MOBILE NETWORK MODERNIZATION IN AFRICA

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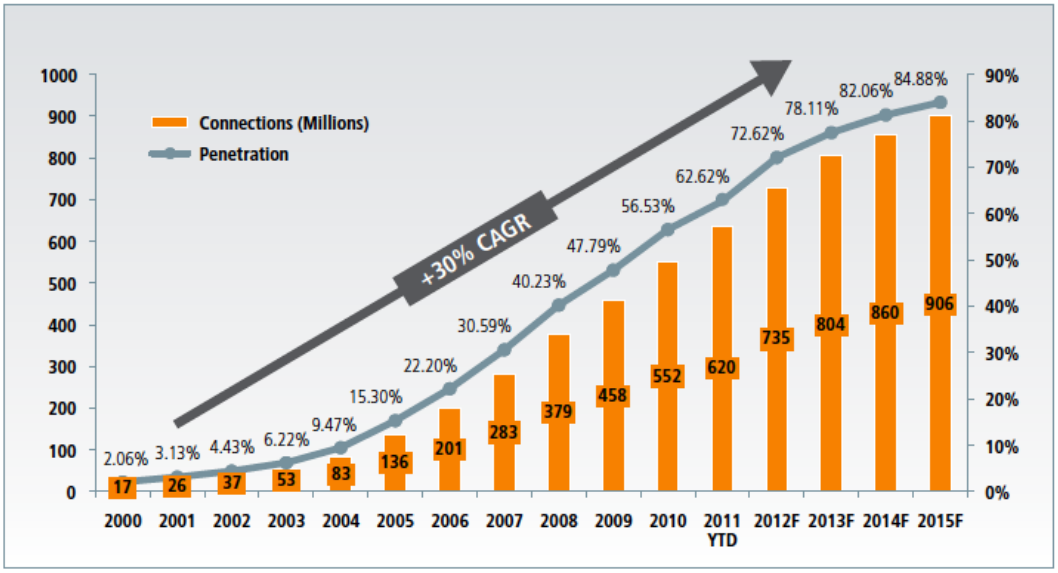
Throughout Africa, a wind of change is blowing as mobile network operators ponder, and in many cases implement, a wave of network modernization. The trigger for this is multi-faceted. Booming subscriber growth, introduction of new data services and arrival of new undersea fiber optic cable links are combining to strain existing network infrastructure to the breaking point.

BOOMING MOBILE SUBSCRIBER GROWTH

According to the GSMA[1], as of September 2011 Africa has overtaken Latin America with 620m mobile connections, making it the second largest mobile market in the world after Asia Pacific. The number of connections has more than doubled over the past four years, with growth expected to continue at the fastest rate of all global regions over the next four years.



Total African Mobile Connections and Penetration Rate (million, percentage penetration). Source GSMA Africa Mobile Observatory 2011

FIRST VOICE, NOW INCREASINGLY DATA

Most networks across Africa were built many years ago to serve the initial rollout of 2G/GSM mobile networks that were designed to provide basic voice services. Many operators have since introduced data services using EDGE, 3G WCDMA and now more recently 3G HSPA, putting an incredible strain on these networks. These data services can be vital for the operator, as they are often supporting premium, prepaid subscribers or new fixed line data services being offered for small and medium-size businesses.

One example of network modernization in action is in East Africa, where a mobile network operator saw subscriber numbers increase 9 percent in 2011, with 3G customers increasing more than 85 percent. This operator was also offering fixed data services to private and corporate customers through the deployment of WiMAX base stations collocated with the existing mobile sites. All this new data

[1]GSMA Africa Mobile Observatory 2011

traffic was growing exponentially and fast outstripping the legacy backhaul network capacity. The operator also had to ensure that existing voice traffic was protected.

PRIORITIES DRIVING NETWORK UPGRADES

Today, several priorities are driving network operators to upgrade their networks including the need for:

- Increased capacity
- More efficient use of backhaul spectrum resources
- Support for increasing volume of Ethernet/IP based traffic
- Network Simplification
- Reduction in Capital and Operational Expenses

These five priorities are all closely interrelated. Let's look at each briefly.

GETTING NETWORKS READY FOR DATA DEMAND

More capacity is clearly needed to cater to the increased traffic generated by new voice subscribers and increased data usage generated by the introduction of 3G HSPA and the rapid introduction of smartphones across the continent.

African operators can expect to see the same trend that we have seen in other parts of the world, where new devices coupled with blazing fast download speeds accelerate data usage at a furious pace. In a competitive environment, it is critical that networks do not restrict subscriber usage, as we saw in the U.S. when the iPhone was first introduced, leading to bad press and lost subscribers for one of the large incumbent mobile operators.

IMPROVING MICROWAVE BACKHAUL MBIT/MHZ EFFICIENCY

Most mobile networks are primarily built using microwave radio systems, which provide point-to-point connectivity in frequency bands between 6 and 38 GHz. Microwave is used extensively across Africa, not only for the shorter "last-mile" connection to the base station but also as a fiber alternative for national backbone networks. Since these frequency bands are a finite resource, spectrum efficiency is key to avoid congestion or even exhaustion of available frequency allocations to provide additional capacity or new links for additional base station sites.

Operators can now increase network capacity by implementing new technologies, such as higher modulations that enable higher Mbit/MHz efficiency. Today, modulation rates are pushing up toward 1024QAM, or 10 bits/Hz, which is capable of moving much more data than the legacy TDM radios. New adaptive techniques such as Adaptive Coding and Modulation (ACM) enable these new higher order modulation systems to be deployed efficiently with a minimal impact on the existing network, while preserving link density.

MIGRATING TO ETHERNET/IP

Mobile networks all over the world are moving their infrastructure from the old TDM, NxE1 and NxSTM1 technology over to Carrier Ethernet/IP. Packet-based networking technologies are now used by 3G HSPA and LTE eNodeBs and enable significantly more flexibility and a lower cost basis than legacy TDM. For microwave backhaul, Carrier Ethernet transport permits more efficient use of

available spectrum, through ACM coupled with prioritization of delay-sensitive traffic. Microwave can now be engineered to support the much higher link capacities demanded by next generation mobile services.

Moving to all-Ethernet/IP is not something operators are undertaking overnight, but rather in a gradual approach. Due to the predominance of voice services in mobile networks across the continent, TDM services need to be maintained alongside new data services. Modern microwave lends itself well to this approach, using hybrid transport where both TDM and Ethernet traffic is maintained in their native formats, without emulation of the former or encapsulation of the latter, for maximum throughput and lowest latency performance

NETWORK SIMPLIFICATION

One of the challenges facing network operators is that their network infrastructure evolves over many years, incorporating a complex mix of new and old technologies, and transport layers—fiber and microwave, TDM, Ethernet, IP and maybe MPLS. Efficient operation and utilization is tough in these circumstances. Bandwidth can be wasted on unnecessary overheads, and latency through the network is high and likely not to meet the demanding requirements of the new generation of radio access standards. Finally, this system will be costly to operate and maintain, while introducing and configuring new services is extremely challenging.

Network simplification involves removing technologies from the network, flattening the architecture to remove inefficiencies and overheads and collapsing functionality into fewer devices. One such example is how new data traffic is transported through the network. In many cases, this new traffic was initially backhauled over legacy TDM infrastructure, using inefficient Ethernet over TDM adapters.

REDUCING NETWORK COSTS

Operators in Africa are no different from those in other parts of the world, with steeply rising demand and flat or only modest revenue growth. Adding capacity is a must, but only while preserving existing voice services that still make up the majority of subscriber traffic. The migration to IP will help lower operational costs, but this also comes with additional demands for capital investment.

TARGETING OPERATIONAL COSTS

Consequently, operators are looking to take cost out of their networks at every opportunity. Operational costs are an obvious target—reducing site air conditioning requirements and energy consumption, but now we are seeing other options being considered that are common among mobile operators on other continents, such as infrastructure sharing and even outsourcing of site infrastructure, where the operator no longer owns and operates its cell sites, but leases them from a third-party provider.

Doing so puts a sharp focus on equipment operational aspects, such as space and power consumption. Specifically in the case of microwave equipment, lease costs for towers are often, in large part, based upon the size of the antenna. In the U.S., where operators rarely own their own towers, lease charges run at about $400 plus $100 per diameter foot, per month. For example, for a link with two six-foot antennas the lease costs amount to $24,000 per year, which dwarfs the initial cost of the microwave equipment. This places a priority on reducing antenna size, which can be achieved through a variety of techniques, such as higher transmitter power, employing ACM and using network redundancy that enables per-link availability to be relaxed.

LOOKING HARD AT TOTAL COST OF OWNERSHIP

Whether or not operators in Africa go the route of infrastructure sharing or outsourcing, undoubtedly reducing operational costs, migration to Ethernet/IP and improved network simplicity and reliability are all going to be increasingly important to operators as they strive to close the gap between revenues and subscriber demand. This means that rather than being focused solely on equipment acquisition costs operators need to take the long view. Building in network flexibility, reliability and scalability has to be a major factor in network design considerations and equipment purchasing decisions.

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