

# Local Loop Unbundling: A Way for Societies to Benefit from ICT

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**Abstract—** In this era of converged Information and Communication Technologies (ICTs) open access to broadband services has remained a challenge in most developing countries. Various online private businesses offering, eGovernment delivery, and eEducation strategies depend on affordable access to broadband networks. Despite the introduction of fixed and mobile broadband in developing countries, access to the last mile copper network has remained as a bottleneck to availability of broadband services. It has been a tradition that last mile copper network is owned and operated by the incumbent operator. This paper discusses local loop unbundling process as a way for societies to benefit from ICT. It is expected that the process will create opportunities for new network operators to participate, foster more applications innovations, enhance environment for more economical growth, increase competition by reducing a duplication of networks and bridging the digital divide.

**Index Terms—**local loop unbundling, ICT, broadband, incumbent operator,

## I. INTRODUCTION

THE convergence of ICTs has fostered an environment that is a key force to the contribution of economic growth. A product of the ICT industry is the increased use of mobile and fixed network infrastructure for voice, data and video applications. As more applications are possible on these infrastructures, new forms of electronic service delivery emerged such as eGovernment, eBanking, eEducation, and eBusiness. This paper will refer to all forms of electronic service delivery as some mentioned above as eWorld. An effective eWorld requires that societies have access to affordable broadband networks. Most of developing countries have failed to provide their societies an access to eWorld as access to broadband remained to be of a challenge. Broadband is a network capability that guarantees the passage of voice, data and video in a more effective way. The lack of sufficient participation in the eWorld makes these countries digitally divided and less empowered to deliver services both nationally and internationally.

Mobile broadband environment has been recently introduced in most developing countries. Some of the reasons for its effective introduction is based on license regulations and its simplicity in deployment in terms of linking customers using radio technologies. However, mobile broadband remains to be costly to most users and its

market segmentation does not allow a second operator to provide alternative broadband technologies on the same network infrastructure. The success of mobile networks has greatly remained in delivery of voice services and low data rate services such as Short Message Service (SMS) and Multimedia Messaging Service (MMS).

Fixed broadband environment can be brought about utilization of fixed network infrastructure. For many years, countries have had national telecommunication operators that enjoyed monopoly and dominance in delivering voice and data services throughout the country. These operators are known as incumbent operators or simply incumbents. The incumbents usually will operate national and international backbones and they have been successful to delivering voice services to their customers. The incumbents have not been successful in spreading broadband services and they have remained as a bottleneck in most of developing countries' milestones of reaching its people through ICT. One major reason that has slowed the pace of incumbents in deploying broadband services lies in the structures that will allow new operators to utilize the last mile copper infrastructure in a competitive manner. It is this last mile copper infrastructure that is known as the "local loop". Duplicating fixed network is not economically feasible. New operators urge that the incumbents acquired the network through Government subsidies and for a long time operated in an uncompetitive environment. Hence to reduce duplication, they should be given access to the local loop to deliver broadband services. The process that allows new entrants access to the local loop is called local loop unbundling (LLU).

This paper therefore, presents how LLU can enable societies to benefit from ICT. The paper gives an overview of LLU, various types of LLU and ways of implementing LLU. It should be noted that implementation of LLU follows an international trend but modifications may be required to fit a regulatory guideline of a particular country. This paper further presents the benefits that can be reaped from this process. Finally, conclusions and recommendations with regard to LLU and its benefits to ICT are presented.

## II. LOCAL LOOP UNBUNDLING

### A. An Overview

The LLU is a process that has a well defined structure covering license acquisition from a telecommunication regulatory body, deployment and operations of services to disputes and business withdrawn involving new operator and the incumbent sharing the same incumbent's network. The LLU can be defined as found on a Wikipedia as a

regulatory process of allowing multiple locally and national telecommunications operators to make use of connections from the telephone exchange central office to the customer's premises (Wikipedia definition). The process allows new entrants access to the local loop in a competitive environment. LLU has been a practice for United States of America (USA), some of the countries in European Union (EU), and some countries in Asia such as Japan.

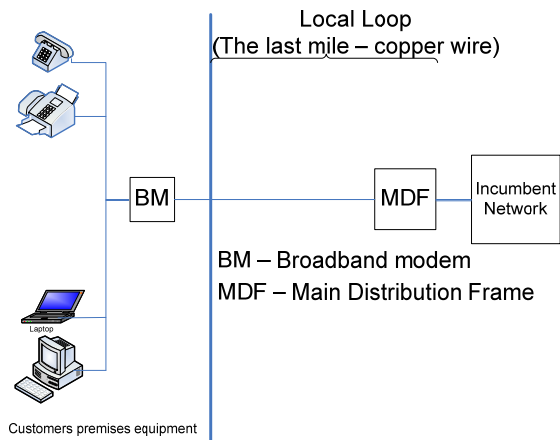


Figure 1: An Overview of Local Loop

Figure 1, shows an overview definition of local loop. The Main Distribution Frame (MDF) is the main network terminating component that on its left hand side access may be given to both new entrants and the incumbent. The LLU allows the competing operators to provide voice or data or both to their subscribers. Introduction of innovative technologies will enable a company to remain competitive by offering more and affordable quality services. The fundamental technology that allows delivery of both voice and data on the same local loop is based on the fact that voice and data is modulated and demodulated at different frequencies. Modulation and demodulation of signals is performed by a splitter which is in a broadband modem at customer premises equipment. The high frequency band is reserved for data channels and the lower frequency band is for voice. The Splitters are also installed at the MDF so that voice and data can be modulated and demodulated before it can be multiplexed to appropriate destination.

### B. LLU structures

This section explains how the LLU are structured. These structures allow operators to select models that will give them a significant contribution to delivery of broadband services and return of their investments. Not only these structures are beneficial to operators but also to customers who can subscribe to operators that are affordable and meet their demands. Globally one or a combination of the following structures has been considered for implementation and are in depth explained in [6]:

- Full unbundling  
This structure allows the operator to have access to the entire local loop for both low and high frequency bands.
- Line sharing  
This structure allows the operator to provide a service of their choice by covering either low

frequency bands or high frequency bands. When one frequency band is occupied by one operator the other frequency band can be occupied by another operator.

- Bitstream access

This structure allows the operator to provide broadband services as an Internet Service Provider (ISP). Instead of investing on the local loop technologies, the ISP may rely on the incumbent or other operators to deliver their content material to subscribers.

Regardless of the structures described above, a regulatory body must initiate willingness to form favorable rules and regulations to govern a new environment that favors competition in the local loop. The incumbents must too participate in this process by allowing unbundling of the local loop through provision of data necessary for the process. New entrants have a role to play as innovator and entities that are not bringing alternative greedy companies but quality services and aim for growth. Customers will therefore have not only choice to the available services and access to broadband network but also afford subscription and services offered. The overall positive results of LLU have to therefore be at a national strategic economic growth that encourages societies to have access to ICT.

### III. SUCCESSFUL IMPLEMENTATION OF LLU

Successful implementation of LLU depends on four entities namely, a regulatory body, the incumbent, new entrants and customers, as introduced in previous sections of this document. A regulatory body is an essential part in the implementation of LLU as it is its duty to oversee the abidance of formulated regulatory policy for LLU. A regulatory body is required to create an environment necessary for transition from monopolistic style of network operations to co-existing and sharing of network resources as per LLU structures. It is up to the regulatory body to resolve disputes and provide licenses to operators who bring values to subscribers. A new regulatory process that will oversee LLU is one of a challenge but with a properly empowered body it can bear successful results to both network operators and subscribers. The regulatory body will have to create and maintain an environment necessary for competition but beneficial to subscribers. It is from this environment that societies will have access to affordable ICT services that will have a contribution to national economical growth.

The incumbents have a major role to play for successful implementation of LLU. They therefore ought to fully participate in unbundling the local loop by providing all the necessary information as may be stipulated by the regulatory body. Under a monopolistic environment, the incumbents are the owner and only ones who have access to the MDF. They should therefore provide at least all the network information regarding the sizes and locations of the MDF to the respective regulatory bodies. All the network information should be readily available at a regulatory body and procedures to request any other essential information for

competing operators should be clearly stated.

New operators or new entrants are not alternative network operators or network parasites but rather additional competitive operators whom will bring more innovations and broadband services to the eWorld. New entrants are expected to bring more business opportunities, lower the cost of broadband services and increase broadband penetration rate. It is from these operators that access to ICT is expected to increase. More broadband services and applications will be made possible and hence effective deployment of local content and global participation in the eWorld. As access to ICT contributes to the national economic growth, the new entrants will be part of the process in opening access to ICT for societies.

Broadband subscribers will benefit from technological innovations that will be brought about by the competition of various operators. These subscribers will range from individuals in rural areas to companies and enterprises in urban areas. The access to ICT will from the other end trigger more demands that will require competing operators to meet. Such demands are such sufficient bandwidth for their applications and the fastest data rates.

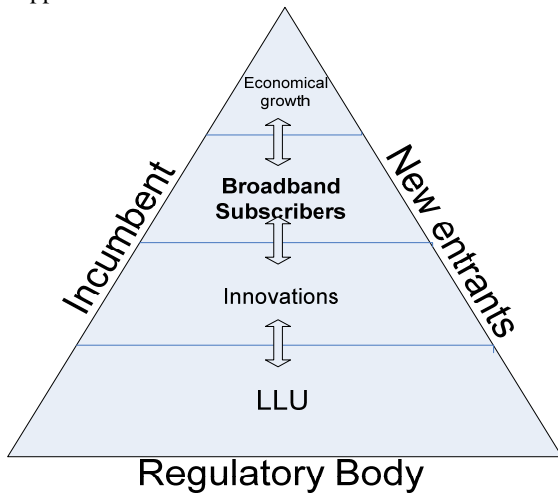
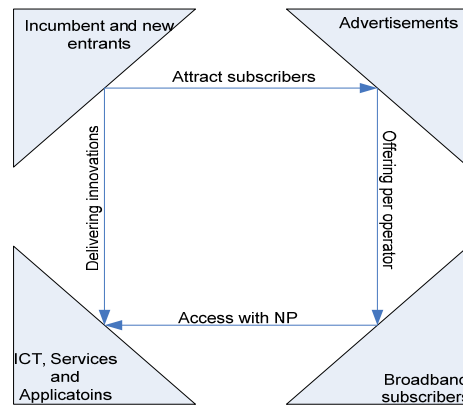


Figure 2: Implementing LLU to economic growth contribution

Figure 2 shows essential entities for LLU implementation and layered values that contribute to national economic growth. It can be seen that the LLU is a foundation to more innovations. As LLU is implemented, more and more innovations are expected. These innovations will come from the inputs of incumbents and new entrants from LLU environment as well as from subscribers as they will be creating solutions for their challenges in ICT. A tip benefit of such arrangement is poverty alleviation and empowerment of citizens in the globalized world. Number Portability (NP) is a network feature that when implemented allows subscribers to retain the same number regardless of operator offering services. NP is an essential part of operation and management of LLU as far as subscribers and operators are concerned. With NP therefore, flexibility of subscribers to choose an operator of better services is made easy.



Note: NP is Number Portability

Figure 3: Subscribers experience on LLU environment

Figure 3 presents broadband subscribers experience under the LLU environment. It should be noted that with the NP, subscribers will be able to retain their business and social network identification regardless of who is offering services. The operators will have to attract customers by delivering innovative solutions and advertise for subscribers to access them. Billing of services is not covered in detail in this paper as it remains a component of innovation that different operators may introduce different billing schemes that make sure an operator maintains an optimum percentage of subscriber base.

#### IV. COLLOCATION AND OTHER OPERATIONAL ISSUES

##### A. Introduction

Despite the benefits of ICT from unbundling the local loop, there are many operational issues that come as a result of how LLU should be implemented. This paper does not explore all the issues but however provides solutions on how these issues should be handled. This section describes a few that are deemed to be crucial. The described operational issues will provide an overview on migration from monopolistic operations to unbundled competitive environment. Details on these issues can be found on the International Telecommunication Union (ITU) report [5].

##### B. Collocation

Co-existence of competing operators is an automatic environment that is caused by the LLU. This environment is called "collocation" and is a crucial strategic issue that requires to be addressed in LLU. Several structures of collocation have been defined and used in Europe and America. These various structures of collocation are called, cage (hostel), cageless (co-mingling), remote (in-curtilage) and virtual (bespoke arrangements) [6]. Cage collocation is formed by the fact that equipments for a new operator are physically separated from the incumbent's equipments in the incumbent's own building. Usually, wire mesh fences are used to separate the two and each one retains access to their fence. Cageless collocation is the vice versa of cage collocation in the sense that there is no physical separation of equipments but rather operations of such equipments. Remote collocation happens only when the new operator is allowed to store their equipment in the incumbent's premises outside the main building. Such areas are usually

unused car parking areas or open grounds. With virtual collocation, there will only be prior agreements between the incumbent and new operator for equipments interconnection but no access is given to new operator to such equipments. A detailed explanation of such structures can be found in [6].

### C. Other operational issues

When the incumbents are providing services in a monopoly environment, operations such as maintenance of the local loop, upgrading of the networks, responding to customers' needs and introduction of new services are dependent on one operator's decision. LLU introduces a challenge on many operational issues such as those aforementioned. It is up to the regulatory body, incumbents and new operators to formulate and agree on the operation standard. The standard will stipulate issues such as, who should respond to subscribers in case there is a fault in the local loop. An example of reducing challenges in operations issues can be found from [7], where an independent company manages operational issues involving competing operators.

## V. THE VALUE CHAIN OF THE LLU

Equipment manufacturers, network operators, governments through tax, IT industry, private sector, individuals, hobbyists and a nation as a whole. ICT has been earmarked as a sector that can assist developing countries to remain competitive in the globalization trend.

## VI. RELATING THE LLU WITH ICT

Some of the primary objects of The New Partnership for Africa's Development (NEPAD) are to eradicate poverty, to provide African's sustainable growth, development and to ensure Africa participates fully in the global economy [9]. One of the priorities that the NEPAD has set in order to achieve its objects is build and improve infrastructure that includes ICT [9]. It can therefore be seen that access to the ICT plays an important role in assuring, the goals set by NEPAD are met. The LLU therefore creates an environment that can create more opportunities and allow more access to the ICT for global economy.

An increase of telecommunication penetration rate and wide spread of broadband services is one part of the equation that will give developing countries an opportunity compete in the globalized world. Many other developed countries embarked into unbundling the local loop in order to create more opportunities, prove more access to ICT, stimulate innovations and increase their share in global economy [1] [2] [4]. There are also some efforts in developing countries to find ways on how the LLU can be introduced and implemented [5]. It can therefore be agreed that one possible way of meeting millennium goals is to allow the LLU that will create competition and services affordability to societies

Africa's share of the global total for various services, 2005

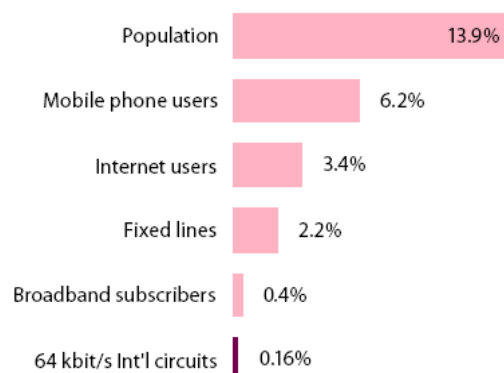


Figure 4: African's broadband subscribers share

Figure 4, is taken from a World Information Society Report 2007 on chapter two which can be found on ITU website [8]. From Figure 4, it can be seen that despite a population share of 13.9%, less than 5% is a total share for internet users, fixed lines and broadband subscribers. It is therefore suggested that more innovations and access to broadband services can be accelerated by the LLU. The LLU will allow additional operators to compete with the result of increasing internet users, broadband subscribers and access to ICT in general. One vivid example that shows the benefit of ICT in productivity can be found on ICT development report of 2006 [8]. In this report it is shown that the labour productivity in manufacturing and services increases with the access to ICT.

## VII. A WAY FORWARD

This section gives a hint on what has to be done in order to increase the competitiveness of African countries in the ICT sector. This competitiveness is essential because the national productivity of any country depends on the telecoms industry. That is why there is now keenness to achieve the goals of universal access, affordability and a speedy response to a variety of technological challenges. It is important to note that the bottlenecks faced by the telecoms industry are not as a result of lack of alternative service providers. They are, in fact, caused by the uncompetitive environment due to the single ownership of the last mile infrastructure.

This therefore implies that the way forward is to provide an environment that will make it possible for the alternative service providers to effectively compete with the incumbent. This will ensure cost reduction and good service quality because each provider will strive to immediately respond to the ever increasing developments in the telecoms industry. The issue of cost is of particular importance because the prices of, for instance, broadband services are extremely high in developing nations as compared to other parts of the world.

One of the early steps of implementing the LLU process has to be taken by the authorities, that is, government. It is important for government to stop favoring a single service

provider due to the ease of policy formulation. This obviously inhibits growth and competitiveness. It is also necessary to integrate the existing regulatory mechanisms into a single Act that will ensure that there is no clash between voice, data and broadcasting protocols. The entrant operators should be given access the local loop without any obligation to purchase other services from the incumbent. This will eliminate the need for new entrants to purchase new last mile infrastructure, which is an unnecessary and costly reproduction of already existing infrastructure.

This LLU process will have to be executed in line with the frameworks put in place by international regulatory bodies such as the ITU and the World Trade Organization (WTO). This is because these frameworks have been formulated with forecasting trends that serve a very useful purpose in this dynamic telecoms industry. The LLU process has been implemented in developed countries before. These include countries like Canada, the United States of America, the United Kingdom and Japan [3]. This therefore implies that the developing countries can employ the same model, but particularly taking heed of the pitfalls experienced by the developed countries, in order to avoid them.

In order for this regulation process to be effective, it should be executed by a multidisciplinary team that includes experts from economics, auditing, business analysis, telecommunications and government representatives. The government representatives will ensure that whatever is suggested by the other experts is in line with the current government policies.

#### VIII. CONCLUSION

With known LLU implementation strategies and experiences from other developing countries, it can be suggested that individually and collectively, African countries should look on possibilities of implementing LLU. The mechanisms and strategies for LLU should focus reaping fruits of having significant share to the global economy. More opportunities should be created and challenges of eradicating poverty, job creation, education to mention a few should be tackled with giving societies an open access to ICT. A future work can be on looking at how African Union (AU) can recommend a collective structure of implementing LLU in Africa. AU can use observations and experience of European Union (EU) to put in place its own structure that fits the demands and telecommunication policies of African countries. It should also be mentioned here that, the collective effort to build international backbone for Africa should be of a priority.

#### APPENDIX

More information on the issues regarding LLU can be obtained from [www.itu.int](http://www.itu.int)

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