Unlocking a New Market: Ultra-Low-Cost M2M Opportunities and Barriers to a New Mobile Frontier

Nick Hughes, M-KOPA

This is Edith Chelangat, a Kenyan mother who for the first time is getting clean, affordable energy and light, thanks to her mobile phone. This lighting system is solar powered and includes embedded GSM technology for monitoring and metering usage. Edith makes micro-payments with her phone to top up her lighting system's 'credit' whenever she wants. It is a pay-as-you-go service with the advantage of no large initial cash outlay. Importantly, it is cheaper and healthier than the alternative, kerosene.

The service that Edith is using is provided by M-KOPA, a company established in 2011 to offer innovative services around machine-to-machine technology (M2M) coupled with micro-payments. The idea is simple; help customers save money by enabling micro-asset financing and allowing them access to previously unaffordable energy products.

Edith represents a vast pool of potential customers in sub Saharan Africa who are off the power grid but have a mobile phone. Her profile is quite typical; she runs a small farm with relatively low income (about USD800 per year), with access to cash being variable, depending on how well her crops have sold. Before M-KOPA, Edith would spend around 50 Kenyan Shillings (KES) (or about USD0.4) on kerosene each day and would spend KES20 three times a week to charge her phone at a local hardware store. With M-KOPA, she pays KES40 per day for all her lighting and charging needs. So, Edith immediately saves money. She can buy units of credit for her lighting system at any time, 24/7 using M-PESA, a mobile payment service operated by Safaricom. As soon as payment is received, a new credit message is pushed to her lighting system. Her payments are flexible allowing Edith to adapt payments to income, and after she has paid down the balance, she owns the system outright.

M-KOPA believes that M2M services for customers like Edith represent a new frontier. There are challenges but there are no impregnable barriers. Principal amongst the challenges is the need to simplify the core M2M technology and reduce its costs to allow it to be used in a wide range of applications. Changing the cost/volume dynamics for appropriately specified M2M units is not easily done, but history teaches us that technology costs will always fall.

The question is: "**Will the M2M incumbents anticipate this and lead the way - or will new entrants steal the show?**". This case study explores this issue and presents some ideas for consideration by the M2M industry.

The Opportunity

Twenty years ago, few people believed that GSM mobile telephony would become affordable for low-income consumers in developing countries. Today, Africa has a population of nearly 1 billion people. In sub Saharan Africa, nearly 50% of people live off less than USD1.25/day, only one in five have access to formal financial services and yet there are over 688 million mobile subscriptions. Lower cost handsets and pre-pay pricing plans opened up the market to make the mobile phone a 'must have' to most families.

The potential scale of embedded M2M services in emerging markets is equally huge. The same technology and business model that is used to sell Edith a solar system is extendable beyond lighting. If a device has an 'on/off' function, then an embedded M2M system can be built to allow remote management and micro-asset financing. M-KOPA has been exploring new applications for M2M with the help of grant funding from the UK Government's DFID, the Shell Foundation and the Lundin Foundation. Working with M2M specialists Eseye Ltd, we see opportunities in a range of verticals across energy, agriculture, health and information-management services. The list is long, for example, water pumps for irrigation or potable supply, chaff cutters for preparing animal feed, egg incubators to drive up productivity, grain driers that can improve storage and retention, water heaters and treatment systems, even smaller items like electric livestock fences. There will be opportunities in cold storage for both domestic and commercial applications, as well as more aspirational products like TVs for family use. The business case firms up if the M2M-enabled device can save customers money or offer them some other benefit, such as improved productivity.

The Barriers

M2M technology is the core enabler for these types of services but it needs to be available at a cost point that allows for scale. Recent research by the GSMA (2012) into the pricing and availability of M2M technology show 3G modules in the price range close to $45 and even the simplest 2G models range between $13 and $15. That is almost as much as a basic phone. This price point of the simplest M2M modules prohibits their potential application in many smaller electronic items. So the key question is how can we drive down costs in a way that provides more business opportunity for all players in the value chain? We present the following ideas:

(1) An "Ultra Low-Cost" M2M specification (*call to action for hardware vendors)

As with GSM mobile communications generally, the basic cost of M2M hardware is the first and perhaps foremost barrier to market change. And like the emergence of low cost mobile phones, we have to begin by asking what are the minimum requirements needed by the end-user in a low income market?

Today, most M2M technology suppliers are focused on 'high value' wrappers for their hardware. For example, M2M units in a car can be used for fleet management, logistics tracking, and security. This is a big market with an estimated 7 million such units already in use throughout Europe. Medical services and remote health monitoring is another exciting area, where M2M connectivity is embedded into a sophisticated piece of medical equipment with the accompanying high levels of reliability and performance. These are great applications of M2M and unit prices in excess of USD45 can be justified where long life / high quality specifications must apply.

However, this is not the specification that applies to Edith's product. The requirements for a M2M-enabled solar system are very simple: 2G data only (no voice required), capable of processing small amounts of data, reliably and at low cost. The relative costs of the M2M module within the total kit price are also likely to be much higher (perhaps 15% of the bill of materials). The amount of data required to be sent over time is also low, typically a few kilobytes at periodic intervals. But despite these lower specification requirements, most 2G modules on the market today are still around USD13 each. M-KOPA believes that this could preclude the adoption of new consumer facing services where the total unit price is sub USD150.

The expense barrier is more difficult to justify when one considers that 2G technology is quite mature. Of course, suppliers will need to protect their investments in intellectual property and the units must work well on the licensed spectrum. But 2G is 20 years old and, in the absence of patent protection (most expire after 20 years), somebody somewhere will build to a low specification without infringing IP, mark it up fairly, and sell it at volume. History has lots of examples of failed attempts to protect high margins on old technology, famously portrayed as the core plot of the "Innovators Dilemma".

The insert box presents the specification of an M2M unit that would suit the consumer applications that M-KOPA is working on:

M2M Module Specification - Outline

Overview
Simple, robust, low power M2M module required for emerging market consumer electrical devices. High volume, cost sensitive applications.

Features:

GSM:	Dual Band, EGSM 900/1800 MHz
AT Commands:	3GPP TS 27.005, 27.007
SIM Toolkit:	3GPP TS 51.014
GPRS:	Class 8, PBCCH support, USSD, Mobile station class B, coding scheme 1-4
Power:	Off <5uA, idle power saving 1.5mA at DRX=9, dedicated mode 230mA (max) GPRS (Class 8) 360mA (max)
Sensitivity:	108 dBm at 900 MHz and 107 dBm at 1800 MHz
Interfaces:	ITU-T V.24 serial link through CMOS UART, baud rate of 9600 bps
Environment:	-5 to 50 degrees C
Approvals:	CE

12/13/12   1

(2) An "Ultra Low-Cost" M2M service proposition (*call to action for M2M service providers)

If modules can become cheaper, then the next challenge comes to service providers, including the likes of M-KOPA and mobile telecoms operators. As with pre-paid airtime, the challenge is to develop service models that suit the price points and needs of low-income consumers. Service providers need to factor a total cost of operation that includes designing the M2M unit into the end-user device, connecting it (with a network operator SIM) and paying for data traffic. Given the highly variable factors in each potential use case, no single fee model exists. In traditional M2M services, when data communication charges are built into the lifetime costs, then USD45 for the M2M hardware pales to a minority cost. Indeed, some M2M applications can have total lifetime costs in excess of USD300. Again, these are not the 'economics' that apply to Edith. The repayment model and total cost of operation must have a shorter life span than more traditional M2M applications (certainly shorter than an auto tracking service or remote meter). Balance sheet risk to the service provider gets prohibitively higher where this 'credit period' extends beyond, say, two years.

Service providers must focus on building relevant price plans, recovering payment for relevant products in a way that suits the customers' ability to pay. Research in the financial inclusion sector now tells us that absolute income is only part of the challenge for these types of customers; it is often as much to do with cash flow and dealing with volatile income. Flexibility is therefore key and mobile payment platforms offer us a way to provide for this – moving small amounts of e-money around at low cost. Attention from service providers can turn to the innovative models for the so-called last mile. M-KOPA has focused on doing just that, building responsive, scalable back-office systems to allow for good service provision (tracking devices for usage and performance, monitoring payments, trouble shooting and providing customer care).

(3) An "Ultra Low-Cost" M2M spectrum (*call to action for GSMA and communications regulators)

Finally, there are opportunities for the industry as a whole, including government and regulators, to examine spectrum and spectrum costs (including taxation, licensing and pricing) and open up lower-cost channels for connectivity. At a macro level, we, in the GSM industry, should also look hard at the spectrum requirements for M2M. Is there going to be under capacity in the older networks as 3G and LTE become more prevalent? Challengers will certainly come with different models, perhaps using parts of the spectrum that are under-utilized but already paid for (the broadcasting channels). The so-called 'white space' solutions could undercut any attempt to cram more devices into the licensed spectrum. It may be uncomfortable to think this way – but the reality is a gravitational pull to lower cost solutions and whilst incumbents will fight this, new entrants could thrive on a slow reaction by the GSM industry.

It must be possible to carve out space for low specification devices without compromising the higher technology solutions of LTE but this will entail thinking creatively when it comes to issues such as module design (e.g. standardizing board footprints), identification of devices (e.g. using device@domain-name models), and certification requirements. For sure, there is an argument that a cheap unit might preclude successful network integration or hinder post-sales support but that didn't stop the proliferation of cheap handsets. The telecoms industry is full of ingenuity when it comes to adaption of technology; we see a case here to repurpose some basic technology for new value-creating services.

<u>Conclusion and Recommendations</u>

At the risk of over-simplifying (it's a big debate in a small case study), a hungry enterprise will see this market and move quickly to scale. In such a scenario, there will be longer term implications for the position taken across the M2M value chain (technology, data, consumer services). For the purposes of debate, M-KOPA would encourage the following objectives to be taken up by the industry to unlock the potential of emerging market, consumer based M2M services:

Short term:

- (1) Supply a M2M unit with specification appropriate to needs and reduce the Bill Of Materials cost; for example, targeting a USD5 wholesale price for Multiple Order Quantities of 100,000 by 2015?

- (2) MNOs and service providers should take comfort from the handset proliferation amongst low income customers and build out innovative service models using mobile payments and M2M

Medium term:

- Develop simplified standards and reduce the barriers to efficient, cost effective scaling of high volumes of connected devices, such as common physical footprint, taking platform model approaches, requiring low or zero certifications, and thinking beyond the MSISDN & IMSI identifier models.