MNS Consulting
Management – Technology – Engineering

MNS Viewpoint: LTE EVOLUTION IN AFRICA

1. Introduction

Wireless communications have evolved rapidly since the emergence of 2G networks. 4G technology (also called LTE), enables to answer the new data market demands by delivering High Speed Broadband Access with high quality, full mobility and seamless continuity of Service with existing technologies. In addition, LTE provides significant improvements versus 3G in terms of speed, connection time / round-trip delay while reducing globally the network TCO.

LTE networks and services are not yet widely available across the African continent, but, in several markets, operators are planning their rollout strategies and some of them have already started offering commercial LTE services.

A key business model for LTE in Africa is DSL (Fixed-Line) replacement and substitution: many markets have limited or even no fixed broadband networks. LTE represents then the perfect solution for very fast mobile broadband access in Wireless at home, in the office and on the go.

LTE relies on an IP system designed to carry High Speed Data traffic and VoIP services called VoLTE (Voice over LTE).

1. The African market

The development of high Speed Data mobile networks is moving fast on the African continent. This growth is driven by user's demand for higher performance operators, the poor presence of fixed networks, and the motivation to efficiently drive the creation of new affordable mobile applications.

As we can see on the Figure 1 below, the 10 most demanded digital services for the next 5 years are: Mobile financial services (Mobile payments, transfers, banking), E-commerce, Health, Education, Enterprises, Advertising Music-streaming, Video-Streaming, Social media and Cloud services.

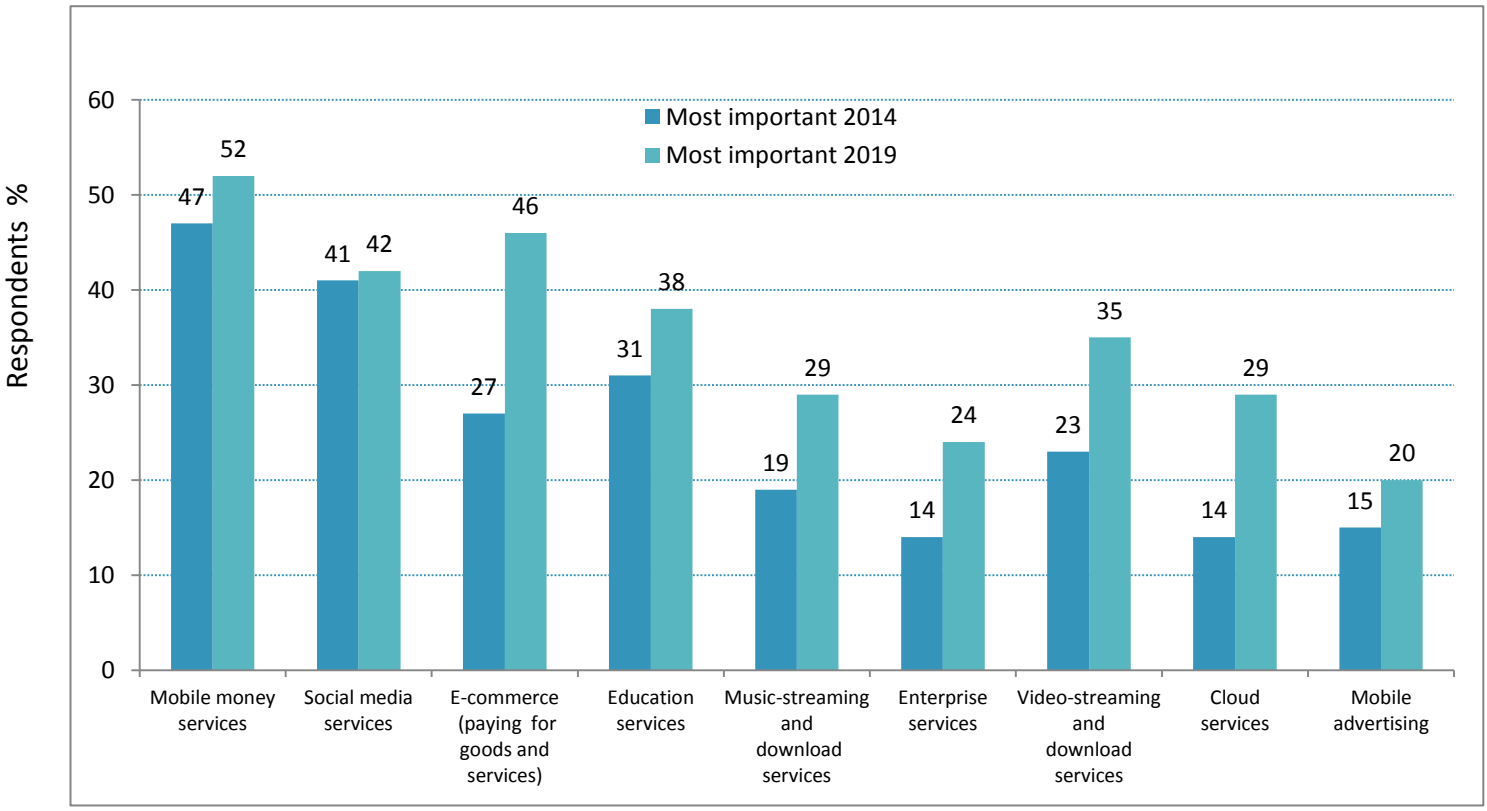


Fig 1: Importance of digital services as a revenue generator, now and in five years
(Source Ovum Digital Africa Survey 2014)

As a result, the mobile Telecommunications industry is playing a major role and each service has a significant impact on the African countries' economy development.

High Speed Data usage and related revenues are increasing strongly in Africa and this growth is driven by three keys factors: the continent's new submarine and terrestrial cables, the rollout of mobile broadband networks and the introduction of low cost Smartphones. We witness a strong rise in data connectivity, as we can see on the Figure 2, which is presenting the evolution of the enablers of data-service usage in Africa for the next five years.

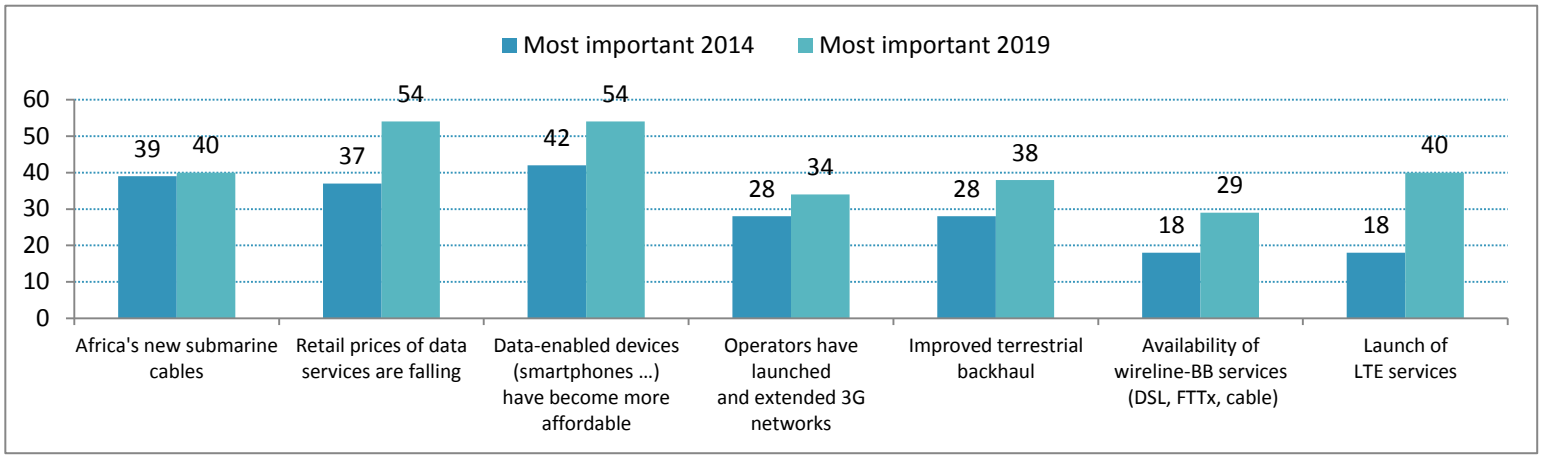


Fig. 2: Enablers of Data-service usage and revenues in Africa, now and in five years
(Source Ovum Digital Africa Survey 2014)

In this new world where high data access demand remains strong and more than crucial, LTE seems to be the ideal and perfect solution by offering all these services with ultra-fast broadband and top quality.

2. The LTE technology

LTE is a wireless broadband technology defined by 3GPP standard. Its architecture is based on « Flat IP » concept, with direct IP connection from the eNode B (the LTE Base Station) to the Core Network (by removal of the Controller equipment). This flat architecture enables the reduction and optimization of the latency time (only 20 ms vs 100ms for HSPA). The table below is providing an overview of the performance comparison between HSPA and LTE technologies.

3G+ / H					
Downlink peak rate theory / practice	**14,4 Mbps / 3,6 Mbps**				
3G++ / H+					
Downlink peak rate theory / practice	**21 Mbps / 5 Mbps**				
H+ Dual Carrier					
Downlink peak rate theory / practice	**42 Mbps / 10 Mbps**				
LTE					
LTE NO AGGREGATION					
Band	**800 MHz**	**1800/2600 MHz**			
Bandwidth	10 MHz	15 MHz		20 MHz	
Downlink peak rate	**73 Mbps**	**110 Mbps**		**150 Mbps**	
LTE AGGREGATION (x2)					
Aggregation band (MHz)	**800-1800 1800-2600**	**800-2600 800-2600**	**1800-2600**		
Bandwidth	10 + 15 MHz	10 +20 MHz	15 + 15 MHz	15 + 20 MHz	20 + 20 MHz
Downlink peak rate (theory)	**183 Mbps**	**223 Mbps**	**220 Mbps**	**260 Mbps**	**300 Mbps**
LTE AGGREGATION (X3)					
Aggregation band (MHz)	**800-1800-2600**				
Bandwidth	10 + 10 + 15 MHz	10 + 15 + 15 MHz	10 + 15 + 20 MHz	10 + 20 + 20 MHz	20 + 20 + 20 MHz
Downlink peak rate (theory)	**256 Mbps**	**293 Mbps**	**334 Mbps**	**373 Mbps**	**450 Mbps**

Source: MNS Analysis

As a cellular system, LTE is using a transmitter / receiver system for sending / receiving signals between the user and the operators' network. LTE is based on two radio systems: FDD (Frequency Division Duplexing) using two channels and TDD (Time Division Duplexing) using only one channel. Existing 2G/3G mobile networks are mainly based on FDD systems. Thus, **LTE FDD will be the most adopted technology** as mobile operators already operating 2G/3G systems will introduce it as a natural evolution of their existing networks. But **LTE TDD is also gaining market traction** and new UEs are supporting dual mode TDD/FDD.

LTE TDD solutions are efficiently replacing WiMAX systems by re-using the same frequency range and finally providing similar strategy to deliver "Fixed Wireless" Access. So LTE TDD will be used by fixed operators to extend their networks while minimizing the investments. With similar strategy, we also see the development of new breed of "data-only" called LTE Players using LTE TDD networks.

Voice services remain fundamental in Africa. As a result, to guarantee perfect voice access and full CS service continuity from Day one, operators are implementing standardized mechanisms call **CSFB (Circuit Switched Fall Back)** 3GPP TS 23.272 to support voice calls

either on 2G or 3G networks while retaining the benefit of ultra-fast data services via LTE.

CSFB requires very few investments as legacy 2G/3G networks are fully re-used: operators only need to introduce an additional interface between MME and MSC elements. However, this solution is presenting a major drawback as the handover to 2G/3G networks to establish voice calls requires long latency delays, creating some major risks to drop the sessions.

Towards Full Voice over LTE

To take full benefit of the « IP native » architecture of LTE networks, Voice over LTE (VoLTE) is built on 3GPP LTE Release 9 and 3GPP LTE Advanced Release 11 standards. Several solutions are existing:

- **SV-LTE - Simultaneous Voice LTE:** this solution is UE specific. The UE is able to manage two radios (LTE and GSM/CDMA/W-CDMA) at the same time. So a user can use packet services from LTE while voice call can be made on other networks simultaneously unlike CSFB. The drawback for this solution is high battery utilization due to dual radio operations.
- **VoLGA, Voice over LTE via Generic Access Network:** this solution uses CS core only from legacy networks and also requires new network elements. Therefore LTE UEs don't need 2G/3G radio capabilities since radio part won't be used from legacy networks.
- **Voice over LTE, via IMS:** in this case, instead of using legacy networks 2G/3G, VoLTE uses IP Multimedia Subsystem (IMS) and provides voice services using the application layer on LTE.

To deliver LTE voice services, the IMS architecture is gaining more and more market traction.

3. The Challenges

The biggest challenges in the rollout of LTE in Africa is to put together all the different components to create a real ecosystem

✓ Cost of deployment

The deployment of a new network is always a key issue in terms of investments (CAPEX) and requires a strong Business Plan. We should note that **LTE technology is cheaper than 2G/3G systems**: **"Full IP"** transmissions are used (less costly than traditional TDM lines) and LTE **architecture** is based on **"Flat IP"**, requiring less equipment (No Controller), with easy deployments for operators. In addition, to avoid new site acquisitions, we have now the possibility to **support 4G with Single RAN** technology which is already available on several existing radio sites.

✓ Spectrum / Frequencies

The **most widely used spectrum** for LTE FDD network deployments is **1800 MHz** (3GPP band 3) followed by **2.6 GHz**.

800 MHz (band 20) is by far the most popular sub 1 GHz coverage choice for LTE, supported by a large user devices eco-system including tri-band devices (1800 MHz, 2.6 GHz, 800 MHz). The switchover from analogue to digital TV would enable to free up 800 MHz and 700 MHz spectrum.

900 MHz spectrum eco-system is also gaining market traction for LTE. As a result, the LTE eco-system supports now the **full refarming of GSM frequency bands** (900/1800 MHz). In addition, the **sub 1 GHz frequency range provide larger coverage than high frequency bands**, enabling **fast deployments** with **minimum investments** in suburban / rural areas.

Concerning LTE TDD, 2.3 GHz (band 40) is the most widely deployed. As mentioned previously, **LTE TDD allows easy reuse of the WiMAX frequency range.**

✓ Device cost

Device Cost is an issue. The price of LTE smartphones and other devices is beyond the capability of many ordinary working people in some markets. Ovum analyst Thecla Mbongue pointed out that outside of South Africa, around **98% of the customer base is prepaid**, meaning that the financing of devices is difficult. Currently, a LTE smartphone costs at least $200, she said, beyond the reach of many consumers.

James Munn, vice president of business development for Sub-Saharan Africa at Qualcomm says is now announcing that the **entry-level smartphone prices are starting to fall**, and increased efforts to build fiber networks in densely populated areas in certain markets such as South Africa, have encouraged operators to pursue LTE deployments that will represent a good asset for the continent.

4. Deployment status

As of **February 2015, there were 34 LTE network deployments across Africa** according to OVUM, up from 22 in mid-2014. South Africa, Nigeria and Kenya are leading the deployments in Africa. LTE deployments have come not only from established operators like Orange but also a new breed of data-only LTE providers that are seeking to service the broadband needs of business and residential users

✓ Established operators

- Orange which has so far launched LTE services in Mauritius and Botswana.
- Vodacom and MTN in South Africa.

✓ Data-only LTE Players

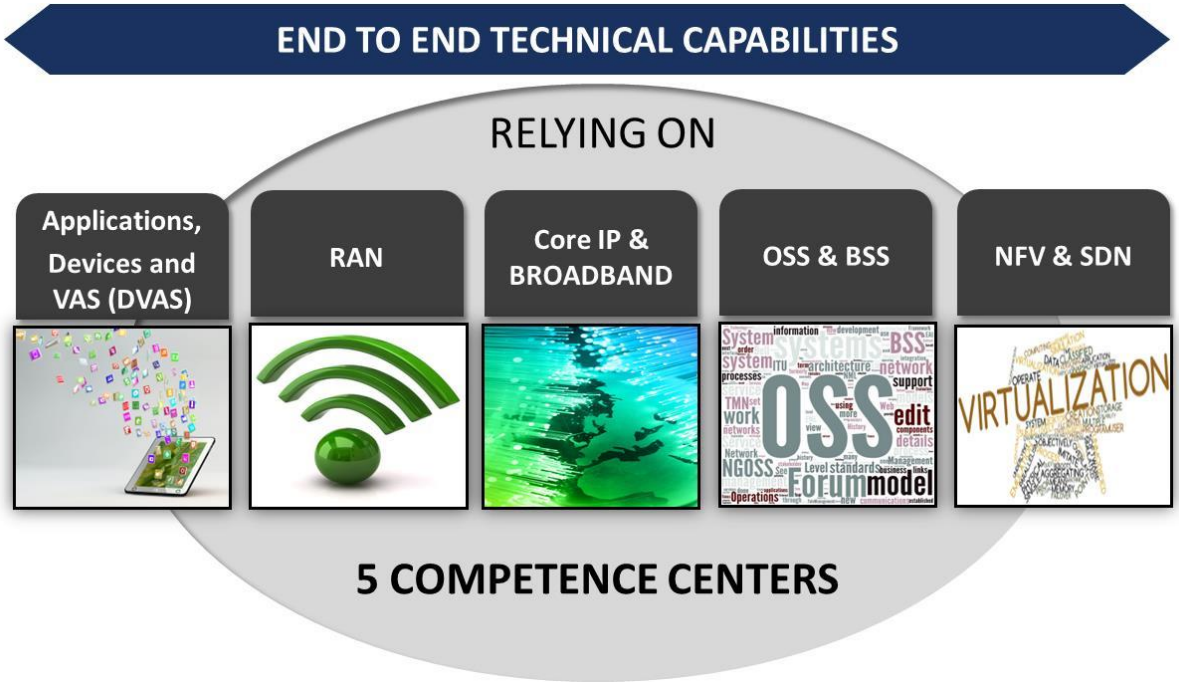
- SURFLINE has already launched 4G services in Ghana. They plan to expand their strategy in other parts of the West Africa sub region.
- SMILE COMMUNICATIONS have launched services in Nigeria, Tanzania and Uganda. They plan to start soon operations in the Democratic Republic of Congo.

Vodafone is entering the African 4G market through deals with partner operators. It has teamed up with Netherlands-based Afrimax, which has built up a portfolio of LTE TDD spectrum in a number of countries. The first LTE network to be launched under this collaboration, Vodafone Uganda, operates in the 2.6 GHz spectrum band.

5. About MNS

MNS Consulting is an international management and engineering consulting firm specialized in the telecommunications industry. We have developed a unique expertise in Telecoms network domains. We distinguish ourselves with a strong-combination of deep technological expertise and strategic vision that allows us to address the challenges of our customers. We are committed to delivering outstanding consulting services and highest value to our clients by helping them to drive growth, manage complexity, and improve operations and performance in a complex and fast changing market. Our engineering consulting capabilities are structured around the 5 competence centers below that allow us to have a full vision of the end-to-end network services management.

MNS is headquartered in Paris and has also operations in Africa and the Middle East.



For further information please visit: www.mns-consulting.com