput**	<90% link(s)/route bandwidth utilization during peak hours (TCBH). If on any link(s)/route bandwidth utilization exceeds 90%, then network is considered to have congestion.	Quarterly
vii.	**Broadband Connection Speed achieved**	• 95% or greater the speed of connection(up-downstream)from ISP's server(s) to the customer shall be achieved fulltime (24/7) • >80% for non dedicated line	Monthly
viii.	**Network Latency**	The round trip delay for traffic within the local broadband network from end-user to ISP/IX should be less than 150 msec for 95% of the time during peak	Quarterly

S/N	Parameters Name	Minimum QoS	Averaged over a period of
vi.	**Service Availability** / **Uptime** (for all users)	Greater than 99% of the time, the network shall be available to the subscribers	Monthly
ix.	**Customer perception of Services**		
(a)	% satisfied with the provision of service	>95%	Quarterly
(b)	% satisfied with the billing performance	>95%	Quarterly
(c)	% satisfied with help services	>95%	Quarterly
(d)	% satisfied with network performance, reliability and availability	>95%	Quarterly
(e)	% satisfied with maintainability	>95%	Quarterly

3.2 Meaning Of the QoS Parameters & Measurement Methodology

The detailed meaning of QoS parameters described in guideline 3.1 and their measurement methods are provided for in the in Appendix 1 attached hereunder.

3.3 Reporting Requirement

The service providers shall submit the Performance Monitoring Reports on the QoS parameters in the format to be prescribed by the Agency respectively on Quarterly basis, ending 31st March, 30th June, 30th September and 31st December, but not later than 15 working days from the end of the Quarter or on Monthly basis. The Agency may review from time to time the periodicity and the format of such report.

3.4 Registration of Demands for Broadband Connections

(1) Providers, who intend to provide Broadband service, in a particular service area or exchange area/ locality/ city shall advertise and make public the Broadband availability plan at periodic interval of at least once in 3 months so that prospective customers can make registration.

(2) In order to ensure that applications for Broadband connections are registered within the country, the service provider shall register all demands for Broadband connections and give registration number to the prospective customer. If it is technically feasible to provide the Broadband connection, the service provider shall provide the list of subscribers and their bandwidth not later than 15 working days of each quarter.

3.5 Auditing

(1) The service providers shall maintain complete and accurate records of Service Provisioning /Activation, Fault Repair/ Restoration, Billing Complaints, Response Time to the Customer for assistance, Bandwidth Utilization/ Throughput, Service Availability/Uptime, Packet Loss and Latency measurements.

(2) Network performance parameters like Bandwidth Utilization/Throughput including Broadband Connection Speed, Packet Loss and Latency shall be measured on sample basis by the Agency from time to time, directly or if need so arises, through an independent agency.

(3) The Agency shall audit / inspect, either directly using its own equipments and software or through an independent agency, the records relating to the reporting of compliance to the QoS parameters. The Agency, if it thinks fit, may require the service providers to get the reports submitted to the Agency audited, at its own cost, through independent and qualified agencies.

3.6 Customer Perception of Service

The Quality of Service parameter for Customer perception regarding Broadband service shall be measured through customer survey conducted by the Agency through an independent agency or online through RURA portal. The results of this survey may be made public for the information of the customers to generate healthy competition amongst service providers to improve service.

3.7 Broadband Connection Speed (download)

The service Providers shall make available a facility to the Agency for measuring Broadband Connection Speed (download) at ISP node once within a period of 3 months of coming into force of these Guidelines. The new licensed ISP should make available that facility within a period of one month from the period of issue of the license.

3.8 Review

The Agency, on reference from any affected party, or for good and sufficient reasons, may review and modify these Guidelines.

3.9 Interpretation:

In case of any doubt regarding interpretation of any of the provisions of these Guidelines, the decision of the Agency shall be final and binding.

APPENDIX ON MEANING OF THE QOS PARAMETERS & MEASUREMENT METHODOLOGY

(a) Service Provisioning/ Activation Time:

1. The service provisioning/ activation time means the time taken from the date of receipt of an application to the date when the service is activated.

2. Technically Non Feasible (TNF) cases such as unavailability of Broadband infrastructure/ equipment in the Area or Spare Capacity i.e. Broadband Ports including equipment to be installed at the customer premises for activating Broadband connection shall be excluded from the calculation of this parameter. Also, problems relating to customer owned equipment such as PC, LAN Card/USB Port and internal wiring or non-availability of such equipment shall be excluded from the calculation of this parameter.

(b) Fault Repair/ Restoration Time:

1. Fault Repair/ Restoration Time mean the time taken to restore an existing customer's service to operational level from the time that a problem or fault is reported.

2. Only those complaints, which have been registered till the close of the business hours of the day, will be taken into account. Complaints registered after the business hours will be taken as being registered in the next day business hours. At the same time, faults due to the customer premises equipment which is owned by customer such as computer hardware and software including LAN card/USB Ports etc. shall be excluded from the measurement of performance against this benchmark, as the service provider is not directly responsible for these faults.

Billing Performance:

The percentage of bills resulting in a customer complaint indicates the billing performance.

$$\text{Billing complaints percentage} = \frac{\text{Total number of disputed bills X 100}}{\text{Total number of bills issued during one billing cycle.}}$$

Billing complaints deals with the percentage of complaints received related to billing, time taken for the resolution of the complaints and also time for making the refund to the customer.

(d) Bandwidth Utilization/Throughput:

1. The measurement of the bandwidth utilization for network links can be made using a traffic monitoring tool (software/hardware)

2. The Internet Service Provider could offer a good quality of service to the customers only if there is enough bandwidth in the Access segment, long distance segment. The Access segment is entirely managed and operated by the ISP. The broadband service can be provided through DSL, OFC, VSAT and

3. The service providers are required to monitor the bandwidth utilization during Time Consistent Busy Hours (TCBH) for all network link(s)/route. ISPs/ Service Providers shall report to RURA the bandwidth utilization (loading) of all the upstream links going to International Gateway Service Provider/ IX with a traffic monitoring tool. However, for local links/intra-network links the service provider need to report, only, exceptions having loading more than 80%. In case there is more than one link, then the average utilization of all the route links should not exceed 90% of loading level for a period of at least three months. The broadband service provider is required to make provision for additional bandwidth if the bandwidth utilization of the network links exceeds the 90% loading level for a period of at least three months. Average utilization of bandwidth in a route means utilization of bandwidth capacity on all the links of the route.

   Measurement Methodology for Link Bandwidth Utilization/Throughput:

   In terms of field monitoring, RURA will require the broadband access service providers to consolidate the monitored traffic charts for the various transmission points within the broadband network and submit them to Agency for verification of the accuracy and consistency of the QoS performance reported. As a further check, Agency would also require the broadband access provider to submit information on the ratio of bandwidth to users. This ratio would serve as an additional guide to indicate whether the bandwidth purchased by the broadband access service providers is overloaded.

(c) Broadband Connection Speed (download):

1. The "bandwidth utilization between the user and the nearest serving ISP node during download shall not be less than 80% of the subscribed level. The Broadband has been defined as **"an always on data connection that has the capability of the minimum download speed of 256 kbps to an individual subscriber from the Point of Presence (POP) of the service provider where multiple such individual broadband connections are aggregated"**. In order to facilitate measurement of download speed from ISP node by the user independently, a measurement facility is needed at each Point Of Presence. However, it would be difficult for the Broadband service provider to install the measurement facility in each Point Of Presence to facilitate the user to test independently the download speed. Therefore, service providers can install the facility at a central location or at an ISP Node. The measurement in this way shall include the intra-network links and loading of intra-network links may affect the speed measurement sometime. Therefore, keeping the reasonable loading level in intra-network links up to ISP Node, the benchmark has been prescribed that service providers shall ensure the speed of Broadband connection is >80% of the subscribed speed.

2. **Measurement of Broadband Connection Speed (download):** The parameter can be measured on a sample basis by the user and service provider. The service providers need to install download speed measurement software in the Server at ISP Node to facilitate the user to measure independently the download connection speed through a web link. The facility shall be made available and the required procedure & information to facilitate such testing by

the customer shall be made known to the customers by the service provider within a period of 3 months of coming into effect of these Guidelines.

$$\text{Data download speed} = \frac{\text{Size of the test file (data) in ISP Server}}{\text{Transmission time required for error free transfer of the entire data}}$$

(d) Service Availability/ uptime:

Service availability/ uptime is the measure of the degree to which the Broadband access network including ISP Node is operable and not in a state of failure or outage at any point of time for all users. It also includes the upstream connectivity uptime. Therefore, it measures the total downtime of the network for all users, including the LAN Switches, Routers, Servers, e-mail facilities etc at ISP Node and connectivity to upstream service providers over a period of one quarter.

Service Availability = (Total operational hours – Total hours of service downtime) X 100% Total operational hours

The Agency has fixed the benchmark for this parameter, keeping in view the fact that Broadband being an always on connection the downtime should be minimal.

Downtime for the purpose of upgrading or routine maintenance of the network system shall be excluded from the calculation of the service availability/ uptime provided that users are informed in advance of any such up gradation or maintenance action.

(e) Latency:

The proposed benchmark of < 150 msec for latency from User to IGSP Gateway is too adequate. The reference points are as User, ISP Node/POP and IX/IGSP nodes. Considering the fact that the latency measurement to IX/IGSP Gateway reference point is more holistic than measuring the latency for each component of the network, the Agency felt that the User (Reference Point) to International Gateway (IGSP/IX) shall be specified and decided that the parameter shall be < 150 msec, which is easily achievable.

(f) Packet Loss:

The Agency has decided <3% and this parameter may be changed.

Packet Loss and Latency Measurement:

1. **Packet Loss:** Packet loss is the percentage of packets lost to the total packets transmitted between two designated CPE / Router Ports.

2. **Network Latency**: Latency is the measure of duration of a round trip for a data packet between specific source and destination Router Port/ Customer Premises Equipment (CPE).

3. **Packet Loss and Latency** Parameters indicate the quality of Broadband access network equipment including leased line resources used as well as the equipment at the ISP/ Service Provider Node. Being responsible to the

customer for end to end QoS, the Broadband service provider needs to ensure that QoS is maintained on all the connected links. For this purpose, the service provider should negotiate Service Level Agreements (SLA) with the upstream service providers. There is a need to measure the packet loss and latency at different points using ping tests.

4. The Packet Loss and Latency parameters proposed are for wired Broadband access network only having Optical Fiber Technologies, Digital Subscriber Lines (DSL) on copper loop in the access network and broadband wireless access (BWA).

5. The measurement will be made for Packet Loss and Latency by the service provider on a sample basis taking the Broadband customer (User) configuration as User Reference Test Point at ISP Node/ POP. This configuration shall have local loop, CPE, ADSL-router/modem or Cable modem and PC/Laptop.

6. Minimum sample reference points for each service area shall be three in number or multiple reference points, if needed. The Packet Loss and Latency shall be measured from user reference points at ISP Node/ POP to IGSP/ IX Gateway location.

7. Ping Test will be generated during the time consistent busy hour (TCBH).

8. For Ping test the defined Packet size shall be of 64 bytes. The test conducted on daily basis shall be averaged for a month and the result of the Ping Test to be indicated for the Packet Loss and Latency.

9. **Packet Loss Measurement** shall be done by computing the percent Packet loss of 1000 pings (with acknowledgement for each previous packet received) of 64 byte packet each. This packet loss is the measurement of packet lost from Broadband customer (User) configuration/ User Reference Point at ISP Node/ POP to the IGSP/ IX Gateway.

10. **Latency Measurement** shall be done from user reference points at ISP Node/ POP to IGSP/IX Gateway location.

11. The round trip delay for the Ping packets from ISP premises to the IGSP/ RINEX Gateway will be measured by computing the delay for 1000 Pings of 64 bytes each, where pings are only sent subsequent to an acknowledgement being received for the same for the previous ping.

12. All the measurements of engineering standards such as Bandwidth Utilization/Throughput, Packet Loss and Latency are to be carried out in the Time Consistent Busy Hour (TCBH) as specified by ITU-T.

(i) Customer Perception of Service:

This parameter has been prescribed to assess the customer perception of service. This shall be done online by the Agency or through the independent agency.

(j) Service Level Agreement:

Service Level Agreement is a formal written agreement made between two parties: the service provider and the service recipient which defines the basis of understanding between the two parties for delivery of the service itself. It may among others, contain a specified level of service, support options, etc. The Committed Information Rate (CIR) shall be defined by the Licensee within the service level agreement.

Done at Kigali, on 04 September 2009

(Sé)

Marie Claire MUKASINE

Chairperson