

Appraisal of Global System for Mobile Communication (GSM) In Nigeria

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ABSTRACT : This paper is an appraisal of the Global System for mobile communication (GSM) in Nigeria. It gives an overview of the history and the trend of GSM in Nigeria; the effect so far; the areas of reconsideration and future expectations as compared to developed countries. GSM has become one of the world's greatest achievements in the field of science and has changed the world of telephony and communication. With the introduction of GSM, Nigerians now have access to a variety of different services that were never possible with Government Owned Telecommunication Company(NITEL), such as mobile banking and so on. As more phones and accessories are being sold, it has helped to stimulate the Nigerian economy. The study concludes that the deregulation of the Nigerian telecommunication sector, hence, the introduction of GSM technology has made very significant positive impact on the economic situation of Nigeria. However, the biggest challenge facing the mobile industry in Nigeria is Energy especially the issue of electric power supply. The study from its findings recommends that the government should expand tele-density and provide the necessary economic infrastructures (particularly power supply) to the GSM operators in order for them to deliver efficient services.

Keywords: Communication, Network, Phone, Technology, Wireless

I. INTRODUCTION

The idea of the first cellular network was brainstormed in 1947. It was intended to be used for military purposes as a way of supplying troops with more advanced forms of communications. From 1947 till about 1979 several different forms of broadcasting technology emerged. The United States began to develop the AMPS (Advanced Mobile Phone Service) network, while European countries were developing their own forms of communication. However, when Europeans quickly realized the disadvantages of each European country operating on their mobile network, it prevented cell phone use from country to country within Europe. With the emerging European Union and high travel volume between countries in Europe, this was seen as a problem. Rectifying the situation, the Conference of European Posts and Telegraphs (CEPT) assembled a research group with intentions of researching the mobile phone system in Europe. This group was called Group Spécial Mobile (GSM). In 1989 work done by the GSM group was transferred to the European Telecommunication Standards Institute (ETSI). The name GSM was transposed to name the type of service invented. The acronym GSM had been changed from Group Spécial Mobile to Global System for Mobile Communications. [1]

A GSM network is composed of several functional entities, whose layout and interfaces are linked and defined. The layout of a generic GSM network is also known as the Basic GSM network Architecture and is shown in figure 1 below. The GSM network can be divided into three broad parts. The mobile station is carried by the subscriber, the base station subsystem controls the radio link with the mobile station. The network sub system, the main part of which is the mobile services switching Centre, performs the switching of calls between the mobile and other fixed or mobile network users, as well as management of mobile services, such as authentication. Not shown is the operations and maintenance Centre, which oversees the proper operation and set up of the network. The mobile station and the base station subsystem communicate across the urn interface, also known as the air interface or radio link. The base station subsystem communicates with the mobile service switching Centre across the A. interface. The central component of the Network subsystem is the mobile services switching centre (MSC). It acts like a normal switching mode of the PSTN or ISDN and in addition provides all the functionality needed to handle a mobile subscriber, such as registration, authentication, location updating, handovers, and call routing to a roaming subscriber. These services are provided in conjunction with several functional entities, which together form the network subsystem. [1]

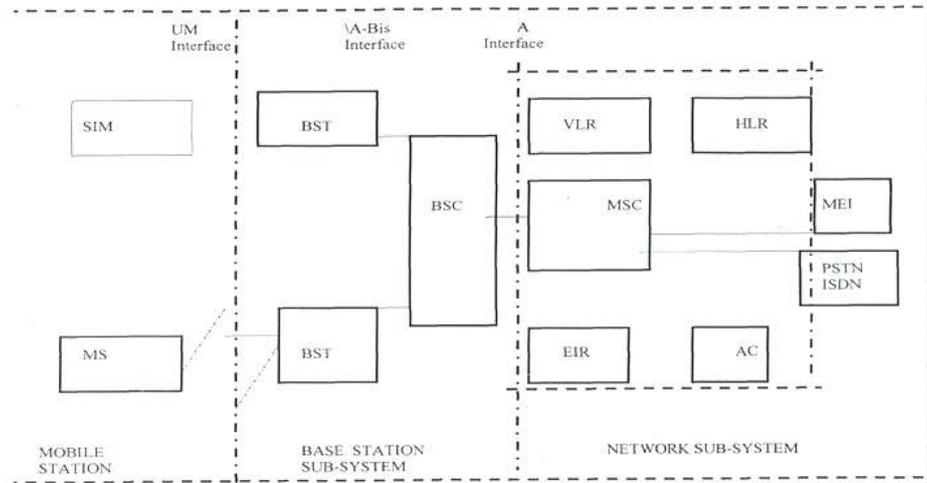


Figure 1: Basic GSM Network Architecture

Legend: SIM: Subscriber Identity Module, MS: Mobile Station, HLR: Home Location Register, VLR: Visitor Location Register, EIR: Equipment Identity Register, AC: Authentication Center, PSTN: Public Switched Telecom Network, ISDN: Integrated Services Digital Network, BSC: Base Station Controller, BTS: Base Transceiver Station, MSC: Mobile Service Center, IMEI: International Mobile Equipment Centre

II. OPERATING PRINCIPLE OF A GSM NETWORK

Cellular Systems use a technique known as frequency Reuse. A Particular available channel frequency is transmitted from a Base station at a power level that supports communications within a moderate cell radius around that Base station. Because this transmitted signal power is controlled to serve only a limited range, the same frequency can be transmitted simultaneously, or reused, by another Base station, provided there is no interference between it and any other base station using the same frequency [1]. The principle of operation of the Basic GSM Network Architecture is as follows:

- **The Mobile Station:** The mobile station in GSM is really two distinct entities. It consists of the mobile equipment, i.e the handset, and a smart card called the Subscriber Identity Module (SIM). The SIM provides personal mobility, so that the user can have access to subscribed service irrespective of a specific terminal. By inserting the SIM card into another GSM terminal. The user is able to receive and make calls from that terminal, and receive other subscribed service. The mobile equipment is uniquely identified by the International Mobile Equipment Identity (IMEI). The SIM card contains the International Mobile Subscriber Identity (IMSI) used to identify the subscriber to the system, a secret key for authentication and other information. The IMEI and IMSI are independent, thereby allowing personal mobility. The SIM card may be protected against unauthorized use by a password or personal identity number.
- **The Base Station Subsystem:** The base station subsystem is composed of two parts, the Base Transceiver Station (BTS) and the Base Station Controller (BSC) and the base station controller (BSC) these communicate across a standardized "Abis" interface, allowing operation between component made by different suppliers. The BTS houses the radio transceivers that define a cell and handles the radio-link protocols with the mobile station. In a large urban area, there will potentially be a large number of base transceiver stations deployed, thus the requirements for a base transceiver station are ruggedness, reliability, portability. Base Station Controller (BSC) manages the radio resources for one or more base transceiver stations. It is the connection between the mobile station and the mobile services switching centre, It manages the radio interface channels (set up, teardown, frequency hopping, etc), as well as handovers.
- **Network Subsystem:** The central component of the Network subsystem is the mobile services switching centre (MSC). The MSC provides the connection to the public fixed network (PSTN or ISDN), and signaling system number 7 (SS 7), use in ISDN and widely used in current public networks. The home location register (HLR) and visitor location register (VLR), together with the MSC, provide the call routing and (possibly international) roaming capabilities of GSM. The HLR contains all the administrative information of each subscriber registered in the corresponding GSM network, along with the current location of the mobile. The current location of the mobile is in the form mobile station roaming number (MSRN) which is a regular ISDN number used to route a call to the MSC where the mobile is currently located. There is logically one HLR per GSM network although it may be implemented as a

distributed data base. The visitor location register contains selected administrative information from the HLR, necessary for call control and provision of the subscribed services, for each mobile currently located in the geographically area controlled by the VLR. Although each functional entity can be implemented as an independent unit, most manufacturer of switching equipment implement one VLR together with one MSC, so that the geographical area controlled by MSC corresponds to that controlled by the VLR, simplifying the signaling required. Note that the MSC contains no information about particular mobile stations- this information is stored in the location registers. The other two registers are used for authentication and security purpose. The equipment identity register (EIR) is a data -base that contains a list of all valid mobile equipment on the network, where each mobile station is identify by its international mobile equipment identify (IMEI). An IMEL is marked as invalid if it has been reported stolen or is not type approved. The authentication centre is a protected database that stores a copy of the secret key stored in each subscriber's SIM card, which is used for authentication and ciphering of the radio channel.

III. THE TREND OF GSM DEVELOPMENT IN NIGERIA

The Nigeria telecommunication sector was grossly underdeveloped before the sector was deregulated under the military regime of General Ibrahim Babangida in 1992 with the establishment of a regulatory body, the Nigerian communication commission (NCC). After the establishment of NCC, the regulatory body issued various licenses to private telecommunications operators. These include fixed telephone providers that have activated 90,000 lines 35, internet service providers with a customer base of about 17,000. The return of democracy in 1999 brought a full deregulated telecommunications sector: by auctioning 3 GSM licenses in January 2001 for 285 million each and further reserved a license for NTEL. In the end, only 2 out of 3 companies at auction, MTN communications and ECONET wireless and NITEL were awarded full GSM licenses. The third successful company, at the auction, communication investment limited, CIL was refused a license on the ground that it did not meet payment deadline. First of the block to commence services was ECONET wireless who commenced operations on August 6, 2001 with its contract package which was followed by its post-paid package, popularly referred to as pay-as-you-go. MTN communications opened its doors to its customers two days later with similar package. Subsequently eager subscribers promptly bombarded both network operators to grab the available lines. The third network, NITEL was nowhere to be found mainly due to its un-preparedness and internal disequilibria. The rest, as the cliché goes is history. These, two companies, according to their image makers, have within 12 months added more telephone lines -over 1 million as at the last count into the Nigeria environment, more than was ever the case in 40 years of independence [2]

This scenario was further spiced when the NCC granted a license for second National operator (NSO) to GLOBACOM Nigeria on August 12, 2002. The motive was to create an alternative network to the government owned NITEL and the other two existed operators MTN and ECONET. GLOBACOM paid the mandatory 200 million dollars for the license before August 30, 2002 deadline. The license involves the following the National carrier service. Digital/ mobile service, long distance communication and fixed wireless access service therefore, obligation to be met by GLOBACOM includes the provision of 150,000 digital lines on its mobile network and 100,000 fixed line network within the first 12 months of operation. In trying to meet the challenges of its-predecessors in the GSM industry, GLOBACOM signed interconnectivity agreement with MTN Nigeria and appointed over 350 dealers nationwide on Friday 29th Aug. 2003, GLOBACOM now known as GLO mobile rolled out their services in Abuja and true to their earlier promise, they introduced a per second billing system with a tariff of 50 kobo per second for the pay-as-go subscribers. Reliable information reveals that a SIM line (card) cost 8,400 Naira with a mandatory 2,000 Naira credit and 18,400 Naira for a SIM line and phone set. They promised to roll out their services in Lagos, Port Harcourt, and Ibadan before December, 2003. In view of the activities of GLOBACOM, it is expected it will be able to create a more competitive environment in the Industry.

Official statistics shows that Nigeria has a telephone subscriber base of about 70million (NCC, 2010), of which about 62million are GSM subscribers. Before now, access to telephone was exclusively reserved for the rich and privileged few in the country until 2001 when the GSM was introduced. [2]

IV. THE EFFECT OF GSM IN NIGERIA

The impact of GSM in Nigeria cannot be overemphasized. If we look back to the period in Nigeria when we lived without GSM and imagine what life used to be, then we can see for our self the positive impact of GSM network on the nation. GSM has touched life directly and indirectly, increase communication, businesses, ways of life etc. According to Ernest Ndukwe, the revolution of information and communication technology (ICT) has brought assurance to many people especially low income earners that they can feed themselves or families, provide shelter for selves and have a secured future [2]. The Global Service for Mobile communication (GSM) serves as a tool for economic, political and social interactions among people of all profession, classes and status. The GSM is said to have improved the capacity of small-scale entrepreneurs who

rely on it as an important means of communication needed to be able to do their jobs. The GSM usage has also helped to bridge the communication gap between urban and rural dwellers as was witnessed in the Niger Delta area of Nigeria. He also noted that about 80% of Nigeria's population is located in the rural areas and to ensure the people's security, there is the important need for access to information and knowledge. Official statistics shows that Nigeria has a telephone subscriber base of about 70million (NCC, 2010), of which about 62million are GSM subscribers. Before now, access to telephone was exclusively reserved for the rich and privileged few in the country until 2001 when the GSM was introduced.

The rural dwellers have been involved in small businesses such as the telephone or GSM call centers. To many people, the introduction of the GSM into the country has transformed them from unemployed or employee status to employers and successful business men and women. A teeming population of 'would have been' jobless people has engaged themselves in the business of phone calls. The umbrella stand call Centre is a prominent feature in every street of the rural areas and even in the urban areas. These operators are never short of customers as people are always patronizing them for one reason or the other, ranging from recharge card purchase to making of calls, some persons even collect the phone numbers of some operators so that they can receive calls through

such centers. This business is very easy to start as all that is needed is a space where the umbrella (parasol), table, chairs and a mobile phone SIM (Subscribers Identification Module) can be set. [3] Here are more of its benefits:

- ✓ **Livelihood Sustainability:** The initial bulk purchase of recharge cards will depend on the operator's starting capital, and this can be increased gradually as the operator ploughs back some of his profit into the business. These operators use special SIM cards meant for business, so that they attract a lower call charges than the non business normal SIM card.
- ✓ **Sponsorship of other Business:** Sometimes, the rural dweller engages in the GSM business as a last resort means of raising money to finance his or her major business of interest. The low income earners do not have an easy access to credit facilities needed to finance the business of their choice and so would readily and willingly resort to the GSM business as a way of raising and saving fund to later start the business of their interest.
- ✓ **Job creation and employment:** The system has created lots of jobs for graduate and undergraduates, skilled and unskilled labour. Many people in Nigeria are being employed daily in to the GSM sector by companies engaged in GSM activities reducing unemployment rate. Besides employment, the system has promoted self employment and a new skill among people. Many has engaged in mobile phone and phone accessories retail business, phone repair business, recharge card business and lot more.
- ✓ **Speedy business:** with the effective means of communication, business transactions are carried out at a very fast rate over the GSM network.
- ✓ **Cheaper call Rate:** GSM network offers a cheaper call rate as compared to the landline means of communication and instalment.
- ✓ **Mobile banking:** Banks in Nigeria are making use of the GSM technology in the banking system. Mobile banking offers a system of banking where a customer to a bank has full access to his or her bank account through an internet mobile phone.
- ✓ **Reduced risk and cost of travel:** Introduction of GSM network in Nigeria has reduced the risk of travelling. People don't have to travel long distance to deliver a message since they can now sit at the comfort of their homes and communicate with anyone at a distant place or country. With this, money spent on such a journey is saved.
- ✓ **Cheap intercontinental call/roaming:** calls to other countries are made cheap over the GSM network including roaming service which is flexible.
- ✓ **Mobile/Car tracking services:** with the internet and the GSM network, security system has been improved with the introduction of mobile and car tracking system. Stolen phones and cars can easily be traced and tracked down with this system.
- ✓ **Internet services:** internet activities that was formally associated with the computer is now widely carried out through GSM mobile phones and devices. It provides cheaper rate in kilobyte per second (kbps).
- ✓ **Mobile/Social media:** The GSM phone now is replacing photo album, radio and cassette player and also video player. With the internet, one can subscribe to mobile TV where TV programs can be viewed through the phone including radio broadcasting stations. Communication and relationship skill is being improved over social network and apps.
- ✓ **Internet banking:** just like mobile banking, the internet banking provides an access to online banking and shopping.

V. CHALLENGES OF GSM DEVELOPMENT IN NIGERIA

The development of GSM in Nigeria and even other parts of the world had faced and is still been faced with lots of challenges. These challenges in one way or the other affects the quality of service rendered to customers by GSM service providers. They affect quality (network and customers service quality) as much as they affect converge, which are critical success factors and the least common denominators of GSM operation anywhere in the world.

The biggest challenge facing the mobile industry in Nigeria is Energy especially issue of electric power supply. As at today, the companies within the industry generate their own power through standby generators located in each of their base stations. This is considered outrageous and makes the whole operations and services very expensive. Other challenges include poor telecommunication infrastructure and inadequate skilled man power. Most of the customers' expectations like cheaper Call rate are also challenges to the industry.

Another factor is multiple taxation, by the government on service providers. However, this is not peculiar to GSM operators only or telecommunications companies, as one can remember over the issue of multiplicity of taxes charged by the Federal, State and Local Government for example, operators are made to pay certain amounts per meter of their masts located in various parts of the country. At times, once your facilities are in place, the host communities will begin to inundate you with letters demanding such infrastructure as road, electricity, schools, hospitals etc.

Other challenges include the twin problem of high foreign exchange and interest rates, charged by government. However, this is not peculiar to GSM operators but considering the volume of imported content of their operations, the impact is certainly more significant. As part of the pioneer status granted the operators, government had granted 25 per cent duty waiver on all import of GSM network materials.

VI. AREAS OF RECONSIDERATION AND FUTURE EXPECTATION.

As earlier mentioned, the future of wireless industry or mobile Industry in Nigeria is strongly tied to meeting the expectations of the customers. In Nigeria, today almost every Telecommunications subscriber has switched over to wireless networks because of the opportunity of high mobility. There is continuous demand for communication service, the wireless Industry is growing at exponential rate. Therefore, the following are the expectations of the users including the potential subscribers.

- ❖ **Lower tariff.** As the subscribers increase in population, the cost of services drops proportionately. But in Nigeria, it has not been so, despite the fact that most of the mobile communication companies have broken-even. Their tariffs are still very high. The future of the industry depends on how well they can meet all these expectations.
- ❖ **Seamless connectivity.** It is not uncommon to see some Nigerians in big cities carrying two or three mobile phones at the same time. This is because inter - connectivity between different networks is still very poor. For example, if a customer is on MTN network and he wants to call on a person who is on another network different from MTN, the call may take one minute or two minutes to go through. These are areas of challenges to the Industry and they must be addressed as soon as possible for the sake of the future of the Industry.
- ❖ **Research and Development.** In the area of research and development, the mobile Industry in Nigeria is not doing enough; it is expected that the mobile industry should take keen interests in research and development. The industry should actively support and encourage research in to new areas in wireless communication networks, e.g., Intelligent Networks (IN); Satellite Telephony Technology and a host of others. This can be done by collaborating with some Universities and polytechnics to engage in progressive and productive research directed at addressing the challenges facing the industry especially in the energy and power supply system and other essential infrastructures that are vital to the growth of Telecommunications in Nigeria.
- ❖ **Training and Technology Transfer.** Because the future of the Industry depends on the qualities of their staff: engineers, technicians, managers, administrators, etc. For example, the London Sunday Times reported how the founder of the 'Source', Daniel Mitchell developed and grew his business from zero to sales of 35MillionPounds. Mitchell argues that "success is about customers, but it is also about the people you employ" [4]. It is expected that the Industry should invest heavily on staff development programmes and look in-wards for the recruitment of young and dynamic ones. The industry should encourage students in the higher institution by taking them for industrial attachment from time to time. In Nigeria, the mobile communications have not been doing this.
- ❖ **Government Policy.** These include the convergence between the wireless networks and the internet technology innovation to enhance the quality of their services and also to bring down the cost of their services. Customers and the society at large expect that the government should urgently address the issue of Energy and power system. This will allow the mobile industry to conserve some resources thereby bringing down their tariff.

VII. CONCLUSION

This paper, which is an appraisal of the Global System for mobile communication (GSM) in Nigeria, had attempted to discuss the history of GSM; the trend of GSM in Nigeria; the effect so far; the areas of reconsideration and future expectations. The paper identified some of the emerging technologies that were developed in response to the demand of wireless communication. The paper also touched on some of the challenges facing the engineers and professional in the industry such as inadequate power supply, theft, multiple taxation by the government, poor telecommunication infrastructure and inadequate skilled manpower and how these challenges could be combated through technological innovation coupled with extensive research and development. In the paper, I identified some very challenging and important trends in wireless communication and how they are affect the industry.

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