Telecommunication Cost Reduction in Nigeria through Infrastructure Sharing between Operators.

Francis E. Idachaba, Ph.D.

Department of Electrical and Information Engineering,
Covenant University, Ota, Ogun State, Nigeria.

E-mail: idachabafe@yahoo.com

ABSTRACT

This paper reviews the cost structure of mobile telecoms operations and presents collocation strategies aimed at reducing the total cost of ownership of mobile telecom service. An approach where everything on the site except for the shelters are shared by two or more operators is proposed with the shelters installed either in a storied fashion or placed side by side while the cost of electrical energy, cooling, tower construction, security, and fuel is shared by the operators on the site. A typical base station BTS requires 3000W of power while the air conditioners are typically the 2HP capacity type requiring about 1500W. Lighting (security lights inclusive) can require up to 3000W. All of these loads sum up to approximately 10000W. This compared with the typical generator capacity of 20KVA shows that an extra shelter (BTS) load of 3000W can be accommodated by the generator on the site with the air conditioning shared in the form of a central air conditioning system. The use of ducts has been found to reduce the buildup of heat in the shelters thereby reducing the cooling required by up to 20%.

The shared resource can be outsourced to a third party while each operator controls the access to their individual shelters. The provision of strict enforceable legislation will also ensure that operators get fair treatment regardless of their status on the site. Collocation has the capacity of reducing the capital expenses (CAPEX) and total site dependent operational expenses (OPEX) for each of the by up to 50% depending on the lease agreements between the operators and at the same time facilitating a faster deployment time for new operators in a mature market and ultimately reducing telecom tariffs.

(Keywords: collocation, telecommunications, infrastructure, ducts, CAPEX, OPEX)

INTRODUCTION

The high infrastructure content of mobile communications technology has a direct and indirect impact on both the quality of service and tariffs charged by the operators. The capital expenses in mobile communications is classified to include cost of hardware, which comprises of the radio equipment, site acquisition and tower installation, generator acquisition and the cost of the license. The capital expenses (CAPEX) comprises of all the cost incurred from the bidding process up to the commissioning of the site. The operational expenses (OPEX) on the other hand, involve costs incurred in keeping the site up, running and profitable [1]. This cost includes customer acquisition and retention cost (advertisements), cost of system upgrades, and staff training with a critical component being amount spent on fuel acquisition for the generators. This is because every cell site is powered by at least two 20KVA generator sets running alternately all year round.

The process of setting up a cell site for mobile communications, after the license has been won and paid for, involves the site survey, site acquisition, system planning, and frequency planning. These processes have to be completed, before the actual construction and civil works can start.

The construction/civil works phase is another time consuming phase and before it starts, the various levies and taxes to the different tiers of government and government agencies, un-receiptable fees to the local landowners (even after proper/legal acquisition of the land) must be paid.

The construction/civil works phase is then followed by the actual installation of the site equipment. This includes the delivery to site and

assembling of the towers, the shelters, the generating sets, the earthing processes, and the radio equipment up to the final commissioning. All these phases could span from one month to one year, depending on the logistic arrangement utilized by the operator. This leads to longer time to market and an increase in cost incurred in the form of interest on loans and the inactivity of capital [2]. This processes described above are mandatory for initial deployment of telecom services anywhere, but when the technology has attained some level of maturity in any market, it becomes a very ineffective approach for any new operator entering the market, both in terms of cost, security, logistics, and time to market.

Infrastructure sharing or collocation is a process where two or more operators share different infrastructure in a particular site [3]. The infrastructure shared could range from the site, to towers, shelter, generators, and even the air conditioning. New operators can lease antenna space on the tower, install their own shelters within the site of an existing operator, and share the cost of running and securing the site, thus reducing OPEX and CAPEX for both operators [4][2].

TELECOMMUNICATION COSTS OF OWNERSHIP

The cost structure of mobile telecommunication service consists primarily of the CAPEX and OPEX. A typical cost structure showing the annual cost distribution associated with the radio access network is listed as follows: [5]

(a)	GSM equipment	18.1%
(b)	Spares, Support, Training	7.6%
(c)	Power	15.8%
(d)	Site rental	10.2%
(e)	Operations and maintenance	9.7%
(f)	Network related OPEX	6.7%
(g)	Civil works	13.1%
(h)	Site equipment	11.3%
(i)	Transmission equipment	7.3%

From the breakdown given, resource sharing between operators can be applied to all the items except items (a), (b), (e), (f), and (i) which would require a higher level of trust between the operators. Thus infrastructure sharing affects more than 50% of the cost structure in a GSM cell site.

Challenges of Collocation in Nigeria

The major challenge facing collocation or infrastructure sharing in Nigeria is the stiff competition between the operators in Nigeria. The operators are in frantic race to capture the market and as such, they try to outdo each other in customer attraction and attention. Another major challenge facing collocation in Nigeria is the absence of enforceable legislation/regulation in favor of collocation. This challenge is capitalized upon by established operators and thus they make difficult demands on other operators who may have to share their infrastructure. This often leads to the suffocation of new entrants and smaller operators by the large and established operators.

PROPOSED COLLOCATION STRATEGIES

The mobile communications service is operated at licensed frequencies and this makes the issue of interference very minimal. As such, the different component parts of the infrastructure can be shared by the operators without affecting the service of each other. The collocation strategies include:

Sharing the Electrical Energy Supply

Based on approximate figures, a typical Base Station costs nearly $100,000 and requires 3000 Watts to run, excluding the Base Station Controller (BSC) and Mobile Switching Center (MSC) [6]. The use of diesel generators as a source of energy supply for cell sites requires regular and costly refueling, high levels of maintenance, and they are susceptible to theft. These factors consume up to 66% of the total OPEX cost for cell sites.[7] A typical cell site in Nigeria is powered by two (2) 20KVA generators running alternately and the generators can be shared by two or more operators in a single site. The electrical energy source is required to provide energy for the following:

(a) Antenna tower lighting
(b) BTS security lighting
(c) Shelter external lighting
(d) Shelter internal lighting
(e) Radio equipment

The sharing of electrical energy source by two operators on one site by the addition of a separate shelter will lead to the addition of the shelter and radio equipment load to the overall load of the site. This increase in load can be accommodated by the generators currently utilized on cell sites as the generators are usually installed with excess capacity. This will reduce the site footprint and reduce the required number of generators from four to two .This will also reduce the required fuel consumption by 100% and reduce the fuel tanks from four to two. This strategy will not only reduce the CAPEX in terms of generator and tank acquisition costs, it will also reduce the fuel consumption costs by 100% and the cell site footprint.

Sharing of the Air Conditioning

The air condition sets of a typical BTS cell site consumes 54% of the total energy supplied [8]. This consumption rate is due to the fact that the radio equipment generates heat which increases the cooling required from the air conditioning units. The use of ducts which transmit this heat to the external environment has been found to reduce the air conditioning load by 20% [8]. This reduction can be used to provide cooling for another shelter by the use of a central cooling system between the shelters. This approach will reduce the number of air conditioning sets required and reduce by up to 75% the air conditioning sets per shelter.

Sharing of Towers

The band structure of the GSM frequencies and the presence of guard bands between the bands reduce the possibility of interference between two communication systems and also the interference possibilities within a single band. These features enable the deployment of two or more antennas close to each other without the antennas negatively affecting each other's systems. The Nigerian Communication Commission guidelines stipulate that towers above 25m in height are not to be sited within residential areas [9].

The guidelines also specify that towers over 25m should be designed and constructed so as to accommodate a minimum of three service providers using the same structure. A minimum spacing between two towers in the excess of 55m in height shall be one kilometer. In view of these provisions and the fact that the farther away from the residential area the tower is placed, the greater the path loss the transmitted signal will experience leading to an increase in the BTS transmitted power, the sharing of the few optimal locations in the residential areas becomes very necessary. Towers are expensive to design and construct and so much time is spent in the construction and testing phases. This coupled with the life span [2] of 25 years after which more funds would be required to disassemble justifies the fact that a shared approach is not only efficient but very economical and timely.

Sharing of Links

The links which include microwave relay, optical, and satellite links are designed to be of high capacity with high reliability and extra redundancies built into the design to cater for the event of a link failure. These links require a lot of resource both in terms of cost of acquisition and deployment, and are designed to function continuously if not deliberately tampered with, either by man or by nature. The current situation in Nigeria where operators build their own links leads to the cost being indirectly transferred to the consumers who are made to pay through high tariffs for under-utilized network capacity.

The sharing of this links will be very effective if the regulators and operators agree on a code of conduct between the link owners and leasers such that a breach by any part is appropriately sanctioned in a timely manner. In that way the link owners will not exercise undue advantage over the leasers and the issues of monopoly will not arise.

IMPLICATIONS OF COLLOCATION FOR THE NIGERIAN TELECOM SPACE

The major challenge facing collocation in Nigeria as described above is the stiff competition between the operators fueled by a lack of trust between them and the lack of enforced legislation governing collocation. A solution to this problem will involve the sharing of infrastructure in such a manner that the integrity and safety of each operator's equipment is assured on each site, regardless of whose staff is on the site per time. It involves the sharing of cell facilities on the site except for the shelter. The storied construction of shelters or the side by side placement of shelter

with a central cooling arrangement where individual operators are solely in charge of access to their shelters and radio equipment coupled with the installation of antennas in conformity with regulator-approved and enforced best practices will reduce the CAPEX and OPEX incurred by operators and ultimately lead to a lower tariff structure.

The regulating body can also locate optimal sites for tower installation in urban areas [10] and acquire the same for leasing to operators with collocation as a precondition for lease acceptance. This provision will eliminate the cases of harassment by local land owners and provide a level playing ground for al the operators on the site.

Other advantages of collocation include:

(a) Reduced CAPEX cost (generator, tower, site acquisition, fueling, etc)
(b) Reduced OPEX cost (security and fuel cost)
(c) Reduced installation and deployment cost
(d) Reduced distortion of the skyline and environmental pollution due to generator set fumes.
(e) Reduced damage to roads due to cable laying.
(f) Reduced taxation and other site associated costs.

CONCLUSION

The process of collocation is an important phase in the life cycle of the telecommunication industry. It has the capacity of reducing the average cost per site by more than 50% with a cost saving of more up to 30% for the individual operator. As the market matures, the income growth reduces and operators must look for innovative ways of increasing their revenue while reducing both the CAPEX and the OPEX.

The collocation process will require a stable and firm regulatory framework so that smaller operators or operators renting or leasing space are not treated unfairly by the landlord operators in a collocated environment. The shared infrastructure can be outsourced to a third party while both operators monitor the shared resource and control their individual shelters.

The advantages listed are significant and the most significant of these advantages is the ultimate reduction in the cost of telecommunication services offered to the consumer.

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ABOUT THE AUTHOR

Dr. Francis E. Idachaba is a Lecturer in the Department of Electrical and Information Engineering at Covenant University Ota in Nigeria. He obtained his Ph.D. in Electronics and Telecommunication Engineering from the University of Benin in Edo State, Nigeria in 2009. His current research interests include rural mobile communication and the design of low cost communication Infrastructure.

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