UGANDA COMMUNICATIONS COMMISSION

QUALITY OF SERVICE FINDINGS FOR MOBILE VOICE TELEPHONY AND DATA SERVICES IN UGANDA

1. Background

Uganda Communications Commission (UCC) was established by the Uganda Communications Act 2013 to champion the development of a modern Communications sector, which includes telecommunications, broadcasting, radio communications, postal communications, data communication and infrastructure.

The functions of UCC include promoting and safeguarding the interests of consumers and operators as regards the quality of communications services and equipment. In fulfilment of this, UCC sets standards for operators on, among others, the quality of communications services to be provided in Uganda. UCC conducts periodic independent audits to verify the reports submitted by operators on their compliance with the various service standards.

In the period September to November 2019, UCC conducted benchmark measurements of mobile voice telephony and data services in Uganda to assess the Quality of Service (QoS) received by users/consumers of these services. The operators whose services were considered under this exercise were Uganda Telecom Limited (UTL), MTN Uganda Limited, Airtel Uganda Limited and Africell Uganda Limited.

The measurements were carried out from the end user perspective in twenty (20) towns across the country namely; Mbarara, Kabale, Moroto, Kasese, Hoima, Mubende, Arua, Mbale, Tororo, Soroti, Lira, Kampala, Mukono, Jinja, Masaka, Mityana, Entebbe, Masindi, Fort Portal and Gulu. However, UTL network was not accessible in seven [7] of the towns considered.

The summary of the findings of this exercise are hereby presented.

2. Interpretation

The following information is provided to facilitate the consideration of the findings:

A. **Quality of Service (QoS)** is defined as the totality of characteristics of a telecommunications service that bear on its ability to satisfy stated and implied needs of the user of the service. QoS covers the entire communication path from end-to-end between user-to-user or user-to-content as illustrated in figure 1 below. This is why QoS measurements are done from a user interface of the service unlike network performance measurements.
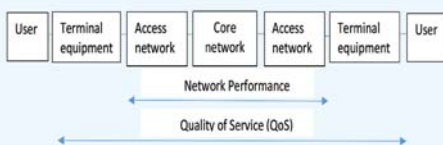
Figure 1: *Schematic of QoS*

B. **Call Attempt** is when a call connection is initiated by dialling the full set of digits of a legitimate subscriber number.

C. **Blocked call** is a call attempt, which although is initiated within the coverage area of the operator, does not establish a connection to the called number;

D. **Dropped call:** a call that is successfully established but is terminated by the operator's network prior to normal termination by the user and without the user's action.

E. **A successful call means a call that:**
- Rings and is terminated with a 'no answer' message from the network or voice mail services or an announcement that the subscriber is not available,
- Is responded to by the network with:
  o a busy signal indicating the called party is on another call,
  o a network announcement that a wrong (invalid or non-existent) number has been dialled, or
  o rings, is answered and terminated by either call party.

F. **Data** is the form in which information moves around the internet or in which information is processed or stored by a computer.

G. **Data throughput** is how much data (number of data packets) that gets transferred from one point on the network to another in a given amount of time. It is measured in bits per second (bps).

H. The **UCC standard for QoS** is as indicated below:

|	Parameter	Definition	Target
1	Blocked call rate	maximum proportion of call attempts on the network that should be blocked	2%
2	Dropped call rate	maximum proportion of successful call attempts on the network that should be dropped	2%
3	Success call rate	minimum proportion of calls attempts on the network that should be successful	98%

I. **Causes of degradation in QoS**

These are typically associated with inadequate performance:
a) of the communications network
b) of the terminal equipment/end user infrastructure (e.g. poor quality or faulty user phone, faulty or poor set up of the local area network, etc.), or
c) a combination of both.

The common causes of inadequate or degraded performance of a communication network include:
o inadequate coverage (resulting in a network signal that is too weak for the user's phone to connect to the network),
o an outage of a component of a network (due to power outage, fibre cuts/theft/vandalism, and software or hardware/equipment problems/failure)
o interference (either within the network or with other radio users),
o inadequate network design causing failure to handover a call from one cell to another and
o congestion,

A mobile network comprises of a mesh of cells with a tower at the centre of each cell that communicates with the different mobile terminals or devices within the cell as illustrated in the figure below.
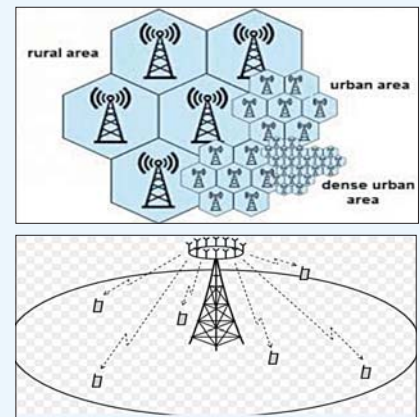
Figure 2: *Illustration of the cell structure of mobile networks*

As a mobile device moves across the network, it moves from one cell to another.

To ensure smooth transfer of the mobile device from a serving cell to another without losing a call or data connection (referred to as handover), the mobile device continuously listens or scans the strength of the cells neighbouring the serving cell. When the strength of the signal of a neighbouring cell is stronger than the signal in the serving cell that the mobile device is currently connected to, it switches to the stronger neighbour cell. Each cell has a neighbour list that specifies the potential cells to which calls/connections can be handed over when required.

A list that has too few or incorrect neighbours can cause dropped calls due to handover failure. This may result from an inadequacy in the network planning or subsequent changes in the environment around the cells e.g. newly constructed building(s) or even moving objects, which may cut off the signal from a listed potential neighbouring cell.

Congestion, on the other hand, typically occurs in a network when or where there is a higher number of users trying to make a call at the same time than the capacity available on the network in that location at that particular time.

This scenario may occur in two (2) ways:

i. due to unpredictable situations that occur on an irregular basis such as a temporary inflow of a large number of people to a location for an event like a concert or rally
ii. occurrence on a regular basis due to a failure by the respective operator to meet the increasing traffic levels in an area with sufficient network capacity enhancement.

J. The QoS of a network can and may be different at different locations across the network or in the same location when measured at different times.

K. The peak seasons each year across the networks, when there is most usage or subscription, are end of June to September and December to January.

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3. Summary of the findings

The findings are presented as follows;

- Figures 3 through 5 show a summary of the QoS results obtained for the mobile voice services
- Figure 6 presents the average download throughput measured for data services and
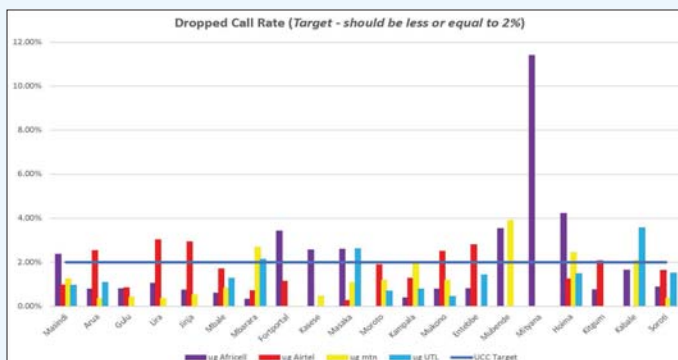- Figure 7 presents the major causes of failures that were observed during the exercise.

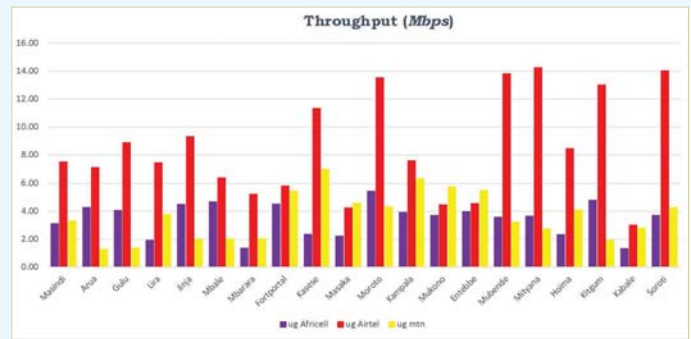*Figure 3:   Comparative results on the Successful Call Rate*
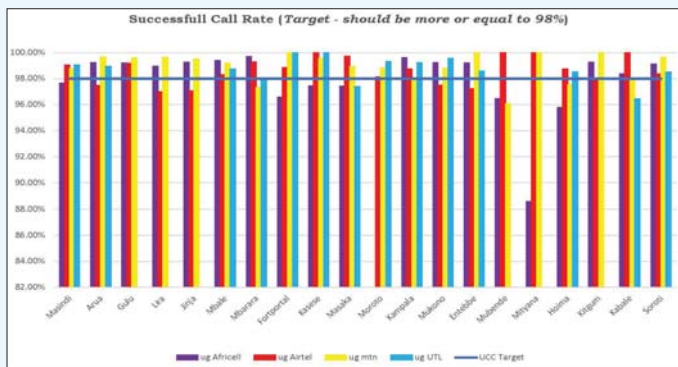
Figure 4:   Comparative results on the Blocked Call Rate
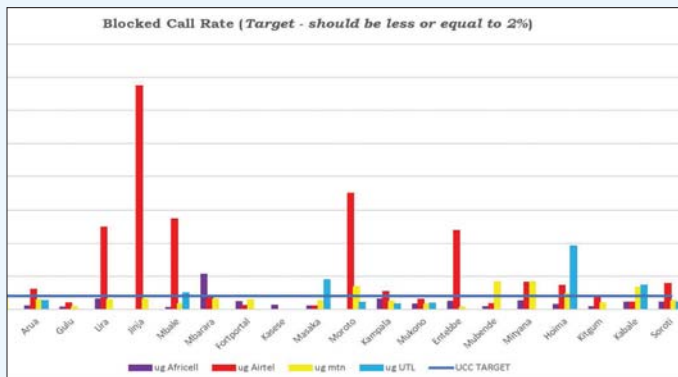
*Figure 5:   Comparative results on the Dropped Call Rate*

Figure 6:   The average Download throughput measured on the different operators' networks

Major causes of unsuccessful call attempts

i.   **Poor network coverage:** Areas where there is no signal or the signal strength/level is too low for a phone to connect to the mobile network.

ii. **Poor signal quality:** Degradation in the quality of the network signal due to interference to the radio signal majorly emanating from another radio in the same network using the same frequency or due to other radio systems in the area.

iii. **Inadequacies in network planning:** Loss of connection while moving from one serving network cell (tower or base station) to another.

iv. Congestion

Figure 7:   Proportion of causes of network failures observed across the operator's mobile networks
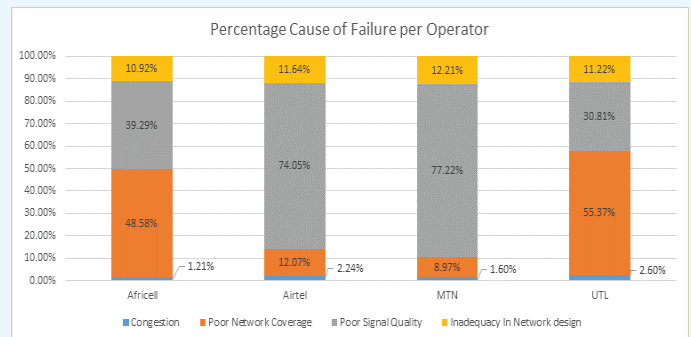
4. Conclusion

From the causes highlighted above, it can be deduced that even where coverage is said to exist, there are shortfalls in terms of gaps in the coverage and optimisation of the networks. The Commission has engaged the operators for justification for the findings of the exercise and remedial plans have been agreed to address the short falls in performance.

The Ministry of ICT and National Guidance also issued regulations in respect of QoS that now enable UCC to fine operators over QoS. UCC remains committed to ensuring the availability of quality and modern communication services to foster the realisation of the transformation of Uganda into a modern and prosperous country.

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