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Analysis of Call Performance in Zoom Mobile Network in Agege Area of Lagos Nigeria

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Abstract: This research is an analysis of call performance in zoom mobile network in Agege area of Lagos, Nigeria. Zoom mobile network operate on a Code Division Multiple Access (CDMA) network. In this research, the call performance in Zoom mobile network for the months of January, February and March, 2008 were analysed using the data obtained from the Huawei customised mobile network integrated management system 2000, which is a centralised monitoring and control equipment for the entire zoom mobile network. The analysis of data revealed that call successful ratios are high >98% and call drop ratios are low <2.0%. Suggestions were proposed to further reduce call drop ratio if properly implemented.

Key words: Call performance, call successful ratio, call drop ratio, code division multiple access, carrier

INTRODUCTION

The Zoom mobile network in Nigeria operates on a Code Division Multiple Access (CDMA) network. CDMA is a spread spectrum technology allowing many users to occupy the same time and frequency allocations in a given space (Freeman, 2006; Waya, 2007). As the name implies, CDMA assigns unique codes to each communication to differentiate it from others in the same spectrum. In a word of finite spectrum resources, CDMA enables many people to share the airways at the same time than do alternatives technologies.

CDMA was commercially introduced into the world market in 1995. In 1999, the International Telecommunication Union selected CDMA as the industry standard for new third Generation (3G) wireless system. Many leading wireless carriers are now building or upgrading to 3G CDMA network inorder to provide more capacity for voice traffic along with high speed data capabilities (Waya, 2007; Huawei CDMA Radio Network Assessment, 2004). CDMA is distinguished by three key elements (Huawei CDMA Radio Network Assessment, 2004; Nevio *et al*., 2006).

The signal occupies a bandwidth much greater than that which is necessary to send the information. This results in many benefits such as immunity to interference jamming and much user access.

The bandwidth is spread by means of a code, which is independent of the data. The independence of the code distinguishes it from standard modulation schemes in which the data modulation will always spread the spectrum.

The receiver synchronizes to the code to recover the data. The use of an independent code and synchronous reception allows multiple users to access the same frequency band at the same time. In order to protect the signal the code used is pseudo-random so that the receiver can reconstruct the code for syndromes detection. Code division multiple access is associated (Huawei CDMA Radio Network Assessment, 2004; Nevio *et al*., 2006) with the following:

Frequency hopping: The signals are rapidly switched between different frequencies within the hopping bandwidth pseudo-randomly and the receiver knows beforehand, where to find the signal at any given time.

Time hopping: Signals are transmitted in short bursts pseudo-randomly and the receiver knows before hand when to expect the burst.

Direct sequence: The code is generated pseudo randomly and the receiver knows how to generate the same code and correlates the receive signal with the code to extract the data.

In the CDMA systems transmitters occupy calls that are allowed different carrier frequencies. There are no two adjacent cells that have the same frequencies as the handset moves from one cell to another. In CDMA network each base station in the system is distinguished by transmitting the same code but at different time. To obtain a unique time offset, CDMA network are synchronized to a common time reference provided by the Global Positioning System (GPS).

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The benefits of users of CDMA systems are increased capacity and call quality. Capacity increases up to ten times that of Advanced Mobile Phone Services (AMPS) analogue system and five times that of Global System for Mobile communication (GSM). Planning is simplified because the same frequency is used in every cell (Webb, 2007; Molisch, 2005).

MATERIALS AND METHODS

Carrier performance index: The carrier performance index is a data chart that clearly shows the record of performance interms of call drop ratio and call success ratio in a particular Base Transceiver Station (BTS) or cell site.

The carrier performance index is achieved from the Huawei I Manager M2000 (2004) customized mobile networked integrated management system, which is a centralized monitoring and control equipment for the entire Zoom mobile network.

Mobile integrated network management system: Huawei I Manager M2000 (2004) is an integrated network management system for Zoom mobile network. Various network elements such as Base Transceiver Station (BTS) Mobile Service switching Center (MSC), Base Station Controller (BSC), Visitor Location Register (VIR) are connected to the Huawei (M2000) system through local or wide area network. This mobile integrated network management system enhances the monitoring capability of the entire network (Huawei I Manager M2000, 2004). The carrier performance index used in this research was generated with the Huawei (M2000).

Base Transceiver Station (BTS): This is a network component which serves one cell. It is controlled by a Base Station Controller (BSC). The BTS contains one or more transceivers (Anonymous, 2004). In this research the BTS name is Agege Lagos and has an ID of 325.

Cell: This is a radio area. The BTS occupies a cell (radio area). The name given to the particular cell used for this work is cell 325.

Sector: A cell is divided into sectors. The antenna used by the zoom mobile in the base station is divided into sectors namely sector 0, 1 and 2. They are displayed at an angle of 120 to each other. They are numbered as shown in Fig. 1.

Carrier system: This is a system in which a number of individual telecommunication channels e.g., data, audio, video or combination are multiplexed for transmission (Saunders and Alejandro, 2005).

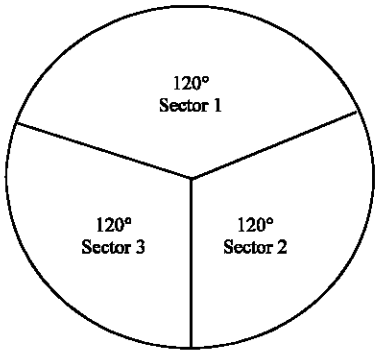

Fig. 1: Antenna sector for zoom mobile Network

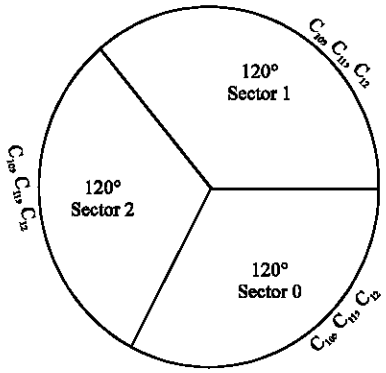

Fig. 2: Carrier frequency distribution around the three sectors

Carrier frequency distribution around the sectors: The Zoom mobile network uses four carriers three for calls and one for data. The carriers for calls are represented as carrier 10, 11 and 12.

These carriers have frequencies as: carrier 10:1100 MHZ, 11:1125 MHZ, carrier 12:1150 MHZ. These carrier frequencies are well distributed around the three sectors as shown in Fig. 2.

Call attempt times: This means the number of times that calls tried going through a particular carrier at a particular time.

Call successful times: This means the number of times that calls were successful out of the number of times that calls attempt was made.

Call success ratio (%): This means the number of call successful times divided by number of calls attempt times. This is calculated as:

$$\text{Call success ratio (\%)} = \frac{\text{Call successful times}}{\text{Call attempt times}} \quad (1)$$

Call drop: This means the inability of call to connect and go through the network and be successful. For a drop call the subscriber does not enter into a queue for potential assignment (Olokede, 2009; Adegoke *et al*., 2008).

Call drop ratio (%): This means the number of unsuccessful calls in percent calculated as:

$$\text{Call drop ratio (\%)} = 100\% - \text{call success ratio} \quad (2)$$

RESULTS AND DISCUSSION

Data analysis

Data collection and presentation: The carrier performance index of zoom mobile network in Agege Lagos for the months of January, February and March 2008 obtained from the Huawei customized mobile network integrated system are presented in Table 1-3.

Table 1: Average call performance index data for the month of January 2008 in Agege Lagos Nigeria

Sector No.	Carrier	Call success ratio (%)	Call drop ratio (%)
0	10	99.4949	0.5051
	11	98.8701	1.1299
	12	98.2143	1.7857
1	10	99.3976	0.6024
	11	96.5714	3.4286
	12	99.4819	0.5181
2	10	99.3976	0.6396
	11	97.2220	2.7778
	12	98.3143	1.6857

Table 2: Average call performance index data for the month of February 2008 in Agege Lagos Nigeria

Sector No.	Carrier	Call success ratio (%)	Call drop ratio (%)
0	10	98.4620	1.5380
	11	98.8601	1.1399
	12	97.1562	2.8438
1	10	98.3602	1.6398
	11	96.5712	3.4288
	12	97.4263	2.5737
2	10	99.4268	0.5737
	11	97.6206	2.3794
	12	99.2102	0.7898

Table 3: Average call performance index data for the month of March 2008 in Agege Lagos Nigeria

Sector No.	Carrier	Call success ratio (%)	Call drop ratio (%)
0	10	99.4640	0.5360
	11	99.8642	0.1358
	12	98.3646	1.6354
1	10	98.5600	1.4400
	11	97.5624	2.4376
	12	99.4364	0.5636
2	10	97.2438	2.7562
	11	97.2642	2.7358
	12	98.5206	1.4794

Data analysis: Table 1-3 and Fig. 3 show that we have an average of 98.5516, 98.1215 and 98.4756%, call success ratio in the three sectors for the months of January, February and March 2008.

Table 2, Fig. 4 and 5 shows that we have an average of 1.4525, 1.8785 and 1.5244% call drop ratio in the three sectors for the months of January, February and March 2008.

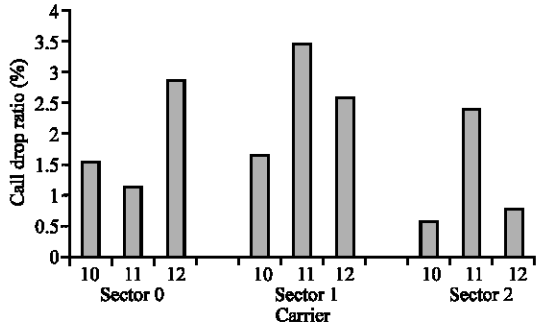

Fig. 3: Bar graph of call drop against carrier per sector for the month of January 2008

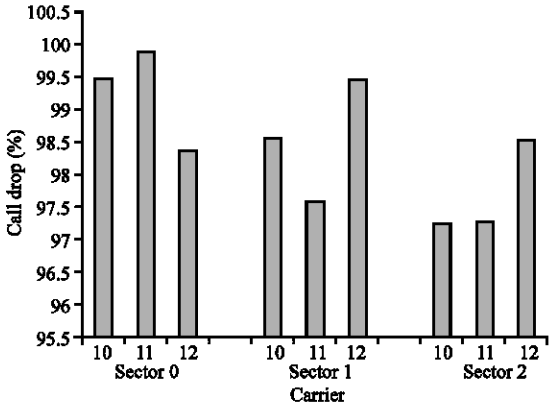

Fig. 4: Bar graph of call drop against carrier per sector for the month of February 2008

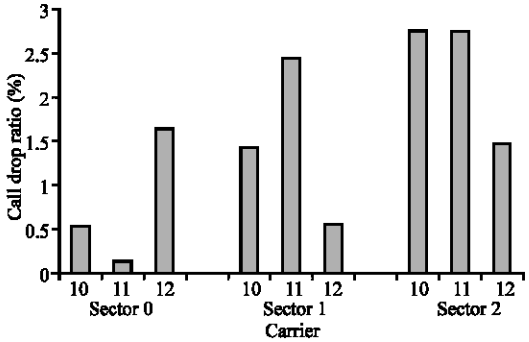

Fig. 5: Bar graph of call drop against carrier per sector for the month of March 2008

SUGGESTIONS FOR FURTHER REDUCTION IN CALL DROP RATIO

Call drop ratio is supposed to be reduced to the least minimum value in mobile communication networks. In order to reduced call drop ratio to the least minimum value we need to carefully adhered to the under mentioned suggestions.

In Nigeria, power supply is very poor and epileptic. This results in a situation where mobile phone companies exclusively power their base stations with generators (Adegoke *et al*., 2008). These generators are not suppose to run out of diesel at any time. When a base station is not powered with electricity, the site goes down and this will result in call drops. Mobile base stations must always have adequate diesel for power generation in the base stations.

The CDMA network has no limit on the number of subscribers in its network, it keeps on accepting more subscribers, therefore CDMA network sometimes suffer traffic congestion which can cause call drops. Optimization in the network in terms of adjustment of system parameter is very necessary in CDMA network at all times. For example we can increase capacity from 32-64 calls per channel per sector. This can reduce traffic congestion and thus reduce call drop.

The channel card is the card that is responsible for call channelling and processing. The channel card is located inside the base station controller. This card sometimes go bad due to age and if that happens will result in call drop. There is need for constant replacement of channel card at regular basis, if call drop is to be reduce to the least minimum value.

In CDMA network, neighbouring cells use the same frequency for transmission and each of these cells are distinguished by the pseudorandom number. It is absolutely necessary that these pseudorandom number be carefully planned and selected to minimize cell interference and reduce call drop.

CONCLUSION

In this research, the zoom network call performance in Agege area of Lagos was obtained and analysed for the months of January, February and March 2008. The analysis shows high call success and low call drops. Suggestions were also presented which if implemented will further bring down the call drop ratio because reducing call drop to the least minimum value will increase call efficiency and thus improve call connection and conversation between callers and the called party.

The data used in this research was obtained from the Huawei customised mobile integrated network management system.

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