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Quality of Services in Mobile Networks in Sudan and the Customer's Choice

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Abstract

In this paper we explained the Quality of serves in Mobile Network and to find simple ways to enhance the Quality by using Statistical method and Customers complaints, and we took high-way as example and test the three service provider in Sudan and analysis this statistical. We used KPIs to analysis and know which server provider is better by this way every customer can know by himself which server provide can use.

Keyword: *Quality of Services, Statistical Method, Server Provider.*

1. Introduction

Quality of Service (QoS) in cellular networks is defined as the capability of the cellular service providers to provide a satisfactory service which includes voice quality, signal strength, low call blocking and dropping probability, high data rates for multimedia and data applications etc [2], we depart from the ITU's defined the Quality of Service as the collective effect of service performance which determines the degree of satisfaction of a user of the service's [3].

The telecommunications have an essential role to play in the world because all the other services depend on the telecommunications, for example, in marketing, information, medicine, news … etc. Quality is a Degree to which a set of inherent characteristics fulfils requirements. Quality of Service *(QoS)* refers to the capability of a network to provide better service to selected network traffic over various technologies [1]. Quality of service represents one of the main problems that faces the communication; nowadays every operator is trying to achieve the best QOS which will lead to increase the number of customers so as to increase the profits.

2. QOS Operation

Quality of Service (QoS) is a suite of technologies used to manage bandwidth usage as data crosses computer networks. Its most common use is for protection of real-time and high priority data applications. QoS technologies, or tools, each have specific rolls used in conjunction with one another to build end-to-end network QoS policies.

Two most common QoS tools used to handle traffic are classification and queuing. Classification identifies and marks traffic to ensure network devices know how to identify and prioritize data as it traverses a network. Queues are buffers in devices that hold data to be processed. Queues provide bandwidth reservation and prioritization of traffic as it enters or leaves a network device. If the queues are not emptied, they overflow and drop traffic.

Policing and shaping are also commonly used QoS technologies that limit the bandwidth utilized by administratively defined traffic types. Policing enforces bandwidth to a specified limit. If applications try to use more bandwidth than they are allocated, their traffic will be remarked or dropped. Shaping defines a software set limit on the bandwidth transmission rate for a class of data. If more traffic needs to be sent than the shaped limit allows, the excess will be buffered. This buffer can then utilize queuing to priorities data as it leaves the buffer [8].

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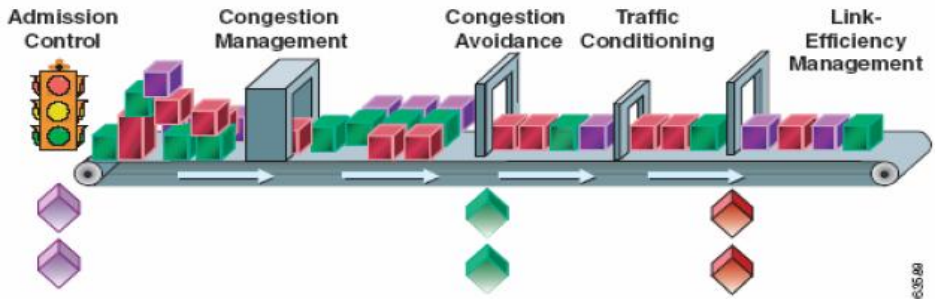

Figure 1: QOS Operation

2.1 QOS parameters

The QoS is majorly provided by the network itself and may be described by various objective parameters called as QoS parameters which affect the performance of network. QoS more narrowly refers to meeting certain requirements typically, throughput, packet error rate, delay, and jitter [9].

Delay or latency could be defined as the time taken by the packets to reach from source to destination. The main sources of delay can be categorized into: propagation delay, source processing delay, network delay and destination processing delay [4]. Throughput is the average data rate of successful message delivery over a communication channel [5]. Availability, Reliability (packet loss), Denial of Service (DoS) and security, Congestion.

2.2 GSM network

The Authors v.renuka, s.gomathi published paper in this title GSM Cellular Scheme [6] this paper explain any component in this network. And the authors Avinash Shivajirao Pawar, Atish Shivajirao Pawar published paper in study of the gsm network [7] discuss in this paper cellular systems the cellular instruction and definition the meaning of Cluster and Microcells, Microcells and explain all network component.

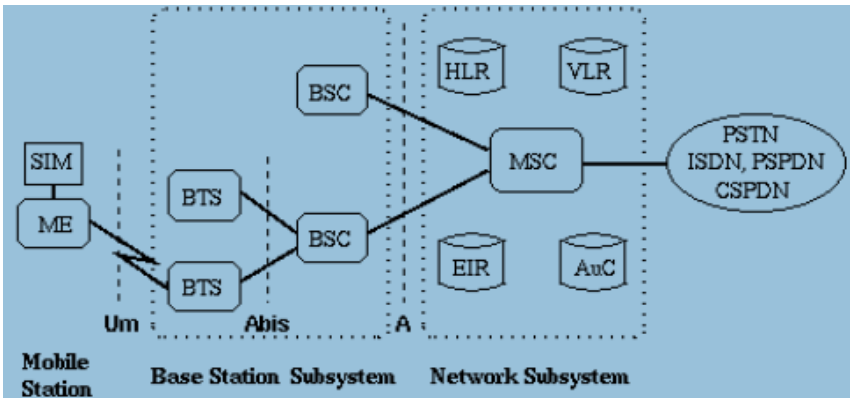

Figure 2: GSM Architecture

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2.2.1 Air Interface

In a mobile network communication, section transmission connection uses radio link (uplink and downlink), this link is used between MS and BS and Uplink/Downlink of 25MHz (890 -915 MHz) for Uplink and (935 - 960 MHz) for Down link [11]. Combination of frequency division and time division multiplexing FDMA 124 channels of 200 kHz and TDMA is Burst and it can used for modulation Gaussian minimum shift keying (GMSK).

2.2.2GSM Channels

They are tow gsm channels the physical channel is the combination of frequency division and time division. It is composed of the slot flow between BTS and MS. Therefore, any physical channel has to be described from two dimensions: frequency and time. And the Logic Channel results from the time complexing on the physical channel. Different logic channels are used for different kinds of information transmission between BTS and MS. The explanation for the logic channel defined in the GSM norm is as follows: Traffic Channel (TCH)TCH carries speech or subscriber data, and the full rate TCH carries the information with the rate of 22.8kbit/s. TCH include the following kinds of traffic channels: Enhanced full rate speech TCH (TCH/EFS) Full rate speech TCH (TCH/FS) 9.6kbit/s full rate data TCH (TCH/F9.6) 4.8kbit/s full rate data TCH (TCH/F4.8) 2.4kbit/s full rate data TCH (TCH/F2.4) Control Channel (CCH)The control channel mainly carries signaling or synchronous data. It can be divided into four kinds according to the different tasks processed: Broadcasting Channel(BCH)BCH is the one-point-to-many-points unidirectional control channel from BTS to MS, which is used to broadcast all kinds of information to MS. BCH can be divided into three kinds :FCCH: Frequency Correction Channel, which is used to correct the MS frequency ;SCH: Synchronous Channel, which is used in the MS frame synchronization and, BTS identification BCCH : Broadcasting Control Channel, which is used to broadcast cell information . Common Control Channel (CCCH) CCCH is the one-point-to-many-points bidirectional control channel, which is mainly used to carry signaling information necessary for the access management function, and it can also carry other kinds of signaling. CCCH is commonly used by all MSs of the network. It includes three parts: PCH: Paging channel, which is used by BTS to page MS; RACH: Random Access Channel, which is used by MS to randomly access the uplink channel of the network; AGCH: Access Grant Channel, which is used to assign the special control channel to the connection with the successful access. Dedicated Control Channel (DCCH) DCCH is point-to-point bidirectional control channel. Based on the requirement for the communications control process, DCCH is assigned to MS to enable it to conduct point-to-point signaling transmission with BTS. The summary for the logic channel is shown as in Figure below

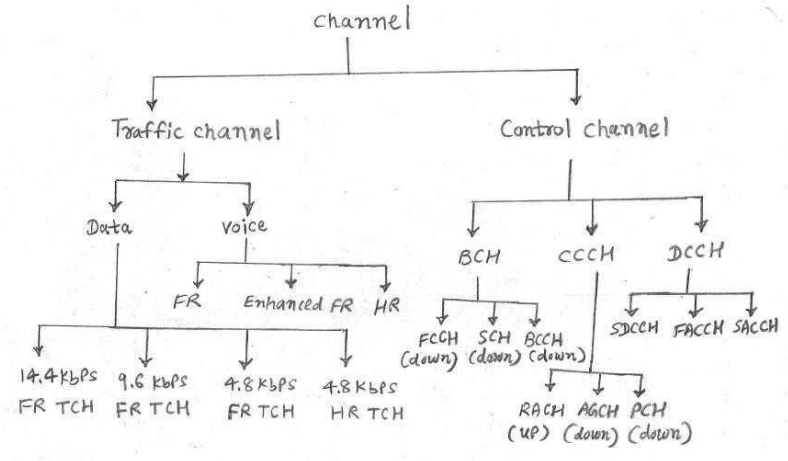

Figure 3: GSM Channel

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3. Methods of Measuring QOS in GSM

The network is always monitored by three different ways: Drive Tests Analysis and Statistical Analysis and System Check Tools.

The Quality of Service (QoS) offered by Mobile Network Operators in (Sudan) to the subscribers means to insure that they must have a good Radio Signal Coverage and Quality and radio Connection Accessibility and Radio Connection Availability, and we have a certain Key Performance Indicators (KPIs) which are used to monitor the Network overall Accessibility Performance Some of these KPIs are Random Access Success Rate and SDCCH Availability (Standalone dedicated control channel) and C-TCH Availability (Traffic Channel) and D-Call Setup Success Rate.

3.1 Statistical Tools

The most important of this KPIs (key performance indicators) in our calculation is

-SDCCH availability= (scanning counter (sec))/ (scanning period (sec))*100

-call setup success rate= ((1-SDCCHdrop rate)*TCH assignment success rate)/100

-SDCCH drop rate= (CNDROP/CMSESTAB)*100.

CMSESTAB: All SDCCH Established Connections

CNDROP: SDCCH Drop Counter

3.2. Counters Data

We take this Data from BSCs Counters that Covered (Khartoum & Omdurman & Bahry) the Counters count many event in network so as to monitor and measure the Quality by using the mentioned equations and we illustrated (drop call and call success rate and traffic assignment rate and Call Setup Success Rate.

Examination of call drop is categorized as network monitoring and evaluation, whose focus is to evaluate the performance of the quality of service (QOS) of a radio network in terms of call drop rate [12]. Call drop problem in mobile communication directly affects the customer requirement. The multiple reasons behind the call drop is handover failure call drops, LAPD (Link Access Protocol on D-channel) call drops and the radio frequency call drops (RF call drops). These are all common type of call drops occurring during the processing of calls in wireless communication [13].

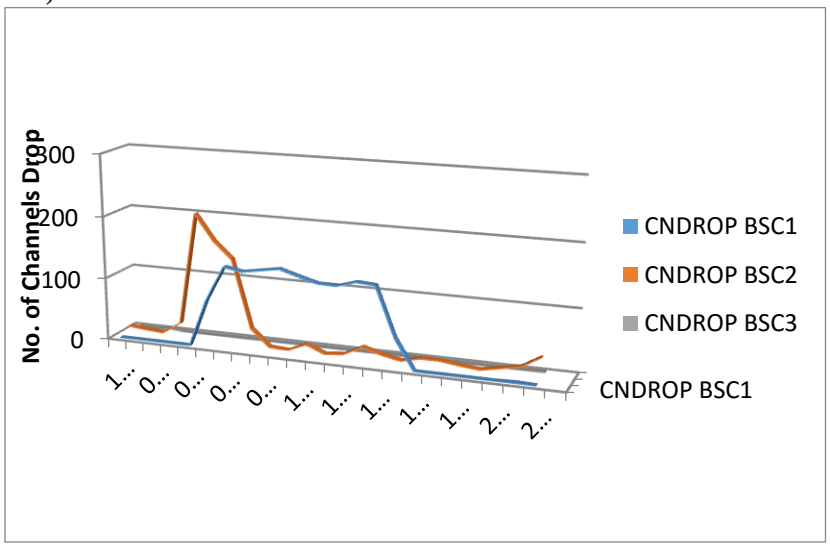

Fig 4: Channels Drop in BSC1 &BSC2 &BSC3

Channel drop is this indicator measures the network ability to retain call conversation when it has been Established or set up. A value of 5% of CDR means that, out of every 100 calls established or setup, 5 will drop [14]. In BSC1the channel drop is very much from 4:00 to 16:00 this is a long time and this is busy time and in BSC2the channel drop from 4:00 to 8:00 compare to the BSC1 the BSC2 less channel drop, the BSC3 they is no channel drop, if we want to compare between which one from three BSCs the diagram is showing the BSC3 is better than the other because they is no channels drop.

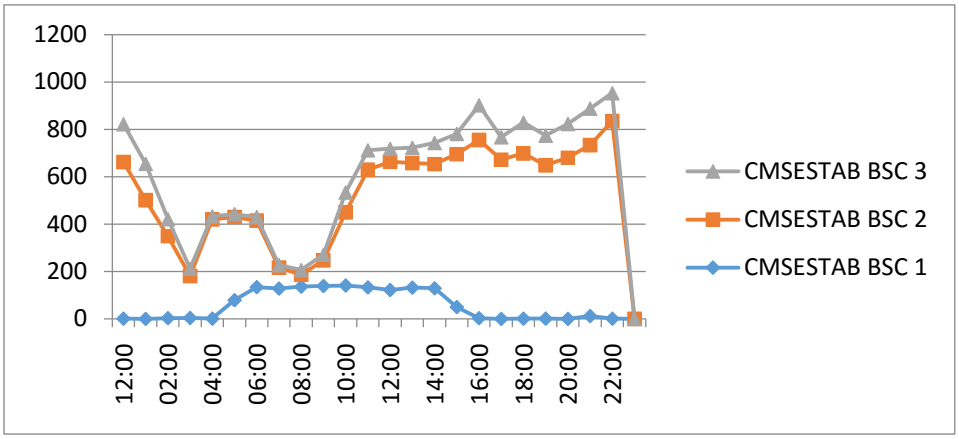

Figure 5: Established Channels

Established channel in BSC1is very low less than 200 channel in period from 4:00 to 16:00 and in BSC2 is more than BSC1 in BSC2 established channel is very high that mean BSC3 is better. We can show in fig 5 the BSC3 is better than all BSCs because the establish channels is very high than the other BSCs.

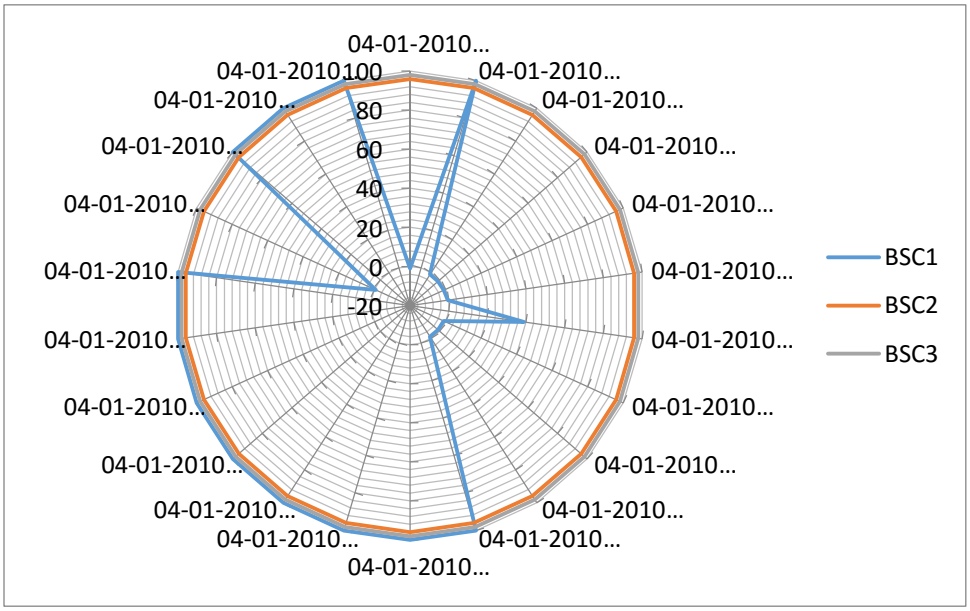

Figure 6: Call Setup Success Rate

Call setup success rate is one of the key performance indicators (KPI) used by the network operators to assess the performance of networks and have direct influence on the customer satisfaction with the service provided by the network and its operator [15]. Call Setup Success Rate is high in BSC3 and BSC2 but in BSC1 in some time the signal is not success.

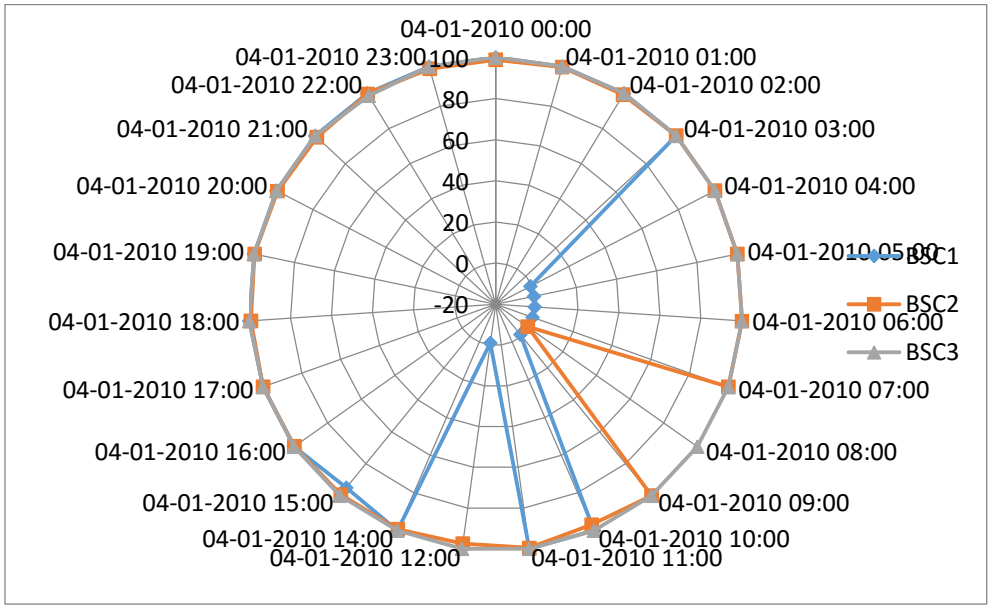

Figure 7: Traffic Assignment Rate

The TCH assignment success rate refers to the rate that the TCHs assigned by the BSC are successfully seized. Successful TCH assignment indicates the procedure from the BSC receiving the Channel Request message sent by the MSC to receiving the Assignment Complete message. TCH Assignment Success Rate is one of accessibility KPIs. It indicates the rate of the MSs successfully seizing the TCHs to make calls. This KPI directly affects the user experience. Traffic assignment rate is high in BSC3 but in BSC2 and BSC1 in some time the signal is not success.

4. Analyses for Sudani & Zain

The Place of Analyses is River Nile street Omdurman from Halafaya Bridge to Shambat Bridge. The Distance approximately = 8000 meter, Programs used for analysis (Open signal) & (G-NetTrack) which is work in Android System. **First Point (Down Bridge Halafaya)**

Figure 8: Zain Measurements point 1

This program is showing many parameter but we concern voice calls and successful call and blocking calls and dropped calls , in simulation above showing zain server provider the voice call=10 call the success calls is 7 calls and the blocking calls is zero and dropped calls is 3 calls.

Figure 9: Sudani in point 1

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This point to another server provider called sudani it can showing degree for voice signal and data signal, and we can see the data is very poor but the voice is excellent.

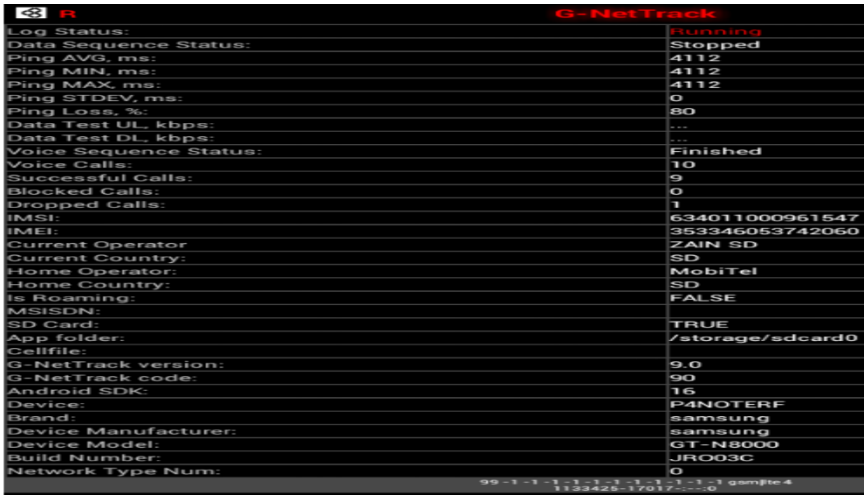


Figure 10: Zain Measurements in Point 2

Here in zain provider this is point 2 the voice calls is 10 calls and the successful calls is 9 and blocked calls is zero1 and dropped calls is 1.

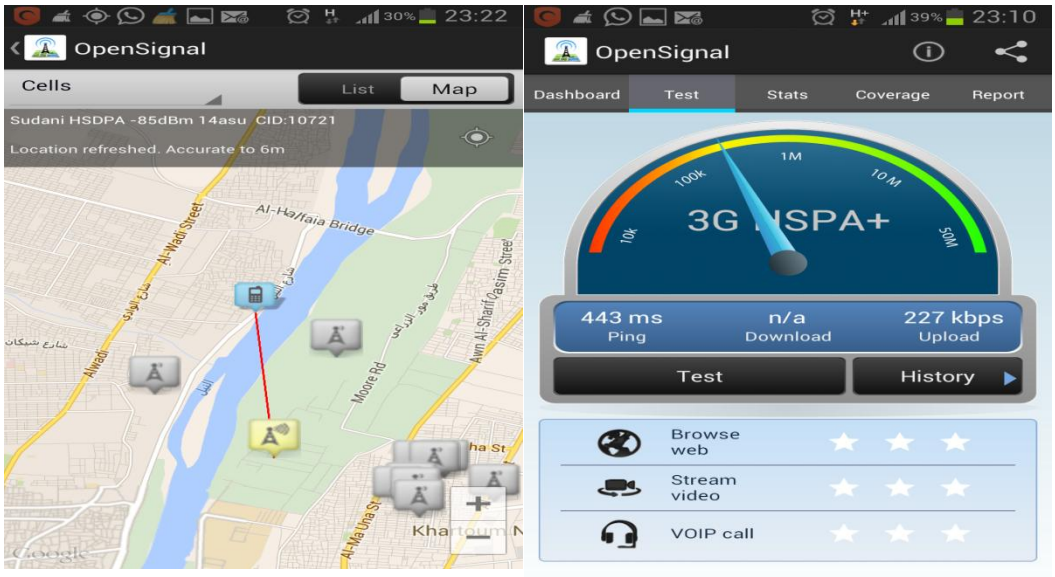
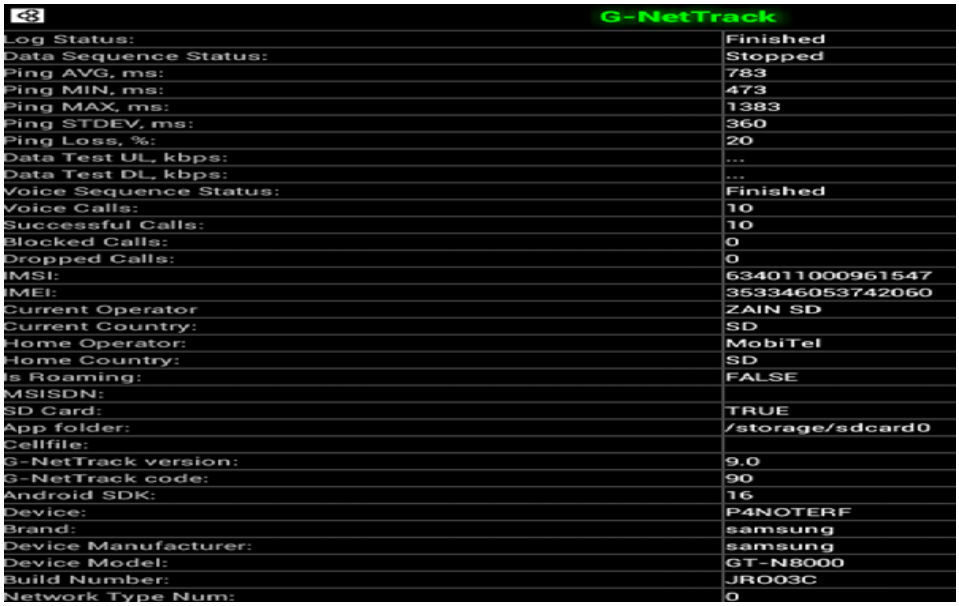


Figure 11: Sudani Measurements Point 2



G-NetTrack	
Log Status:	Finished
Data Sequence Status:	Stopped
Ping AVG, ms:	783
Ping MIN, ms:	473
Ping MAX, ms:	1383
Ping STDEV, ms:	360
Ping Loss, %:	20
Data Test UL, kbps:	...
Data Test DL, kbps:	...
Voice Sequence Status:	Finished
Voice Calls:	10
Successful Calls:	10
Blocked Calls:	0
Dropped Calls:	0
IMSI:	634011000961547
IMEI:	353346053742060
Current Operator	ZAIN SD
Current Country:	SD
Home Operator:	MobiTel
Home Country:	SD
Is Roaming:	FALSE
MSISDN:	
SD Card:	TRUE
App folder:	/storage/sdcard0
Cellfile:	
G-NetTrack version:	9.0
G-NetTrack code:	90
Android SDK:	16
Device:	P4NOTERF
Brand:	samsung
Device Manufacturer:	samsung
Device Model:	GT-N8000
Build Number:	JRO03C
Network Type Num:	0

Figure 12: Zain Measurement Point 3

Here in zain provider this is point 3 the voice calls is 10 calls and the successful calls is 10 and blocked calls is zero and dropped calls is zero.

Figure 13: Sudani Measurements Point 3

This point to another server provider called sudani it can showing degree for voice signal and data signal, and we can see the data is not good and the voice is not good.

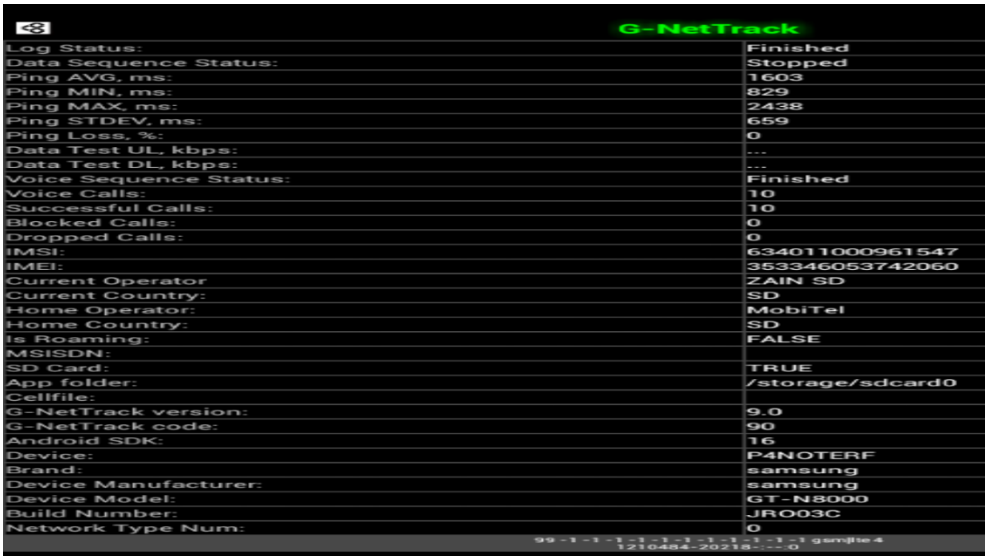


Figure 14: Zain measurements in Point 4

Zain provider this is point 4 the voice calls is 10 calls and the successful calls is 10 and blocked calls is zero and dropped calls is zero.

Figure 15: Sudani Measurements Point 4

This point to another server provider called sudani it can showing degree for voice signal and data signal, and we can see the data has data rate 434 ms and the voice is excellent.

5. Conclusion

MTN: The BSC1 Need more Channels to avoid congestion &channel drop. Zain & Sudani: Preplanning for River Nile Street area to solve problems of Handover & voice Quality It will be better if we share the Customers the issue to enhance the quality by making department taking all customers complaint to be analysis.

They are some parameter to know which BSCs is good like channel drop and Traffic Assignment Rate and Call Setup Success Rate and Established Channels and all diagram in fig (4 and 5,6,7) illustrates the BSC3is best because is no drop channels and high Traffic Assignment Rate and the high establish channel.

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