Community Telecommunications
Part I: A New Technical & Business Model
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Over the past several years there has been an evolving and growing focus of attention by an array of international development organizations on closing what has been referred to as the "digital divide." While in recent years this terminology has fallen a bit out of favor, the issue is often cast on two core notions; 1) that the leveraging of information and communication technologies (ICTs) holds significant promise for improving the delivery of a range of socio-economic improvements, and 2) there is a radical gap between those that have access to ICTs and those that don't have access. A wide spectrum of activities have been launched by virtually all international development organizations, bi-lateral as well as multilateral, aimed at closing this gap and thus gaining the advantages available through the use of these ICTs.

While significant progress has been made in a number of locations, finding viable and sustainable approaches in the more sparsely populated rural areas of developing countries, where income levels are notoriously low, continues to be frontier with few examples of successes that can serve as models for expansion. Specific challenges in these environments include, but are not limited to, the following elements:

1. **Low Population Density**—In many locations in sub-Sahara Africa the density of population in the rural areas is extremely low. In many locations while there may well be a need for the value-added services, this demand is simply not thought to be such that one can think of it as a market.

2. **Low Income Levels**—In addition to low population densities, frequently those living in the more rural areas of developing countries are at a very low income level, at times only $1 or $2/day. This is frequently at a subsistence farming level where the ability to pay for these value-added services is limited.

3. **Lower Literacy Levels**—For the most part the primary focus for delivering value-added services in developing countries has tended to focus on computer-based ICT services. As a result of relatively low education and literacy levels, the potential users of more sophisticated ICTs is limited.

4. **Technology Limitations and High Costs of Delivery**—The bulk of the focus in recent years by developed countries has been in broadband solutions, and specifically fiber, cable, and DSL; all of which are primarily of value in high density environments. More recently there has been a focus on wireless technologies such as WiFi and now WiMAX. But again, these have been for either small coverage "hot spots" or for higher density areas. While there continues to be improvements and price reductions in these newer wireless technologies, the costs to deliver connectivity in these situations still remains a challenge, though there are recent developments showing promise. While satellite technology does provide rural access, costs are typically quite high.

5. **Restrictive Government Policies**—In most developing countries, the starting point for expanding connectivity into the more rural areas is a rather inefficient government monopoly. In most cases it is a long path from a government monopoly to a fully-liberalized telecommunications marketplace with multiple private sector engagement.

And even here the focus is typically on serving the richer urban areas, with limited attention on serving those in the more rural areas. A number of countries have, and others are now, moving to the adoption of universal service/access funds. This has been an encouraging sign in recent years, though even here the execution is spotty.

6. **Limited Private Sector Engagement**—Unfortunately with the rural areas suffering from a potential lack of market, combined with a restrictive government policy, there are few if any incentives for the private sector, the typical engine of innovation and the economy, to become involved. The use of universal service/access funds, coupled with an opening up of the market for private sector firms to operate in the telecommunications market do show some promising signs in some countries. But at present this is still not a broad-based experience amongst developing countries, though it is gaining momentum.

7. **Inadequate Business Models**—For the past approximately 10 years, the notion of telecenters has been one of the dominant forms of delivering access to ICTs in the more rural areas of developing countries. Unfortunately the experience gained over this last decade has proven that while the cyber café (a telecenter located in a more urban area) can generate sufficient revenues to be economically sustainable, with few exceptions those located in the more rural areas are typically only viable so long as donor funding continues to be provided and subsidize the costs of running these centers.

The above is not meant to portray the situation of extending ICTs into the more rural areas of developing countries as impossible or hopeless. Rather, it is to simply state up front that perhaps the single most valuable "lesson learned" over the past 10-15 years of trying to deliver these ICT-enabled value-added services into the rural areas of developing countries is that as yet, we haven't figured it out. We've made progress, and certainly have extended the use of ICTs to areas previously without, but there simply remains much to be done. And as put forward in this paper, perhaps what needs to be done needs to be done differently.

A Needed ReLook

There is little question that during this last decade a growing number of developed and developing countries alike have undertaken significant efforts to liberalize their telecommunications sector. There have emerged a range of best practices where new telecom laws are put in to place, new and more independent regulators are established, and opportunities are put into motion where competing private sector firms enter the marketplace and provide a much broader range of telecom services, along with in many locations, lowering of prices for these services. For the most part, this is a global work-in-progress, with few if any developing countries having reached some mature state of stasis.

In addition to market liberalization, a number of developed and developing countries alike have actively pursued the establishment of universal service/access funds. Typically these are set up such that; a) they `collect a percentage of gross receipts (though there are a range of collection schemes) from the existing telecom carriers, b) these funds are placed into a central fund that is managed by a Ministry or sub-unit responsible for the use/distribution of these funds to support rural expansion, and c) the funds are distributed though a range of mechanisms to encourage the carriers to expand connectivity into the more rural areas of the country. This is frequently carried out through public tenders and in some locations via an approach being referred to as

reverse tenders, where the firm getting the license to operate in these rural areas is that firm that proposed the least, or even no, subsidies. More recently the notion of output-oriented tenders and payment schemes are being considered the "best practice," where the government subsidy from the universal service fund is predicated on delivering real results.

There is little question that there are a growing number of "success stories" with regards to liberalization of the telecom environment and establishing viable universal service funds in developing countries. And there is little question that the bilateral and multilateral development organizations have had an impact with regards to supporting countries in this positive dynamic, as well as in expanding the use of ICTs in more rural areas of these same countries, though here the success may not be as widespread. But I suspect we'd all agree that there is much work to be done still…with many countries simply continuing to move along their current path further, and others needing to change course.

The following does not seek to challenge the successes of these dynamics, but rather to put forth a modified approach that may hold more promise with respect to; a) delivering those services most in demand, and b) delivering them faster.

With respect to those services in most demand, to a considerable degree the international development community has focused on delivering computer-based ICT services whereas the highest demand in rural areas is most likely voice-based services. While some may object to the portrayal, it could be argued that elements of the international development community have "leapfrogged" over the more obvious high-demand voice-based services, while focusing on more sophisticated computer-based services. And with regards to delivering these services faster, the almost universally-applied approach for expanding connectivity into rural areas is an urban-to-rural expansion model. Substantially more progress could be made faster with an approach that instead is rural-to-urban and is undertaken in what can be thought of as *a massively-parallel, local community-based* approach. Build in; not build out.

1. **Voice**—When one takes into account the literacy rates of those living in the rural areas, combined with the very nature of their practical needs, it does not take much of an imagination to anticipate that voice will trump data as to highest demand within most all rural communities across the globe. In fact, it's the case in the most advanced developed countries in the world today….and has been consistently for over a hundred years! Even with the sophisticated potential of the Internet, the "killer application" for the last 20 years has been for basic person-to-person communications; e-mail—the data equivalent to voice. And what is the next Internet killer application? Oddly enough we're back to voice. Only now it is Voice over Internet Protocol or VoIP. The message here is not in any way to stop the expansion of data services off of the Internet. The message is however of the need to refocus on the highest demand first and make sure voice is delivered to rural areas along with, or even ahead of the data services. And recognizing that VoIP is technically a data service over the Internet both voice and data services can now be delivered over one convergent and lower cost network.

2. **Massively-Parallel**—Few fully appreciate that the most rapid growth of telecommunications in any rural area on the planet took place in the U.S. in the early 1900s. The triggering event was the end of the Bell patents on the telephone. Within but

a few years there were over 6,000 small community-based telcos in the U.S. Interestingly each of these small telcos served an average customer base of less than 200 customers, and none of these community telcos were interconnected to the neighboring community or a national network. How did it happen? First, there was no government institution to prevent it from happening. The FCC didn't exist at the time. Second, the demand for communities to talk amongst themselves was such that the local communities by the thousands put up their own systems. Third, technology was readily available such that local farmers, businesses, and individuals could put it into place. It was only later that there was consolidation of these small community-level telcos and later still interconnection…in many cases, twenty, thirty, and forty years later. Simply put, this rapid growth was brought about by the availability of technology (bought through catalog sales), the local population mobilized to meet their own priority demands, and nothing was in the way. The initial impediment to interconnection was simply limitations in the technology at the time…the signals couldn't transmit that far at the time. This is not an issue for us today, but in fact even today recent studies continue to show that the bulk of voice calls made in developed countries are local.

One has to wonder if given the same opportunities that existed in the U.S. in the early 1900s, if tens of thousands of local communities in developing countries wouldn't act in a similar manner today. One also has to question the common international approach for expanding connectivity and closing the "digital divide" as being dominated by an urban-to-rural orientation, where the solution in many cases consists of installing a single satellite-based phone into a community of 500, 1,000, 1,500 or even more. This is not only an expensive solution that satisfies none of the latent local demand, but it also assumes that those living in the rural community would rather talk to someone in a regional capital or the capital city than their local counterparts within their own community.

The above two topics serve to add focus on voice services with the expansion of these services undertaken through a local-community focus in a massively parallel approach. Fortunately with today's technologies this is not an either-or of what is currently underway, but rather as a refinement and augmentation of the dynamics currently underway in many developing countries. Naturally if small rural community-telcos were to adopt an expansion strategy of this type, there would likely need to be some policy and legal/regulatory changes required. Though maybe not. It would be possible that current carriers adopt this approach through a local franchising scheme within the current licensing and market structure.

Promising New/Enhanced Technologies

During the past 2-3 years, two enabling technologies have become commercially-available that hold significant promise for expanding rural connectivity in developing countries at a substantially reduced cost. Fortunately these technologies are such that their demand in more developed markets are such that pricing is already showing the result of competition with a lowering of prices continuing to take place. Some of the newer components just now reaching the market will also experience significant price drops within this next few year.

The core technology upon which this dynamic is taking place is the Internet. But specifically it is the Internet Protocol (IP), the packet switching component of the Internet, not necessarily all the additional value-added components we frequently think of when we refer to the Internet. The fundamental change brought about by the IP is that telecommunications can now take place through a packet-switched network, rather than a circuit-switched network which dominated communications up until the Internet. This factor alone provides for substantially lower costs simply due to the fact that the costs associated with delivering the network infrastructure is significantly reduced and the capacity is increased. Further, this IP network is capable of delivering both voice and data services through a single network, again realizing significant efficiencies.

Upon this IP-based infrastructure, two more recent technology advancemnts now make it possible to;

a) deliver connectivity to more rural areas at a substantially lower cost through wireless technologies, specifically **WiFi and WiMAX**, and

b) deliver voice services through lower cost **Voice over Internet Protocol (VoIP)** switching, including the deployment of software-based switching that runs on lower-cost commodity servers, including PCs. These VoIP soft-switches include the ability to provide VoIP-PSTN gateways such that calling to/from existing phone systems is totally transparent to the user.

This combination of WiFi/WiMAX and VoIP is a current dynamic that is just now gaining momentum and being implemented in selected locations in developed countries. Internet access through WiFi HotSpots are becoming increasingly common through services being provided by T-Mobile (at virtually all Starbucks coffee shops) as well as Cingular and other smaller more independent carriers and Internet Service Providers (ISPs). As to WiMAX, a range of what can be thought of as pre-WiMAX installations are beginning to be implemented on some limited deployments, primarily as a component in Wireless ISPs or WISPs. The VoIP technologies have seen a very rapid adoption through firms such as SKYPE (computer-to-computer based), Vonage (the first large scale adopted phone-to-phone service), and more recently AT&T's Advantage plan. VoIP is also being rapidly deployed in the office setting where it is rapidly replacing more expensive specialty-hardware based PBXs.

There are also a growing interest in deploying these technologies into developing country settings as visionary professionals see the rich potential of the technology for delivering access at a substantially reduced cost to areas which are currently simply un-served by anyone. And it is this later opportunity to which this paper is addressed.

A Proposed Technical and Business Model

A quick summary of the proposed technical and business model is for;

1) the development of a fully-functional community-based telecommunications network that is built to serve the local demands for voice communications; a network that is…

2) IP-based and built on a combination of a WiFi and/or WiMAX wireless technology infrastructure that provides the community with a convergent network capable of supporting voice and data service; with

3) a local VoIP-server providing low-cost flat-rate intra-community voice access that in turn is augmented such that it is…

4) supported by intra-community access through a range of trunk lines which broaden the community-focused service by providing…

5) expanded inter-community voice services through centralized VoIP gateways that connect to the PSTN as well as mobile systems, and

6) with data gateways, also provide full access to the Internet to the local communities.

The primary shifts in this proposed approach from more traditional approaches is that; a) it first focuses on meeting the more latent local-community voice communication needs but does it with a convergent network that will also support data, and b) upon this community core the network is extended to interconnect to the PSTN and the Internet.

This is a virtual inverse of the more common approach that seek to place one or a small number of phones in the local community for the sole purpose of connecting the community to larger urban areas, but not to itself. This approach also represents a shift in that while it relies extensively on the Internet, its primary focus is on providing voice services, using the Internet to do so through its much reduced cost-effectiveness (along with the lower-cost wireless technologies, but not the more costly mobile or cellular technologies).

This approach, by expanding the number of phones in the local community, and ideally providing these services on a flat-fee basis, has two critical advantages over other approaches; a) it rapidly makes the use of telephony ubiquitous for calling those living within the community, while at the same time, b) establishing more local access points for those seeking to make inter-community calls. This will have the impact of capturing more of the latent demand for long distance calls, which in turn will provide the needed revenue required to support the more costly satellite or long-distance services. This is in lieu of the community having only a single access point.

With regards to providing these services to the local community, there are several options that can serve as places to start. One obvious approach is to upgrade an existing telecenter to become a true "last mile" solution provider by focusing on voice services and delivering expanding access into the community through selected businesses or even homes that serve as "phone shops" for the immediate neighbors. This may be the only solution for making some of these rural telecenters financially sustainable. Another approach is to expand upon the current vogue of satellite-based phone approaches being implemented through universal service fund subsidies, by turning the satellite link into a backhaul/truck line into the community and add the local WiFi/WiMAX distribution and local VoIP-based voice services through the establishment of a local community telco. Naturally a new start up from scratch is yet another viable option.

Regarding a business model, the most obvious and likely the quickest to implement would be for current carriers with existing licenses and possible rural obligations built into their licenses, to undertake this approach through the granting of local community-level franchises. This could be augmented with technical support and even financial lending instruments from the carrier. This approach would also enable the current carriers to consolidate their central investments in VoIP

gateways that can serve multiple locations for interconnection. With this community-oriented approach the carrier simply off-loads local management and operations, while it the same time augments their existing network and brings on a new customer base that over time will make greater and greater use of their network, and in doing so, provide a revenue growth with minimal investments.

Other approaches in the policy/regulatory arena would be for the regulator to establish an approach whereby if the licensee does not deliver adequate services to rural communities, they can apply for their own community telco license. Also, Universal Service/Access funds could be established such as to give precedence to small local community telcos, and provide the initial funding through loans, not grants as is typically the case.

Summary

As mentioned earlier in this paper, this proposed reorientation is not without proven success. At the time when Bell's monopoly ended in the U.S. (e.g., the phone patents expired in 1894) there were an estimated 270,000 lines within the Bell system, and these were virtually all concentrated in cities. There was little or no phone penetration in rural areas. Teledensity in the U.S. in 1885 was estimated at 0.2/100. It was but 0.43/100 ten years later in 1895, a year after the patents expired. By contrast, during the 13 years following the end of Bell patent, over 6,000,000 lines were in service. These were evenly split between Bell and the independent telcos. And no longer was service limited to high-density urban areas. Rather, service and access levels were reasonably-well distributed across the country; urban and rural. The number of telephones had grown by approximately 2,100 percent between 1894 and 1907.[i] Teledensity in the U.S. was estimated as growing from 0.43/100 in 1895 to 6.67/100 in 1906[ii], just 11 years later. The rural state of Iowa had a higher teledensity than New York City—a location where Bell retained a virtual monopoly.[iii]

But we don't have to look back 100 years to see this approach as being successful. The following reflect a few more recent examples that have deployed similar models to what has been put forth above, though they have deployed only part of the proposed approach, relied on different wireless technologies, or are just now getting underway with their ultimate success yet to be determined.

Perhaps the most well-known rural telecommunications initiative is that of the **Grameen Telecom's Village Phones**. While built off of GSM technologies, this business model reflects a tremendously successful approach for delivering voice services into low-income rural areas. It also demonstrates the latent demand that exists in rural communities, and that this can be captured and done in such a way as to be financially sustainable. For a more complete write up on this approach, see http://www.digitaldividend.org/pdf/grameen.pdf.

Yet another approach for providing phone services to rural and low income communities is that put into place in South Africa through **VodaCom's Community Service Phone Shops**. Here again, like the Grameen approach, the platform is a more traditional cellular service coupled with local entrepreneurs. And also as with Gremeen, the orientation is that of extending services to the more rural, low-income population. For a more completed write up on this approach, see http://www.digitaldividend.org/case/case_vodacom.htm.

A third example of a community based approach for delivering ICTs into rural areas of India is that of **n-Logue**. Here a three-tiered franchising model is used to deliver low-cost Internet through a wireless technology called corDECT. Under the current situation they also provide telephony services but only through partnerships with current carriers, and not over their own wireless network. For a more complete write up on the n-Logue experience, see http://www.digitaldividend.org/pdf/nlogue.pdf.

Yet a final example of a rural-focused ICT initiative is USAID's **Last Mile Initiative (LMI)**. This program is relatively new, being just over a year old, but is already gaining experiences in several countries that reflect progress on not only rural connectivity, but applications of the ICTs. LMI projects are underway in several countries that are considering an approach along the lines outlined in this paper. For additional information see http://www.usaid.gov/our_work/economic_growth_and_trade/info_technology/last_mile_initiative.html.

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[i] Brock, Gerald W. *The Telecommunication Industry: The Dynamics of Market Structure*. Cambridge, MA: Harvard University Press, 1983, pp. 89-176

[ii] Gabel, David and Weinman, David. Historical Perspectives on Competition between Local Operating Companies: The United States, 1894-1914. Queens College, CUNY-NYC,NY. 46 pp.

[iii] Mueller, Milton L. Jr. (1997) *Universal Service: Competition, Interconnection, and Monopoly in the Making of the American Telephone System*. MIT Press and the AEI Press. ?? pp.